Figure 1. Professor Lima, technicians Julita Maria Frota Chagas and Antonio Apoliano dos Santos working with centrifuge.

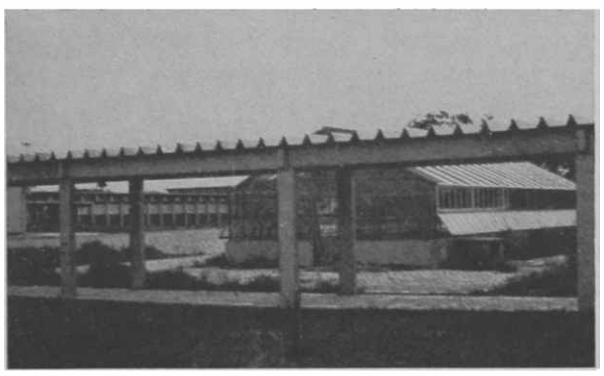

Figure 2. Greenhouse being converted to a screenhouse for plant virus research.

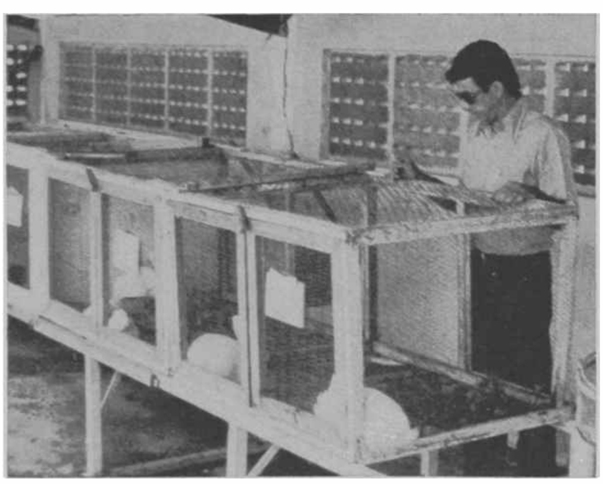

Figure 3. Professor Lima and rabbits to be used in serological studies of plant viruses.

Establishing a Plant Virus Research Program in N. E. Brazil

*by Merritt R. Nelson & J. Albersio A. Lima**

While the importance of plant virus diseases have long been recognized in the state of Ceara, Brazil, it was not until the beginning of 1973 that a full fledged active research program was begun. This new program was possible because of the University of Arizona's contract with USAID for furthering development of the Esocla de Agronomia, Universidade Federal do Ceara. This contract made is possible for Professor Lima to receive training in plant virology at Tucson and also possible for his major professor, the senior author, to spend 6 weeks in Ceara, at the conclusion of Professor Lima's training, to advise him in the initial phases of the work.

As with any plant disease the first problem encountered with a virus disease is identification of the pathogen. This is particularly difficult with a virus disease because the properties of viruses useful for identification are those relating to their resemblance to chemical molecules. A microscope and cultural facilities are usually adequate for working with most other plant pathogens. Such facilities have long been available in Ceara. Under ideal conditions ultracentrifuges, spectrophotometers, an electron microscope, greenhouse facilities, growth chambers, animal rooms and a well equipped laboratory are desirable for virus work. The challenge of this project was to bring modern virology to Ceara with far less equipment. Ironically enough, recent advances in virus methodology have made dependence on high priced "complicated machines" less crucial for an up-to-date research program. In addition to having some equipment available, it is also important to establish and maintain contacts with virologists in all parts of the world so that exchanges of materials with scientists working on similar problems be maintained. Often through such contacts and exchanges of materials, virus identifications and characterizations can be made that would not be possible any other way.

The easiest and most positive way to identify plant viruses is by serological tests. Such tests are simple to perform and require little equipment. The principal difficulty is that the specific virus antiserum needed to conduct such tests must be prepared in a warm blooded animal using an identified, purified, concentrated solution of the specific virus in question. This solution is injected into the animal and, while no infection takes place, the animal (usually a rabbit) develops specific antibodies to the virus. These antibodies are obtained by bleeding the animal (without killing it) and separating the serum bearing the antibodies from the blood cells.

There are two ways of obtaining antiserum. One is to make it yourself as described above; the other is to request small samples of antisera from other researchers who have worked with the same or similar viruses. In establishing the program in Ceara the latter method of obtaining antisera was used initially (22 obtained) and the former method is being developed for future and sustained activity.

The technical developments required to support antiserum production revolves around the methods required for virus purification. New methods of precipitating viruses with polyethylene glycol 6000 have reduced dependence on the high priced "god" of the virus lab, the ultracentrifuge, and made it possible to do much with a low speed (10,000 rpm or less) centrifuge. Such a centrifuge is ideally refrigerated but this is not an absolute necessity. Other equipment needed includes a grinder to extract plant juice, a pH meter and various other common pieces of laboratory equipment. Another essential required is a plant propagating facility in which virus sensitive test plants can be raised and inoculated. It is here that other useful properties of the virus such as symptoms and host range can be determined and where quantities of infected plant tissue for virus extraction and purification are grown. Finally, to pursue the program as outlined, a source of suitable rab- →

**Professor of Plant Pathology, University of Arizona, Tucson; and Professor of Plant Pathology, University of Ceara, Fortaleza, Brazil; respectively.*

Saving Energy

while using appliances

*by Doris Broten**

A recent Stanford Research Institute report states that major home appliances use approximately 5.3 percent of the energy consumed in the U.S. While the energy crisis will not be solved by efficiency moves directed to appliances alone, contributions through appropriate methods of using them can be made. With increased utility rates, reduction of usage will reduce the utility bill.

There are many ways that families can reduce amounts of energy consumed in use of appliances. A few simple skills can be of great assistance.

Skill in reading the nameplate on electrical appliances will show how much energy will be consumed by the appliance. This information along with the amount of time the appliance is in operation can be used to compute the cost of operation.

Sample: A toaster oven nameplate shows that it requires 1500 watts of power. Since 1000 watts is equal to one kilowatt, the toaster oven uses 1.5 kilowatts. In one hour, the toaster would use 1.5 kilowatt hours. (watts x time) If the rate for electricity is 3 cents per kilowatt hour, the cost for operating the toaster oven for one hour (assuming it is drawing power the entire time) would be 4½ cents.

This information can be used in making a choice of which piece of equipment to use to do a particular job. For instance, assume an electric skillet or a toaster oven (1200-1400 watts) is available in addition to a regular (built-in) oven (4800 watts). For certain dishes, especially small portions, the portable appliance will require less energy than the regular oven.

Skill in planning can also benefit energy conscious consumers. By utilizing appliances to the recommended capacity, optimum benefit will be obtained. Examples of helpful planning include: washing only full loads; preparing an entire meal in the oven, or baking several things at once; preparing large amounts of food at once and freezing meal size portions for later use; and using dishwasher only when full. One caution should be observed. Use appliances according to instructions provided by the manufacturer. Overloading can harm the appliance and produce less than satisfactory results. This may apply especially in the case of a dishwasher or washer.

The hot water heater is at the top of the appliance list for power usage in the home. Turning down the thermostat can reduce power consumption. A hot water heater requires from 2000-4000 watts for conventional or 6000 watts for a quick recovery model and operates about 4 hours total per day, on the average. Draining the sediment off the bottom of the tank regularly allows the water heater to operate to capacity.

Ranges require large amounts of power. A conventional range requires from 14,000 to 16,000 watts. A single built-in oven requires about 4800 and a built-in surface cooking unit 4800. The larger the burner, the greater the wattage.

Often maligned is the pyrolytic self-cleaning oven. However, current research done by General Electric has shown that this work saving feature is actually an energy saver, too. The oven is well insulated to prevent excessive heat loss during the cleaning cycle, and it actually requires only about 85 percent as much energy as a regular oven for normal oven cooking. This margin of energy conserved is equal to the energy needed for 12 oven cleanings per year. Since the kitchen will stay cooler during regular baking, some savings in air-conditioning may be realized.

Microwave ovens are often promoted as energy savers. It is true that they do require less energy than a conventional oven and are very quick. However, they are not designed to do all cooking normally done in a household. A regular oven still is needed for many preparations.

An automatic clothes dryer requires from 5000-9000 watts. Hanging clothes out to dry will obviously reduce power usage. For permanent press garments, a short cycle with no heat or air dry will tumble wrinkles out. Garments may then be air dried.

Conventional refrigerators (those with freezer and refrigerator space in the same compartment) require less power than frost free models. Keep the refrigerator defrosted. A frost build-up of more than ¼″ acts as insulation and requires the refrigerator to run more. Refrigerators operate more efficiently if the condenser coils are kept clean. Regular vacuum dusting gives best results. A dollar bill can be used to check the seal. If it slips out when closed, replace the seal. A freezer requires the same care as a refrigerator.

To effect any substantial savings, family members must work together. A plan for use of electrical appliances will help each member contribute to the goal of reduction of energy usage.

**Instructor, School of Home Economics.*

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bits and a place to raise them are necessities along with some simple medical equipment available almost anywhere in the world.

With these minimal facilities, either available or promised, the formal beginning of the program took place in early January, 1973.

Armed with 22 antisera to different viruses obtained from investigators at Purdue University, North Carolina State University, Oregon State University and from stocks at the Uni-

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