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5-1. **WHAT VARIETIES OF CITRUS WILL GROW TRUE FROM SEED?** Jerry Larson with Double Harvest in Haiti asked us what varieties of citrus might come true from seed. I checked with Dr. Carl Campbell at the University of Florida Extension research center. Carl has given me many in-depth, insightful answers to tropical fruit questions sent by several of our readers. He said that a great number of citrus trees will come true from seed. There is a way you can tell by examining a few seeds from the tree. Peel off the outer and inner seed coat. If the seed is polyembryonic, i.e. has many embryos, it will come true. I asked what it would look like if it were polyembryonic. Carl said that the various embryos would be convoluted upon each other. If it is mono-embryonic there will be one embryo with two distinct cotyledons. Almost any sweet orange will come true from seed, as well as key limes, grapefruit, tangerine and tangelo. Two varieties that will not come true from seed are temple and pomelo.

What are the advantages and disadvantages of growing citrus from seed when that is possible? One obvious advantage is that it is much less labor intensive to simply sow citrus seeds and eliminate the grafting step. Another advantage is that the seedling will most likely be free from viruses that sometimes get into the budwood that is used for grafting large numbers of trees. I asked Carl about reports that non-grafted citrus trees live longer, up to twice as long, as grafted trees. He said that this can be true, depending on the number and kinds of disease organisms that may be present in the budwood. If one uses certified disease-free budwood, and if there are no microorganisms present that we don't even know to look for yet, then there should be no difference in the longevity of the trees.

One advantage to grafting is that one can combine the best traits of the above ground part of the tree with the best adapted rootstock for the particular soils and conditions of the area. A seedling will tend to grow upright, tending toward a single trunk, and becoming quite thorny. A grafted tree will be more highly branched. The seedling tree will not fruit for 6-7 years, contrasted to 3-4 years for a grafted tree. The earlier fruiting of the grafted tree is partly responsible for the more highly branched form of growth. Apparently the weight of the fruit after about 3 years bends the branches and causes new buds to begin growing, resulting in a more highly branched tree. But not all of the reasons for the differences between seedling and grafted trees are known.

If you live in an area where citrus is not a major crop but would like to introduce it, you might consider trying some of the polyembryonic seeds. If you are more adventuresome, in a few years also plant some accepted rootstock varieties for grafting using budwood from the new trees you have introduced. If you prefer to start with a Florida variety rather than a good local variety, and want only a few seeds, we can at times provide them. If you want larger amounts, we have located a supplier, Lawrence Reed at Holm Citrus Seed Co., who routinely ships overseas. Seed currently sells for $30 per pound plus air-freight. He can proved phytosanitary certificates if you so request and include your full address and phone number. I asked about the danger of introducing a new disease. He said this does not appear to be a problem with citrus seed. There has never been an instance where a citrus disease has been proven to have been introduced by seed. They are sending me a one page guide to help select seed for rootstock. I will send you a photocopy upon request. If you have money on deposit with us, we will be glad to place orders for you.

I asked Dr. Campbell to proof-read the above. He added that in some of the polyembryonic citrus, <u>some</u> of the embryos are of gametic origin and therefore do not come true. The percentage varies by species and variety.

5-2. **MUSCOVY DUCKS FOR DEVELOPMENT PROJECTS IN THE TROPICS** We mentioned in the last issue that both Frank Martin with the USDA and Fred Harder with the Heifer Project had told us that for really efficient meat production in the tropics we should be looking at Muscovy ducks. I asked if any of our readers could help us out from their own experience. We received some interesting replies.

FREMONT REIGER in Botswana wrote that "Along with our rabbits and a few laying hens, we kept quite a few Muscovy ducks in Zaire. We had duck as our favorite Sunday dinner. We found them much more hardy than chickens -- once you got them past the early few days. As hatchlings they were very susceptible to drowning in waterers, rain, getting killed by predators, etc. But once they were a week or two old, they were almost disease free, and grew very rapidly. We fed them chicken mash and often had a hen and her new brood on grass in a false bottom pen/house combination that we moved each day over new grazing grass. I have seen Muscovy ducks in many countries under varied conditions. They seem to thrive everywhere. Taboos against duck meat were a problem in Zaire with some groups. Fencing is easy because ducks normally require a quite low fence. An occasional one may take off and end up outside the pen. We had to build some small pens to keep drakes away from new ducklings, for they would kill them. They do not need water to swim in, but need lots of water to drink, which they dirty quickly by mixing feed in their water. Setting hens also need water to wet their feathers to maintain incubation humidity conditions."

CHERYL CAMPBELL wrote from Zaire. "I have had good success with Muscovies. Unlike rabbits, cattle, goats and local chickens, the ducks need no veterinary products or special feed requirements. Where we work we can never count on medicines or feed supplements. Muscovies like water but survive well on only a dish pan full. They breed readily on land and are not as well equipped for swimming as are other ducks. There is no need to make a pond for them. They are better foragers than most ducks. Here in the village they survive quite well on foraging only. They take much less care than rabbits. They come in various colors. Ours are black and white. The Africans think the black ones are less susceptible to hawks. We started with one male and two female adults. After 8 months we have had about 25 eggs to eat and 45 ducks of various sizes to eat. We had losses from drakes killing ducklings until we separated them. You must keep the ducklings out of the rain and tall wet grass. I keep them penned up in the rabbit house at night. In fact, I raise the ducks with rabbits because they clean up all the feed that the rabbits spill. Make sure that the feeder and waterer are close together and that the waterer is shallow enough that they cannot get trapped in it and drown. I use a basin with a small log in it so they can get out. They need to have enough water to keep their noses clean. Feeding can be just a nice lawn if you don't mind them wandering. They usually will return to their pen before dark. They eat insects and grass enough to keep them healthy. I supplement my older ducks with manioc flour mixed with very little millet and corn. Or I feed millet if I have a lot. They can survive from scavaging around the yard, but grow very slowly. When I can feed them a high protein ration with soybean flour or dried fish in a millet base during the first 2-3 weeks, they grow much faster.

Nesting boxes should not be anything fancy. Just a corner in a dry place. No floor or ceiling is needed. Let them nest on the ground -- fowl eggs often need the extra moisture. Provide a little dry grass or straw for nesting material, then partition them from any disturbances in a 3-sided box. They lay about 9-16 eggs, then set for 33-35 days.

Spacing in the pens is important because too many ducks can result in cannibalism. You will know when there are too many ducks because there is a definite pecking order, with the youngest the most affected. After 3 age groups were put together we noticed the fourth group was not well accepted. So we put all the older ducks in a new pen and start to fill the old one again. Once they are old enough to defend themselves we can add them with the older ducks. Drakes especially tend to fight more if they are crowded. In other words, it is nice to have an extra pen.

GEOFF CLERKE in Papua New Guinea sent us an excellent 8 page mimeographed article called "Muscovy Ducks for PNG Villages". We will send you a copy of this upon request. Let me mention a few highlights. The Muscovy is ideally suited for PNG village conditions where farmers rely on natural incubation and foraging. You need good shade, because the ducks may get sick if they stay in the sun for a long time. Do not put them near a pig fence because hogs kill and eat ducks. If possible, feed commercial feed for 6 weeks. A duckling will eat about 3 kg. In the highlands you might need a brooder for extra heat for the first two weeks. To do this, make a small round enclosure about 1 meter in diameter with flat iron, woven bamboo, cardboard etc. and cover it with old bags, leaving an uncovered strip about 30cm wide in the middle. Put a kerosene lamp inside in the strip not covered by the bags.

After 6 weeks, ducks can be fed entirely on locally produced food. Sweet potatoes, taro, banana, pumpkin, choko etc. Ducks will eat anything that humans eat. But it must be cooked. Follow this rule to know how much feed to give them. If they eat everything within half an hour they are still hungry. Cook more the next time. If they start to wander away from the feed after half an hour and some is left, they have had enough. Feeding locally produced feed is not enough. They must be able to graze daily in order to get enough protein. This is mainly from insects and grass seeds which are not found on bare ground or in short grass. A big, even a very big fence, is not enough because as soon as all the grass is finished it will become bare and hard from grazing and trampling. There must be no fence around a duck house. A fenced in project is a project that will fail. It is better to have a few ducks lost to dogs or other predators than to have the whole flock dying due to protein deficiency. Lack of protein will result in poor growth, never getting heavy enough to eat. Also, lack of feathers will let it get cold and die. Finally, they will never lay eggs.

In selecting breeding stock, choose the heaviest drake with a belly parallel to the ground. Do not keep any drake which looks like it is standing with the breast much higher than the belly. Do not keep more than 10 ducks for breeding. Otherwise it is probable that the garden produce will be in short supply to feed the flock and all the birds will do poorly. Hens can be kept for 3 years and drakes 2. Ducks start to lay at 8 and 1/2 to 9 months. The first eggs are small and should not be used for hatching. They are likely to be either sterile or to give small and weak birds. If a duck does not lay eggs, it should be eaten or sold. It can be recognized because (1) it is heavier than the other birds, (2) the flesh around the eyes is red, like a drake, instead of being pink or orange, (3) the space between the two pelvic bones is about 1 finger wide instead of 2 or 3. Eat or sell ducks at 4 months unless they are to become breeding stock. [There is much more practical information like this in the PNG write-up.]

Where can you obtain Muscovy ducks? Try to obtain ducks in your own country. If this is not possible, you might ask the Heifer Project for help. Dr. Jim DeVries at the Heifer Project said that Muscovy ducklings are especially difficult to ship, even in the States. If they do not receive special care within 48 hours, the losses will be high. It would probably be best to ship eggs. This would cost 64 cents each plus shipping. They are very difficult to hatch in an incubator. He would recommend that you hatch them under a chicken or duck. They would need to be ordered in January for spring shipment. If you need their help, write to Jim, telling him something about your plans and stating that you would be ready to pay the full cost of purchase and shipping, and will assume all risks. I would suggest that you send a substantial down payment. They will arrange the shipment and send you a bill for any balance. Write Heifer Project, P.O. Box 808, Little Rock, AR 72203 USA. [UPDATE: We find that muscovies periodically swing through planting areas eating young vegetables. We fenced in the pond and clipped their wings to keep them in, but then predators killed most of them.]

5-4. **EXCELLENT NEWSLETTER SPECIALIZES IN ANIMAL HUSBANDRY IN THE THIRD WORLD** If your outreach into the community includes working with animals, you will find the Heifer Project Exchange to be an excellent complement to ECHO DEVELOPMENT NOTES. The 4 page newsletter is sent six times a year at no charge to legitimate development workers in the third world. Dr. James DeVries wrote that "we will be happy to send it to those involved in livestock production projects upon receipt of their addresses and some description of the work they are involved in". I am sure they would send it to others for a small donation to help cover expenses.

The Exchange shares with ECHO a determination to make available sufficient information that you can act on what you read. I have not found tantalizing articles that leave me frustrated because the key practical information or address has been omitted. Articles are a mix of practical information and techniques with occasional comments providing perspective on a particular question.

Let me pick some items that I come across in leafing through recent issues: "A goat medicine cabinet" suggesting medications that should be kept on hand by those working with goats; announcement of an upcoming seminar on beekeeping; a discussion of Caseous lymphadenitis in goats; plans for a manure-heated brooder; a method for pasteurizing milk on a small scale; midwifery for shepherds; lambing supplies check list; design for a Zimbabwe fly trap.

I especially appreciate the section called "Practical Materials which Readers May Find Useful". This is a very brief summary of articles that have come to their attention. In most cases they will send a free copy upon request from readers. If you would profit from the Heifer Project Exchange write to Dr. James DeVries, Heifer Project International, P.O. Box 808, Little Rock, AR 72203 USA.

5-5. **NO-TILL GARDENING** I first read of this method of gardening in Organic Gardening magazine where it was referred to as permanent mulch gardening. My reaction was that there must be something wrong with anything so easy or everyone would be using it. But our garden has performed so exceptionally well with so little work using this method that we have now converted all of our growing beds to this system.

Ruth Stout first popularized this method in her book No Work Gardening (Rodale Press, $9.95). She noticed that under a small stack of hay that she removed in the early spring, there was no need to till the ground. From that time on, her garden had at least a 6 inch layer of mulch 12 months of the year. At the appropriate seasons she simply removed mulch from a row or spot for a transplant, and planted.

The first season. We began our no-till garden in September of 1981. It has been in continuous production since then. It was an area of well-grassed lawn. To this day it has never been plowed, cultivated, spaded or hoed. The first season it is necessary to do some extra steps if you are to start with an uncultivated area like we did. It is described in the March 1981 issue of Organic Gardening in an article by Jamie Jobb called "Tossing an Instant Garden". (ECHO will send a copy of this article to overseas development workers who request it.) A layer of newspapers is spread over the area. They should be no less than 3 sheets thick and well overlapped at the edges. Then organic materials of any kind are placed on top. We use either chipped wood that is given to us by the power company when they trim along the power lines, or grass clippings. You could experiment with other materials that may be available to you such as rice hulls, sugar cane bagasse, tall cut grass, leaves, coffee pulp, etc. The method works because weeds are not able to push their way up through newspapers and a layer of mulch, but roots can go down through wet newspaper. Wherever a seed is to be planted a small mound of earth is placed on top of the newspaper (or a narrow row of soil about one inch thick is used if seeds are small and to be planted closely together). The mulch is then pulled back against the earth and a thin layer put on top of it to prevent drying of the soil. The seeds must be watered more frequently than

when planted in tilled soil because the thin layer of soil can dry out quickly. When we pulled mature plants at the end of the first season we found that some roots had gone through the paper and others had grown along the top of the paper to the first edge, then gone underneath for normal growth. Transplants do surprisingly well when simply planted into the sod through a hole cut in the paper.

Subsequent seasons The procedure with newspapers is for the first season only. Before the season is over you will find that the newspaper and the sod have decayed and turned to compost. From then on if you keep a layer of mulch about 6 inches thick over the area, the soil beneath will be ready to plant whenever you wish. Our garden has been in continuous use since the day it was first planted. We use the word "no-till" because it is analogous to the system of farming by the same term where herbicides are used just before planting, then seeds are planted directly into unplowed sod. However, this is a more"organic" method, using no herbicides.

What are the advantages? (1) Gardens can be started in any area without the need to plough or spade. You can plant in areas that would be difficult to plough, such as around dead trees or in rocky soil. Grasses and other weeds are better controlled than if the ground had been cultivated. (2) There is much, much less work involved in controlling weeds. But it is a no-till, not a no-work, garden! It can take a lot of time gathering and placing the mulch periodically around the plants. And some weeds will come up that must be removed. (3) Less water is needed for irrigation. (4) The soil is kept cooler. This can be a disadvantage, however, for colder areas. If soil temperatures are too low, the mulch can be raked back in areas to be planted a few days before planting, so that the sun can strike the soil directly. The soil will be dark after a few months of no-till gardening and should warm up quickly.(5) Soil moisture and temperature are more uniform, an advantage for most plants. (6) Nematodes will likely be kept under control. The soil environment is much less suited to nematode growth than, for example, the hot dry sand found in our area. Furthermore, some fungi found in the decaying organic matter will kill nematodes. We have had some signs of root knot nematodes in the no-till garden, but they have not been a problem after the first few months of operation. It is almost impossible to garden in the same plot for more than one season here without the heavy use of nematicides with normal gardening techniques. We have not yet had to use any nematicide. (7) the only need for a compost pile is for a small one to put large or diseased plants or weeds. When the mulch decays, it is automatically compost and is already in place! Earthworms will soon help carry organic matter down into the soil. (8) Soil erosion from sloping land should be less of a problem.

We periodically add a fertilizer with complete micronutrients. This is necessary in our sandy soil and high rainfall. If you wish to use completely organic methods, remember that you have a mulched garden but not a composted one until at least one season has passed and the mulch has had time to decay. We have not had problems with acidity in spite of all the wood chips that we use. If this becomes a problem you would need to use lime.

At first thought you might think that we would run into a nitrogen deficiency by adding so much undecomposed organic matter. As you probably know, adding a lot of fresh organic matter with a lot of carbon and little nitrogen can actually harm plant growth the first season. The reason is that the micro-organisms use up all available nitrogen in the process of decaying the rest of the material. This nitrogen will become available later when the microorganisms die, but it presents a short term problem. The no-till garden does not have this problem because the mulch is not incorporated into the soil. All of the decay is taking place above-ground. So there is no way for microorganisms growing in the mulch to remove nitrogen from the soil. Once the mulch is decomposed it is incorporated slowly into the soil by leaching, mechanical mixing during the planting process and by earthworms.

We have had no unusual problems with insects or other pests. There is always the possibility that in your area there will be some pest that will find the mulch to be an ideal home and may give you problems. People often ask if inks on the newspaper will add toxic heavy metals. Such metals are only found in colored print. Anyhow, such a small amount of newspaper is used, and that only once, that we consider it perfectly harmless.

I believe that the no-till gardening method may give you far better gardens with much less work. Some ECHO visitors who could no longer garden for health reasons are gardening with the no-till method! But as with nearly everything that we suggest, it is presented as an idea with which you can experiment under your conditions. Only you can evaluate its potential for your area. It should certainly be thoroughly tried before introducing it into the community. We will be very interested to learn of your success or problems with it. Please let us hear from you if you try it.

One final note. You have heard it said that there is nothing new under the sun. A graduate student at Purdue University studied farming methods of early Mayan Indians. He discovered that Mayan farmers spread banana leaves over the land to retain soil moisture and keep out competing weeds. Planting was done through individual holes dug through the banana-leaf mulch!!!