HortCRSP

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FROM THE AMERICAN PEOPLE

Horticulture CRSP News

Reducing poverty, improving nutrition and health, and improving sustainability and profitability through horticulture.

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In this issue

HortCRSP by the numbers...

15 university partners
30 projects
34 countries
55% of trainees are women
241 new technologies under research
1,418 rural households impacted
2,293 people trained

In Focus: Horticulture CRSP Technology Projects

Roughly half the world's population live in rural areas of the developing world. Two and a half billion of them belong to households that earn income through agriculture(1). Most of these developing-world farmers are plowing their fields with animal traction and weeding by hand. The average hectare of farm land in the developed world is up to 5 times more productive than the average hectare in the developing world(2), and the technology gap is the driving force behind that disparity.

Horticulture CRSP is working to narrow the technology gap by delivering financially-sustainable technology to developing-world growers. For example:

- The Coolbot uses a 'tricked' air conditioner, feathers and solar panels to provide developing-world farmers with access to cold storage.
- The concentrated solar drier uses large 'mirrors' and novel design to dry horticultural produce in cloudy weather.
- The Horticulture CRSP seed drier uses improved desiccants and simple, air-tight jars to preserve seeds.

These are a few of Horticulture CRSP's financially-sustainable technologies that we would like to highlight in this issue of our newsletter.

The Horticulture CRSP is taking a multitudinous approach to improve the agricultural technologies available to developing world growers. Nevertheless, a reoccurring theme in all of our projects is the collaborative effort between farmers, U.S. researchers and researchers from our focus countries, who test these technologies on the ground, in developing-world realities.

---HortCRSP editorial staff: Mark Bell, Amanda Crump, Peter Shapland, & Elana Peach-Fine

(1) The World Development Report 2008, Agriculture for Development http://econ.worldbank.org/
(2) Agriculture and Rural Development. Maxwell School of Syracuse University http://faculty.maxwell.syr.edu/

COLD STORAGE FOR DEVELOPING WORLD FARMERS

While postharvest losses in the U.S. are roughly 12%, it is estimated that these losses can be as high as 80% in many developing-world countries. For smallholder farmers eking out an existence on the tattered edges of our global economy, watching so much of their hard work spoil on the way to the paying consumer is particularly disheartening. Postharvest losses erode the farmgate value of their produce and reduce the amount of fruits and vegetables available to the surrounding populace, who typically suffer from high rates of micro-nutrient deficiency.

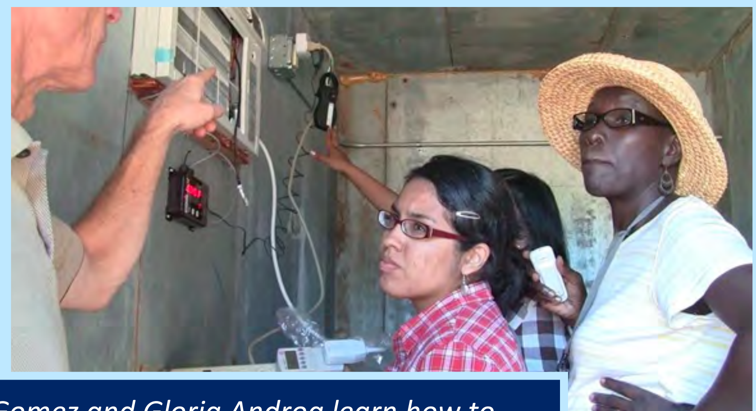
High temperatures are the main cause of postharvest loss in the developing world, and that makes post-harvest cooling the most effective way of reducing losses. The need for temperature control is especially acute because ambient temperatures are often above 30°C, which can accelerate the deterioration rates of produce by a factor of twenty. However, cold storage can be prohibitively expensive. Conventional coolrooms and transportation systems employing mechanical refrigeration cost thousands of dollars and are very difficult to maintain in developing countries; unreliable electricity also thwarts cold storage possibilities. For resource-limited farmers, conventional coolrooms are economically and practically infeasible.

The Coolbot is the answer!

The Coolbot provides inexpensive cold storage to developing-world farmers. The Coolbot is a small black box that is wired into a standard air conditioner. It overrides the air conditioner's temperature gauge and tricks it into working harder, thus turning an insulated room and an air conditioner into a coolroom. To prevent the fins from icing up and disrupting airflow, the Coolbot monitors the fin temperature and stops the compressor when ice builds up. The ice on the fins continues to cool the air until it melts and the compressor turns on again.

The Coolbot reduces the cost of cold storage from thousands of dollars to mere hundreds, making it a viable option for developing-world farmers.

Through USAID funding, Horticulture CRSP researchers investigated appropriate methods of delivering the Coolbot technology to farmers. They examined a range of locally available materials that can be used to insulate the coolrooms, including feathers, straw bales and shredded paper. They also evaluated the use of solar panels to power the system in order to solve the problem posed by unreliable electricity. Finally, the Horticulture CRSP researchers designed a passive transportation container that will keep produce cold during its journey to local markets.



Julia Gomez and Gloria Androa learn how to operate the Coolbot so they can deliver this affordable cold storage technology to farmers.

USAID funds enabled collaborating scientists from Uganda, India and Honduras to travel to California to work with UC Davis researchers on the Coolbot and postharvest issues. Three scientists, Julia Gomez, Gloria Androa, and Neeru Dubey, participated in the UC Davis postharvest short course and received training in Coolbot operation and coolroom construction. Julia Gomez returned to Honduras and began working with a women's cooperative that produces tropical flowers for export. The team identified a room at the packing station that was insulated and fitted with the Coolbot system. Neeru Dubey built a coolroom in India that employs a sandwich construction model with rice hulls as the insulating 'material' in the mud-brick sandwich. Gloria Androa and her local partners identified a site for the Coolbot in a village in Uganda

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CONCENTRATED SOLAR DRYING

In the summer of 2009, Diane Barrett and her husband Pieter Stroeve were driving through the southern deserts of California. They were taking a vacation from their positions at the University of California-Davis, where she works as a food scientist studying the effects of processing on food quality and he works as a chemical engineer studying solar energy. Diane and Pieter were discussing project ideas to submit to Horticulture CRSP. They were looking for a project that could capitalize from the unique intersections of their expertise and deliver leap-frog technology to farmers in East Africa.

Gigantic magnifying glasses that cook vegetables and reduce deforestation? Too costly.

Solar powered canneries? Infeasible, besides, it's too cloudy in East Africa.

As they were brainstorming, they drove by a solar energy field that used large mirrors to concentrate the sun's rays onto the panels and that's when it hit them. Concentrated solar drying of fruits and vegetables! They could use mirrors to concentrate solar energy onto a dryer. Fruits and vegetables could be dried in cloudy weather, and in sunny weather, the concentrated rays would reduce the product's exposure time to heat and ultraviolet rays. As a result, the product would have superior color, texture and nutritional content. Diane and Pieter had found their idea. They would develop a solar dryer that would capture his knowledge of engineering and solar energy, her knowledge of food processing and the sun's concentrated radiation.

The concentrated solar drier uses reflective surfaces to increase drying capacity.

When they returned from their desert vacation, they found that concentrating solar panels were already used for a variety of energy technologies from simple solar cookers to electricity generation. These technologies use reflective surfaces as sophisticated as machine-polished surfaces or as simple as aluminum foil covered cardboard. They also found that concentrated solar power had never been applied to the drying of horticultural crops. Their geographic research indicated that Tanzania bears the environmental and economic conditions that could maximize the potential impact of concentrated solar dryers. Tanzania has two rainy seasons with the western parts receiving over 200 centimeters of rain per year. Previous attempts at establishing solar drying in these regions had been unsuccessful due to a conventional solar dryer's low throughput capacity and its inability to operate in cloudy environments. Moreover, the opportunities were great. An estimated 50-80% of fruits and vegetables produced in Tanzania are lost, and only 1% are processed for off-season consumption. Due to Tanzania's variable fruit and vegetable production throughout the year and a genuine dearth of post-harvest processing, horticultural produce is expensive and limited in supply between harvest periods. During the harvest, the lack of processing and conservation options results in a glut of produce and growers receive little recompense for their product, so tons of the horticultural crop ends up wasted.

Diane and Pieter's goal was to develop a concentrated solar dryer that would enable smallholder Tanzanian farmers to process fruit and vegetables for off-season consumption and marketing. Their project would boost nutrition and profits for these rural farmers. They received funding to develop their prototype at UC Davis and initiate product testing and dissemination in Tanzania.

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Coolbot - from page 2

and determined that papyrus, already used in domestic construction, is the best insulation material for their coolrooms. In Honduras, Uganda and India, the Coolbot is proving to be an effective means of bringing farmers together to reduce postharvest losses.

The Coolbot overrides the air conditioner's temperature gauge and tricks it into working harder, thus turning an insulated room and an air conditioner into a coolroom.

High temperatures are typical in most developing countries. Low temperatures are an elusive goal for the local farmers. This gulf between high and low temperatures in developing-world horticulture leads to high postharvest losses. As Julia, Gloria, and Neeru have demonstrated, the Coolbot bridges that gulf by providing farmers with inexpensive cold storage opportunities. The Coolbot is an excellent example of a leap-frog, sustainable technology that increases the profitability of smallholder farms and improves the lot of rural communities.

---Michael Reid, Peter Shapland, and Mark Bell

Drier - from page 3

Pieter and Diane's concentrated solar dryer has four key elements. One, adjustable mirrors focus the sun's rays onto the solar dryer throughout the day. Two, clear material allows the sunlight to pass into the dryer. Three, black material in the base absorbs heat for extended heating times. And four, airflow drives hot air through the product – air enters the bottom, heats up the pyramidal cavity, rises through the platforms and exits through the chimney. Pieter and Diane are testing the concentrated solar dryer in Northern California's rainy winter and are working with the Tanzanian Ministry of Agriculture to test and spread adoption.

Pieter Strove, Bertha Mjawa, Dianne Barrett and Simon Li dry tomatoes under cloudy skies.

Eighty percent of Tanzania's population lives in rural areas, and the majority are women farming small tracts of land. Smallholders and landless farmers are often the poorest people and rely on off-farm employment to survive. Postharvest processing creates rural agribusiness and employment opportunities for these vulnerable populations, but Tanzanians are missing out on these employment opportunities. The concentrated solar dryer provides Tanzanian farmers with a simple, sustainable means of processing the harvest for off-season consumption. This innovative dryer will boost employment and year-round nutrition for vulnerable populations in East Africa.

See the concentrated solar dryer in action at: http://hortcrsp.ucdavis.edu/main/1Drying.html.

---Diane Barrett, Pieter Stroeve, Peter Shapland, and Mark Bell

RELIABLE, INEXPENSIVE SEED STORAGE FOR FARMERS

Delivering improved seeds to smallholders in the developing world is an efficient and sustainable method of increasing yields. While fertilizers, pesticides and equipment are often costly and non-renewable, seeds represent an inexpensive, transportable and reusable technology. Furthermore, improved varieties of horticultural crops often reduce dependence on synthetic pesticides, improve food safety, reduce pre- and post-harvest losses and fetch higher prices in the market. However, all the benefits that developing-world farmers accrue from improved varieties depend on their local systems of seed production and storage.

When farmers plant seeds degraded by poor storage conditions, the resulting crop is hampered by poor stand establishment, lack of uniformity, reduced yields and poor marketability. The farmers' experience with poor seed performance lowers their incentive to invest in improved seeds and stymies development of a breeding and seed marketing system for more productive horticultural varieties. On the other hand, when developing-world farmers can store seeds successfully, they strengthen local seed markets, increase yields and are better able to preserve native land races.

Seed storage is a major problem for developing-world farmers because the majority of the world's poor countries are located in the tropics, where the combination of high temperature and high relative humidity causes rapid deterioration of seed quality. Seeds absorb water from the air when they are stored in humid environments and lose water when stored in conditions of low relative humidity. Generally speaking, a seed's longevity is reduced by approximately half for every 1% increase in seed moisture content or 5°Celsius increase in temperature, and the effects are additive.

In collaboration with Horticulture CRSP, University of California-Davis Professor Kent Bradford and his international team of plant scientists are delivering a simple, inexpensive and widely-adaptable seed-storage technology to smallholder farmers in India, Nepal and Thailand. Dr. Bradford and his team believe that, in the developing world context, maintaining a low seed moisture content is key to successfully storing seeds. For one, cold storage is expensive and difficult to maintain because electricity is often inconsistent, and two, seeds that are dried to low moisture content have much greater storage longevity, even at high temperatures. The team is drying seeds with inexpensive hermetic containers and zeolite beads, a recently developed desiccant technology. Zeolite beads quickly remove water from seeds and maintain low relative humidity in hermetic storage containers, enabling both postharvest drying and extended storage of horticultural seeds. Storage of dry seeds inside sealed containers also reduces mold and rodent problems. Whereas other desiccants can be reused only a limited number of times, zeolite beads can be reused at least 10,000 times without loss of function, by simply baking them in an oven for an hour between uses.

Zeolite beads quickly remove water from stored seeds and can be reused at least 10,000 times without loss of function, by simply baking them in an oven for an hour between uses.

The unique properties of the zeolite beads, combined with inexpensive hermetic containers, make it feasible for developing-world farmers to store seeds inexpensively and conveniently. This technology can be scaled from individual farmers to large seed companies and is applicable to all tropical environments. Horticulture CRSP researchers believe that widespread local adoption of this technology will boost yields and profits for rural farmers all around the world.

---Kent Bradford, Peter Shapland, and Mark Bell

Ellis & Roberts (1981) Seed Sci & Tech 9: 373-409
Flynn & Turner (2004) http://data.kew.org/sid/viability/index.html

The HortCRSP Trellis Fund

Goal: The goal of the Trellis Fund is to link horticultural graduate students in the U.S. to agricultural NGOs, universities, or government agencies in developing countries, and enable these organizations to extend new ideas to 1,800 farmers worldwide.

Scope: Trellis Fund proposals can address horticultural production, pest management, postharvest, marketing issues, or horticultural-related community development.

Methodology: The developing world organization will identify a horticultural problem facing local farmers and the type of expertise they seek in a U.S. graduate student. The organization will create a project proposal and the Trellis Fund will match awarded organizations to a horticultural graduate student and partially support their farmer outreach program.

Funding:
The Trellis Fund will offer:

- $2,000 contracts to the developing world organization to extend horticultural research to local farmers and horticultural stakeholders.
- $1,500 fellowships to graduate students in horticulture and related programs for corresponding with the developing world organization via email. The graduate student will be encouraged to spend their fellowship on a trip to meet their counterparts and their clientele farmers to gain a better understanding of the on-the-ground situation.

Focus Countries: Uganda, Zambia, Rwanda, Kenya, Malawi, Ethiopia, Mozambique, Tanzania, Senegal, Ghana, Mali, Liberia, Guatemala, Nicaragua, Honduras, Haiti, Bangladesh, Tajikistan, Nepal and Cambodia

More Information: Visit http://hortcrsp.ucdavis.edu/main/trellis.html for more information. Proposals must be submitted to hortcrsp@ucdavis.edu by March 4, 2011. For clarifications and questions, e-mail Peter Shapland at pcshapland@ucdavis.edu

Farmers working with Horticulture CRSP projects are weighing orange-fleshed sweetpotatoes in a field demonstration project in Ghana.

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