2017 ECHO International Agriculture Conference

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This article summarizes several of the plenary sessions presented at the 2017 ECHO conference in Florida. If you were unable to attend the conference, or would like to review some of the talks, many of them can be viewed on ECHOcommunity (https://www.echocommunity.org/pages/conference_presentations). Other 2017 presentations that appear there include "Tropical and subtropical fruit crops for small to moderate farm holdings," "Dialogue education and farmers," and "Integrating practical nutrition education into community agricultural programs." Talks given in previous years are also available on the website.

Moringa-coated sand filters as a sustainable solution for clean water (Dr. Stephanie Butler Velegol)

Moringa seeds can be crushed and used to clean dirty water. However, water treated in this manner must be used right away, or else the small amounts of organic matter that remain in the water will allow bacteria to grow.

Dr. Stephanie Velegol has been working for seven years to make the process of water treatment with moringa more effective for the long-term. She shared some exciting information:

- **The antibacterial mode of action**. Moringa seeds contain 1% of an antimicrobial cationic protein peptide that has a positive charge. Pathogens have a negative charge and are attracted to the protein. Dr. Velegol described the mechanism by which bacteria are rendered inactive: the bacterial membranes fuse and the bacteria can no longer reproduce.
- **"Sticky killer sand."** Sand filters do a good job of filtering out particles in water but cannot remove bacteria like *E. coli.* Dr. Velegol has shown that the active proteins from moringa seeds can be adhered to the surface of sand. This "functionalized sand," or *ƒ*-sand (also referred to as "sticky killer sand", can then be used in sand filters; as water filters through, microbes have sustained contact with the *ƒ*-sand. Here are some details about the process:
    - Experiments showed that **mixing crushed seeds (in water) with sand for five minutes is long enough** for the proteins to adhere to the sand's surface.

    - **"Sticky sand" also sticks to plastic and glass, because of the latter's negative charge**; this can be an easy and helpful test to check whether or not sand is functionalized.
    - **A sand water filter made with "sticky killer sand" works on bacteria like *E. coli*** that are 1 µm in diameter, that are hardest to remove with a filter.
- A 1 m x 1 m filter, using seeds from six trees, can remove 99.99% of 1 um particles and can treat water for 1000 people. Models have demonstrated that such a filter will be functional indefinitely. It will clog up long before it ceases to be effective.
- Moringa seed can yield multiple products. The seed can first be pressed for oil. The seed cake that is left can be used to produce *ƒ*-sand; the remainder of the seed cake can then be used for animal feed.

Questions remain, of course. In experiments, very large quantities of *E. coli* were introduced into the test sand filter, and none were detected in the water that came through. But what if, at lower and more realistic concentrations, the *E. coli* bacteria are less attracted to the charged sand? It is also not clear whether the filter can remove viruses. Because of these unknowns, Dr. Velegol was hesitant to recommend that an *ƒ*-sand filter replace other methods of water treatment. However, she agreed that after filtration, other methods of water treatment (e.g. UV light, iodine, or chorine) could be used at a lower dose. Dr. Velegol's work was recent published (http://edn.link/ppjdf3) and is now available.

An ex-post evaluation of 10 years of Conservation Agriculture (CA) promotion in Zimbabwe: Lessons for food security interventions (Putso Nyathi)

Christian Care promoted Conservation Agriculture (CA) in five districts of Zimbabwe from 2006 to 2014, in areas that receive little rainfall for five or six months. In her plenary talk, Ms. Putso Nyathi began with a brief overview of CA principles, which include minimum tillage, maintenance of soil cover, and crop rotation. Then she described Christian Care's program, which also included introduction of open-pollinated varieties (OPVs); use of cover crops; and extension with lead farmers.

Ms. Nyathi spent most of her talk describing an evaluation that was conducted after the program ended, to assess the impact of the effort. A team collected data using household interviews, focus group discussions, key informant interviews and field visits. The team found high adoption of CA principles; 95% of respondents continued to use minimum tillage methods, and around 80% continued mulching and rotating crops. There was good evidence that the practice of CA had led to increased food security; one respondent commented, "Even where there were no granaries before, they are now there because of CA." However, the evaluation team found that farmers only devoted about one quarter of their cropland to CA, with the rest planted using conventional practices. Though group seed banks had been

promoted, household seed banks proved more sustainable. Only cowpea was planted as a cover crop, due to limited understanding of gmccs and to lack of seed availability.

Ms. Nyathi discussed some of the reasons farmers adopted CA practices. The main driver for adoption was higher yields. The evaluation also revealed barriers to adoption; for example, using a hoe was too labor-intensive. Ms. Nyathi suggested the introduction of other, mechanized options for minimum tillage.

Ms. Nyathi shared a few other interesting results of the CA promotion. First were the program's impacts on women, which were both positive and negative. On the one hand, many women became lead farmers and as a result, women had more access to agricultural extension; use of the hoe (known as a woman's tool) made CA accessible for women; and the increased production from CA benefited the whole household. On the other hand, the weeding and mulching meant more work for women.

The other interesting finding had to do with the extension farmers. Though no longer paid once the program ended, the lead farmers continued to give technical and moral support when asked. Government extension for CA also continued after the program.

Conservation Agriculture has been promoted and practiced by farmers for well over 10 years in southern Africa. Ms. Nyathi gave a very helpful presentation of a rigorous evaluation that took a critical look at the impact of this widely promoted farming practice.

Integrated Development Done Right: Farmer-led Research on Agroecology and Nutrition (Dr. Rachel Bezner Kerr)

Dr. Rachel Bezner Kerr shared results of 17 years of multi-faceted, farmer-led research in Malawi and Tanzania. The research resulted in dramatic improvements in infant, child, and family nutrition and food security, through promotion of crop diversification (http://www.pnas.org/content/107/48/20840.short), soil improvements, nutrition (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5126822/) and cooking education, and open dialogues about family dynamics and gender roles. Dr. Bezner Kerr's research has evolved through five stages, with each successive stage incorporating feedback from inclusive and participatory discussion groups (https://www.ncbi.nlm.nih.gov/pubmed/27983973).

Participating communities experience high rates of chronic malnutrition due to factors that include severe poverty, high unemployment, low wages, and poor soil fertility. Traditional diets are high in carbohydrates, but low in protein, vitamins, and minerals with little money available to purchase food. In addition, unequal gender dynamics divert food and income away from infants and nursing mothers during critical developmental stages.

Dr. Bezner Kerr described many results of the farmer-led research. Legumes (e.g., pigeon pea, groundnut, soya, cowpea) were rotated with or planted among maize, to increase available soil nitrogen and organic matter levels, and to suppress weeds, conserve water, reduce erosion, diversify diets, and supply livestock fodder. Increased chicken and pig production helped supply more protein and increase incomes. Compost helped improve dry season vegetable gardens and efficient wood stoves reduced fuelwood consumption.

Discussion groups helped encourage community and family dialogue about gendered labor roles (https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/55820/IDL-55820.pdf), financial decision making, and childcare to highlight how the attitudes of grandparents and husbands impact nutrition outcomes. Special community events, such as cooking and recipe competitions (http://www.tandfonline.com/doi/pdf/10.1080/03066150.2014.971767) (with men cooking!), dramas, and music reinforced the benefits of working together to strengthen families and helped to adjust gender roles.

Dr. Bezner Kerr's talk included fascinating examples of the wide-ranging interactions of agriculture, nutrition, and gender relations. For example, one graph showed correlations between farm diversification and improved child growth. Dr. Bezner Kerr shared, "models show that legume intercrops, number of crops cultivated, and discussing farming with a spouse are significant predictors of food security and dietary diversity after holding other factors constant." Analysis of research in Tanzania showed a "significant relationship between household food insecurity, gender inequity, and depression."

Post-Conflict Agriculture (Dr. Joshua Ringer)

Dr. Ringer has worked with smallholder farmers in Myanmar, Vietnam, and the Philippines, in locations where armed conflict has torn apart the physical and social structure of society. Many smallholder farmers that live in areas of conflict, or that have lived through conflict, have been displaced. They may have lost loved ones, their homes, and their livestock. Dr. Ringer shared the importance of grieving with farmers over their losses, but cautioned against viewing farmers as victims. Development efforts should maintain people's respect and dignity, and should build on steps farmers have already taken. Those affected by conflict often develop avoidance and escape strategies in order to survive. Agricultural development alone is not enough; for families who have lived through situations of conflict, spiritual and personal needs also must be addressed in order for healing to happen.

Agricultural development and extension can play a vital role in stabilizing and rebuilding food production in post-conflict situations, if done carefully. Aid workers and agricultural extension workers must gain the confidence of farmers and engage them in a true participatory manner to develop solutions to their problems. Agricultural networks will need to be rebuilt. Marginalized and traumatized farmers may need encouragement to rebuild.

Recovery starts with meeting people's most basic needs, including food, shelter, sanitation and personal safety. Then chronic development issues can be addressed. Villagers must work together to rebuild food production, to raise animals again, to adopt new technologies presented by extension officers and NGOs, to preserve their resource base, and to regain access to markets.

Dr. Ringer suggested that practitioners work with key farmers to develop agricultural options that can be incorporated into farming systems. Farmer field schools and farmer self-help groups can improve opportunities for agricultural development. Dr. Ringer commented on the importance of planning for the long-term (at least ten years). He suggested small-scale on-farm field experiments that can be evaluated and adapted.

[*Related: In her conference plenary (https://www.echocommunity.org/resources/52752640-5523-4c64-b0f2-0c165ded17ba) session in 2013, Robin Denney shared her experience in post-conflict areas, including challenges, different agricultural development approaches, and how faith influences recovery. Also, some of the strategies to help prepare for and respond to disaster from EDN 122 (https://www.echocommunity.org/resources/5c894c87-d31f-4493-ba19-997b9945f95a) might be helpful in post-conflict situations*.]