Donor Country Profile: Canada

OUR RELATIONSHIP with Canada might be fairly termed as a 'mixed bag' of activities, especially in terms of restricted (special project) funding. What we appreciate most is the consistently high level of unrestricted (core) support at a time when so many donors are confining their money to specific projects with short life-spans.

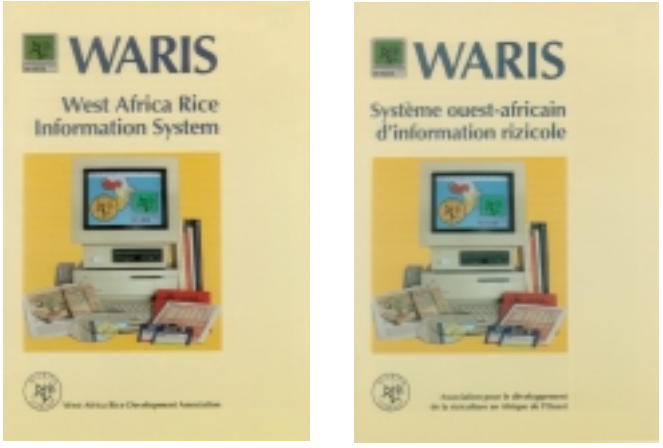
The funding that WARDA receives from Canada comes via two routes. The first is direct from the Canadian International Development Agency (CIDA) and the second via the International Development Research Centre (IDRC). IDRC is a public corporation created and funded by the Canadian Government to help communities in the developing world find solutions to social, economic and environmental problems through research.

Canada's contributions to WARDA from 1988 to 2000 are shown in Figure 10—we are particularly grateful for the consistent donations to our unrestricted core budget, averaging over US$0.55 million a year.

Library and information services

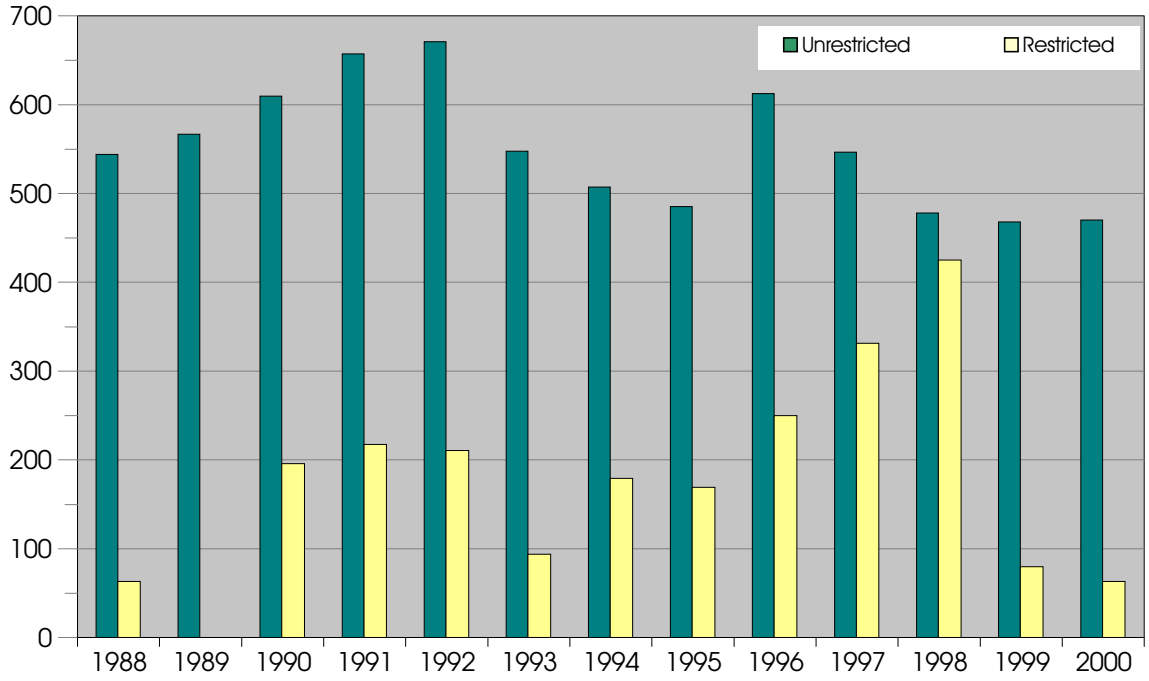
In 1990, IDRC agreed to provide funds for the upgrading of WARDA's library and documentation service. Information has always been one of the 'pillars' of IDRC and an area in which they promote growth in developing countries and the institutions that serve them. When the project started, the library had only four full-time staff—a documentalist, a junior librarian, a bilingual secretary and a library clerk. By the end of 1994 (when the project finished), a production assistant and a messenger had been added to the team, and an assistant documentalist was being recruited. Although these recruitments were not funded by the IDRC, the project provided the impetus to put information onto a higher plain.

The project was titled 'West Africa Rice Information Service (WARIS)' and the development or enhancement of WARDA's capacity to operate a modern information system was a key element of the activities. During the lifetime of the project, although independent of it, a new building was constructed specifically for the Library and Documentation Center at WARDA's Headquarters, and was occupied in January 1993. The four-year period also saw major upgrades in information and related technology, the project contributing 1 computer, 2 printers, 1 CD-reader, 2 photocopiers and a microfiche-reader.



Leaflets on WARIS (English and French)

Figure 10. Canadian funding to WARDA, 1998–2000.



The project provided funds for the WARDA Documentalist Alassane Diallo to visit the libraries of the International Rice Research Institute (IRRI) in the Philippines, the *Centre de coopération internationale en recherche agronomique pour le développement* (CIRAD) and the International Complex for Research and Higher Education in Agriculture (AGROPOLIS) in France, and other information services in those countries. "Those contacts were instrumental in upgrading WARDA's information delivery service," he explains.

'Standard' information services were promoted and expanded during the project, comprising selective dissemination of information (SDI, 20 profiles by end 1994), literature searches (135 main searches in 1994, compared with 40 in 1990), *Current Contents at WARDA* (200 copies per month in 1994, compared with 46 in 1991), and document delivery to WARDA and NARS scientists (on demand). The project was also around to help WARDA in the early days of the electronic information age. Over the four years, WARDA developed various in-house bibliographic databases, and started its collection of CD and other electronic databases from outside. Capacity-building funds enabled nine personnel from the national agricultural research systems (NARS) plus a secretary from WARDA's Sahel Station to be trained, 'on the job,' in information management, and the project provided funds for the WARDA Documentalist to make follow-up visits to Benin, Congo, The Gambia, Sierra Leone, and Abidjan and Bouaké (Côte d'Ivoire) to monitor the progress of former trainees. These visits and other contacts also provided a means of increasing WARDA's collection of 'gray literature'—mostly unpublished research reports from NARS and theses. Some 1249 titles were collected in 1994, compared with only 15 in 1991. "All this contributed to 'breaking' the isolation of the NARS scientists of the region," says Diallo.

In that period, WARDA library staff were also able to produce a directory of rice researchers active in West Africa, and bibliographies on the increasingly important *Oryza glaberrima* and rice yellow mottle virus.

IDRC provided vital funds at a strategic moment in WARDA's development. Today, WARDA's library is housed in a new purpose-built Information and Documentation Center, and is part of the department of the same name. However, the legacy of IDRC's input is not forgotten. WARIS lives on providing relevant rice information to NARS researchers throughout the region and beyond—it forms the basis of WARDA's drive to be the hub of an information system on rice for the whole of Sub-Saharan Africa.

Human Health Consortium

From 1994, IDRC payed a double role in the activities of the WARDA-hosted Human Health Consortium. Up to 1998, the Consortium received direct funding from IDRC. In addition, the office of IDRC based in Côte d'Ivoire was one of the partners in the research. Aspects of the Consortium's work were reported earlier—malaria research in the 1996 Report and schistosomiasis research in 1999.

In particular, IDRC was a key proponent of the intersectoral, multidisciplinary research methodology, developing the original protocol and actively seeking funding for the Consortium. They provided guidance in developing the work plans for the socio-cultural aspects of environmental and health appraisals, plus six months of consultancy time to develop the social-science components of the research agenda. Finally, IDRC participated in the institutional review of the research approaches.

Crop modeling

In 1997, we initiated a collaborative project with Laval University, Quebec, aimed at alleviating food insecurity in developing countries through the development of rice plant types that are competitive against weeds while remaining high yielding. The project was funded by the CGIAR–Canada Linkage Fund (CCLF), and lasted three years.

The overall goal of the project was to develop interspecific plant types for resource-poor upland-rice farmers, drawing superior weed competitiveness and drought resistance from *Oryza glaberrima* parents and a high-input-responsive yield potential from *O. sativa*. In the shorter term, the project aimed to assist breeders exploit the rich genetic diversity recently made available through the NERICA technology, by developing detailed plant-type concepts for weed-competitive, drought-resistant, high-yielding rices. An interdisciplinary systems approach was followed, involving a rice breeder, a weed scientist and a natural-resource management specialist at WARDA, and a weed scientist and a weed-and-crop-competition modeler at Laval University. A Postdoctoral Fellow position nominated by Laval University was out-posted to WARDA, and was filled successively by Folkard Asch (1997–1999) and Frank Abamu (1999–2000).

The project used as its starting point a crop–weed competition model developed by IRRI and Wageningen Agricultural University (INTERCOM). Rice and weed trials were established over several planting dates to generate cultivar-specific data for the model. Data from one date were used to 'parameterize' the model (that is, reconfigure the model specifically for rice), then data from a later date were used to verify that it worked. When the timings of plant growth stages (phenology) were fixed, the adapted INTERCOM accurately predicted both total plant production and grain yield in both weed-free and weedy scenarios.

Vegetative and reproductive growth stages of five weeds were well predicted. Plant height was simulated very accurately in four of the weeds, but that of *Sphenochlea zeylanica* (a common weed of lowland rice that is fast-growing and small) did not follow the logistic pattern assumed for rice and weed species in the model. Further experimentation is required to explain this observation. More work is also needed to quantify other

morphological and physiological aspects. However, the competitiveness of both rice and weeds was well explained by the model (*see* Figure 11).

A user-friendly manual was developed for application of the modified INTERCOM model for plant-type design for improved competitiveness against weeds. The guide facilitates applying the model for sensitivity analyses against specific stresses or agronomic issues, such as climate, planting time and planting density. It was specifically prepared for partners in national programs, who may be less familiar with details of ecophysiological principles that were used to the model's development—it is structured so that users do not need detailed understanding of the physiological, ecological or mathematical principles used to develop the model.

An array of 27 hypothetical rice ideotypes was generated by the adapted INTERCOM, combining morphological and physiological parameters of *O. glaberrima* (CG14) and *O. sativa* (WAB56-104). The best prototype was one with 20% faster leaf growth rate, which gave 139% of the yield of the *O. sativa*. This suggests that breeders should add leaf growth rate to their criteria when selecting for

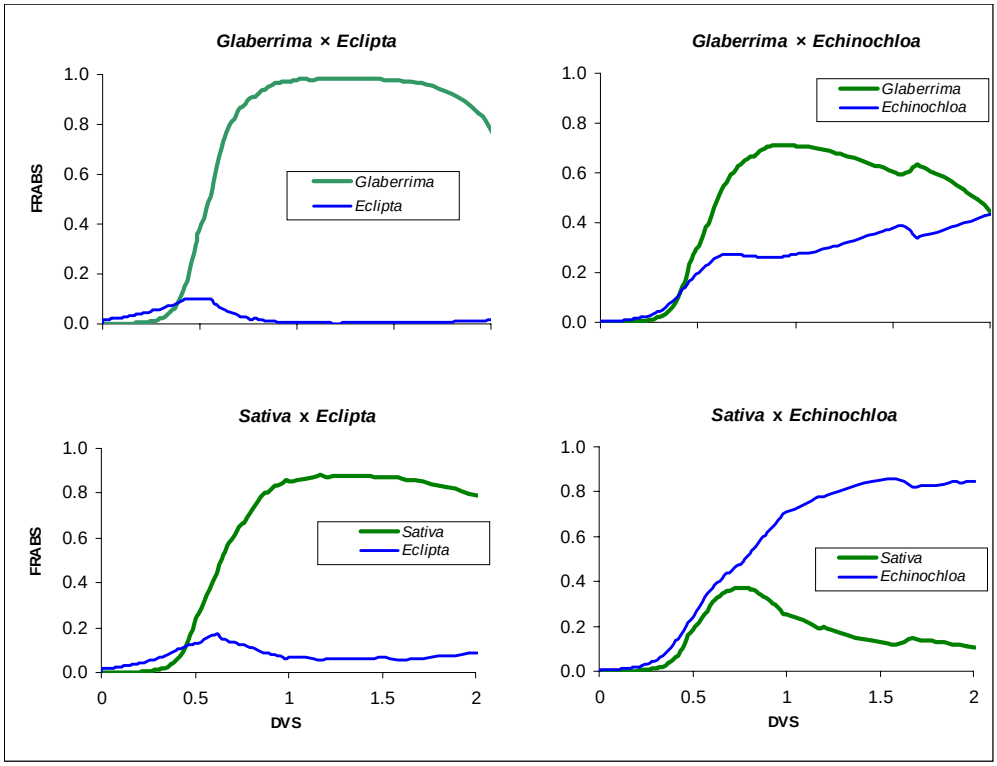


Figure 11. Fraction of incoming radiation (FRABS) interception by rice cultivars of *O. glaberrima* (CG14) and *O. sativa* (WAB56-104) during competition with a broad-leaf weed (*Eclipta prostrata*) and grassy weed (*Echinochloa crus-pavonis*). DVS = rice developmental stage, where 0 = emergence, 1 = flowering, 2 = maturity. Simulation was performed with the adapted INTERCOM model. These results show the effectiveness of the *O. glaberrima* variety in smothering weeds, by intercepting most of the incoming light.

weed competitiveness. Adjusting the phenology with a view to making the rice grow faster resulted in a less-competitive plant type.

Taking the thresher–cleaner to Burkina Faso and Mali

Following the success of the thresher–cleaner (ASI) produced by WARDA and partners in Senegal (*see* Box, page 50), IDRC provided funding for two years (1998 and 1999) for WARDA to work with similar partners in Burkina Faso and Mali to assess the thresher–cleaner's potential there.

Specifically, the project aimed to: (1) evaluate the capacity of local workshops to produce the thresher–cleaner using locally available materials; (2) assess potential benefits to service-providers and farmers; and, (3) assess likely shifts in labor demand with adoption of the thresher–cleaner, particularly the effect on women and laborers who sift straw for paddy, and winnow and clean rice.

Prototype thresher–cleaners were successfully produced from locally available materials, first in Niono (Mali) during the 1998 wet season and then in Bobo Dioulasso (Burkina Faso) during the 1999 dry season. Construction took place in sparsely equipped workshops, representative for the working conditions of the agricultural machinery industry in the region. WARDA trained four agricultural machinery manufacturers in Mali and three in Burkina Faso. Technical drawings of the machine were compiled in collaboration with the University of Saint Louis in Senegal in January 1999, and sent to all partners involved in the project.

The machines were tested during the 1998 wet-season and 1999 dry-season harvests in Mali. Testing in Burkina Faso started in October 1999. Surveys were conducted among groups of stakeholders—rice producers, people who thresh, winnow or glean manually, local artisans and operators/owners of mechanical threshers—to find out their perceptions of the machine. All respondents considered the thresher–cleaner a major improvement over threshers currently in use. Where the thresher–cleaner was not replacing family labor, such as among women involved in winnowing and gleaning for cash or paddy fees, the primary concern was that introduction of the equipment will diminish demand for manual labor. During the second half of 1999, a total of 10 thresher–cleaners was produced in Mali by local manufacturers trained within the project.

Support to Key Sites in Côte d'Ivoire

In 1998 and 1999, CIDA provided funds through the *Fonds De Contrepartie Ivoiro-Canadien* (FDCIC) towards agronomy and breeding activities in WARDA's Key Sites in Côte d'Ivoire. The Key Sites are used by WARDA for research that needs to be conducted in ecologies other than those available at its main research stations. At that time (and up to 2000), WARDA operated five Key Sites within Côte d'Ivoire, in addition to the Main Research Station at M'bé, north of Bouaké in the southern guinea savanna zone:

- Bouaké peri-urban areas, in the center of Côte d'Ivoire, in the transition zone between the forest and the savanna; it has a bimodal annual rainfall regime, with a total of about 1100 mm rain;
- Korhogo, in the north of the country, is in the northern guinea savanna zone; it has a relatively cool dry season and rainfall of 1300 mm per year;
- Boundiali, is also in the northern guinea savanna zone; it receives 1500 mm of rainfall;
- Danané, in the west of the country, is in the humid forest zone; it has annual rainfall of 2000 mm;
- Gagnoa, in the center-west of the country, is in the forest zone; it has a bimodal rainfall regime, with a total of 1400 mm per year.

In effect, the small grant funded one field 'observer' and general agronomy and breeding activities. Part of it was also used to purchase a few small-scale threshing machines and two motorbikes.

The thresher–cleaner in West Africa

History of its introduction and spread

Several times over the last four years we have alluded to the success of the thresher–cleaner that WARDA has helped introduce to the Sahel. However, the pages of the *WARDA Annual Reports* have not carried any of the story since the 1996 Report. That report—part of the story 'A Tradition in the Making,' specifically pages 35–37—gave the background to the story, but by the end of 1996 the machine still required modification for the Sahelian environment (it had been introduced from The Philippines).

Modified prototypes were built by local artisans in Senegal in 1997, and then tested on farmers' fields. On 5 November 1997, over 500 participants (including senior government officials) attended the commercial launch of the thresher–cleaner at Saint Louis, '*Journee du lancement de la batteuse/vanneuse ASI.*' It was at this meeting that the thresher–cleaner was named 'ASI,' from WARDA (**A**DRAO in French), the Senegalese extension authority for the Senegal River (*Société d'aménagement et d'exploitation des terres du Delta du Fleuve Sénégal et des vallées du Fleuve Sénégal et de la Falémé,* **S**AED) and the Senegalese national agricultural research institute (*Institut sénégalais de recherches agricoles,* **I**SRA)—the principal partners in its development. The ASI has subsequently been a commercial success in Senegal, and by the end of 2000 there were over 100 working machines, mostly in the Senegal River valley.

As it was principally designed for the conditions of the Senegal River valley, it was a simple move to extend the Senegalese prototype to southern Mauritania. With World Bank support, two Mauritanian machinists were trained in ASI construction at the WARDA Sahel Station in 1998/99. These men then returned and constructed the first prototype thresher–cleaner for Mauritania. The accepted and commercially released thresher–cleaner in Mauritania was dubbed 'SAC,' for the Mauritanian rural extension service (*Societé nationale pour le développement rural,* **S**ONADER), **A**DRAO and the Mauritanian national agricultural research center (*Centre national de recherche agronomique et de développement agricole,* **C**NRADA). As in Senegal and each subsequent country to which the thresher–cleaner has been extended, the work has been a partnership between WARDA, national research and extension, and local artisans. By the end of 2000, there were about 15 SAC thresher–cleaners operating in the Senegal River valley of Mauritania.

Next, the thresher–cleaner was introduced to Burkina Faso and Mali with funding from the International Development Research Centre (IDRC) in 1998 and 1999 (*see* main story). By the end of 2000, there was still only the one prototype INADI—*Institut de l'environnement et des recherches agricoles* (**IN**ERA), **AD**RAO, *Institut de recherche en sciences appliquées et technologies* (**I**RSAT)—thresher–cleaner in Burkina Faso, but at least 30 ACIER—***A****DRAO en* ***C****ollaboration avec l'Institut d'economie rural* (**IER**)—thresher–cleaners in Mali.

In February 2000, a prototype thresher–cleaner was made at the WARDA headquarters workshop and tested in the M'bé valley, Côte d'Ivoire. In 2001, the thresher–cleaner is being 'taken' to The Gambia.

Performance of the ASI thresher–cleaner

The ASI project was started by WARDA in response to farmers' complaints about the performance of the then 'best available' thresher, the Votex, during a survey in 1994. The Votex had been introduced to the region in the early 1990s, to provide a better option than 'waiting in line' for the aging combine-harvesters that had been around for some time (and were not being replaced), or manual threshing. However, the farmers criticized the Votex for its inefficiency (especially in terms of separating grain from straw) and its high labor requirements. Thus, WARDA sought help from the International Rice Research Institute (IRRI) and imported a prototype thresher–cleaner that had been developed in The Philippines (TC800). In addition, IRRI lent the Sahel Station an agricultural engineer to advise on the first Senegalese-built prototype.

Substantial modifications were made to the TC800 design in the development of the prototype ASIs for conditions of the Senegal River valley in the Sahel. Many of these were to do with the need for the ASI to handle manually harvested paddy (as opposed to machine-harvested paddy) and generally to make the machine more robust. It took about 2½ years to develop the ASI into the model that is 'mass-produced' in Senegal today. We could simply say that the success of the ASI—especially in northern Senegal—speaks for itself, but it really does measure-up well against the Votex (*see* Table 3).

Particular attractions of the ASI over the Votex are:

- the processing capacity (6 tonnes per day v 4.3 t/day)
- the grain separation rate (97–99% v 85%), which means that the farmer does not have to provide additional labor for sifting grain from straw, or winnowing
- the net revenue (US$8.02 per tonne v $4.47/tonne), which is mainly a result of the higher capacity of the ASI.

Table 3. Comparison of the first prototype ASI with Votex (Senegal River valley, Senegal, 1996).

Parameter (units)	ASI	Votex
Machine type	Axial flow	Tangential flow
Grain separation rate (%)	97–99	85
Processing capacity (kg per 6-hour day)	6000†	4300
Purchase price (US$)	4138	3276
Fuel consumption (liters per hour)	2	0.8
Total cost per tonne (US$)‡	9.23	9.32
Total cost per hectare (US$)‡	41.51	41.94
Total cost per year (US$)‡§	3044	2204
Net revenue per tonne (US$)‡	8.02	4.47
Net revenue per year (US$)‡§	2645	1058
Internal financial rate of return (%)	65.7	34.1
Benefit/cost ratio	1.7	1.4

† Conservative estimate; Malick Ndiaye cites 1.5 t/hour for the 12.5-hp prototype, and 2 t/h for AGRITECH's 19-hp version.
‡ Including operator labor costs (2 operators for ASI, 1 for Votex), but excluding farm labor (usually 4 farmer-laborers with both machines).
§ On the basis of 55 working days per year.

More of the same... only different

"The whole idea of producing small-scale machinery locally is that modifications can be made for each market niche," says Irrigated Rice Program Leader Kouamé Miézan. "As a first level, each country to which we have taken the prototype design has made its own modifications for local conditions." Thus, there are at least five versions of the thresher–cleaner in the region—two of these are in Senegal.

Senegalese machinist and director of the manufacturing company AGRITECH, Malick Ndiaye 'beefed up' the original ASI prototype. "The original machine was only suitable for towing behind a conventional car," he explains, "but we could see a market for something that could equally well be pulled by animals. Also, the lightweight first model was not suited to the rough conditions prevalent in much of the valley. So, we made a four-wheel version," (the original had only two wheels) "and also made it more robust." AGRITECH also saw a need for greater processing power, so upgraded from a 12.5 horse-power motor to a 19-hp one. "At the same time," continues Ndiaye, "we made some minor modifications to regulate air-flow to compensate for differences in grain moisture content" —wetter grains require stronger air-flow— "and to prevent straw aspiration."

The Mauritanian SAC is almost identical to AGRITECH's ASI. "Almost no modifications were required for Mauritania," explains former Sahel Station Agronomist Marco Wopereis, "because we were still in the same environment—the Senegal River valley."

The Malian ACIER retains the more simple air-flow regulation of the first ASI, and has a 14-hp motor. It has four wheels, but is towed (dragged) along its longest axis, which makes it narrower (for transportation along narrow tracks), but less stable; it can also be pulled by animals.

The Burkina INADI also retains the simpler air-flow regulation, and the smaller motor of the first ASI. Like the ACIER, it has four wheels, but is only suitable for vehicle-towing.

The first Ivorian prototype retains the early air-flow regulator and two wheels for vehicle-only towing, but is heavy framed and has a 19-hp motor.

Information and communications technology

In July 1999, Adrian Q. Labor joined WARDA as Information and Communications Technology (ICT) Manager, on a two-year contract paid for by IDRC. "Up to that point in time," explains Director General Kanayo F. Nwanze, "we had been handling ICT matters on an ad-hoc basis, with a lot of the burden falling upon the Biometrics Unit. With the arrival of Labor, we were able to establish an ICT Unit within the Office of the Director General, and really started to make some headway with our ICT capacity building." In fact, the only 'core' ICT staff in post—Technical Assistant Yoni Lébéné—was immediately transferred from Biometrics to ICT.

When Program Division staff were relocated to the new research building and Information and Documentation Center in 2000, ICT Unit was allocated three adjacent offices in the main research complex. "In one of the three rooms," explains Labor, "we have centralized WARDA's servers. One room serves as an ICT reference library thanks to funds provided by IDRC, and the other as a modest computer-training laboratory."

On the hardware side, the 'backbone' fiberoptic cabling has been increased, giving a robust local-area network (LAN) to all buildings at WARDA's M'bé headquarters. And connection to the Genetic Resources Unit buildings some 3 km away is well underway. "This increased capacity has been matched by a 30% increase in computers attached to the LAN," says Labor, "which have been drawn from a combination of new purchases and refurbishment of older machines that were already here."

WARDA's principal servers are all on a Microsoft platform, running either Windows 2000 or NT4.0. They comprise the primary domain server, the Intranet, the SQL, the Exchange (e-mail), the Finance SunSystem, and the experimental servers. "The Intranet, SQL and Exchange servers have all been linked," explains Labor, "so they all now 'talk' to each other. This enables us to establish Center-wide database access to all available information, and we have software accessing all three servers simultaneously." To date, the combined LAN and server system has been used for budgeting, with senior staff being able to plan and monitor their budgeting from their desktops. In addition, an integrated database has been established for both research and administration, enabling related data to be accessed from diverse sources across the Center.

WARDA's computer servers are 'centralized' in one room for easier management by ICT Unit staff

"On the software front," explains Labor, "one of my first tasks was to purge the Center of unwanted computer viruses." This has been done with up-to-date anti-virus software being installed and regularly updated on all machines. "When we got hit by the 'Jokes' virus," (a.k.a. 'Funny,' 'Life cycle stages') continues Labor, "we were immediately able to install the latest anti-virus update, and a monitoring system to watch it spread across the LAN—it was a harmless beastie, but it was interesting to watch how a virus replicates itself across a system so quickly."

With the establishment of its own Intranet, WARDA has been able to move to Web-based applications. Sharing of information has become mush less demanding on the upgraded LAN system—where e-mails were previously sent to all users, such information is now stored in Shared folders on the Exchange server, or on the Intranet itself. "Network printing has now become an acceptable

practice at WARDA," says Labor, "after we successfully recalled most of the personal dot-matrix printers and established network laser printers within each department. We can now manage with fewer printers, which require less maintenance and consume less supplies."

Despite these major advances, the one event that will probably stick in the minds of staff members the longest was the installation of a satellite link to the principal Internet service provider in the USA. Almost overnight, WARDA went from being thoroughly isolated from the majority of the world to high-speed Internet access. "The Internet is revolutionizing our information services," says Assistant Documentalist Florent Diouf, "we have now moved to combined print and on-line subscriptions for several journals, and the future of the WARDA Library certainly lies in that direction."

"With the connection of the Exchange server to the satellite link," explains Labor, "we were able to transfer staff mailboxes from their desktops to something that is available across the Internet." WARDA staff can now access their mailboxes from anywhere they can connect to the Internet. WARDA sites beyond headquarters have benefitted from the ICT Unit, too. An Internet lounge has been established at the Bouaké Liaison Office, giving access to the Internet after office hours, not to mention a convenient on-site connection for visitors staying at the WARDA Guest House (in the same building as the Liaison Office). Out-posted staff at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, and in Abidjan are better integrated with headquarters via CGNet (WARDA's service-provider), with dial-up electronic-mail, Internet services and public folders.

Mutual satisfaction

As a consistent donor of unrestricted funds, Canada can justly claim some input into the rest of our research program. When Donald McMaster, Canadian Ambassador to Côte d'Ivoire, visited WARDA's headquarters in 1999, he wrote "The work you have done in developing new varieties adapted to the special conditions of WARDA member countries is most impressive. We can report full satisfaction with the use of Canada's contribution to your Centre."

"We are very happy with Canada's interest in and continued support to our research," says Director General Kanayo F. Nwanze. "With the departure of Labor in mid-2001, the latest round of IDRC–WARDA collaboration will come to an end." However, IDRC has recently been involved in helping the CGIAR to develop a proposal for a 'System-Wide Initiative on the Impact of HIV/AIDS on Agriculture, Agricultural Research and Development,' and WARDA is taking a leading role in that Initiative. "We look forward to doing new things with both IDRC and CIDA," concludes Nwanze. "We are not yet sure what the next area of mutual interest will be, but we are confident that it will be as successful as our earlier collaborative links."