



Kitchen Gardens in Burundi – “the new way to grow vegetables”

by Sara Delaney, Senior Program Officer, International Programs, Episcopal Relief & Development

Editors: Sara Delaney presented at ECHO's November 2015 International Agriculture Conference. One project she mentioned had remarkable adoption rates, and we thought it would make a good case study to share in EDN. In the course of introducing new ideas or practices, why are some accepted more easily, quickly or widely than others? This article proposes some reasons for the initial success of kitchen gardens in Burundi, and also shares a method for trying to measure the impact that kitchen gardens will have on the food security and nutrition of the families who use them.

The country of Burundi is one of the smallest and most densely populated on the African continent. If you spend a little time there, you will see people on the streets of the city, walking on the roads between city and village, out in the hilly fields...everywhere!

Burundi is also very hilly. The topography is almost continuous hills, leading down to the shores of the large Lake Tanganyika. This makes for beautiful scenery, but some big challenges. The hills are prone to soil erosion, and land access is difficult and becoming more so with the growing population. Infrastructure, seed supply and market access are limited. East African crop diseases such as *Banana Xanthomonas Wilt* and *Cassava Mosaic Virus* have made their way to the country.

Burundi received a score of 35.6/extremely alarming on the 2014 Global Hunger Index (IFPRI 2014), placing it at the very bottom of the rankings for the third year in a row. Under-nutrition has been identified as the foremost concern in all regions of the country.

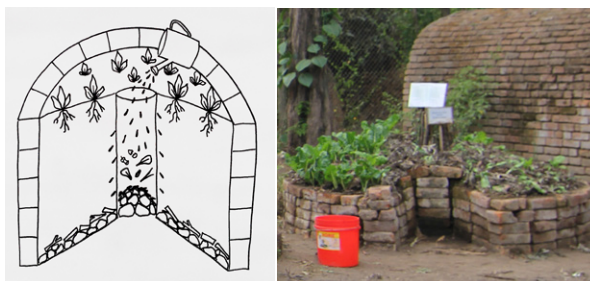
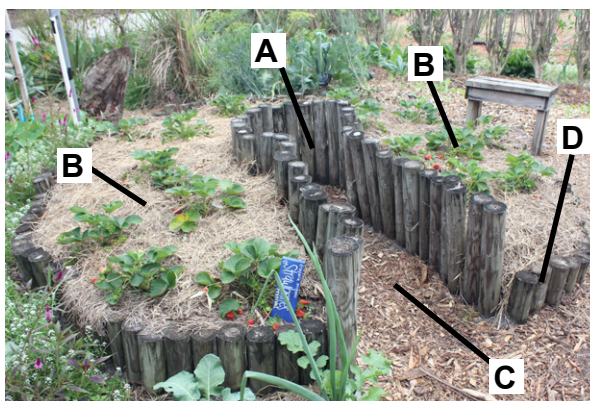


Figure 1: Examples of keyhole gardens, built with wood (top, ECHO, Florida), bricks (bottom right, Tanzania) and a cross-section (bottom left). Compost can be placed in the center (A), with an optional covering, to supply nutrients to surrounding plants. The planting area (B) is filled with a mix of soil and organic material, topped with a layer of mulch. If drainage is an issue, a layer of rocks or other coarse material could be placed at the base of the planting area. The keyhole (C) provides access to the center (where compost can be placed) and to the planting area. An outer wall (D), constructed with locally available material such as wooden posts, rocks or used rice sacks, keeps the garden contained. Source: Tim Motis, Betsy Langford and Nate Flood.

Burundi is also still recovering from a widespread conflict which lasted from 1993-2005. Further, from April 2015 to the present, political unrest and conflict stemming from a President over-staying term limits has resulted in significant migration of families, disruption of food supply, and high levels of insecurity.

Community Development Program

To help address these complex issues, the Anglican Church of Burundi's community

development office, in partnership with Episcopal Relief & Development in New York, has conducted a national integrated agriculture, environmental restoration and health program since 2008. As a Program Officer with Episcopal Relief & Development, I have worked closely with the team in Burundi since 2012.

Through the agriculture program, improved seed varieties are sourced from the in-country research center, and seed multiplication centers are managed in conjunction with farmer groups. Farmers also participate in training on techniques to improve yields and increase resilience to climate stresses. Alongside these efforts, land on hillsides is being restored through the planting of trees and digging of anti-erosion trenches with stabilizing grasses.

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ECHO is a global Christian organization that equips people with agricultural resources and skills to reduce hunger and improve the lives of the poor.

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In 2013, I worked to initiate an additional partnership between the Anglican Church of Burundi (referred to as PEAB in French) and the International Agriculture and Rural Development (IARD) program at Cornell University. After some brainstorming, we decided to first use this team to add a focus on family nutrition to the program activities. Specific objectives were to:

- 1) Contribute to household food security and diet diversity in rural Burundi through the introduction of a kitchen garden technique;
- 2) Test and document good practices for kitchen garden introduction, dissemination, construction and maintenance in the rural Burundian context; and
- 3) Facilitate a sustainable seed supply system for selected vegetable varieties through support for seed saving and exchange and identification of sources for quality seed.

The Kitchen Gardens

After some research and conversations within Burundi, the team decided to introduce a kitchen garden model, based on the 'keyhole' garden concept, to a group of 60 interested women within the communities where PEAB was actively working. The kitchen garden (Fig. 1) includes an outer wall made from local materials, a central composting basket, and raised beds (FAO 2008; Walker 2012).

The kitchen garden model has many benefits. It requires only a small area, and can be made inexpensively or even at no cost by using readily available or recycled materials. The design can easily be modified. The garden is supplied with nutrients by the compost basket in the center. Especially when mulched, the garden requires less water than a typical garden.

PEAB and IARD led a series of trainings on kitchen garden construction techniques, and then—following construction—on composting, crop management, seed saving, nutrition, and cooking techniques. Each household received 4 to 10 training sessions, over a period of two or three months. Staff later followed up with visits that included opportunities to receive advice and troubleshooting.

The program coordinators also decided to distribute starter seeds, due to low availability in the area and the desire to



Figure 2: A woman shows two kitchen garden techniques: a one-tier garden with mulching (background) and a garden-in-a-sack (foreground). Photo: Sara Delaney.

target particular nutrient groups. Seed varieties were sourced from small shops (imported vegetable seeds) and from the local market, and included leafy greens, cabbage, carrots, squashes, tomatoes, peppers, amaranth, eggplant and onions (Siele 2015).

The gardens take off!

The kitchen garden model has proved to be hugely popular amongst rural households in Burundi (Fig. 2). Sixty gardens were originally constructed. Between mid-2014 and the end of 2015, over 2,000 gardens (Fig. 3) were constructed by individual women, in 3 provinces and at least 15 communities, having spread from the south of the country up to the west and center. Women are growing a mix of vegetables, including amaranth, eggplant, tomatoes, carrots, hot peppers and onions. They use the produce primarily for home consumption, and also for cooking for guests, selling, trading and giving to neighbors.

During a visit to Burundi in late 2014, we were able to visit with a number of women, both

in the original group of 60 and in another area that had started more recently. Through informal conversation, we asked them how the gardening was going, why they had decided to create a garden, and (for those who had started to harvest) what benefits they had realized so far. Many of the responses were expected: a desire for more food available for the family close to home; the challenges of accessing seed; and dealing with pests.

Some responses were more surprising. When I asked one woman who had recently finished constructing and seeding her garden why she had decided to do so, she looked at me and said, "Well, it's the new way to grow vegetables." As if I was the last one to know. I laughed happily in my head as she explained further, while trying to keep a serious face. I didn't want her to realize that a member of the team who had originally proposed the gardens wasn't up to speed with how 'on-trend' the kitchen gardens had become!

Another woman told us of a benefit beyond increased nutrition or income. She explained that she likes having her garden nearby, because now, if visitors unexpectedly show up, she always has something to cook and offer!

Just as exciting as the spontaneous spread of kitchen gardens, many women are innovating and adjusting the original design based on available materials and individual preference. Walls are being made from mud bricks, used rice sacks, and banana leaves. Women are choosing to use one, two or three tiers (Fig. 4), and to focus more or less on certain vegetables.

The kitchen garden work has also inspired women and men to initiate the formation of farmer associations in their communities, in

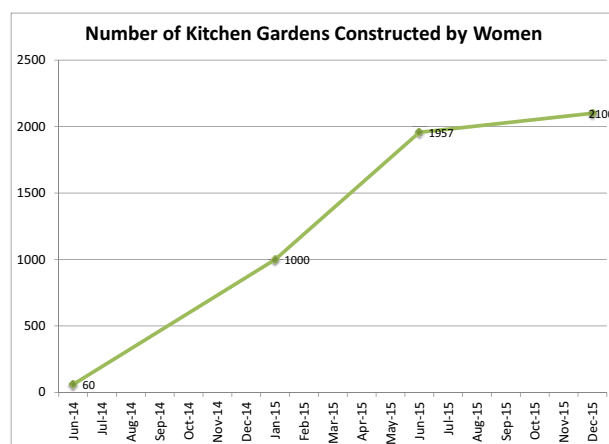


Figure 3: The number of kitchen gardens rapidly multiplied at the start!



Figure 4: PEAB staff members speak with a woman about her multi-tiered kitchen garden. Photo: Sara Delaney.

order to pool resources and to grow larger plots of vegetables for market sale.

Factors in the garden adoption

With this technique spreading so quickly, we have been working to keep up! We have also been looking at what factors may have helped the adoption to be so fast and widespread. Many other techniques that have been shared through the agriculture program for years (such as crop spacing, or compost-making) have not proved as popular. We will need to wait longer to see if more women continue to build and use similar gardens, and to determine the longer-term sustainability of the activity. However, a few factors seem to have been important:

- Exchange visits. Following the initial enthusiastic training on kitchen garden techniques, the program facilitated exchange visits for women from other areas to see and learn from the original adopters—women like themselves.
- Local facilitators to provide support. PEAB's community-level facilitators in each diocese provide extension services—leading follow-up trainings, offering support to families, and monitoring progress. These facilitators are local to the area and are farmers whom the women know and trust.
- Low-cost and local to enable spread to neighbors. Because the gardens can be made without any outside inputs, women can easily share the idea with their neighbors and friends, who can then start even if they haven't been to an exchange or training. Out of the ~2100 gardens constructed as of December 2015, ~580

(30%) resulted from spontaneous spread of information from neighbor to neighbor. The program coordinator shared that most women showed at least one other woman how to make a kitchen garden; not all of them will adopt the idea, but many do, and very likely more gardens have been made than have been recorded.

Measuring impact

[Note: as will be explained later in this section, political unrest prevented the planned follow-up measurements for the project. However, information about the measurement tools that were used might be helpful for other readers—so the information is still included here.]

To help us gauge how the addition of gardens is helping us to meet the objectives of improving household food security and family diet diversity, we decided to use two available measurement tools. These were USAID's Household Hunger Scale ([Ballard et al. 2011](#)) and FAO's Women's Dietary Diversity Score (WDDS) and Individual Dietary Diversity Score (IDDS) ([FAO 2010](#)), translated for the local language.

The Household Hunger Scale asks a family a set series of questions about their experiences over the last thirty days, including if there was ever no food to eat, if a member ever went to sleep hungry, or if anyone went a whole day and night without eating. Choices include *rarely*, *sometimes*, and *often*, and the responses are then scored using a standardized method to produce a score from 0 to 6, or "no hunger" to "severe hunger."

The diet diversity survey, by contrast, asks respondents to recall everything which they ate or drank over the previous 24 hours. All of their meals and snacks are recorded, with meals such as soup broken down to record main ingredients. Afterwards, we sort the items into specified food groups (based on the types of food needed for adequate women's or child's nutrition) and total how many food groups the individual consumed. Similar to the HHS, the total food groups are then scored using a scale from low

diversity (three or fewer food groups), to high diversity (more than six groups).

A baseline survey was conducted in June 2014 following a recent harvest, with 116 women who live in the area of original kitchen garden introduction. Results illustrated the food security situation in the region: 82% of surveyed households experienced moderate to severe hunger. In the recall period of 30 days, 105 families had at least one household member go to sleep hungry because there was not enough food.

The Women's Diet Diversity Score baseline showed 42% of women consuming a diet of "low diversity" and 54% a diet of "medium diversity," with particularly low levels of animal-based vitamin A sources. Approximately 79% of children consumed a diet below the minimum dietary diversity requirement of four food groups.

A follow-up survey in the same area was scheduled for around June 2015, so that families could be questioned during the same season as previously. However, due to the unrest, a full follow-up survey was not possible. Instead, a small sampling of 36 women was conducted in August 2015. The results were impacted not only by the unrest, but also by the fact that August is further into the dry season and availability of food was therefore decreasing.

Results showed that 72% of the 36 surveyed families experienced moderate or severe hunger, with severe hunger increasing from 4% to 17% (Fig. 5). Of the 36, 92% had consumed a low diversity diet the day before, and only 8% achieved medium diversity.

So – these results clearly do not show an improvement! However, this was not surprising considering the huge disruptions in the region. We will need to do another follow-up HHS and WDDS/IDDS in 2016, and future years, to see how the families are progressing. The program team can also survey families in the same region, who have not built or used a garden, to compare food security and diet between the two groups.

Conclusion

The kitchen garden technique has been widely adopted by rural women in Burundi, giving a much-needed source of vegetables at the household level. Good practices in dissemination, construction and maintenance are actively being gathered and

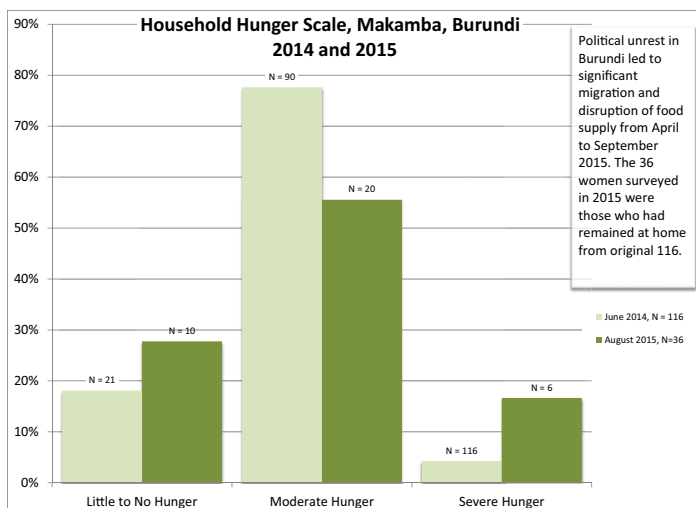


Figure 5: Levels of household hunger in the area of original kitchen garden activities, in June 2014, and August 2015 (partial survey).

documented by PEAB, IARD and Episcopal Relief & Development. In particular, as women innovate on original design specifications, we are working to keep track of all their ideas. Recommendations for key features such as size of composting basket, seed spacing, watering and appropriate varieties for the garden are being established.

A sustainable seed supply is crucial for success. Families are being supported to save some seed from season to season, but as kitchen gardens spread, demand for quality seed is already being identified as a constraint. PEAB is in conversation with the national agricultural research

institute, the Ministry of Agriculture, and the World Vegetable Center in Tanzania, to brainstorm ways of increasing the availability of quality vegetable seed in the country. A locally managed “Quality Declared Seed” system could also improve access and give the communities more control over chosen seed varieties.

Improvements in vegetable disease management are also needed going forward, and the program is looking at promotion of locally adaptable natural insecticides. Mulching and other techniques are also being advised to increase water retention.

Long-term success is also highly contingent on political stability, both in terms of government support for seed supply and/or testing, and also for family food production and stability. While PEAB’s local facilitators continue to work with and be available to women in the various rural dioceses of the country, the PEAB head office has not been able to do the normal level of monitoring from late 2015 to the present, and we therefore don’t currently know as accurately

if gardens are being maintained, expanded, or abandoned.

If we are able to continue measuring the impact of both women gardeners and “control groups” in the same areas, the findings could provide helpful insight into the role of the Anglican Church of Burundi’s programming, and the kitchen gardens in particular, in helping families to cope with the effects of political instability and conflict.

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Use of Moringa Leaf Extract as an Effective and Easy Crop Growth Enhancer

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In November 2015, ECHO staff member Dr. Tim Motis attended the First International Moringa Symposium in Manila, Philippines. There he met Dr. Basra, who has studied and promoted moringa extensively and who presented a talk with valuable information on moringa leaf extract. Basra’s research on the use of moringa leaf extract to enhance crop yields builds upon and confirms findings by Nikolaus Foidl, whose pioneering work in this area was briefly summarized in EDN 68 (in 2000) in an article by Lowell Fuglie, one of the early promoters of moringa. Basra graciously agreed to share what he has learned about this topic with ECHO’s network. Below are his responses to our questions.

Editors: For those who are not aware of this concept, could you briefly describe what “moringa leaf extract” is and what it is used for?

Basra: Moringa leaves are rich in many compounds that can be helpful in promoting the growth of most plants. When moringa leaf extract (MLE) is applied at an optimized dose, it increases growth, alleviates biotic and abiotic stresses, and sometimes improves the quality and yield of the produce. Typically, MLE is applied to crop leaves as a foliar spray.

Editors: How did you learn about and become interested in studying moringa leaf extract?

Basra: I learned about MLE through Nikolaus Foidl and colleagues (Foidl *et al.* 2001), who first reported that moringa leaves are rich in many growth hormones, antioxidants and minerals, and that a diluted aqueous solution (made with tender moringa leaves) can increase yield of many crops by up to 20-35%.

Editors: Tell us about your research with this. What crops have you tried it on? Have you seen consistency in results?

Basra: During a stay at University of California, Riverside, I tested the MLE concept reported by Foidl and found that an aqueous extract of fresh moringa leaves, sprayed on cherry tomato, significantly increased the fruiting periods, number of fruits and final tomato yield. Then I analyzed the moringa leaves and found them to be rich in cytokinins (plant hormones that promote cell division) in the form of zeatin, along with high levels of total antioxi-

dants, soluble proteins and potassium. After returning to Pakistan, I continued this research on a number of crops. An extract from dried moringa leaves was also effective as a growth promoter. However, in most of the experiments, the maximum increase in yield was achieved with MLE from fresh/green leaves (comprising 3% of the weight of the water-based solution; a recipe for farmers is described later) used to prime the crop seeds (by soaking them in MLE for 8 hours before planting), and then also applied as a foliar spray at critical growth stages of the crop.

There are at least three different types of *Moringa oleifera* in Pakistan. They include two local types with white- or black-covered seeds, and an Indian-cultivated variety called 'PKM1'. Extracts of these three moringa sources were compared, and all were effective as growth promoters. However, the local landrace with a white seed cover performed better than others.

I tested the extract on a large number of crops, including maize, cotton, rice, wheat, canola, peas, carrot, radish, okra, spinach, citrus, range grasses, tomato, sunflower and sorghum. In all experiments, economic yields increased by 13 to 40%. I then evaluated foliar-applied MLE for its potential to boost the tolerance of various crops to different stresses such as salinity, drought and heat. The application of MLE successfully induced stress tolerance in most cases. Although results varied (with MLE used under different conditions, locations and crops), there was always increase in yield.

Editors: From what you have observed in Pakistan or elsewhere, have farmers adopted the use of moringa leaf extract?

Basra: This technology is being successfully adopted by many farmers, most of whom have small land holdings and limited access to proper fertilizers. Under such farming conditions, the increase in crop yield is even better (than in research plots that receive adequate fertilizer). Many progressive farmers (those most willing to try new ideas) have also adapted this technology. However, most farmers are reluctant to adopt it because of additional labor cost or unavailability of moringa.

Editors: How would you suggest that a farmer or development practitioner go about making and applying the extract? What ratio of leaves to water would one use, say, for application through a backpack

Basra: For the farming community, I have developed a very simple method to make MLE and apply it to crops. Usually a 20-liter capacity backpack sprayer is used in Pakistan. Take one kilogram of fresh moringa leaves, wrap them in cheese cloth, and beat the cloth with a wooden stick to crush the leaves. The crushed leaves, still inside the cheese cloth, are used like a tea bag. MLE can be obtained by dipping the cloth-wrapped leaves many times in a water-filled backpack spray tank. Alternatively, the crushed leaves in the cheese cloth can be submerged in the water and left to soak for 5 to 10 minutes. The resulting extract has the required dilution for priming or spraying. Three such tanks (3 kg fresh leaves in 60 liters of water) are sprayed on an acre (0.4 ha). This simple technology is working for many farmers.

Editors: Are factors such as application timing or age of moringa leaves important for success using MLE? Have you had to overcome challenges to succeed with MLE?

Basra: I recommend two to three sprays, at critical stages of a crop. A wheat crop, for example, could be sprayed at the tillering, booting and heading stages. When a crop is young, three 20-liter tanks of spray per acre will be sufficient. Use four tanks per acre at the later growth stages.

The best time to spray is in the evening or early morning, especially in hot climates.

The effectiveness of MLE from the leaves of full-grown trees is almost the same as that from leaves of a multi-cut, densely-planted crop of moringa. However, an intensively-managed multi-cut plot of moringa lends itself well to repeated harvests of large quantities of moringa leaves.

Recently, I have been studying the effective shelf life of MLE, so that it can be marketed or used during times when fewer moringa leaves are available. I have noticed that the effectiveness of MLE declines after one month. It would be difficult to market MLE with only one month of effective shelf life. More research is needed to explore the effectiveness of dried moringa leaves as a source of aqueous extract. Dried leaves could potentially be stored for a period of time before making the extract.

Editors: What advice would you give to someone who is initially trying this out, to evaluate its potential for a given project area? Are there any publications, for

example, that you would suggest for more in-depth reading?

Basra: I advise that they consider the health of moringa plants from which they are making extract. Remove any damaged and diseased plants from the field, and take only healthy moringa plants for leaf extract.

I regularly publish articles in local languages in newspapers and farmers' magazines, to share with farmers about the benefits and use of moringa, including use of MLE as a growth enhancer. I have also recorded many talks on radio and TV, and video clips are available on Facebook and YouTube.

Editors: If you are open to doing so, how should people contact you if they would like to correspond with questions?

Basra: I organize regular farmer field days to educate and motivate farmers to use MLE, and I provide literature in the local language. I have also established a Facebook page called "Moringa for Life," where this information is shared. Farmers regularly contact me by telephone or social media about the availability, benefits and use of moringa.

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ECHOES FROM OUR NETWORK

ROLAND BUNCH, 5 YEARS IN AFRICA

We recently received a report from Roland Bunch regarding his efforts to promote green manures and cover crops in Africa.

Mr. Bunch's main point is that soil fertility has steadily declined, due mainly to shortening and elimination of the fallow period required to keep the land healthy and productive. Bunch reports:

"Back in 2009-10, during a 6-nation study I carried out in Africa for World Renew, I realized that because 80% of smallholder farmers in sub-Saharan Africa now have less than 2 hectares of land (roughly 5 acres), they are no longer able every year to have 3/4 of their land sitting idle (ie in a fallow) and still feed their families with what's left. Fallowing is the way by which African farmers have kept their soil fertile for some 3,000 years. But as their plots have diminished in size (mostly because of population growth, but also because a lot of land has become wasteland), they have gradually reduced their customary fallow periods from 15 years to 10 years, 8 years, 4 years, and down to nothing. In most of sub-Saharan Africa, fallowing is now a thing of the past; it is in its death throes."

He also asserts that "as fallowing dies out, the organic matter content of farmers' soils starts dropping, crop yields diminish, and people go hungry. My study found that yields of staple foods were decreasing by about 5 to 10% per year!"

Most affected are around 15 lowland, drought-prone countries in Africa.

Since fertilizers are not cost effective on poor soils Bunch contends that "green manure/cover crops are the only feasible and sustainable route farmers can take." He adds "A farmer using gm/ccs can produce over 100 tons of biomass (green weight) on two hectares of land. By way of comparison, I have never heard of a smallholder farmer ever making and applying more than 10 tons of compost in a year. This quantity of biomass is more than enough not only to maintain the fields' fertility, but to gradually restore the soil, even on wastelands, to its naturally high fertility."

Realizing that each location and farming system would require different leguminous green manure/cover crops (gm/cc), Bunch



Figure 6: Farmers and program personnel in Mozambique are impressed about the incredible ability to survive a drought of the high-protein 60-day cowpeas that they have planted for the first time. All the crops in the background were stunted by last year's drought. Source: Roland Bunch report.

set a goal to "identify or develop in each of ten nations, at least one widely applicable, successful green manure/cover crop system and promote it to the point that it is spreading spontaneously from one farmer to another." After five years Bunch reports "in five countries we have already developed very good gm/cc systems, and in two others we have identified excellent already-existing systems."

In brief, the systems being promoted are:

- Mali – *Gliricidia sepium* for light shade, soil improvement and fodder



Figure 7: Savings group members walk through their plot of 4-year-old *gliricidia* trees in central Mali. The furrows below the trees are where crops have been planted each year. Source: Roland Bunch report.

- Cameroon – *Tephrosia vogelii* for a one year fallow period (existing system)
- Kenya – *Gliricidia sepium* on terrace faces
- Rwanda – *Mucuna pruriens* (velvetbean) as a cover crop for bananas and *Lablab purpureus* intercropped with maize

- Tanzania – *Lablab purpureus* intercropped with maize and ongoing experiments with four or five other gm/ccs with maize (existing system)
- Zambia – *Cajanus cajan* (Pigeon Pea) ratooned and intercropped with maize
- Mozambique – *Cajanus cajan* (Pigeon Pea) and *Vigna unguiculata* (Cowpea) intercropped with maize.



Figure 8: Ratooned pigeon pea plants intercropped with maize in Mozambique. The stunted maize plants among the pigeon peas are testimony to the effects of the drought on most other crops. (This field has received only two rain storms since the week it was planted.) Source: Roland Bunch report.

Bunch points out that we are already seeing famine, food shortages and child stunting in many of the lowland, drought-stricken countries. The situation is desperate for many people but there is hope that including green manures and cover crops in cropping systems can restore soil health and productivity.

To read his full report, go to <http://foodfirst.org/wp-content/uploads/2016/02/AfricaReportFinal2.pdf>.

In 2012, Roland Bunch published an extremely helpful guide to assist farmers and extension workers choose the most promising legumes to evaluate for their systems. The book *Restoring the Soil: A Guide for Using Green Manure/Cover Crops to Improve the Food Security of Smallholder Farmers* is available free of charge to download from the FAO: http://www.fao.org/ag/ca/CA-Publications/Restoring_the_Soil.pdf.

FROM ECHO'S SEED BANK

ECHO's Seed Bank has several new legume varieties that are excellent choices for use as green manure/cover crops.

Velvet Bean, '**90-Day**' (*Mucuna pruriens*), is less vigorous than the tropical variety. It is a day-length neutral variety that grows well in temperate areas. It does have irritating hairs, so skin must be protected during harvesting and seed processing.



Lima Bean, '**7-year**' (*Phaseolus lunatus*). This variety originated in Central America, but has also been found in parts of East Africa and South Africa;

our seeds come from southern Africa. '7-year' lima is commonly used as a cover crop. If grown along the ground, it produces a 2-foot high mat of foliage that smothers weeds. It can also be trellised. The seeds are large, and can be identified by distinctive red caps atop the seeds.

Cowpea, '**Thailand Long**' (*Vigna unguiculata*) originated in Thailand during the late 1980's. This variety has long pods and a bush-like habit growing close to the ground.



Pigeon Pea (*Cajanus cajan*) is a perennial shrub that produces green seed or pulse in the low dry and humid tropics, this frost-sensitive species has reportedly been cultivated up to elevations of 2,000 m (6,000 ft) in the Himalayas and to 3,000 m (9,000 ft) in Venezuela. Pigeon peas can be grown in many types of soil, and are capable of fixing nitrogen. Plants are used for a vegetable, fodder, green manure, and in agroforestry. The '**Georgia TWO**' variety was developed by Dr. Sharad Phatak at the University of Georgia. It is a short-duration, day-neutral variety that is said to be determinate. Plant on well-drained soils with a pH between 6 and 7.2. It does well planted in rows with plants 5 to 15 cm (2 to 6 in) apart. Plant 1.2 cm (0.5 in) deep, when soil temperatures are at least 12°C (55°F). This variety needs moisture at planting and then needs at least 2.5 cm (1 in) more of rain to make a crop.

This cowpea works well as a cover crop. The young pods can be eaten fresh, or the beans can be dried and used in cooking.

Blooms are yellow and pods begin to set 60-70 days after planting. This plant is very vigorous and productive, and may produce up to 4,480 kg of dry seed per hectare (4000 pounds of dry seed per acre). With



less vegetative growth than other varieties, '**Georgia TWO**' is recommended for human consumption but not for animal fodder. We have yet to plant this variety here at ECHO Florida, so we welcome your feedback. Another variety, '**Agrofor-**

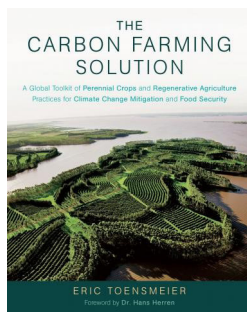
estry Select', grew up to 8 feet tall on the ECHO farm. It was selected for use as animal fodder, so it is not a heavy seed bearer.

For more information on these varieties as well as many other seeds ECHO has to offer, go to "Plants & Seeds" on the resource bar at www.ECHOcommunity.org. Active development workers can request free sample packets of these seeds through their profiles.

BOOKS, WEB SITES AND OTHER RESOURCES

The Carbon Farming Solution by Eric Toensmeier

Reviewed by Rick Burnette



The 2015 Paris Climate Summit attempted to define specific actions related to the sequestration of atmospheric carbon, which continues to reach ever greater concentrations (currently over 400 parts per million of carbon dioxide). To curb climate change, 350 parts per million or less is regarded as the crucial threshold. Among a wide array of climate change mitigation strategies that are being proposed, the recognition of

agriculture as both a carbon source and a means of carbon capture is essential.

During the Paris talks, world leaders identified carbon capture in the soil as a significant strategy for responding to the climate crisis. This is where carbon farming, a combination of "crops and practices that sequester carbon while simultaneously meeting human needs," can play a vital role helping to prevent catastrophic climate change by "removing carbon from the atmosphere and safely storing it in soils and perennial vegetation."

Eric Toensmeier, the author of *Paradise Lot* and *Perennial Vegetables*, and co-author of *Edible Forest Gardens*, is no stranger to the ECHO network. He has spoken often at ECHO conferences and workshops. His latest book is *The Carbon Farming Solution* (Chelsea Green Publishing): A Global Toolkit of Perennial Crops and Regenerative Agriculture Practices for Climate Change Mitigation and Food Security.

This 480-page work is highly readable and offers comprehensive descriptions of carbon farming approaches that include annual cropping systems that are well known to the ECHO network, such as Conservation Agriculture and the System of Rice Intensification. It also addresses the appropriate role of livestock systems such as managed grazing and improved pasture management.

Most of the book is devoted to perennial crops and cropping systems. Eric offers considerable information related to the role of perennial staple crops (e.g., root crops, bananas, pulses, plantains, nuts) as well as the potential of perennial grain crops. Another sizable section details perennial industrial crops grown for energy, biomass, fiber, industrial starch and hydrocarbons.

In addition to suggesting crops and systems, Eric offers a three-point plan for scaling up carbon farming by empowering farmers to make the transition to such agriculture,

supplying effective financing and reforming international agriculture and trade policies.

The title of *The Carbon Farming Solution* may not be attractive to those still struggling with the concept of human-induced climate change. Even so, the book is an encyclopedia of perennial crops and

farming systems with global relevance. One valuable tool is the 34-page Global Species Matrix (Appendix A) that lists 698 crop species. This table efficiently summarizes essential information related to the classification, origin, invasiveness, climate/humidity requirements, cropping categories and agroforestry potential for each entry.

The book is not cheap, but *The Carbon Farming Solution* would be an excellent resource for agricultural scientists and other professionals, and for institutional libraries. It may be purchased through on-line retailers, such as Chelsea Green Publishing, and is sold at the ECHO bookstore.

UPCOMING EVENTS

ECHO Florida Events:

Location: ECHO Global Farm, USA
Presented by: ECHO

Tropical Agriculture Development 1: The Basics
July 25-29, 2016

Tropical Agriculture Development Workshops

- **Appropriate Technology**
May 24-27, 2016
- **Introduction to small-scale livestock production in the tropics**
September 20-22, 2016

ECHO International Agricultural Conference
November 15-17, 2016

International Events:

ECHO West Africa Forum
April 12-14, 2016
Location: Scripture Union Guest House-Training and Conference Center, Nigeria
Presented by: *ECHO West Africa* and *CAPRO*

Other ECHO West Africa Events:

- Pastors training in Bobo Dioulasso, Burkina Faso (April 20-23, 2016)
- Pastors training in Koutiala, Mali (May 11-13, 2016)

Central America/Caribbean Regional Conference
September 27-29, 2016
Location: Best Western, Las Mercedes, Managua, Nicaragua

Highlands Symposium
November 1-3, 2016
Location: Addis, Ethiopia

Each of ECHO's Regional Impact Centers regularly offers smaller-scale country or topic-specific training workshops throughout their respective regions. Please watch ECHOcommunity for further information. Subscribing to "calendar notifications" will help ensure that you don't miss out.

More information and registration details can be found on www.ECHOcommunity.org.

This issue is copyrighted 2016. Selected material from *EDN* 1-100 is featured in the book *Agricultural Options for Small-Scale Farmers*, available from our bookstore (www.echobooks.org) at a cost of \$19.95 plus postage. Individual issues of *EDN* may be downloaded from our website (www.ECHOcommunity.org) as pdf documents in English (51-131), French (91-129) and Spanish (47-130). Recent issues (101-131) can be purchased as a group from our bookstore (www.echobooks.org). Earlier issues (1-51 in English) are compiled in the book, *Amaranth to Zai Holes*, also available on our website. ECHO is a non-profit, Christian organization that helps you help the poor to grow food.

PLEASE NOTE: At ECHO we are always striving to be more effective. Do you have ideas that could help others, or have you experimented with an idea you read about in *EDN*? What did or did not work for you? Please let us know the results!