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16-1 SOME OF MY MOST HELPFUL PERIODICALS. Agricultural Science Digest is published in England by the Massey Ferguson company, a manufacturer of tractors and other farm equipment. I have gotten many good ideas from their 8 page newsletter for Third World farmers. Much of the material is more high-tech than EDN readers can use, and some of it is interesting but premature in that more research is needed before you can use the information. However, there are always relevant items that I do not encounter anywhere else. Addresses are always given where you might request more information or seeds. I will comment on a few items from the February 1985 issue. "Insecticides from water hyacinth." Scientists in India have found that a crude extract from leaf stalks of water hyacinth contain juvenile hormone mimics that keep certain insect pests from reaching maturity. "Cowpeas fill rice fallow gap." Rice land in S. E. Asia often lies fallow 2-3 months a year between rice crops. The International Institute of Tropical Agriculture in Nigeria (IITA) has developed extra early maturing varieties of cowpea that can fill the gap, yielding up to 2 tons per hectare. "Reducing chilling injury to grapefruit." Dipping grapefruit in vegetable oil provides a simple way of protecting them from damage during cold storage. "Tropical Soybeans." After a 10 year breeding program, IITA in Nigeria has released varieties of soybeans that can be grown successfully in the lowland tropics. "How cassava survives drought." An unusually rapid response of its leaf pores to changing humidity may explain why cassava stays green when everything else is dying from drought, according to CIAT in Colombia. You can obtain this free newsletter by writing Kathy Jarvis, Massey-Ferguson PR Department; Stoneleigh, Building 2 (40G); Stareton, Near Kenilworth; Warwickshire, CV8 2LJ, England.

16-1 HOW FAR APART MUST CORN BE KEPT TO PREVENT CROSS-POLLINATION BY OTHER LOCAL VARIETIES? Ray Vander Zaag in Haiti asked this question because he wanted to increase seed for the high lysine corn (see issue 11). I referred to Agricultural and Horticultural Seeds (Reviewed in #14) for the following summary. Because corn is pollinated by the wind, a considerable distance is required to eliminate the possibility of cross-pollination. In U. S. A. seed production, different varieties are isolated at least 180 meters, though the distance depends on normal wind velocity in the area. In South Africa varieties are kept 360-740 meters apart.

Natural barriers such as tall trees are useful, and give extra safety in case of very strong winds. Often several rows of the same variety are planted around the field as "border rows". The seed from these border rows are used as food, but not saved for seed. A good general practice would be to harvest seed from the interior parts of the field if neighboring farmers are growing other varieties of corn.

If the ideal distance cannot be maintained, you can reduce the required distance by either (1) increasing the size of your field or (2) planting several border rows. For example, a 16 hectare field requires 165 meters separation from other varieties and a 4 hectare field 200 meters. The effect of having several border rows can be dramatic. The same 16 and 4 hectare fields with 13 border rows require only 15 and 50 meters separation, respectively.

16-2 HOW CAN I GROW LADY BIRD BEETLES IN CAPTIVITY? Harold Watson in the Philippines noticed that lady bird beetles were eating the plant lice that have done so much damage recently to leucaena trees in that country. He asked how he could grow them in quantity to release into special problem areas.

We visited Dennis Warkenten at the Yoder Brothers nursery, one of the country's largest plant nurseries. Dennis is involved in both research and technical application of pest control operations, including biological control whenever possible. The answer was surprising.

It is true that these beetles are sold commercially in the States. However, to their knowledge, they are not raised in captivity. There are certain places in the mountains near our west coast where huge populations of the beetles come to rest during the winter. They are scooped up by the shovel full while they are dormant. When eventually warmed up, they resume activity. They mentioned that it is really not an effective approach for an individual to bring lady bird beetles into his garden because they are "programmed" to disperse when they resume activity (they were all clumped together before), so the first thing they do is leave the garden.

Dennis also checked a reference for diets used in mass-rearing insects and found no reference to lady bird beetles. It is still possible that someone has a formula for rearing these insects. If so, we would like to hear about it. However, our best information at present is that folks who cannot purchase them will have to rely on natural buildup for predators.

16-2 HOW CAN I GET PALM OIL FROM OIL PALMS? Lennie Clement in Nigeria asked this after our article about using palm oil to control bruchid beetles in stored beans. The following is summarized from the Liklik Buk.

The oil may be extracted easily at the village level, and used for cooking, or in making soap or oil for lamps. Palm oil is very rich in vitamin A. First, harvest nuts in bunches. A chisel with a long handle might be helpful in cutting the main stem of the bunch. Break nuts off the cluster and wash them. Boil them for 30 minutes in a large can [I presume which contains some water]. Squeeze the boiled nuts in a screw-type press. The juice that comes out is mostly water, but also contains considerable oil. Some small bits of pulp will also be present. When the oil rises to the top, pour it off. Filter the oil by pouring it through a sieve to remove bits of pulp. If oil will be used immediately, no further treatment is needed. If the oil is to be stored for weeks or months, it must be heated briefly to sterilize it.
The authors did not know how hot, but recommended it be quite hot but not allowed to burn. It is common in West Africa where a screw press is not available to cook the nuts in a drum and skim off the oil as it rises to the surface. This is less efficient than using the oil press.

Palm kernels can be fed to pigs, which quickly learn to crack the shell. Too many palm kernels causes a very yellow fat, and the high fiber slows growth. The high-yielding oil palms produce well with this process. Other oil palms may or may not contain enough oil to be worthwhile.

16-2 ARE BRUCHID BEETLES THE SAME AS WEEVILS? In two recent issues we have mentioned using cooking oil to control bruchid beetles in stored seeds. Lennie also asked if they are the same as weevils. Good question. The answer is yes. Quoting from Insect Life, "There are two general groups of seed borers: species that feed in green or living seeds and those that attack dry seeds. The [former] deposit eggs in the seeds by means of a long ovipositor that penetrates the flesh of the fruit. The adults usually emerge after the fruits have decayed. The latter, the common feeders upon dried seeds, are known as weevils." Several generations can develop in a container of stored seeds.

16-3 DR. PETERSON HAS SENT A GOOD SUPPLY OF SEED FOR HIS NEWEST HIGH CAROTENE CARROT, THE BETA III. I. It is similar to the A-plus and B951-1 varieties we offered this past year, except it has been improved by additional selection. The USDA release announcement refers to it as a "market carrot." Carotene content ranges from 180-320 ppm, compared to 80-100 ppm in standard varieties. Because carotene is the precursor to vitamin A, these carrots could be useful in prevention of blindness in children, especially if they already eat carrots. We have three sizes of packets. When writing specify if you only need enough for a small garden trial or enough for half a dozen gardens. Both of these packets are free. If you want seed in quantity for many gardens, tell us your needs. There would be a charge in the latter case. (Price for U. S. gardeners is $1.50 per regular packet). It looks like these have passed the experimental stage and will be commercially available. At least one major U. S. seed catalog is listing the A-plus. (Note to Peace Corps volunteers: I have sent a good sized packet to the central PCV office in each country. If you will be in the office you might be able to get seed immediately).

16-3 SOME COMMENTS ON WORMS IN MANGOES. William Boykin in Zambia wrote, "We had 40 trees of peach mangoes. They are a lovely orange color, have very little fiber and are delicious. For four years we had only a small crop and nearly all that did mature were full of worms. On the other hand, the common local mangoes hardly ever have worms -- but they are very stringy and fibrous. As a result we had most of the peach mangoes cut down and planted the common variety. Is there anything we can do to control the worms in the few remaining peach mangoes?"

I phoned our old standby for tropical fruit questions, Dr. Carl Campbell. As usual, I learned more than just what I phoned to ask. Carl said the pest is most likely the larvae of the fruit fly, most species of which like mangoes. There is very little that can be done. It is considered impractical to spray an entire area to get rid of the fruit fly. However, in Central America some folks get a crude molasses from the sugar mill at very low cost and mix malathion with it. Carl does not know the proportions or dilution. A swath is then sprayed onto leaves as a person with a backpack sprayer walks down the row of trees. Because it is a bait, it is not necessary to cover all the leaves or even every tree. Flies are attracted to the bait and are killed by the insecticide. He has seen it work fairly well with the Mexican fruit fly in Honduras. To make sure your species of fruit fly is attracted to the bait, try placing molasses on a few leaves and see if it attracts flies. I asked at what stage this should be done. Carl replied that control would be important about 3-4 weeks before the fruit is mature. Carl referred me to Dr. Jorge Pena, a specialist in insect control with tropical fruit, to answer my question of, "Why is it not used in Florida if it works so easily?" Dr. Pena said it is used by some. The problem is that it is not specific and kills a lot of beneficial insects as well. [For this reason you should definitely use it only during that key time when the fruit is susceptible to infestation.] People also make traps out of vinegar, hydrdolyzed protein or anything that will ferment, plus insecticide. This method is used mostly in greenhouse and research plots.

Is there a general rule that fibrous mangoes are less susceptible to insect damage? Not necessarily, but there are great varietal differences in insect susceptibility between fruits of many species, including mangoes. I always urge our readers to do some of their own experimenting. Plant a lot of mango seeds here and there and see what kind of fruit each yields. Perhaps you will come up with a superior mango that is even more resistant to the fruit fly! Carl is all for that, but said to watch out for polyembryonic mangoes. If you are still interested after that big word, read on.

Chances are extremely high that the local fibrous mango is polyembryonic. This means that each seed contains not only the embryo that resulted from cross-fertilization (called a gametic embryo), but also several (nucellar) embryos that developed from the parent tree's own tissue, the nucellus. Several trees may emerge from the single seed, but one of the stronger nucellar ones are more likely to survive. This can be a benefit if you like the parent tree and want to start identical trees from seed. But if you want to start trees hoping that some will be better than the parent you are out of luck. You can tell if you have the polyembryonic type by removing the husk from the seed. You will find a lot of cotyledons curled around each other. If it is monoembryonic, you will find two big cotyledons and a single embryo. Trees coming from monoembryonic seed will have a combination of genes from two parents, resulting in many different combinations of traits.

In summary, if you want to try to develop a better mango, get seed from as many sources as possible, and concentrate on monoembryonic seeds. (Note that citrus presents a similar situation (see issue # 5). It would be a shame to plant 100 citrus trees hoping to get a few superior ones only to find that all were polyembryonic and "came true" from seed).

16-4 WHERE CAN I OBTAIN INOCULANT FOR LEUCAENA TREE SEEDS? Because leucaena trees are legumes, they can fix nitrogen. This process requires the presence of the right kind of bacteria. If leucaena is growing widely in your area it is likely that the bacteria is already present. If you are just now trying it, or if you want to make sure it gets a good dose of the best bacteria, you will want to apply this bacteria in the form of a commercially available inoculant. We have found it difficult to provide inoculant to our readers because it cannot be purchased from the major supplier except through stores, and they only order whole cartons. So I wrote to Joann Roskoski, the associate director of the NifTAL Project (Department of Agronomy and Soil Science, University of Hawaii, P. O. Box O, Paia, Hawaii 96779, USA).

She replied that part of their mandate from the Agency for International Development is to make available, at no charge, inoculant for the major tropical legumes, including leguminous trees, to individuals in developing countries. "At present we have available inoculant for several species of Leucaenas, Acacias, Prosopises and for *Gliricidia sepium*. Each bag contains 100 grams of inoculant which is sufficient to inoculate one pound of leucaena seeds. If a small number of bags is requested by individuals/institutions from developing nations, there is usually no charge. However, if more than 20 bags are requested then a fee of $3 per bag is asked." I have requested one bag to be able to provide much small packets for those of you who are just trying a few trees, especially those who request seed packets from ECHO. By the way, we have ample seed for several varieties of leucaena, including the low mimosine varieties. There is no charge for those registered in the ECHO network as helping small farmers in the Third World. To others they are $1.50 per packet. We can supply larger quantities also, but orders for larger quantities of seed are not free. I recommend you plant a small packet. In about a year you will have thousands of seed at no cost.

Alternatively, Dale Withington with the Nitrogen Fixing Tree Association suggested that one can use soil beneath healthy, fast-growing leucaena trees that have been inoculated or that you can see have formed nodules with naturally occurring rhizobia. Such soil can be mixed with other nursery soil, or made into a slurry and applied with water to seedlings. You can tell if nodulation has occurred by pulling up a seedling or two after three months.

16-4 WINROCK INTERNATIONAL MAY BE ABLE TO ANSWER SPECIFIC QUESTIONS ABOUT LIVESTOCK. If something comes up in your work that you cannot answer, this free service by Winrock can be quite helpful. They are not sure what will happen when the special grant to provide this service ends in January, but I would suggest that even then you write and see. Drs. Will Getz and Andy Martinez head this program, which includes a library and computerized data system to back them up.

Some of the more frequently asked questions have led them to prepare Tech Notes on the topic. These 2-4 page notes are available in English or Spanish, at no cost to development specialists. Topics to date are: Protein sources for swine in the tropics; Alternative feeds for pigs in the tropics; Mammalian coccidiosis; Internal parasites in sheep and goats; Poultry and salmonella; Colostrum for the newborn; Vaccination and the Needle; Diarrhea in young livestock; Stocking rates in the tropics; Facilities for rearing young stock; Feeding the lactating female; Selection and management of replacements; Methods of animal identification; Establishing an artificial insemination service; and Techniques for feeding young ruminants. Their address is Route 3, Petit Jean Mtn.; Morrilton, AR 72110, USA.

16-4 UPCOMING EVENTS. Winrock International will conduct a two week conference on Sheep and Goats in the Tropics this November in English in Haiti and in December in Spanish somewhere in South America. Attendance is limited to 25 people who are actively engaged with the subject. The format is 40% lecture and 60% field experience. It is designed to train development specialists to train other people. If accepted, the only cost will be transportation. Tuition, room and board are covered. Write to Winrock at the above address for more information.

16-5 LLOYD ROWLANDS COMMENTS ON HIS GRAIN AMARANTH TRIAL IN ZAIRE. "I planted two varieties of Amaranthus cruentus that I got from ECHO. I was pleasantly surprised by the yield. I gave a small quantity to my workman to try cooking. He tried it roasted -- awful. Then he tried cooking it like rice -- and asked me for seed!!!!. Variety 81-037-21 out yielded 81-039-21. They were sown December 3 and harvested in March."

16-5 SEED FOR TRITICALE AND A "SWEET" LUPIN (*Lupinus albus*) IS NOW AVAILABLE FROM ECHO. Dave Sweere and Gary Riestenberg with the United States Agricultural Development Corporation contacted ECHO recently and offered free seed of their latest variety of triticale and of "sweet" lupin. We now have them in stock and can send a small packet for trial to those working in the Third World. (All seed packets are $1.50 each to folks wanting them for their US gardens). The following three paragraphs are based on material written by Drs. Fred and Nancy Elliott, who developed the varieties for the company.

Most Americans know lupins as an ornamental or as a wildflower in the Rocky Mountains that can make cattle and sheep sick. But Europeans know it as a commercial crop which, for generations, has provided nutritious feed for their farm animals. In the South American Andes, people have eaten a lupin called tarwi for centuries. Lupins contain alkaloids, which cause a bitter taste and toxic effect when eaten. The folks in the Andes soak the beans several days in running water to remove the alkaloids, then make a gruel which is often fed to babies or into a flour used in many breads and noodle recipes. The same procedure was described by Florentinus in 218 A. D. and is still used in Egypt and Italy to prepare lupins for animal feed. Lupins were grown for human and animal food centuries before Christ. The Roman author Varro reported that every Roman inn had a "labrum lupinarum," a basin used to soak out the alkaloids.

In this century "sweet" varieties of lupins have been developed which lack the bitter alkaloids. In many countries these are now grown like soybeans. The quality of the protein is similar to the soybean. In the processing of soybean meal the oils are removed and the meal is heated to inactivate the trypsin inhibitors and other compounds that inhibit digestion. Such processing is not necessary with the sweet lupins. They can be fed directly to animals, including poultry, pigs, cattle and sheep. Because no heat treatment is needed they are a natural for the small farmer in remote areas. Getting enough protein to maintain good egg production is often a problem. Dr. Elliott says that studies at the University of Minnesota and Tufts University indicate that lupins can provide an adequate poultry diet.

Another advantage over many legumes is that the lupins do not produce gas in the intestines (technically one says they do not produce flatulence). Many beans contain the complex sugars raffinose, stachyose and xylose which are not digestible by humans and many other animals. However, after they have moved into the intestine they are attacked by microorganisms which can break them down. In the process they produce gas. This could be a special consideration if you are looking for a legume to put in baby food. Gerry sent us several kinds of pasta that they sell commercially (too early for a report on taste). Their recipes are proprietary, but he suggested that up to 30% lupin flour could be used.

Who should try lupins? Lupins would be a good crop to try at higher elevations, depending on your latitude. The book Food Legumes says that they are successful in Kenya between 5000-8000 feet (1500-2400 meters). In fact they can tolerate temperatures down to 16 F (-9 C). The tropical lowlands would not be suitable for lupins because the seeds will not set if the temperature is high during flowering (over 90 F or 30.5 C). Farmers can grow a crop of lupins in the cool season and, because it is a legume, it will add nitrogen to the soil for the next crop. Lupins may be thought of as being for the more northerly parts of the temperate region. This is because breeders have had success in adapting them to cold regions. Remember, though, that they originated in the Mediterranean. The variety ECHO was given should be one of the more adaptable. The same book says that this particular species (there are several other species) will tolerate mildly acid to mildly alkaline soils of only moderate fertility. They have been grown on saline (i. e. salty) soils in the Sudan and Egypt. I asked whether it would work to save your own seed. The answer is a qualified yes. Every time you grow the crop, roughly 2-10 plants per thousand mutate back to the alkaloid type. Because this is a dominant trait, the quality gradually diminishes. Gerry says that this variety, "altra," is one of the more stable. They have had excellent results through 7 years and expect they can go for 14 years. They have a clean-up program in which a large number of people go through one of the smaller fields tasting a seed from each plant. If the taste is bitter the plant is pulled out. The harvest is then used to start a new lot of seed that can be increased for about 10 years. You could either buy new seed every so often or go through the same exercise yourself.

I have wanted to add sweet lupins to ECHO's seedbank for some time, so this was a welcome gift. We will be eager to receive your reports on how the lupins performed for you and what people think of them. We will share your findings with Mr. Sweere, as it will be useful to them in their larger-scale work with government projects in the Third World.

They also sent us a supply of triticale seed. This is a cross between Durham wheat and rye. It can out yield wheat and contains 15-17% protein. Triticale is another seed we are glad to add to our seedbank. Winter triticale requires a period of cold to do well. This is the spring type, which does not require cold weather. Gerry said that both rye and older varieties of triticale have fair amounts of trypsin inhibitors

(the same problem as with raw soybeans). This variety has been selected for low content of this inhibitor. If you want to see what triticale looks like and how it does in your area, write for a small packet. If you wish larger quantities of either lupins or triticale, let us know your needs and we will check into prices for you.

CAN YOU HELP US? We have heard reports of people using the tree *Gliricidia sepium* (madre de cacao, mata raton etc.) to kill rats. ECHO is eager to hear more about this. If you have seen it done, please share all the details you know.

For example, Roland Bunch with World Neighbors in Honduras, has seen the following done. A couple good sized pieces of bark are stripped from the tree and boiled in water together with about 20 pounds of corn. The corn is then tossed into the fields. Both rats and mice are killed by the treated corn. It is not as effective as regular commercial rat poison but it does work and is less lethal in case of an accident. It takes a day or two before they start finding dead rats and mice in the fields. We have heard rumors of other methods, including some manner of fermenting the leaves. A computer literature search turned up nothing about this, so we are counting on you.