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and Dawn Berkelaar

ECHO is a Christian non-profit organization whose vision is to bring glory to God and a blessing to mankind by using science and technology to help the poor.

Issue Highlights

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"Cafeteria Feeding" of Chickens

By George Peckham

George Peckham has been a volunteer at ECHO for years, after retiring from a career working with poultry feeds and production in various locations in Latin America.

Chickens are an important source of meat and eggs for many small-scale farmers. When only a few chickens are kept, they are usually able to meet their dietary needs with kitchen scraps and a bit of grain, and by scavenging for seeds, insects, worms, etc. However, if the flock size is increased without developing a good feeding plan, egg production usually declines.

The solution to this problem might be "cafeteria feeding." This system offers a way to use "on the farm" feeds for a larger flock, while producing more eggs and meat for home consumption and for sale. It requires re-thinking feeds and feeding. (In the tropics it may also be necessary to install artificial lights in the roosting area. With fewer than 14 daylight hours, egg production declines quickly. Artificial light can be added in the morning and evening to keep a steady 14 hours of light. One or two 40-watt bulbs or kerosene lamps with clean chimneys in a space adequate for 50 roosting hens would be sufficient.)

The small-holder wanting to increase flock size (e.g. to 10 to 50 hens) can use ingredients that big commercial producers cannot use; things like root crops, leaves, blossoms and worms, as well as grains. "On the farm" ingredients don't have to be mixed together. They only have to be individually available to the chickens. Chickens by instinct will pick out the correct quantity of each type of feed needed for healthy productivity. This is reminiscent of people walking through the serving line at a cafeteria, selecting the foods and amounts of each from many possible choices—hence the name "cafeteria feeding." (Interestingly, chickens often make healthier choices than people do.)

Table 1 indicates roughly what chickens will want to eat—about 2/3 energy sources, about 1/3 protein sources and a few items for vitamins and minerals (especially calcium for egg shells). Though they are categorized based on their main nutritional content, each of the items listed contains some protein, some energy, plus some vitamins and minerals. Remember, the idea of "cafeteria feeding" allows the chickens to balance their own diets. To help them do so, it is best to offer the chickens at least two or three items from each column.

Table 1 may be used as a guide for what to feed daily, or every other day (you may want to feed them every other day if you want the chickens to forage more). It is best to allow chickens to have free choice of at least two items from each column. Water should be freely available. (Chickens will consume three kilos/liters of water for each kilo of feed.) Also, there should be small bits of limestone, crushed shells, or another source of extra calcium available. There will be lots of calcium available from the leaf feeds. If it is necessary to limit a particularly scarce ingredient, do so on alternate days. If you feed 180% of the daily ration "every other day," weaker chickens will have access to their share. In contrast, limiting the feed to 90% every day allows stronger chickens to eat more than their share, to the disadvantage of the weaker.

When cereal grain is not available, a variety of chopped fresh root crops and/or bananas can be given. This can be more economical, even though weight gain and egg production will be lower (due to lower levels of digestible energy and higher amounts of non-digestible fiber). It is always necessary to supply small rough stones or grit, as chicken gizzards use grit to grind things like weed seeds, dried leaves and coarse grains.

Table 1: Some suggested chicken feedstuffs (you may have others available)

ENERGY (65%)	PROTEIN (32%)	VITAMINS, ETC (3%)
Corn	Peanut meal[1]	Termites
Sorghum	Soybean meal[1]	Manure worms (red)
Millet	Coconut meal	Earth worms
Broken rice	Sesame meal	Moringa leaves[2]
Barley	Cotton seed meal	Leucaena leaves[2]
Triticale	Amaranth florescence	Broccoli florescence
Wheat	Sour milk	Amaranth leaves[2]
Amaranth grain	Garbanzo beans[1]	Dried fish meal
Buckwheat	Peas[1]	Vitamin premix
Cassava	Sesame seeds	Ground sea shells
Taro	Sunflower seeds	Ground, dried bones
Sweet potato		
Other root crops		
Fresh coconuts		

[1] For best results, all beans (legumes) must be cooked to neutralize trypsin growth inhibitors. For example, soybean meal is toasted before it is used in poultry feed. Layer chickens are less affected than broilers by trypsin inhibitors. If reliable information is not available, trial and error will inform you.

[2] Moringa, amaranth and leucaena leaves have excellent amino acid, vitamin and mineral content. They should be dried **in the shade** to preserve the vitamins and to reduce volume. They can also be fed fresh by hanging them in the pen (leafy end down) to keep them from being trampled. Either way, feeding leaves to the chickens will contribute greatly to the flock's health and productivity.

Cafeteria feeding will allow flock numbers to increase even when the free range is limited. "Limited range" will result in fewer insects in the diet (because chickens have less freedom to forage). If some animal protein is available—worms, for example—the diet will be balanced and egg production will be good, even with "limited range."

An animal protein source (worms, insects, dried fish, etc) is necessary to supply vitamin B-12, which is not available from plants. Worms are a rich source of protein. Farm level production of worms (vermiculture) is becoming increasingly common worldwide. Animal manure is locally available and a very good worm food for producing "red worms." Worms can also be grown on rotting fruits and vegetables, rotting leaves and well-aged compost. As an added benefit, the worms produce castings that are a valuable organic fertilizer. [We are planning an article on vermiculture for an upcoming issue of *EDN*. Information is available on the web or from ECHO.]

"Cafeteria feeding" provides a way for small-scale farmers to enlarge their flocks without experiencing declines in egg production. If combined with vermiculture, benefits can also extend to better crop production.

New Advances in Rope Washer Pumps

By Danny Blank

For many years, a popular demonstration on ECHO's farm has been the rope washer pump, made from materials that are available in any country—PVC pipe, an old tire, rope, washers made from tires, and a little wood. Because it can be made on the farm it can also be repaired by those who made it.

Figure 1: Two models of rope pumps being demonstrated at Aerobombas de Mecate, Managua, Nicaragua. The pump on the right, similar to one ECHO recently purchased, is used for lifting water several meters above ground level for gravity feed systems. Photo by Danny Blank.

Before a recent trip to Nicaragua, I was told that more sophisticated and efficient pump designs were being made in Nicaragua. While there, I found one of the small-scale manufacturers, Mr. Luis Roman Rivera, and bought a new pump for our farm. I understand that Mr. Rivera is one of several rope pump manufacturers in Managua. He was incredibly helpful and had more than a dozen working models on display, including a couple windmill pumps.

He referred me to the website http://www.ropepumps.org, which is funded by two Dutch organizations, Kerkinactie and PRACTICA Foundation. The website is filled with helpful information about rope pumps, showing various models (including their pump capacities) and how to make them. The home page points out that the pumps are an attractive product for local small-scale enterprises to manufacture. They are produced with standard materials and are simply constructed so that even after many years of use farmers can do their own repairs. Evaluations show that more than 95% of these pumps are in operation after many years of use. At their website, be sure to click on "how it works" for a helpful outline of the advantages of rope and washer pumps compared to the common piston pumps.

How Will Using Agricultural Land for Biofuels Affect Smallholder Farmers in Developing Countries?

By Martin Price

All of us must be wondering how smallholder farmers that we serve, as well as global consumers of food around the world, will be affected by the enormous efforts being made in both temperate and tropical countries to grow their own fuel and move toward energy independence. Most likely, reduced competition from imported grains will be good for smallholder farmers and bad for urban consumers. For example, a couple years ago we were hearing that some farmers in Central America were not able to profitably grow corn (maize) because the price of imported corn was so low. This year we heard of protests in the streets of Mexico because so much corn was being used for making “gasohol” [a blend of gasoline and ethanol] in the USA that many could no longer afford their staple corn tortillas.

Regardless of what we think of using vast amounts of farmland to produce gasohol or biodiesel, it is a growing reality and we need to keep abreast of it. We’ve heard from many in ECHO’s network who are looking for ways to involve even smallholder farmers in producing energy crops, e.g. requests for information and seeds of jatropha. The web article on jatropha published on ECHO’s website (www.echonet.org) received the highest number of hits of any article for several months.

If you have experience with biofuels (biodiesel and/or gasohol), we would like to hear from you. Is the production of these impacting your communities? In what way? We are especially interested to learn of situations where smallholder farmers are either growing or using biofuels. If we receive sufficient response, we will include the feedback in a future article. While ECHO is not planning on making biofuels a major focus (unless we see opportunities evolving for smallscale farmers), we will keep our eyes open for insights or opportunities that might be of interest to our readers. Here is a recent example.

Soybean oil is the primary oil used in the United States for biodiesel fuel production. I would not have thought that peanut oil could ever compete with soybean oil as a source of biodiesel. However, an on-line article about research at the United States Department of Agriculture on http://www.ars.usda.gov/is/pr/2007/070730.htm suggests that certain peanuts can produce much more oil than soybeans.

“Soybeans produce approximately 50 gallons of fuel per acre, while traditionally grown peanuts can produce approximately 120 to 130 gallons of biodiesel fuel per acre.” Scientists in Georgia are testing a peanut variety called Georganic. “It's not suited to current commercial edible standards for peanuts, but is high in oil and has low production input costs. Georganic—or similar varieties—will likely be the future of peanut biodiesel because it can be planted and grown with just one herbicide application for weed control, compared to the three to four applications typically sprayed during a growing season for edible peanuts. Additionally, these fuel peanuts are grown without fungicides, which are the greatest input cost in traditional peanut production.”

Scientists are screening other non-edible peanut varieties, to see if some may be exceptional for biodiesel.

Controlling Weeds in Tree Plantings

Overstory Issue 188 (about accelerated natural regeneration, or ANR) included information about weeding in forests. Here we share an excerpt on reducing competition with weeds.

The smaller tree seedlings or saplings [are], the more they benefit from weeding, especially during the rainy season. In the dry season, a weed canopy may help to protect small tree seedlings from desiccation, but this potentially beneficial effect must be weighed against the fire risk posed by the dried vegetation. Weeding around tree stumps is unlikely to be beneficial, since stumps already have deep root systems that extend well below those of herbaceous weeds.

Before weeding, tree seedlings or saplings should be clearly marked with brightly colored [pieces of cloth, poles, strips of plastic bag or ribbons] to make them more visible. This prevents accidental trampling or cutting during weeding. Weeding should first be concentrated around the marked trees, before clearing weeds from the rest of the site. Around small seedlings, it is better to hand-pull weeds than to use tools, as digging can damage seedlings' delicate root systems.

One weeding method [mentioned in the *Overstory* issue] is "lodging", i.e. flattening weeds with a board, rather than cutting them or digging them out. This does not kill the weeds immediately but each time the weeds grow back, they use up food reserves stored in their root systems. If weeds are flattened often enough, food reserves are eventually exhausted and the plants die. Lodging weeds does not disturb the soil surface and, by shading the soil, the flattened weeds suppress germination of light-dependent weed seeds. This technique is particularly effective against grasses and bracken fern.

Use a wide plank of hard but lightweight wood (about 5 x 25 x 130 cm [2 x 10 x 52 inches]). Carve out semicircles at both ends of the plank so that it can be used to flatten weeds growing close to tree saplings. Attach a piece of sturdy rope and a shoulder pad to both ends of the plank, making a loop, long enough to pass over your shoulders. Lift the plank onto the weed canopy and step on it with full body weight. Repeat this action, moving forward in short steps. (For more information log on to http://www.fs.fed.us/psw/publications/documents/other/3.pdf). The method has been used to great effect in the Philippines to clear cogon grass (*Imperata cylindrica*) and accelerate forest regeneration on abandoned slash and burn sites there.

Deep Pipe Irrigation: an inexpensive and efficient method to irrigate crops and trees

By Dr. Edward Berkelaar
Redeemer University College;
Formerly Research Director at ECHO

Irrigation is required to ensure the survival of crops or trees planted during times of inadequate rainfall. Irrigation techniques vary in the technology required (from buckets to pumps and drip lines), the quality of water (e.g. drip irrigation systems require filtered water so the small holes do not clog), and the efficiency of water use (e.g. buried drip lines minimize loss of water to the air, while surface irrigation results in substantial losses of water to the atmosphere). The July 24, 2006 issue of the online publication *The Overstory* (Issue # 175) contained an article titled "Deep Pipe Irrigation," by David A. Bainbridge. Deep pipe irrigation is fairly simple and inexpensive, does not require high quality water, and makes very efficient use of water.

Deep Pipe Irrigation is not new, but is probably underutilized. A number of years ago ECHO published an article describing a method of irrigation that makes use of many of the same principles employed by Deep Pipe Irrigation. In an article titled "Partially Buried Flower Pots or Tin Cans Save on Watering" (*Amaranth to Zai Holes*, page 186-187), the following method of irrigation was described. A flower pot (15 cm diameter/6 inches) is partially buried about 7.5 cm (3 inches) deep just outside the root ball of transplanted trees, or surrounded by vegetable plants. To water the plants, pots are filled twice with water and the water is allowed to drain into the soil near the roots. Advantages of the method include efficient delivery of water to the root zone, and less weed seed germination since surface soil remains dry.

The deep pipe method is similar. A pipe 30-50 cm (12-20 inches) long and 2.5-5 cm (1-2 inches) in diameter is drilled with a series of holes, 1-2 mm in diameter and 5-7.5 cm (2-3 inches) apart down one side of the pipe. The pipe is then buried either vertically or on a slight angle (with the holes facing down), about 2.5-7.5 cm (1-3 inches) from a young seedling. If watering a tree, several pipes can be used around the tree to encourage symmetrical root growth. A screen cover can be added to the open end of the pipe to keep small animals out.

Water is added to fill the pipe (usually using a bucket). The water leaks out the holes, watering a column of soil and feeding both shallower and deeper roots with water. If shallow rooted plants are planted next to a pipe without holes, water may be delivered too deeply to be easily accessed by the plant.

There are a number of benefits to irrigating newly established plants in this manner.

Simplicity: The method is simple; it uses minimal materials, and does not require drip tape, filtered water, or pumps. Pipes can be collected after the growing season to allow cultivation. They can then be reused. There is flexibility in choosing pipe; it probably does not matter exactly how long or wide the pipe is. The author even suggests that if pipe is not available, bamboo (with the partitions punched out), rolled veneer, or even a tightly tied bundle of twigs could be used in its place.

Water use: The method is very efficient in its water use, since water is delivered to the plant's root zone instead of the soil surface where some would be lost to evaporation. As already mentioned, water does not need to be filtered because 1-2 mm holes are not easily clogged. The method has a similar water use efficiency to buried drip lines, but does not require the extra equipment associated with this type of system.

Plant Health: Experiments employing Deep Pipe Irrigation in Africa have shown that crop yield and root spread was markedly improved with deep pipe irrigation, compared with both surface drip and conventional irrigation (Sawaf, 1980). Since the water is delivered deeper in the soil, roots grow deeper as well, allowing a better rate of survival after irrigation is terminated (e.g. after plants are well established). In another experiment in the Sonoran desert in California, USA, trees provided with 10 L (2.6 gal) of water each over three years using the deep pipe method had a tolerable survival rate, while trees each given the same amount of water over four months by surface watering did not survive (Bainbridge, 2006).

While Deep Pipe Irrigation works well by itself, it is a flexible system and can be modified in a number of different ways. First, if a drip irrigation system is available, emitters can be placed above vertical pipes. If this is done, care must be taken to ensure that water leaks out of side holes and not just the bottom of the deep pipe. This can be done in two ways: by making sure the flow rate is sufficient to fill the pipe (i.e. by adjusting flow rate and/or using a smaller diameter vertical pipe (~1 cm); or by placing the vertical pipe on a slight angle with the holes facing down, so that water leaks out as it slides down the inside of the pipe. [Eds: Another option might be to plug the bottom end of the pipe with a ball of clay.]

Second, microcatchments can be used to deliver limited rainfall into vertical pipes for more effective delivery of water to the root zone.

In conclusion, Deep Pipe Irrigation is a simple way to irrigate that makes efficient use of water, and may be suitable in many areas where rainfall is limited and/or water is scarce. [For added moisture conservation in dry areas, combine Deep Pipe Irrigation with the use of mulch, especially around new plantings. In addition to moisture conservation, the mulch buffers soil surface temperature and pH extremes; creates food and habitat for organisms; contributes to long-term fertility; and reduces weeds.]

References

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Pot Drip System for Tree Irrigation

By Dawn Berkelaar

An article in the April 2001 issue of *Waterlines* describes an efficient and inexpensive watering system for trees, similar to the deep pipe irrigation described in the previous article. Some of the results in Table 2 may be of particular interest.

The system, called "pot drip," was introduced by BAIF, a voluntary organization, in south Gujarat where water sources are 0.5 to 2 km away in the summer. The irrigation system was used to water newly planted mango grafts. Instead of direct watering, water was poured into four cylindrical clay pots installed around the plant. Pots were large enough to hold 1.5 L (0.4 gal), and each pot had a hole of 5 to 6 mm diameter at the bottom. In Gujarat, such pots sold for US$0.16.

Pots need to be relocated each year because the plant canopy will spread. The authors wrote, "Water is poured into the pots regularly. Initially water gets absorbed into the soil immediately as the infiltration rate is high. But as the soil moisture increases, water in the pot is retained for two to six days depending on soil characteristics and climatic conditions. During this two- to six-day period, it slowly drips down and becomes available to the plant roots. If water drips down in a short time (i.e. less than a day) then the addition of soil in the pot will reduce the water flow, and if water stays for a longer period than five to six days then pots with more holes can be used."

The pot drip system was studied between October 1997 and September 1998. Farmers on 20 plots used pot drip, while farmers on another 20 plots watered the plants directly. Each plot had 20 mango plants. The results clearly showed the beneficial growth- and water-related impacts of pot drip (Tables 2 and 3, respectively). Plants watered with pot drip were taller, had a wider canopy, had more main and sub branches, and had more sproutings than those watered directly (Table 2). Plants watered using the pot drip method also used less water, took much less time to water, and as a result were watered more often (Table 3).

According to the article, "more than 3500 farmers have accepted the technology in the tribal areas of Dharampur."

Reference: Mahajan, S., P. Pednekar and S. Patel. 2001. Pot drip: an efficient low cost watering system. Waterlines 19(4): 26-28.

Table 2. Effect of pot drip on plant growth: a comparative analysis.

Type of watering system	Effect on growth-related parameters				
	Plant height (m)	Canopy (m)	Branches		Number of sproutings
			Main	Sub	
Directly watered	1.2-2.0	1.2-1.9	3-4	30-90	1-3
With pot drip	1.8-2.5	1.5-2.25	4-6	70-150	3-4

Table 3. Effect of pot drip on watering of plants: a comparative analysis.

Type of watering system	Effect on water-related parameters				
	Water requirement (l)	Watering time		Frequency of watering (number of waterings per month)	
		Days	Hours	Winter	Summer
Directly watered	300-600	1-2		2	3-4
With pot drip	100-200		2-4	2-3	4-5

ECHOES FROM OUR NETWORK

Propagating Artemisia

After reading the last issue of *EDN*, Tim Wise wrote to us. "I have been reading your information on propagating *Artemisia annua anamed*. I was working in Uganda with that plant for several months and found that, when taking cuttings, if you dipped the cut ends in number 2 rooting hormone (for soft stemmed cuttings), then placed the cutting in a plastic container with some water, within about 2 weeks about 90% of the cuttings had developed roots and could be planted directly into the field. I used old water bottles (250 ml), as the cuttings would stand up in those "pots.". "Many people were very discouraged from trying to start the cuttings either in water or in soil and were happy to hear about this idea."

Moringa now the second most important vegetable in Niger

Dr. Dov Pasternak has lived and done research in Niger for several years, and often shares important findings with ECHO. He works with the International Crops Research Institute for the Semi-arid Tropics, ICRISAT, headquartered in India.

Dr. Pasternak wrote in response to our comment in *EDN* 96 that the moringa variety from India, PKM-2, has become the preferred variety at our farm in Florida. He has also evaluated several moringa accessions and found that our second choice, PKM-1, did best there. (He is going to take another look at PKM-2.)

He told us that moringa has now become the second-most important vegetable in Niger. Only onions are more important. "I say this as a **personal** impression that I get from visiting markets and talking to people. Last year we conducted a survey of traditional leafy vegetables in Niger and moringa was by far the preferred leafy vegetable."

Figure 2: A woman selling moringa in the market in Niger. Photo by Dov Pasternak. Used with permission.

He adds, "Moringa popularization is a recent development in Niger. No promotion—it was spontaneous. It started about 50 to 60 years ago in the area of Maradi, a city by the border of Nigeria. The first Moringa leaves were imported from northern Nigeria. Import from Nigeria is still going on. Gradually it has spread all over the country.

Figure 3: PKM-1 moringa trees, loaded with pods. Photo by Dov Pasternak. Used with permission.

"I talked to many people here that did not know Moringa when they were children. It is estimated that one tree can bring in Niger an income the equivalent of US$2.00 each year. The planting density is about one tree per two square meters. Here that is considered a high value crop."

He points out that moringa and other indigenous leafy vegetables (ILVs) are very important for food security for a very specific reason. "The rainy season (June-September) is regarded in the Sahel as the 'hunger period' because by that time many farmers have exhausted the supply of stored millet and do not have the resources to purchase food. The ILVs grow fast after the onset of rain and are harvested long before the grains. In this period the ILVs become a central component of the daily nutrition of the rural population. One of these [that we are not familiar with at ECHO], *Leptadenia hastata*, has an especially important role in food security since it is the only leafy vegetable that produces fresh leaves even before the rains start."

FROM ECHO'S SEEDBANK

Winged Bean Revisited

By Tim Motis
ECHO Seed Bank Director

Winged bean (*Psophocarpus*

tetragonolobus), an amazingly productive and multi-purpose legume, grows as a vine typically staked on 1.5 to 2 m (5 to 6.5 ft) poles or trellises. Likely originating in the Asian tropics, it thrives in hot, humid areas and grows at elevations up to 2000 m (6562 ft).

In 1975, the US National Academy of Science published a study of winged bean. An incredible amount of interest and research followed. The reasons for this were many:

- Nearly all parts (pods, beans, leaves, flowers, and tubers) of the plant are edible to humans. Note that tubers must be cooked, and leaves should be cooked if eaten in quantity.
- Productivity of leaves [8 t/ha (7137 lb/acre)], pods [10 to 40 t/ha (8922 to 35,687 lb/acre)] and seed [usually 2 t/ha (1784 lb/acre)] is high.
- Leaves are exceptionally high in vitamin A, and both the leaves and pods are fair sources of vitamin C.
- Seeds contain up to 37% protein (or more, according to some sources), with a nutritional value similar to that of soybean.
- Seeds are a source of low-cholesterol, edible oil (about 17% can be extracted).
- Seeds in storage have shown resistance to bruchid beetles.
- Tubers contain an average of 20% protein, several times the protein of potatoes.
- After harvesting pods to eat as a vegetable, the stems and leaves can be used as animal fodder.
- The plant thrives in hot, humid areas and tolerates many plant diseases and pests.
- If residue is added to soil, winged bean can improve soil fertility, as it is highly effective in fixing nitrogen.

When ECHO first wrote about winged bean (*Amaranth to Zai Holes*, pages 70-71), we had been distributing winged bean seeds for 14 years. At that time, our overall impression from our network was that there had been no major success introducing winged bean outside of countries where they were already popular. Harvest trial reports since 1995 indicate no change in that assessment. As pointed out in an earlier EDN, several attributes of winged bean limit its potential:

- The hard seeds take a lot of time—and firewood—to cook.
- Seeds may need to be soaked in water or nicked before planting for optimum germination. [Note: ECHO has obtained excellent germination without nicking the seeds.]
- Special recipes are usually needed to make the seeds and tubers tastier.
- Staking is required for maximum pod production.
- It is adversely affected by waterlogged (extremely wet and poorly drained) soil.
- Short days are required in order for most varieties to flower. [ECHO carries a day-neutral type that flowers regardless of day length.]
- Not all varieties produce tubers.

- Plant roots are badly damaged by root knot nematodes [as are most beans].

Yet, we continue to receive numerous requests from overseas for winged bean seeds. Thus, it merits thought as to how this crop might be of benefit.

A starting point, of course, is to find out if winged bean will grow well in your area. Consider climatic conditions in your project area. Danny Blank, ECHO's farm manager, comments that winged bean fills a niche because it is "a bean that produces—actually thrives—under hot, humid and wet conditions." Also consider and experiment with several varieties of winged bean. This is the beauty of ECHO's small seed packets. Each packet contains about 40 seeds, enough to try on a small plot. Organizations working to help small-scale farmers may request, free of charge, one packet each of any or all of the varieties shown in Table 4. Others are asked to send $4.00/packet to cover seed and mailing costs. Packets including a mix of several varieties are also available—save seed from any plants that do well in your area.

If a planting fails, think about why it failed before completely giving up. Problems reported by our network are poor or delayed germination, cool temperatures [especially at elevations higher than 2000 m (6562 ft)], leaf-cutter ants, heavy rain (likely combined with poor drainage), and extreme drought.

Assuming winged bean grows in a particular area, its acceptance by farmers will likely depend on whether or not it addresses a need not met with other crops. For instance, it might succeed where protein is lacking and other beans are either not available or are less disease resistant than winged bean.

In finding a niche for winged bean, determine which part(s) and attributes of these plant parts will be of greatest benefit to farmers. Varieties differ in how much of a particular plant part they produce. Among seven varieties evaluated in a recent trial at ECHO, 'Ribbon' and 'Bogor' were the highest pod and seed producers (Table 4). Varieties also differ with respect to pod color, size and shape. The large, crimson-red pods of 'Chimbu' may give it extra market appeal. Pods of 'Flat' and 'Square' are shaped as their names imply; with these varieties, shipping-related damage to the pod wings would probably be minimal.

Growing practices influence production of various parts of the plant. Tall stakes favor pod and seed production over tuber production. In Malaysia, seed yields were maximized to 6.26 t/ha by supporting vines on 2 m (6.6 ft) stakes, harvesting an initial crop of mature pods, and then ratooning at 19 weeks after seed germination. Ratooning involved cutting the plants 30 cm above the ground, resulting in regrowth of vines and pods.

Success introducing winged bean also requires careful thought as to how to prepare it for eating and then transferring that knowledge to local farmers. A few quotes from members of ECHO's overseas network of community development workers illustrate the point: "People don't like the taste although they did not prepare them correctly." "Locals do not really know this vegetable yet. We are still trying to promote it as part of their diet." "My experience…is that they prefer not to try new cultivars or vary their diet."

When growing winged bean for fresh pods to be eaten like green beans, the pods must be harvested while young and flexible enough to bend without breaking. When harvesting mature pods for dry bean production, consider ways to reduce the cooking time needed to soften the seed coats. A method suggested by Dr. Frank Martin and quoted in *Amaranth to Zai Holes* (page 279) reads as follows: "Measure the volume of beans to be cooked. Rinse and add 5 volumes of water. To the water add 1% sodium bicarbonate sold as soda or baking powder [about ½ teaspoon per cup of water]. Boil the beans and simmer for 3 minutes. Remove from heat and soak the beans in the solution overnight. The following day, discard the soaking water, rinse

Table 4. Total grams (g) of mature, dry pods (with seeds) per plant, grams per pod, timing of pod production, mature pod length, total dry seed yield, seed weight, and tuber attributes for seven winged bean varieties planted at ECHO on 18 Aug. 06 and harvested six times between the 20th and 31st week after planting (WAP). Data from six plots were averaged.

	Pod yield and timing of production			Pod length	Seeds		
Variety	**g/plant**	**g/pod**	**WAP pods harvested**	**cm**	**g/plant**	**g/seed**	**Tubers**
Bogor	132	4.7	22nd to 28th	16.1	58	0.28	none observed
Chimbu	41	8.7	20th to 22nd	26.0	16	0.33	small and thin
Day Neutral	61	3.3	20th to 26th	16.9	25	0.28	medium-sized
Flat	88	4.4	20th to 26th	18.6	36	0.25	none observed
Ribbon	122	6.6	22nd to 31st	18.2	51	0.38	none observed
Siempre	28	3.6	22nd to 31st	12.2	11	0.23	large roots/tubers
Square	68	5.2	22nd to 31st	20.4	24	0.27	thick roots
P value*	0.011	0.001	not applicable	<0.001	0.006	0.168	not applicable
LSD value*	62.4	1.47		2.63	26.5	N/A	not applicable

*For those interested in statistics, real (statistically significant as opposed to chance) differences between values within a column exist if the P-value for that column is less than 0.05. Within a column, any two numbers are statistically similar unless the difference between them exceeds the least significant difference (LSD) value given for that column.

twice with fresh water and boil in double their volume of fresh water for 20 to 25 minutes." For other cooking hints, request or download (www.echotech.org) a technical note entitled "Winged Bean Recipes."

UPCOMING EVENTS

14th annual ECHO Agriculture Conference

ECHO, Fort Myers, FL, USA
November 6-9, 2007

"Health, Agriculture, Culture, and Community" Workshop for Christian Health and Development Professionals

ECHO, Fort Myers, FL, USA
November 12-16, 2007

The workshop will enable Christian health and community development personnel to help people improve their own health, agriculture, and nutrition through understanding and applying scientific, biblical and culturally appropriate principles, and making behavior changes necessary for transformational development. The workshop is designed for Christian health, agriculture, and community development professionals who work with rural and urban communities internationally or in the US. Where health and nutrition conditions are below standard, the aim is to motivate community leaders to take the initiative in improving the health and nutrition of their people. This workshop is co-sponsored by King College in Bristol Tennessee. The workshop will be led by Dan Fountain, who has 35 years of overseas medical experience, and by several ECHO staff members.

"HIV/AIDS, Nutrition, and Agriculture" Workshop

ECHO, Fort Myers, FL, USA
December 3-7, 2007

For the second year in a row, ECHO will host a practical, hands-on workshop to equip development practitioners, in both medical and agricultural realms, to address nutritional needs through better agricultural practices. One element of this is to understand how to utilize nutritious plants as part of a response to HIV/AIDS.

The focus of this workshop will be plants that are high-yielding, high-nutrition and low-maintenance. Featured crops include plants such as: moringa, amaranth, chaya, papaya, Lagos spinach, pigeon pea, and 7-year lima with practical information for preparation, processing, harvesting, cultivation, and propagation.

Registration information for these three events is at www.echoevents.org.

On-Line Course for Medical Staff Preparing to Serve in Developing Nations

Health professionals who enter international service often discover their education poorly prepared them to work effectively in poorer nations, primarily because:

- Diseases are different. Malnutrition, unique injuries, and certain infectious diseases are common in developing nations, but rare in the West.
- Medical resources are minimal. Advanced diagnostic technologies, subspecialty consultants, and highly developed treatments are rarely available in poorer nations, forcing physicians to depend upon more basic clinical skills.
- Cultural context is different. Success in combating disease requires an understanding of human behavior, which often contrasts sharply with that of developed nations.
- Leadership training is lacking. Effective health care requires attention to the needs of entire communities, a concept infrequently addressed in medical education.

The purpose of this course in international medicine is to equip physicians and other health professionals with the unique knowledge necessary to serve successfully in developing nations. This course will address four particular bodies of knowledge:

- International Health – Provides an orientation to the status of and determinates of health in developing nations
- Diseases of Poverty - Focuses on those unique medical conditions that are most frequently associated with low income and encountered in developing nations
- Cross-Cultural Skills - Addresses how to adapt to living and working effectively in unfamiliar cultures
- Health Leadership - Details how health professionals can work in cooperation with communities to design and lead effective health systems.

You can register for this on-line course at http://www.inmed.us/course/. CME credits are available. The same material is covered in a book that can be purchased at the same website. The sponsoring organization, INMED, exists to recruit and prepare medical professionals for service in developing nations.