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LESSONS LEARNED: A PRIVATE-SECTOR FOUNDATION'S SUPPORT TO DEVELOPING-COUNTRY AGRICULTURAL RESEARCH

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Since its inauguration in July 1983, the agricultural research station in Cinzana, Mali has established a relevant mandate, a well-focused program, and a functional organization within a complex national agricultural research system (NARS). The station is well staffed (some 10 researchers and 20 technicians), competently managed, under sound leadership, and has generated new and useful technologies. More importantly for present purposes, Cinzana is an example of a unique approach to donor and technical assistance.

In its founding years the station benefited from joint donations and technical support from the United States Agency for International Development (USAID), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), and the Swiss CIBA-GEIGY Foundation for Cooperation with Developing Countries. Most recently, the CIBA-GEIGY Foundation has been the main provider of external financial support and very limited technical assistance. In this, the Foundation, a philanthropic arm of the Swiss multinational chemical corporation, is demonstrating how the private sector can support research oriented towards small-scale, poor farmers in sub-Saharan Africa.

The Cinzana research station is often cited as a model of international cooperation. Reviews of the station have revealed a series of key factors in its success. Taken together, these factors provide some lessons for successful external support to developing-country agricultural research institutes. This Briefing Paper presents some of these lessons. A first lesson for donors is that research requires a long-term financial commitment of at least 15–20 years and a willingness to fund non-salary, recurrent expenditures. A future important lesson is that a research station's relevance may be jeopardized if its program does not continually adapt to the needs of its target farming community. Private-sector involvement can facilitate both sustainable support and adaptability. A final section of the Briefing Paper highlights the evolving role of the CIBA-GEIGY Foundation in supporting the Cinzana station. NARS leaders as well as decision makers in industry will benefit from these lessons and may find opportunities to apply them under their own conditions.

A New Venture in Agricultural Research

The agricultural research station in Cinzana, Mali began operations in 1983. The Malian government, USAID, ICRISAT, and the CIBA-GEIGY Foundation for Cooperation with Developing Countries were the four partners involved in planning, building, and operating this new public-sector venture in agricultural research. In constructing the station, USAID and CIBA-GEIGY bore the bulk of the capital costs, while ICRISAT and the Government of Mali sited and designed the facilities.

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The station was designed to be an integral part of the Malian agricultural research system, operated by the Malian government and staffed by Malian personnel. The non-Malian partners provided advice, technical assistance, and funding. ICRISAT provided scientific advice. Funds were provided by USAID and the CIBA-GEIGY Foundation, which funded equipment, vehicles, and recurrent operating expenses.

The four partners continued their relationship until 1990, when USAID and ICRISAT terminated their support. This was not because of dissatisfaction with the project. Rather, they wanted to focus their resources on projects with regional, as opposed to largely national implications. Indeed, in their final project evaluation both USAID and ICRISAT urged CIBA-GEIGY to continue funding the Cinzana research station, and to provide additional funds to fill the gap arising from their withdrawal. After its own internal review of the situation, the CIBA-GEIGY Foundation undertook to fill this gap and, provided the center's performance warranted it, to provide sustained support over the foreseeable future.

CIBA-GEIGY now has been involved in the project for some 15 years. While other donors are involved in supporting particular research projects at the station, CIBA-GEIGY has been the major external partner since 1990. Thus far, the Foundation has contributed about five million Swiss francs. Under the current five-year contract (1990–95), it provides the station 500,000 Swiss francs yearly. Essentially, the Malian government pays staff salaries, and CIBA-GEIGY provides between 80 and 90 percent of the station's operating funds.

Establishment and Management of the Project

Focus. In 1979, the CIBA-GEIGY Foundation set out to initiate an agricultural research project to benefit small-scale African farmers. The head of agricultural research in Mali suggested that the Foundation help to establish an agricultural research station in the Malian Soudano-Sahel. From the beginning the objective was clear: to establish a national agricultural research station for the improvement of millet-based agriculture. With that mandate, in 1980 Mali's Ministry of Foreign Affairs gave the CIBA-GEIGY Foundation official status as a nonprofit technical assistance agency.

Repeatable Lesson: A common, well-focused objective should be defined early, with clarity on the part of both the donor and the host country.

Continuity. During the construction of the station, CIBA-GEIGY seconded, on a periodic basis, a civil engineer from its Basel headquarters to help oversee the work and to follow through on purchases. Upon completion of construction, the Foundation created four part-time support positions: project manager, research support scientist, station management support, and electric engineer. These are filled by staff sent from CIBA headquarters. Each of these positions requires an average of 10 days per year spread over one or two trips.

The CIBA-GEIGY support persons are associated on a long-term basis with the Cinzana project. Accordingly, they are very familiar with their Malian counterparts and with specific needs at Cinzana. Built-in, long-term expertise ensures pertinent, timely support from the Foundation to the project. However, because external support is periodic, Cinzana's Malian staff are able to demonstrate leadership and initiative. Because there are no expatriate staff salaries to bear, the Foundation's financial support is focused almost entirely on Malian on-station expenses.

Repeatable Lesson: Long-term technical assistance is essential for research projects. The benefit of long-term assistance can be sustained by using persons seconded for short periods but with lengthy, well-defined associations with the project. This formula ensures pertinent expertise and continuity at a minimum cost for expatriate support. At the same time, it fosters the full-time responsibility of national staff. Local staff enjoy their own successes; they also make their own decisions and mistakes, but with sustained support as it is needed.

Working partnerships. At the beginning of the project, a board of directors was established to oversee the development of the research station. Membership is the head of agricultural research in Mali, the Cinzana station director, the station accountant, a CIBA-GEIGY Foundation representative, and a representative from another donor to the station. Until 1990 an ICRISAT staff member served on the board. With the termination of ICRISAT's involvement and an increase in Dutch project funding, a Dutch representative has served on the board since 1992.

The role of the board is to oversee finances, maintenance, and the research orientation of the station. The board meets formally once each year, but interacts informally more regularly. Over the years the board has served to foster clear communications, to provide a forum to settle differences of opinion, and to give moral and political support to the station's director.

Repeatable Lesson: The creation and operation of a board of directors composed of both Malian leadership and representatives of key donors and support groups enhances transparency in finances and management and provides a legitimate forum for input from all key partners regarding the repartitioning of the budget. This also ensures that donors have a forum in which to insist on result-driven research.

Physical Establishment of the Station

Site choice. The station site was decided after several months of reconnaissance studies in the Segou area of Mali. The chosen site contains all of the major Malian agricultural soil types on one contiguous piece of land. It also offers the possibility of growing good crops of both millet and sorghum, and is situated in close proximity to a mix of traditional farming systems and ethnic groups in nearby villages. Accessibility by road also was an important consideration.

Repeatable lesson: In hindsight, the most important element of siting the station was its reasonable proximity (5 km) to a paved national road with a fairly good laterite access road. Of all the Malian agricultural research stations, the Cinzana station has the best accessibility.

Water. Only after commencing building construction was it discovered that the groundwater recharge was insufficient to permit an adequate water supply from wells dug on the station. Rather than "making do" with a feeble water supply, or having water hauled onto the station in cisterns, project leaders decided to find an adequate water supply in the proximity and to pipe water onto the station. A Swiss hydraulic engineering team was brought in and discovered a very adequate underground tributary at 12-meter depth, seven kilometers from the station. Buried pipe was installed and turn-out valves were provided intermittently along the pipeline to allow for irrigated isolated fields. An electric pump was installed at the well site and an elevated water storage tank was erected on the station.

Systematic annual water analyses over the past 13 years have confirmed pure, uncontaminated water. The availability of pure water has translated into an unusually low incidence of intestinal parasites and other ailments among station personnel and their families residing on the station. Adequate water has been a major factor in attracting good Malian researchers to reside on the station. Pure water has contributed to excellent hygiene standards on the station. Also, the regular, reliable water supply has enabled dry-season breeding nurseries to be established and for seed production to be increased every winter. Irrigation capacity has enabled the Cinzana breeding programs to produce two generations per year. It additionally has given the station the flexibility to quickly multiply seed of promising experimental varieties of millet, sorghum, cowpeas, and groundnuts.

Repeatable lesson: The initial expense and bother of finding a good water supply is well worth the money and the effort expended.

Housing. In addition to low-cost but adequate housing for principal and support staff, a conference hall and guesthouse were constructed on the Cinzana station. Initially four rooms, the guesthouse has now been expanded to eight rooms. The availability of this clean, comfortable accommodation attracts visiting researchers and encourages them to spend adequate time at the station to complete all necessary tasks. The guesthouse has been used by dozens of students, both Malian and expatriate, doing thesis work. The conference hall is used not only for Cinzana staff meetings, but also has been the site of numerous regional meetings and training sessions.

Repeatable lesson: The construction and operation of a clean, comfortable guesthouse attracts a regular flow of visiting scientists to the station. This enhances the value of the research done and provides a stimulating environment for the regular exchange of ideas between visitors and staff.

Stable and corral. Animal traction is the standard tillage and cultivation power used on many traditional farms in the Segou area. Research leaders therefore integrated animal and mechanical cultivation techniques for experimentation on the Cinzana station. Animal traction training techniques were imported from India whereby one person leads the animals using voice commands. Adequate infrastructure was provided for the animals, which average about 50 head. In addition to meeting its own traction needs, Cinzana regularly supplies traction animals to other Malian research stations. The animals provide routine farm power, serve as tools for improving farming techniques, serve at training sessions, and provide manure for compost experiments.

Repeatable lesson: The importance of animal traction may justify the provision of adequate infrastructure for farm labor animals.

Fencing. In the Malian countryside, freely roaming animals frequently damage farmers' fields by eating plants or walking through fields. The precision of agronomic research cannot tolerate such damage. Cropped fields must be protected and adequate pasture must be ensured for the station's herd. To these ends, a 1.6 meter fence was erected around the station's perimeter. As a public road transects the station, the total fence perimeter is 10 kilometers. The fence mesh is small enough to keep out sheep and goats. Adequate gates are provided for vehicles and pedestrians. The fence is regularly monitored and repaired when necessary. Bushes planted along exposed sections break the wind and prevent damage. Now, 13 years after construction, the fence and gates are still in excellent condition.

Repeatable lesson: The erection and maintenance of adequate fencing provides experiment fields with excellent protection against animal damage and ensures the protection of pasture for station animals. The fence is especially important for protecting irrigated crops during the winter, when local farm animals are allowed to roam free.

Baseline studies. A series of baseline studies to describe and quantify water, soils, socioeconomics, crop varieties, and farming methods was carried out at the beginning of Cinzana station research. Results of these studies can be compared with similar surveys to be conducted in future years. In 1980, in conjunction with the Swiss hydrologic exploration, Cinzana researchers surveyed the wells in the villages surrounding the station. Estimates were made of high- and low-water

levels during the year. In 1982–83 an extensive soil survey was conducted on all five of the Cinzana soil types. A station soils map was carefully drawn with references made to permanent markers. That map since has been used to record an accurate crop and fertility history. In addition to the map, a soil "library" was collected, with samples from 300 sites at three depths each. The soil survey also provided contour information that was used to construct permanent earthen terraces. Maintained with grass since 1983, these have held firmly against erosion. Finally, in 1984 a Malian team of economists conducted an extensive socioeconomic survey designed in collaboration with ICRISAT. The survey aimed to produce data comparable with other such studies in the Sahel. Villages within a 50 kilometer radius of the Cinzana station were characterized for ethnic and household organization, field sizes, cropping patterns, and income sources and levels. In 1989 a follow-up survey was conducted in many of the same villages. Using the results of both surveys, adoption rates of some agronomic techniques were readily and accurately detected. A third follow-up study was carried out in 1994.

Following the 1984 socioeconomic survey, millet varieties were collected and millet varietal preference was surveyed. These samples and information have been the basis for the establishment of varietal and agronomic reference checks in experiments carried out on the Cinzana station.

Repeatable lesson: The information collected at the onset of station operations provides a reference point for detecting changes in water levels, soil fertility, and village socioeconomic conditions, as well as for calculating technology adoption rates.

Establishment of an On-Farm Research Program

The need for an on-farm testing program became evident in 1985, when researchers discovered that some station-developed intercropping techniques were complete failures in farmers' fields. The major reason was the significant difference in soil fertility between farm and station fields. On-station millet yields were regularly two to three tons, while they rarely surpassed one ton on farmers' fields. In addition, researchers discovered that under farm conditions many millet and sorghum varieties developed on-station gave significantly lower yields than local varieties.

Before 1985, the Cinzana station conducted research only on the station itself. On-farm research was designed, planned, and executed by a group of agronomists based in Mali's capital, Bamako. After considerable pressure from the board of directors, a position was created at Cinzana for an agronomist to carry out on-farm trials designed by the Bamako-based group. The Cinzana agronomist gradually was given more autonomy until, from about 1991, on-farm experiments were designed, executed, and reported entirely by Cinzana staff.

By 1993 Cinzana's on-farm research program included three village "antennas," with station personnel living temporarily in village centers during the crop season to follow test plots. The on-farm program now embraces a network of more than 50 on-farm locations supervised both by the station agronomist and by collaborative extension services. The on-farm research program also plants several demonstration fields along major roads and entrances to weekly markets.

The on-farm agronomist also serves as the station's liaison person with regional extension agencies, and regularly participates in extension planning meetings, training activities, and farmer demonstrations. The agronomist also ensures the transfer of accurate information and pure seed once the technologies are confirmed through on-farm tests. Technology transfer from the Cinzana station has been facilitated by regional extension agencies that have received ample funding through the World Bank and the International Agricultural Development Fund (IFAD). Locally adapted, proven technologies suggested by the Cinzana station have been backed by the funding agencies, which are determined to make visible, measurable, on-farm impact.

Repeatable lesson: The creation, support, and operation of an on-farm testing research program play a determinant role in assessing the relevance of station research as well as in directly contributing to the efforts of local extension agencies. It is essential that the on-farm testing program be planned locally, rather than by a centralized group in another location.

Research Planning and the Technology Pipeline

Until 10 years ago, most Malian food crop research was directed by scientists headquartered at Sotuba in Bamako. Stations such as Cinzana were merely testing sites for Sotuba-designed experiments. With its attractive infrastructure, however, many of Mali's better scientists were enticed to transfer to and reside on the Cinzana research station as early as 1983. Before coming to Cinzana, the station's first director had been responsible not only for millet breeding, but also oversaw the strategic direction of the other food crop breeding programs in Mali. Cinzana soon became the base for all millet research.

Initially, each year's research results were reviewed at an annual national research meeting. At the same meeting the research program for the coming year was approved. The meeting, however, was broad, national in scope, and did not provide a sufficiently detailed overview of the flow of technologies from discovery to adoption by farmers. With the

creation of the on-farm research group and the on-farm success of Cinzana's early maturing cowpea varieties, it became obvious that an annually updated technology pipeline was needed. This pipeline would track the flow of technologies through stages, from the definition of research objectives and exploratory testing to extension on farms.

In 1987, a technology pipeline was designed for the Cinzana station based on existing Malian procedures and comparable to the technology flow in a commercial seed company (tables 1 and 2). Cinzana technologies are categorized as varietal, technological, or plant protection. Chronologically, the stages in the pipeline are definition of objectives, station exploratory tests, station preliminary trials, station advanced trials, on-farm confirmation, on-farm pre-extension trials, and extension.

In addition to clarifying planning and facilitating monitoring, the pipeline overview highlights research and extension successes, and serves as a vehicle for clear communication among research's stakeholders.

In its technology pipeline, Cinzana innovated by establishing an "exploratory testing" stage. Researchers are allowed to test any innovative, preliminary ideas in a single replication for one year—just to check the feasibility of an idea. If preliminary results look promising, then the theme may become a formal, replicated on-station research theme. If not, the theme is thrown out without having spent significant resources. Exploratory testing has been an effective method for identifying new agronomic intercrops such as millet-manioc and millet-yam, both of which have successfully gone on to formal station experimentation.

Repeatable lessons: The definition of an annually updated technology pipeline brings transparency to station research planning and monitoring. It also clearly identifies for extension agencies those themes that will soon reach on-farm application. The flexibility for researchers to do exploratory testing encourages innovation at minimum expense.

Table 1. Blueprint of the technology pipeline of a private seed company compared with that of the Cinzana research station

Private seed company		
Stage of development	**Duration (years)**	**Locations**
Commercial sales	5-15	varies widely
↑		
Product development (large on-farm plots)	2	minimum 12 average 20
↑		
Small plot trials	3	6-14
↑		
Varietal or technological development	3-4	1 station
↑		
Definition of objectives (interdisciplinary encounters)	-	3-4 times per year

Public agricultural research in Mali		
Stage of development	**Duration (years)**	**Locations**
Extension	long term	varies widely
↑		
Pre-extension and multilocational tests	2-3	5-12
↑		
Preliminary and advanced tests	4-6	6-10
↑		
Exploratory testing	1-2	1 station
↑		
Definition of objectives (interdisciplinary encounters)	-	1-4 times per year

Research Results and the Technology Pipeline

The Cinzana research station as an institution has evolved from focusing only on improving millet to addressing a broader range problems facing the Segou area farming communities. Cinzana research results are best outlined in its current technology pipeline (table 3). Key technologies that have reached on-farm adoption are presented in chronological order.

Key technologies at the adoption stage

Early cowpea varieties. Starting in 1984, the station produced cowpea foundation seed that was later grown by Malian state seed production farms. Some of the seed produced at Cinzana escaped informally in the hands of seasonal workers. Within two years there was a strong demand for the new varieties. The two best adapted varieties were selected at Cinzana. They were obtained from the International Institute of Tropical Agriculture (IITA). By 1986, an IFAD-funded project had diffused several tons of seed to farmers in the region along with appropriate insecticides. The socioeconomic survey of 1989 determined a full 45 percent adoption rate of the new cowpea varieties within a 50 kilometer radius of the station.

Cowpea-millet flour blends for weaning foods. Preliminary research done by the food technology group at Sotuba indicated that a 25 percent blend of cowpea flour in weaning and adult food was undetectable by consumers, while doubling the

Table 2. Stages, objectives, tasks, and measures of progress in the Cinzana research station's technology pipeline

Technology pipeline of the Cinzana research station, Mali				
Stage of development	**Objective**	**Duration (years)**	**Tasks**	**Measure of progress**
Extension	Meet farmers' needs	-	Communication and demonstration	Adoption rates
↑ Pre-extension	Final confirmation of technology	2-3	Test on-farm quality information packages	Useful feedback
↑ Multilocational tests	Confirm technology's performance on-farm	2-3	Conduct on-farm trials	Postive results
↑ Advanced testing	Confirm technology's performance on-station	2-3	Conduct research station trials	Postive results
↑ Preliminary testing	Evaluate the technology's potential	2-3	Conduct research station trials	Postive results
↑ Exploratory stage	Identify promising varieties and techniques	1-2	Conduct preliminary observations of innovations	Preliminary success
↑ Definition of objectives	Provide research focus	-	Organize interdisciplinary encounters	Clear research focus

protein and lysine content of the food. With the unexpected success of the new cowpea varieties, there was suddenly an abundance of cowpeas in local households. Cinzana researchers confirmed the Sotuba group's findings in villages and dispensaries around Cinzana. A brochure and poster (in both the French and Bambara languages) were created with the assistance of the CIBA-GEIGY Foundation, and the theme was launched for extension in 1989. Since then, radio information spots, demonstrations, and training sessions have been conducted. The Cinzana station leadership on this theme has had a national impact.

Alternate row millet-cowpea intercropping. Following initial failures with more complicated schemes, Cinzana researchers found a simple intercropping of alternating rows of millet and cowpea to be a success. On-farm tests indicate a consistent 10 percent increase in total grain yield per area compared with crops of only millet or only cowpeas. In addition to the yield advantage, the technique offers flexibility in cultivation and harvest, excellent wind-erosion control, and a built-in blueprint for millet-cowpea rotation whereby the farmer simply plants millet on the ridges where cowpeas were grown in the preceding year. This technique was launched for extension in 1991 and was being adopted with great success by the summer of 1993.

Toroniou millet variety. Toroniou is one of 850 local millet varieties screened for various characteristics in 1981–83. Toroniou was found to have remarkable tolerance to stem borer, as well as wide adaptation within Mali. Toroniou originally came from a remote village in the Dogon country. Until recently, it was not known in the Segou region, although it is very well adapted there. Toroniou was reselected and purified by Cinzana personnel, tested on-farm, and has been widely

Table 3. Detail of the 1993 technology pipeline of the Cinzana research station

Technology pipeline of the Cinzana research station, Mali 1993			
Stage of development	**Varietal**	**Agronomic**	**Pest control**
Extension	Toroniou millet Early cowpea varieties (KN-1 and Gorom-Gorom)	Alternate row millet-cowpea intercrop Composite millet-cowpea flour for weaning food "One man, one team" animal traction method	Apron-Plus seed treatment Striga control in cowpea by genetic resistance (Gorom-Gorom)
↑ Pre-extension tests (on-farm)	ICRISAT millet ICMV-88-102-04	Rotations within millet-cowpea intercrop Millet-groundnut intercrop	Combined effect of manure application and Apron-Plus seed treatment
↑ Multilocational tests (on-farm)	Early groundnut varieties Sorghum variety	Managed farmyard manure use	-
↑ Advanced testing (on-station)	Millet and sorghum selections Virus-resistant manioc selection	Millet-manioc intercrop Zizyphus living fences	-
↑ Preliminary tests (on-station)	Varietal crossing in millet, sorghum, cowpeas, and groundnuts	-	Selection and recombination of mildew-resistant millet Selection and recombination of leaf-disease-resistant sorghums
↑ Exploratory tests	Introduction of orange-flesh yams in millet-yam intercrop	Millet-yam intercrop Managed farmyard manure in intercrops Effect of timing on manure applications Vitamin analyses of baobab fruit and orange-flesh yams	-

extended by extension agents. On-farm tests indicate average grain yields about 10 percent higher for Toroniou compared with the local varieties.

Mixed technology package. Toroniou was extended in 1993 in a technology package along with the millet-cowpea intercrop, a Striga-resistant cowpea variety (Gorom-Gorom), and the use of an insecticide-fungicide seed treatment called Apron-Plus. This technology package results in yield gains as high as 50 percent compared with local varieties and production techniques, even without additional fertilizers.

Apron-Plus seed treatment. Apron-Plus is a CIBA-Switzerland seed treatment mixture of one fungicide and two insecticides. In the mid 1980s it was successfully introduced in Nigeria to control downy mildew on maize. As downy mildew is a major millet disease in Mali, Apron-Plus was tested on-farm by Cinzana staff beginning in 1988. In four years of on-farm tests, Apron-Plus improved yields an average of 30 percent due not only to mildew control, but also to soil insect control, bird repulsion, and a slight but detectable growth boost to young seedlings. It ensures seedling establishment from a single planting. Uniform emergence and growth translates into uniform seed setting and plump grain formation. These encouraging on-farm results have prompted the CIBA seed treatment unit and plant protection farmer support team to become interested in developing the product commercially in West Africa for millet. After an initial prelaunch of 250 kilograms (sold in 10 g sachets) in 1992, more than 2.5 tons were sold in 1993, and five tons were planned for sale in 1994. In 1993 alone, an estimated 12,500 extra tons of millet were harvested in Mali thanks to the seed treatment. The CIBA-GEIGY Foundation did not intend the Cinzana project to bring commercial benefit. Likewise, Apron-Plus was not developed with millet as a target crop. But Apron-Plus works well on millet, and the Cinzana station effectively measured the benefits. Now Malian millet farmers reap the results.

Key technologies in the pipeline

New millet and sorghum varieties. After more than 10 years of breeding work, new experimental millet and sorghum varieties appear promising enough for on-farm testing. The CIVAREX series of millets are medium height (about 1.5 m while local varieties are 2–3 m) and offer yield potential slightly greater than local varieties. Selections were grown on-farm in 1994. The sorghum varieties are local tall varieties and high-yield short-statured varieties, but with significantly higher yield potential than the locals. In both cases, the research objective is to establish intensive and sustainable intercropping systems.

Rational use of manure and compost. Experiments are now under way to maximize the fertilizer effectiveness of farmyard manure by composting it with straw, and by changing the method of application. Already, on-farm trials indicate that application of only 3–4 tons manure per hectare improves millet yields on the order of 20 percent. In exploratory tests, application placement, amount, and timing are being varied on the millet-cowpea intercrop in order to optimize the fertilizer effect while minimizing the amount of manure applied. The objective is to produce a manure recommendation that can be used to further enhance the millet-cowpea intercrop and crop rotations.

Use of living fences. The agroforestry group at Cinzana discovered a native bush (Zizyphus sp) that establishes well without depressing yields of adjacent millet crops. The berries produced by the bush are used as a household condiment. The use of living fences to protect areas against roaming animals is an idea welcomed by farmers. Traditionally, winter hedges are constructed from cut branches, competing with firewood uses. The first Zizyphus seedlings were distributed to farmers in 1994. Methods are now being developed to enable farmers to grow their own Zizyphus tree nurseries.

Millet-manioc and millet-yam intercropping. Both the millet-manioc and the millet-yam intercrops have proven very promising in on-station experiments. Success with these methods may lead to the widespread introduction of manioc and yam propagation stocks, now lacking in the Segou area. Manioc cuttings were distributed to some farmers in 1994.

Social marketing of natural vitamin sources. Fruit from the Baobab tree contains a very high concentration of vitamin C (2200 ppm), and are found in abundance in the Sahel. While people do use the fruit for drinks and gruels, they are unaware of its vitamin content and health benefits. Similarly, the orange-flesh yams introduced in the millet-yam intercrop contain a high level of vitamin A. Vitamin A deficiency is a chronic health problem in rural Mali, yet the vitamin A benefits from orange-flesh yams is not widely known. In collaboration with agronomists, foresters, and food technologists from other institutes, Cinzana researchers will promote a social marketing message of these benefits in 1995–96, once the millet-yam intercrop is ready for on-farm testing.

Repeatable lessons: To retain its relevance, a research station must continually update its core program to adapt to the changing needs of its target farming community. An interactive link between station and on-farm research helps to maintain links with farmers, and is determinant in a station's ability to produce appropriate technologies. Finally, the use of a technology pipeline can be vital to maintain the focus of research on well-defined technology packages and time frames.

The Evolving Role of the CIBA-GEIGY Foundation

Initially, the CIBA-GEIGY Foundation established a number of criteria about the type of agricultural project it might support: the project should be in a poor country, it should benefit poor farmers, it should increase food production, and it

should be part of a government effort rather than an expatriate enclave. Additionally, the project was to be noncommercial in the sense that it was not intended or expected to develop market opportunities for products made by the CIBA-GEIGY corporation in Switzerland. The decision to support the Cinzana research station met these criteria.

The Foundation's role evolved as circumstances changed. Initially, it was to join USAID in cofinancing the management and operation of the research station. The Foundation also provided some technical assistance, especially with regard to the layout and management of the station's workshops and the maintenance and operation of farm equipment. The technical aspects of the Cinzana research program were assisted by staff from ICRISAT. CIBA-GEIGY also had a representative on the research station's board of directors, which has met infrequently to review station operations. With the withdrawal of USAID and ICRISAT, the Foundation took on a bigger role in the agrotechnical aspects of the station's work.

Over the long run it is likely that CIBA-GEIGY will continue to be called upon to provide more scientific support to the researchers at Cinzana. Many of these scientists are recent graduates who could benefit from the advice and views of the scientific staff of the CIBA-GEIGY corporation itself. Such support could be pivotal in reducing the sense of isolation of researchers and enhancing the quality of research.

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The "CIBA-GEIGY Foundation" mentioned in this paper refers specifically to the CIBA-GEIGY Foundation for Cooperation with Developing Countries. There are several CIBA-GEIGY Foundations.

About ISNAR: The International Service for National Agricultural Research (ISNAR) assists developing countries in making lasting improvements in the performance of their agricultural research systems and organizations. ISNAR promotes appropriate agricultural research policies, sustainable research institutions, and improved research management. ISNAR's services to national research are ultimately intended to benefit producers and consumers in developing countries and to safeguard the natural environment for future generations. A nonprofit autonomous institute, ISNAR was established in 1979 by the Consultative Group on International Agricultural Research (CGIAR). It began operating at its headquarters in The Hague, the Netherlands, on September 1, 1980.

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