...Reliable roots

other farmers see its performance and help themselves.

In the savannah of northern Cameroon, root crops play more of a backup role in case of crop failure. In the Adamaoua region, however, where dark volcanic crags overlook expanses of plateau, cassava is still the primary carbohydrate staple. The area's population of semi-sedentary livestock herders had been neglected by food crop researchers until CNRCIP turned its attention northward in 1981, with IITA assistance.

In just a few years, improved sweet potato varieties became the first new food crops to be distributed in the region. They were enthusiastically acclaimed by farmers for their high and stable yields, resistance to disease and weevils, and good taste. In 1985, the program also began distributing three improved cassava lines, which yield 25 to 50 percent better than local types.

"Nothing passes 'em!" a farmer near Ngaoundere, Adamaoua's largest town, tells visitors about the new sweet potatoes. He says that he and his neighbour, to whom he passed planting material, now grow the crop for commercial sale -- a change from the past, when farmers grew the low-yielding local varieties mainly for home consumption.

The outreach approach of Cameroon's root crop scientists gives them a thorough grasp of the country's different growing regions and the varying needs of farmers. Agricultural scientists from around the country all agree on the importance of networking as a way to ensure that improved varieties reach remote farms. This means keeping in touch with government extension workers, influential farmers, village chiefs, local farmers' groups, religious missionaries, and representatives of parastatal organizations.

CNRCIP's campaign to distribute new varieties and train farmers in new technologies is now in full swing. The scientists believe, though, that success is not measured only by the number of cassava stems distributed or extension agents trained. "It's also a question of attitude," explains Malachy Akoroda, an IITA scientist in the Cameroon program. "If we sensitize farmers so they're eager to take our varieties, then we have created the potential for rapid change in the future." ■

WATER QUALITY TESTING IN THE TROPICS

Western-style lab tests for determining drinking water quality are a major problem for many developing countries. They are usually too expensive, too complicated, and inappropriate for rural areas where most people live. A network of researchers from several developing countries is now examining promising alternative tests that are cheaper and easier to administer.

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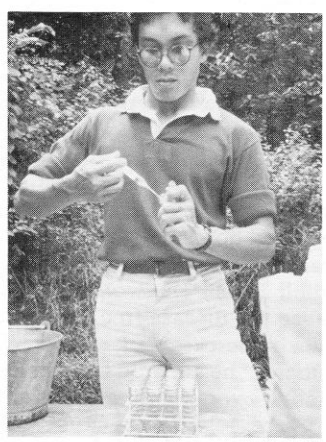
In villages and cities around the world, new wells, pumps, reservoirs, latrines, and sewage systems have been installed during the last decade in pursuit of the goals of the International Water Decade. But unless these water sources are protected from contamination and proper monitoring and maintenance procedures instituted, all these efforts will have been in vain.

Among the ingredients of a realistic program to assure water quality are simple tests for determining microbiological properties of water, and a scheme for classifying water sources according to their health risk to users.

Few developing countries, however, have enough lab space, equipment, chemical supplies, or trained personnel to carry out the sophisticated water-quality tests routinely done in the industrialized world. Long incubation periods and lack



Technicians collect water samples to test for coliphage. Small amounts of dried E. coli, nutrient medium, and a gelling agent are combined in a twenty-milliltre water sample.

Researchers at the University of Malaya in Kuala Lumpur use an insulated water container that keeps the water sample at the right temperature for incubation. The kit was designed for use in cool mountain villages.

of quick transport of time-sensitive samples to the lab are added hurdles.

Because of these factors it often takes a serious outbreak of waterborne disease to push officials into action -- an approach not unlike closing the barn door long after the horse has bolted.

Unrealistic safety standards also pose a problem, since developing countries have difficulty meeting international criteria for the microbiological and chemical quality of water. If they were adhered to, many water sources, especially ones that rural people depend on, would have to be closed down. For this reason, "Ministries of Health tend to allocate too few resources to water quality control programs," says a recent report on an international water-quality research project funded by IDRC.

Researchers have been examining several simple, inexpensive testing techniques to see whether they are suitable for use in developing countries. They have been assisted by experts from the National Water Research Institute, part of Canada's Ministry of the Environment.

The project was formulated following a 1983 seminar in Singapore sponsored by IDRC. Last February, representatives from eight countries -- Brazil, Peru, Chile, Egypt, Morocco, Thailand, Malaysia, and Singapore -- met in Ottawa with U.S. and Canadian water quality specialists to review their progress.

The microbiological quality of water is tested for bacteria known as coliforms, including ones of fecal origin. In particular, the presence of the bacterium *Escherichia coli* is generally considered to be an indication of fecal contamination. This, however, has been called into question following the recent detection of naturally occurring *E. coli* in tropical soils known to be free of fecal matter.

The presence of fecal coliforms like *E. coli* -- found in the bowels of human beings and other mammals -- signals the possible presence of other dangerous bacteria, viruses or parasites transmitted by people. Both fecal coliform counts and total coliform counts are used to assess the potability of water.

Existing tests for detecting coliforms are based on sophisticated and expensive technology, often requiring water samples to be incubated for a long period. In Malaysia, for example, the coliform test kit currently used costs over US$3000. At that price, each district can afford to test rural community water sources only about once a year.

A simpler alternative for testing water quality is to detect "coliphages" -- viruses that accompany coliforms and prey on them. A Malaysian research group is designing an inexpensive, portable kit based on this technology. (See box.) One recommendation from the Ottawa meeting was to improve the sensitivity of this promising water test.

The international network of researchers are also investigating other tests. Two of these -- the hydrogen sulphide (H_2S) test and the Presence/Absence (P/A) test -- are highly promising.

In the H_2S test, a paper strip in a tube is incubated for one to three days. If undesirable bacteria are present, they will produce hydrogen sulphide which darkens the paper strip.

Researchers at the Ottawa meeting reported that the H_2S test has a long shelf life, is the least expensive of the tests and the easiest to perform. They recommended it be modified into a "quantitative test", that is, one that indicates the degree of water contamination.

The P/A test, in which a water sample is mixed with a special broth medium and incubated overnight, was found useful for testing treated water where minimal contamination is expected. Like the H_2S test, though, it would be more useful if it were a quantitative test.

An encouraging finding of the research group is that the coliphage, P/A, and H_2S tests all appear to give good results even when incubation is done at ambient temperatures -- between 20 and 30 degrees -- rather than at the standard 35 degrees. The research group has recommended field evaluation of the tests to set these technologies on a firm track for future application in developing countries. ■

The coliphage test kit

Dr Wang Chee Woon, associate professor of biochemistry at the University of Malaya in Kuala Lumpur, Malaysia, has been developing a simple coliphage-detection kit as part of the IDRC-sponsored water quality research network.

He says the kit is much simpler and more economical than commercial kits and it permits more water points to be tested for microbiological quality. It is designed for use by rural communities and Ministry of Health personnel, and can be used by anyone with three years of high school education.

Dr Wang and his colleagues initially tried the coliphage technique on 200 water samples. Then they produced and tested the first prototype kits, each capable of handling eight samples. A second kit, with a 10-sample capacity, is now in the works.

A major advantage of the coliphage test is that the incubation temperature of the water sample is relatively low: 27 to 31 degrees Celsius, which is just above room temperature. Standard coliform tests, on the other hand, require a temperature of 35 degrees. The latest kit design contains an insulated water sample holder for use in cool, mountain villages.

The tiny disks of filter paper hold the specially dried *E. coli* host bacteria, extending its shelf life to upwards of three months. The mixture is poured into four petri dishes and left overnight to incubate. Round clear spots (or "plaques") in the dishes indicate areas where the host bacteria have not grown because of the presence of coliphages. The larger the number of spots, the more coliphages there are in the water sample, thus indicating contamination with fecal coliforms that include *E. coli*. ■

Gerry Toomey