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Inexpensive Mass Propagation Techniques for Introducing Improved Potato Varieties in the Tropics

by Dr. Tapani Haapala, FELM (Finnish Evangelical Lutheran Mission), Phnom Penh, Cambodia

Editors' Note: Dr. Tapani Haapala is an adjunct professor, agriculturist, horticulturist, and researcher. He currently works as global food security advisor for FELM (the Finnish Evangelical Lutheran Mission) and is the regional development manager for FELM in Cambodia.

Keywords: *Solanum tuberosum,* potato, rejuvenation, cutting propagation, non-sterile conditions

Key Ideas:

- *Potatoes can produce a lot of protein and other needed nutrients.*
- *They are difficult to grow in the tropics due to the hot climate.*
- *New varieties are available for the tropics.*
- *Inexpensive and efficient multiplication methods for producing the starting material are needed.*
- *New methods of multiplication are being tested*

Summary

Potatoes (*Solanum tuberosum*) contain high-quality food properties and are very good protein and energy sources on a daily per hectare basis of production (Frusciante *et al.* 2000). Potatoes are grown mostly in cool climate areas. In the tropics, they easily suffer from several different kinds of stress related to hot climate, which sometimes ends up causing problems such as attacks of fungal diseases. New potato varieties that are better adapted to hot climates could enable development of potato production in the tropics and could potentially provide livelihood opportunities for small-scale farmers. However, providing enough stock material to meet the potential need could be challenging.

Micropropagation is an efficient method to rejuvenate and multiply potato plant materials. It is mostly used to multiply disease-free seed potatoes. Often, only cuttings from juvenile plants can be rooted; this ability is lost when plants get older and they reach maturity. Rejuvenation is needed to multiply plant material efficiently. However, the micropropagation method is typically very expensive and requires highly educated personnel. If a method to rejuvenate potatoes was affordable and accessible to NGO

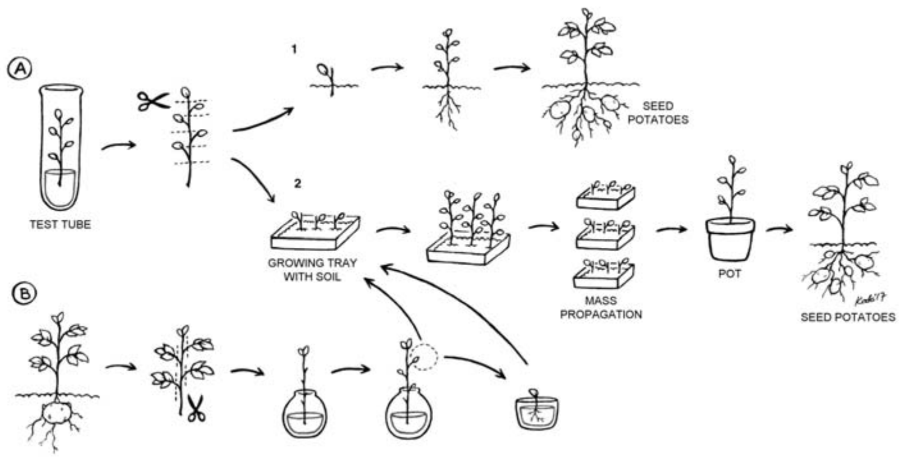

***Figure 1**: Diagram of 2 different multiplication techniques. 1A: Creating seed potatoes using tissue culture planting material and growing cuttings in 1A1: soil or 1A2: a growing tray with mass propagation in mind. 1B: Creating seed potatoes using older, larger cuttings from mature tuber-grown plants as mother stock for small new rejuvenated cuttings, which also results in the ability to mass propagate the potatoes.(illustration by Katariina Koponen)*

Featured in this AN

The ECHO Asia Impact Center operates under ECHO, a non-profit Christian organization that helps you help the poor to produce food in the developing world.

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workers, communities, and farmers, rapid adoption of new potato varieties for the tropics could result, adding another tool to the toolbox in the quest for food security. Here, we share about one such low-cost method that was successfully studied and that appears to have great potential.

Definitions

Juvenility is the plant stage from germination to early flower production. When a juvenile plant moves to the adult stage, it passes through what is called a “phase change.” Flowering is not possible until this change has occurred. Juvenile plants have some unique characteristics that often do not appear in mature plants; perhaps the most economically important characteristic is the ability of cuttings from juvenile plants to form roots. Many mature plants partially or totally lose this ability, while young plants root easily from different kinds of cuttings.

Micropropagation is the practice of rapidly multiplying plant material to produce a large number of offspring plants, usually using modern plant tissue culture methods. Micropropagation is often conducted using tissue culture and other specialized techniques, which require sterile environments, growth chambers, media, and other expensive inputs.

Rejuvenation is the opposite of maturation and ageing. The rejuvenation process can take place naturally by sexual seed reproduction (when a plant’s flower is fertilized and creates a seed) or with human involvement by the use of micropropagation or stem cuttings.

Potato Production is most often done by planting mature potato tubers (the thickened underground stem/storage organs) from ***seed potatoes***; the resulting potato plants will be clones of the mother plant and will form genetically identical tubers. Potato tubers are considered physiologically mature, so the resulting cloned plants will not pass through a juvenile stage. Plants grown from ***potato seeds***, which would pass through a juvenile stage, have unpredictable characteristics and are not very useful for commercial production of potatoes.

Micropropagation is most commonly used to rejuvenate mature potato material while retaining the desired genetic information. However, it is a very expensive method to multiply plant materials. The study described in this article was done to determine if a low-cost, low-input method to clone and rejuvenate potato varieties could be used in the tropics, to introduce new genetic material and potato varieties.

Materials and Methods

Two code-named potato varieties (PO7 and PO3) received by Professor Hong’s team from Vietnam were tested for production and productivity in Cambodia. We used a few shoots grown via micropropagation from a tissue culture vial, and some tuber-grown shoots, to test two low-cost mass propagation techniques (Figure 1, page 1). These techniques, although used in the current study only on the two code-named potato varieties, could be used on most other varieties of potatoes.

Figure 2: Indirect sunlight and two desk lamps provided needed light for a 16-hour photoperiod. This photo is to show how office space was modified to work as simplified and inexpensive laboratory environment.

This experiment utilized new varieties of potatoes from Vietnam and occurred in a regular office in Phnom Penh, Cambodia. Plants were placed near a window to receive indirect natural light; two desk lamps provided extra light and were used to provide a 16-hour photoperiod (Figure 2). Small cuttings were grown at temperatures between 23 and 36 °C. Further growth and part of the single-leaf rooting experiment took place outdoors under normal Cambodian climatic conditions.

Two different methods were employed to ascertain whether a small amount of new potato stock could be multi-

Figure 3: *Micropropagated shoots of potato, directly from tissue culture vessels, were cut to one-leaf cuttings and kept on moist tissue until they were planted in soilless media to stimulate rooting.*

Figure 4: *The mini-cuttings were planted mostly in plastic Vefi®(PK060) trays but also in plastic lunch boxes.*

Figure 5: *Primary rooting was also made in water using the same plant material as in Figure 3. The tropical climate made it more difficult to maintain the needed humidity during the early rooting stage. Here, several small cuttings are hanging into water through aluminum foil, to reduce evaporation and keep the humidity high.*

Figure 6: *Four days in water is enough for primary root formation, and the cuttings are ready to be planted in soil.*

Figure 7: *When left in water, the cuttings soon develop many primary and secondary roots and grew taller.*

Figure 8: *Most leaves of the mature potato shoots were cut off to prevent drying during the rooting stage in water. This kind of cutting provided rejuvenated side shoots for further propagation experiments (Figure 9).*

Figure 9: *Cuttings for the rejuvenation experiment were from 1.2 cm to 1.8 cm long.*

plied under conditions likely to be encountered in the tropics (Figure 1, page 1). The first technique utilized one-leaf cuttings taken from tissue culture starter plants (Figure 1A; Figure 3). These one-leaf cuttings were kept moist until they were planted in soil in a moist tray (Figure 2A2; Figure 4). They were left to grow until roots were initiated and the tiny plants had grown several new leaves. At that point, each small plant could yield more one-leaf cuttings, initiating mass propagation. Alternatively, these one-leaf plantlets could theoretically have been planted out into the field and cultivated to seed potato production (Figure 1A1). In both cases, seed potatoes would result, with tubers that could then be cut and planted for further potato production.

To improve the rooting process and hasten it, we tried also tucking the plants through holes in aluminium foil over a cup of water in order to help to reduce evaporation and increase humidity around the roots (Figure 5). In water, they produced primary roots in four days (Figure 6). When left for a longer time in the water, the original one-leaf cuttings grew longer shoots with several new leaves and developed substantial primary and secondary roots (Figure 7).

Older, larger cuttings from mature tuber-grown plants can also be used to rejuvenate and propagate potato plants (Figure 1B). In this experiment, cuttings were also taken from tuber-grown plants. All but the top leaves were removed. Then, the cuttings were placed in water and left in the same conditions as the technique above (Figure 8). Small side shoots (0.8-1.2 cm) of these cuttings became the stock material for rooting new rejuvenated plants (Figure 9).

The rooting process of the original mature cuttings was very slow, and we did not end up planting these cuttings from tuber-grown plants. Instead, minor side shoots grown during the water-rooting stage were removed and rooted in soil (Figure 1B). Shoots from 1.2 to 1.8 cm long (Figure 9) quickly formed primary roots when covered with small plastic cups to help maintain humidity (Figure 10).

Figure 10: *The small cuttings rooted easily under plastic cups.*

Once established, the tiny plants from any of the three kinds of cuttings (direct planting one-leaf cutting in soil, one-leaf cuttings first rooted in water and then transplanted in soil, and small side shoot cuttings from mature cuttings in water) started to perform like the shoots from the first micropropagation technique, and could be utilized for mass propagation to create seed potatoes (Figure 11).

Results and Discussion

The one-leaf cuttings rooted and grew as consistently as in previous experiments (Haapala, 2004; Haapala 2005; Haapala *et al*. 2008). Direct rooting was more difficult in Cambodia than in Finland (where this experiment had been conducted in the past) due to the extreme tropical weather conditions. “Mini-greenhouses” (i.e. transparent cups placed over the planted cuttings), the us of aluminium foil over water, and some plastic covers over the new transplants made the work more successful.

The small plants that were being rooted in soil using the methods above were sensitive to root neck diseases, presumably from a fungus. Watering underneath the soil tray clearly helped with the problem.

Small side shoots (Figure 9) from the tuber-grown cuttings (Figure 8) rooted well under small plastic cups. As they grew, they started to perform like the other shoots originally from micropropagation. Leaves from juvenile potato plants look very different from leaves from mature plants, so we assumed that the plant material during the two rooting stages was rejuvenated and could be used for mass-propagation. Cuttings taken from shoots of originally mature material did not differ from the other rooted one-leaf cuttings.

Conclusions

Propagation via one-leaf cuttings can be a low-cost and efficient multiplication method for new varieties of potatoes meant for the tropics, enabling the creation of many plants from a small starting population. The rejuvenation process is usually done through micropropagation in a sterile environment, but we have shown that it can be done in a normal office space in the tropics by using tissue culture material or small side shoots taken from mature cuttings of tuber potatoes.

Acknowledgements

I am grateful for Professor Hong (Figure 12) and his team at the RUA for the good cooperation during the last three years.

References

Frusciante, L., A. Barone, D. Carputo, M. R. Ercolano, F. della Rocca, and S. Esposito. 2000. Evaluation and use of plant biodiversity for food and pharmaceuticals. Fitoterapia 71:66-72.

Haapala, T. 2005. Use of single-leaf cuttings of potato for efficient mass propagation. Potato Research 48: 201-214.

Haapala, T. 2004. Establishment and use of juvenility for plant propagation in sterile and non-sterile conditions. Academic dissertation. University of Helsinki, Department of Applied Biology. Publication no. 21. *Available*: http://ethesis.helsinki.fi/.

Haapala, T., R. Cortbaoui, and E. Chujoy. 2008. Production of disease-free seed tubers. A simple, low-cost technology can help developing countries produce the healthy seed tubers farmers need for sustainable potato production. FAO Factsheets. *Available:* http://www.potato2008.org/en/potato/seedtubers.html

Figure 11: *A small tray can be a source of hundreds of new one-leaf cuttings. It is an inexpensive method to produce healthy starting material for further seed potato production.*

Figure 12: *Professor Hong with a successful potato trial in Mondulkiri, Cambodia.*

Comparing Locally Available Waste By-Products as Feedstocks for Gasifier Cook-Stoves

by Elliot Carey[1], Patrick Trail[2], Kenneth Brown[3], Ph.D, & Abram J. Bicksler[4], Ph.D.

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Author Bio: Joining our team as a gap-year student in 2016-2017, Elliott was involved in various agricultural projects at our Chiang Mai office and seed bank sites. In addition to this experiment, Elliot contributed to our coffee seedling research experiment, an edible fern project, and expertly guided our social media accounts into the 21st century! We wish him all the best as he continues his B.S. studies at Nottingham University in the UK.

Editors' Note: Biogasifier stoves can provide cleaner cooking and utilize low-quality feedstocks, while creating a value-added product (biochar) in the process. The experiment described in this article resulted from our questions about these stoves' efficiency and about the effects of different feedstocks on cooking times, temperatures, and thermal efficiencies. We utilized the Novotera stove model from the NGO with the same name. ECHO Asia is getting more stainless steel models made here in Thailand to be used as templates; if you are interested in purchasing one, please let us know (echoasia@echonet.org) or look for them for sale at the 6th Biennial Agriculture and Community Development Conference happening here in Chiang Mai from October 3-6, 2017.

Figure 1: *The TLUD Novotera gasifier cook-stove used in this experiment. Note the use of an electric fan for updraft. (photo credit: Boonsong Thansrithong)*

Introduction

In many developing world households, meeting the daily energy needs required for cooking is burdensome and costly. Fortunately, low-cost cooking methods that require less fuel while burning more cleanly and efficiently are becoming available at the household level. One such method is the household gasifier cook-stove, designed to convert small amounts of carbon-based solid biomass (usually from waste or low-cost material) into combustible gases used for cooking (see Dr. Dussadee's work for information on how gasifier stoves work (2013)).

Gasifier cook-stoves provide many advantages over cooking techniques in which traditional wood or other biomass is burned. The combustion of secondary gases (pyrolysis) in gasifier stoves allows for a cleaner and more efficient burn, reducing smoke that could otherwise lead to severe health problems (Berkelaar 2004). Since these stoves are designed to use small amounts of carbon-based biomass material, they can also greatly reduce the amounts of fuel needed for cooking. As a result, less time and energy are needed for gathering wood, and fewer trees need to be cut down, especially when low-quality or waste feedstocks can be used instead of wood. In some cases, these stoves can even help sequester carbon, rather than releasing it into the air—for example, when the spent fuel (a high-quality carbon-rich waste product created from the low-oxygen environment of the gasifier stove) is used as a biochar soil amendment (Hugill 2013).

Numerous gasifier stove designs and arrangements now exist. The basic TLUD (Top-Lit Up-Draft) gasifier stove design remains popular; these stoves are easy to light and quick to get started.

Using a relatively simple fan-powered updraft gasifier stove (Figures 1 & 2), staff at ECHO Asia designed an experiment to test the feasibility and practicality of using several different locally available, carbon-based, waste by-products as fuel. We tested rice hulls, coffee parchment, sawdust, and corn cobs, all of which are readily available agricultural by-products and are typically free in northern Thailand. We wanted to quantify the thermal efficiencies of the respective fuel types, temperatures at which they burned, and time of burning for each.

Materials & Methods

This experiment was conducted in October 2016 at the ECHO Asia Regional Impact Center in Chiang Mai, Thailand. On each of five separate occasions, four different locally available waste by-product materials (coffee parchment, sawdust, corn cobs, and rice hulls) were pyrolized using the same Novotera biochar cook-stove (Figure 1), a TLUD updraft gasifier design that utilizes a fan to force air up from the bottom (Figure 1).

For each fuel type, we recorded the time it took to boil 1 L of water, total time of each burn, temperature of the burner from start

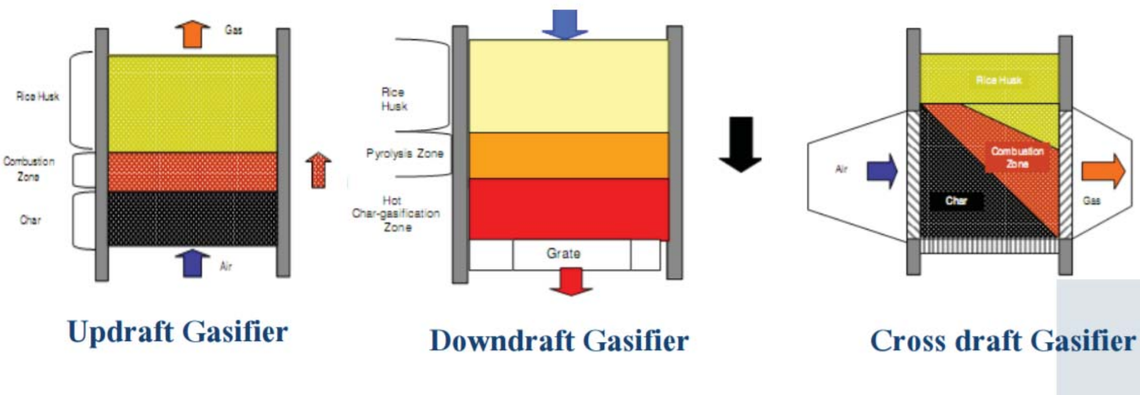


Figure 2: *Different household gasifier cook-stove design options (Dussadee 2013).*

to finish, and weight of the spent fuel at completion. We used this information to calculate the thermal efficiency of each feedstock when pyrolized in the gasifier stove, using the following equation:

$$\text{Thermal Efficiency} = \frac{\text{Energy to Heat Water to Boiling (J)} + \text{Energy to Vaporization (J)}}{\text{Energy in Dry Fuel (J)} - \text{Energy to Dry Out Fuel (J)} - \text{Energy Remaining in Char (J)}}$$

We kept the initial fuel mass constant across fuel types at 600g per burn event. We deemed this number an appropriate amount of fuel based on the size of the gasifier stove and on previous experience. We used the following assumptions and information in our assessment of the recorded data:

Assumptions
Moisture content of fuels is zero (i.e.- it is completely dry)
Energy content of ash is zero (i.e. - all charcoal has been burned)
No evaporation during warm-up phase

Fuel Properties (Heating Value of Dry Material (ECN Phyllis 2017))	
Rice Hulls	12.27 MJ/kg
Coffee Parchment	19.07 MJ/kg
Sawdust	18.12 MJ/kg
Corn Cobs	16.38 MJ/kg

Water Properties (The Water Boiling Test 2014)	
Initial Temperature	20 ^{0}C
Boiling Temperature	100 ^{0}C
Heat of Vaporization	2,257,000 J/kg
Specific Heat of Water	4,186 J/kg/K
Density of Water at 100 ^{0}C	0.9584 kg/l

We logged temperature data using an EasyLog Thermocouple and USB Datalogger that we placed between the flame and the stove-top on which the pot of water rested (Figure 1). We started recording time and temperature data once we deemed the fuel was burning on its own, usually within a few minutes of igniting one or two pieces of paper on the top of the fuel. We considered a burn event to be complete once the temperature dropped below 100 ^{0}C. We completed the entire experiment over the course of two weeks, avoiding any major changes in local climatic conditions and air temperatures.

Results

The results in Table 1 indicate that the gasifier model used in this experiment burned at high heat for a short period of time, with maximum temperatures reaching between 600 and 750 degrees Celsius across all fuel types. Once the fire was ignited, a liter of water came to a boil in less than eight minutes on average (Table 1). Combustion of secondary gases was observed in each of the burn events, indicated by the blue flame coming out of the secondary air holes, and the presence of a smokeless flame.

Table 1: *Time, temperature, and power measurements from four different fuel types pyrolized in the gasifier stove. Numbers are averages from five burn replications.*

	Coffee Parchment	Sawdust	Corn Cobs	Rice Hulls
Time to Boiling (mins)	03:51	04:44	07:45	04:03
Avg. Temp. of Burn Period (^{0}C)	269	218	200	201
Max Temp (^{0}C)	658	716	615	746
Power during Hot Phase (kW)	1.38	1.43	1.13	0.74
Power during Cold Phase (kW)	0.74	0.77	0.95	1.28
Mass of Ashes/Biochar (g)	11.82	11.72	62.26	107.22
% Biochar Leftover	2	2	10	18

Rice hulls burned the hottest (Max Temp) (Table 1) and the fastest (Total Burn Time)(Figure 3), while corn cobs reached lowest maximum temperatures and burned the longest (Figure 3). Rice hulls had the highest thermal efficiency of the four fuel types in this experiment, at 9.1% efficiency (Figure 4). Rice hulls also produced significantly higher rates of biochar compared to the other fuel sources, which were reduced almost entirely to ash (Table 1).

A high value for thermal efficiency is desirable. Various gasifier stove models have claimed 30 to 50% thermal efficiency. Although thermal efficiency can vary based on factors such as fuel source, moisture content, and age of the material, our tests never achieved thermal efficiencies greater than 10%.

Conclusions

We would need to experiment further before we could optimize the thermal efficiency of this stove model and determine the optimal quantity or mass of each fuel type for the most efficient burn. However, we found that each of the tested fuel types can be used as an appropriate fuel source and will burn sufficiently well in this up-draft model. Coffee parchment, sawdust, corn cobs, and rice hulls are all locally available, inexpensive, and easily attainable in Southeast Asia. They were easy to ignite and burned quickly in gasifier cook-stove systems. Rice hulls appear to be an especially good fuel source; they burned more efficiently than the other fuel sources and created a higher biochar output, resulting in a secondary waste product that can be used to amend soils.

We noted some drawbacks of the Novotera biochar cook-stove: 1) the stove must be pre-loaded with fuel, making it difficult to add fuel during cooking; 2) temperature adjustment during cooking is challenging; and 3) this particular model uses an elec-

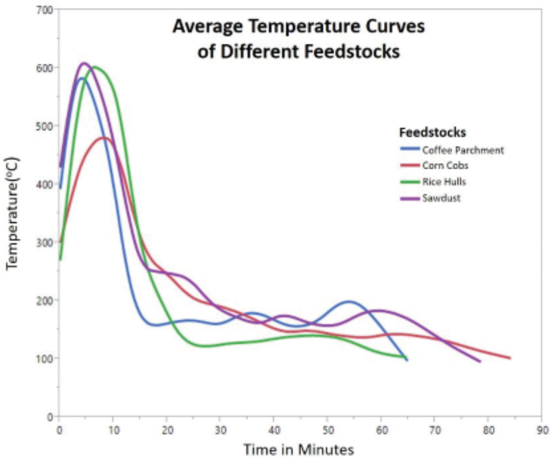


Figure 3: *Temperature curves from averaged measurements taken during five burn cycles for each of four different fuel types. Note that curves have been smoothed using a Lambda Function and may not correlate with the numerical values presented in Table 1.*

trical mains electricity fan to force air in from the bottom. A fan with an adjustable speed would enable a user to increase or decrease airflow, which could overcome the temperature control issue to some degree. Likewise, powering the fan off a battery would allow for greater use in areas without mains power.

References

Berkelaar, D. 2004. Indoor air pollution from cooking fire smoke. ECHO Development Notes. 85:1-5. *Available:* https://www.echocommunity.org/en/resources/116af501-ac2e-4303-8c46-7a3d586a0818.

Dussadee, N. 2013. Household and farm level gasifier technology. ECHO Asia Alternative Energy and Appropriate Technology Symposium. *Available*: https://c.ymcdn.com/sites/echocommunity.site-ym.com/resource/collection/25f7955d-c19f-44ae-aa75-18a5dfc2b980/Household_and_Farm_Level_Gasifier_Technolog.pdf?hhSearchTerms=%22stove%22

ECN Phyllis Classification. 2017. *Available*: https://www.ecn.nl/phyllis2/Browse/Standard/ECN-Phyllis#sawdust

Hugill, B. 2013. Biochar - An organic house for soil microbes. ECHO Technical Notes 75:1-4. *Available*: https://www.echocommunity.org/en/resources/60196dbc-c62a-4bcf-a33f-251e7195d62c.

Kolmel, O., and D. Maxwell. 2017. Smokeless Novotera biochar cook-stoves. *Available:* https://www.facebook.com/pg/Novotera-442666302431979/about/?ref=page_internal

The Water Boiling Test: Cookstove Emissions and efficiency in a Controlled Laboratory Setting, 2014. 2.4.3. *Available:* http://cleancookstoves.org/technology-and-fuels/testing/protocols.html

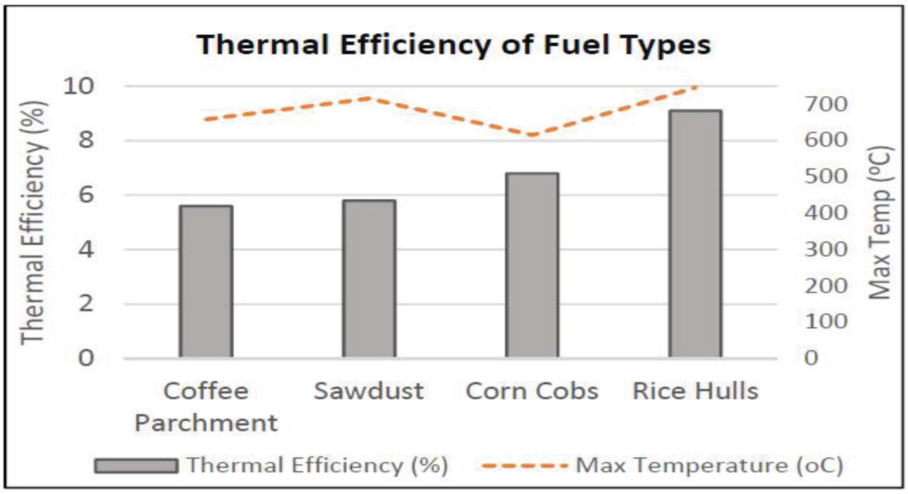


Figure 4: *Thermal efficiencies and maximum temperatures of different fuel types.*

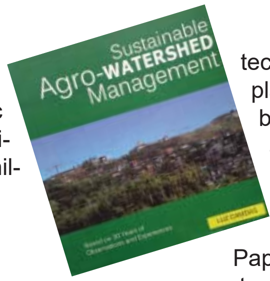
Book Review: Sustainable Agro-Watershed Management

Review by Patrick Trail

Author: Luz Camdas

Publisher: Socio Economic & Gender Advocacy Association, Inc.; Baguio City, Philippines

Book: 85 Pages



Written as a manual of observed best practices, author Luz Camdas shares with the reader her insights and experiences gained over 30 years of trial and error, and subsequent successes in transforming a degraded piece of sloping land in the highlands of the Philippines into a diverse, productive, and ecologically healthy environment.

The result of years of observation and meticulous note taking, this book summarizes a number of plants, practices, ideas, and considerations useful in restoring marginal lands. The author shows that through the introduction and management of a diverse set of plant species, pruning techniques, mulching practices, and planting arrangements, erosion can be mitigated, soil fertility restored, and entire watersheds can even be improved. Bringing together a background in horticulture and years of experience working in Papua New Guinea in similar environments, Camdas creates an approachable work that has been written for the benefit of those seeking to restore degraded land.

The book is filled with simple and informative diagrams explaining methods of contour planting, properly pruning trees, and the integration of cash crops, timber species, nitrogen-fixing legumes, and even firewood species. Serving its intended purpose as a manual rather than a novel, this book is a good resource for those looking for practical steps and decision-making tools. There is little attempt to convince the reader that this particular set of experiences is the right way, or the only way, but rather serves to pass on to others a wealth of knowledge gained over time and through trial and error.

Overall, I find it highly encouraging to know that there are people who have dedicated their efforts to stewarding their land well, and have proven that degraded land can be made productive over time. Not only has this piece of land in the mountains of the Philippines been turned into an oasis of plant diversity in the midst of its poorly managed surrounding landscapes, but is has been shown that there is hope even for broader issues as complex as the restoration of watersheds! This book highlights the importance of maintaining forested lands for limiting soil erosion, building up soil fertility, and even recharging ground waters.

Please contact Ms. Aida Pagtan (apagtan@gmail.com) for more information and/or about book availability.

Upcoming in October 2017- Early Bird Pricing Closing 31 August!

6th Biennial ECHO Asia Agriculture & Community Development Conference
Chiang Mai, Thailand 3-6 October 2017

IMPROVING LIVES

ASIA AGRICULTURE & COMMUNITY DEVELOPMENT CONFERENCE 2017

ECHO Asia Impact Center

Our conference theme **"Improving Lives"** expresses our desire to partner with you as we train, equip, and grow our network to impact the lives and livelihoods of farmers and their families across Asia.

We are now less than 2 months away and things are really starting to take shape! Because of the overwhelming response by our network members to conduct workshops, posters, and papers, we are going to have a full agenda with 9 plenary speakers, 42 afternoon workshops, and at least 8 different site visits for choose from!

Speakers will share practical solutions to agricultural challenges, personal experiences, and strategies for improving the lives of millions who daily face the threat of starvation. The event offers an open exchange of information, connecting the people and ideas that can make a real and sustainable difference.

In addition to speaking sessions, we will have a poster session, coffee, resource tables, a seed exchange, closing banquet and much more.

This year we will also be offering a mobile application to reduce the use of paper as well as the ability to increase the opportunities to network and dialogue! More information soon!

If you have signed up for a workshop/poster/paper, please make sure you have registered so we can capture your lodging prefrences, etc.

Conference Packages in USD/THB if registering before 31 August 2017

- Day Package (conference only, no lodging): $150USD/ 5,250THB
- Shared Room (conference and 4 nights shared room) Package: $200/ 7,000THB
- Single Room (conference and 4 nights single room) Package: $250/ 8,750THB
- Spouse Package (4 nights lodging, no conference): $60/ 2,000THB

Early Bird Deadline is 31 August. Prices will increase $50 after the deadline. Register today to take advantage of lower package price and to secure your place!

Come join us for 3-days of plenary speakers, workshops, coffee cupping, paper proceedings, a poster session, and a seed exchange followed by a 1-day site visit!Go to **AsiaConference.ECHOcommunity.org to register and to learn more about what our conference seeks to offer.**

For more information and to register email us at echoasia@echonet.org or go to:

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Call for Conference Posters & Manuscripts for Proceedings

We are pleased to offer an opportunity to submit posters and/or research papers for publication and distribution to our network during our conference in October. This will provide conference attendees the ability to share and exchange information with one another.

We will continue to accept applications for poster and paper submissions until 15 August. If you are interested, please submit an abstract to Patrick Trail (ptrail@echonet.org) as soon as possible!

Posters: consider creating a poster for display at the conference venue. Your poster can then be viewed by other conference delegates at their leisure, as well as during designated times for poster presenters and other conference attendees to interact. We are happy to offer guidance and more information. To start, click here for more information.

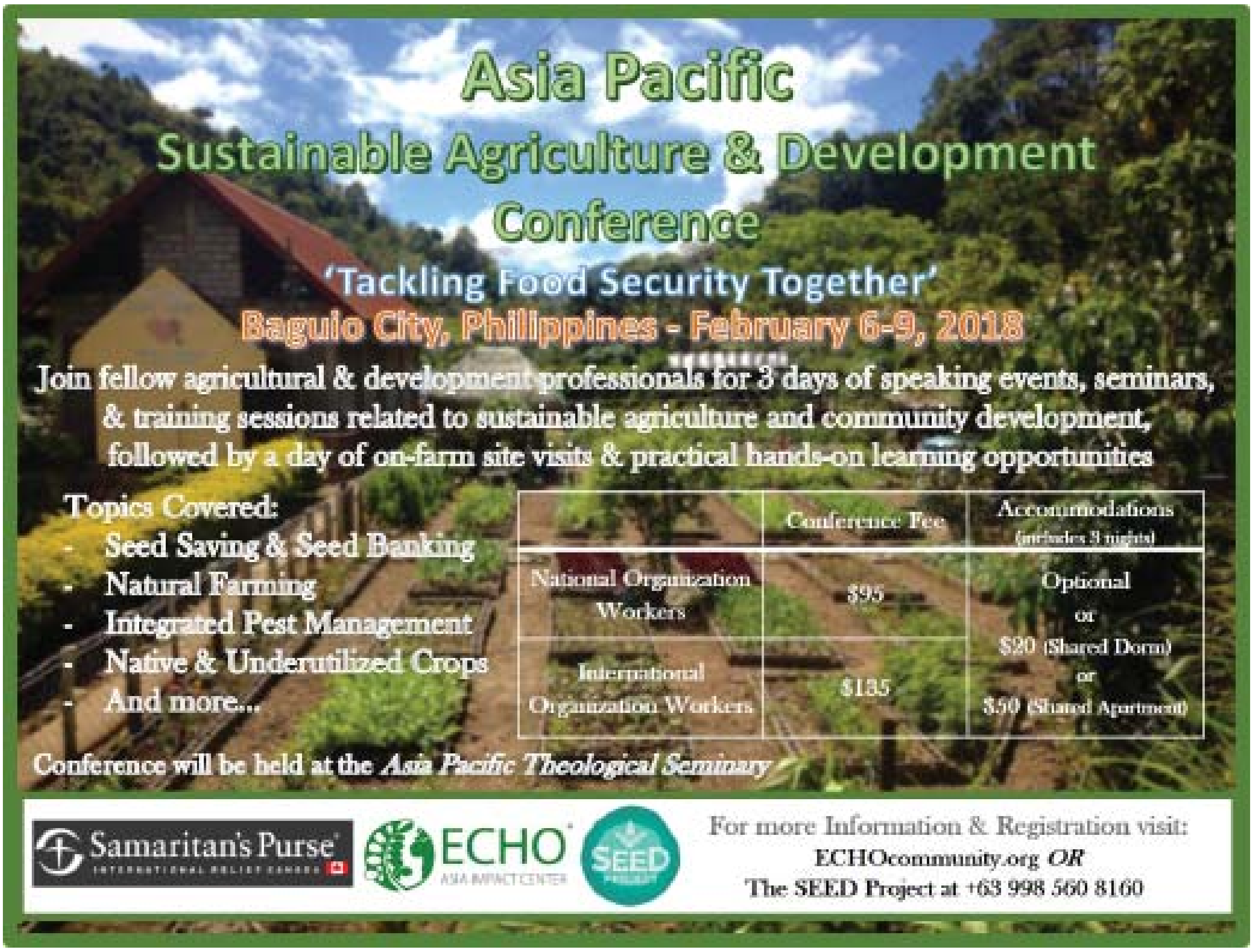
Papers: we also encourage you to consider submitting a paper summarizing some of the research you may have conducted in recent years. We hope that in this way, any interesting research findings from within our network may be shared in a more formal manner with practitioners throughout the region.

Poster Template. *Click here for a PDF of this template*

There will also be an opportunity, during a late-afternoon or evening session, to give a five-minute oral summary of your poster.

To learn more, go to our conference website or go directly to the application page to learn specifics on how to submit your proposal.

Upcoming in February 2018



Opportunities from the Network

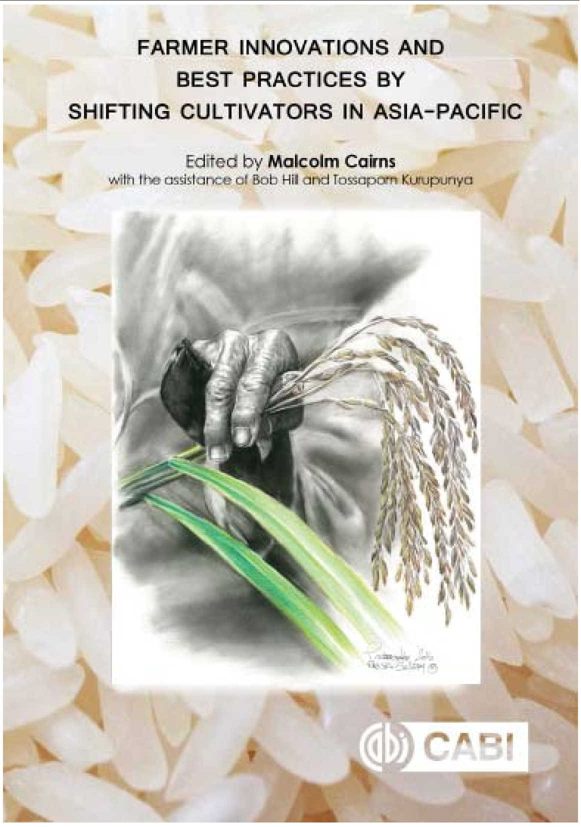
Call for Papers Related to Shifting Cultivation

This is an invitation to contribute to the final publication of an encyclopaedic trilogy on shifting cultivation in the Asia-Pacific region.

Edited by Dr Malcolm Cairns, **Volume One, Shifting Cultivation and Environmental Change: Indigenous People, Agriculture, and Forest Conservation** (Earthscan, 2015), has already received wide acclaim. **Volume Two, Shifting Cultivation Policies: Balancing Environmental and Social Sustainability**, enlisted contributions from many of the world's leaders in the field, and will be published by CABI Publishing in the UK in mid-2017.

Now Dr Cairns and his team are working on **Volume Three, Farmer Innovations and Best Practices by Shifting Cultivators in Asia-Pacific**, and are casting a wide net in order to gather the best contributions. Much like its predecessors, Volume Three will be a 1,100-page collection supported by an online Addendum, aiming to make this trilogy essential reading for scientists, students, policy-makers, and extension workers around the world.

We would warmly welcome inquiries at **mfcairns@gmail.com**. Papers should be submitted before December 31, 2017.






All photos by M. Cairns.


Earth Building Workshops at Mae Mut Garden

ECHO Asia network partners, Marco and Nok, are offering earth building workshops both before and after the ECHO Asia conference in October! This beautiful place is one of the site visits at our conference, but if you wish to learn more and get your hands dirty, these courses would be great for you!

Each course is an introduction to the basic techniques of earthen building, covering all aspects from soil selection to final decoration, with constant hands-on supervised practice. Each course is limited to ten participants to ensure a high standard of application. Instruction will be in English and Thai.

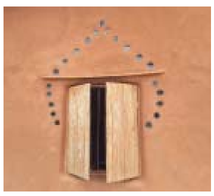
The courses will take place at Mae Mut Garden, in the Mae Win district of Chiang Mai province, at the foothills of Doi Inthanon on the following dates:

Workshop 1: Sep 27- Oct 2, 2017

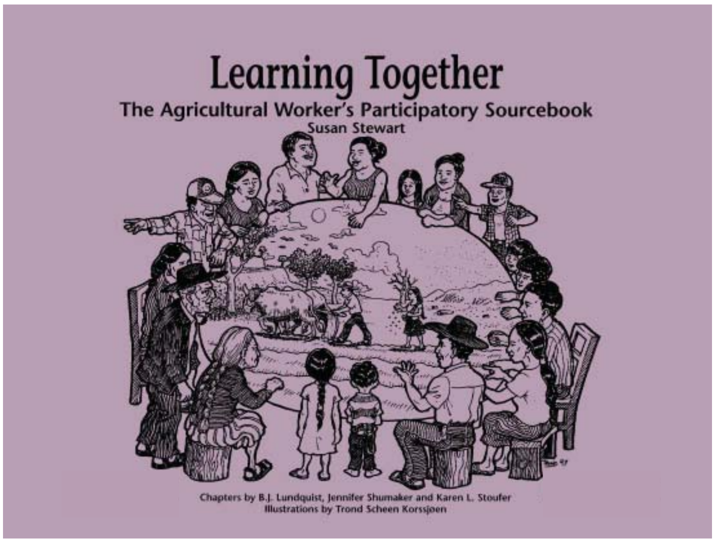
Workshop 2: Nov 5 – Nov 10, 2017

To register, email Marco at maemutgarden@gmail.com or go to their blog by clicking here.




New Publications Available



ECHO Asia is pleased to partner with International Animal Health Consultants to make this fantastic resource available to our network.

In **Learning Together**, Susan Stewart, along with B.J. Lundquist, Jennifer Shumaker, and Karen L. Stoufer (one of ECHO Asia's Conference plenary speakers), present a guide to help those agriculture and community change agents engage in participatory techniques.

Its 342 pages offer an incredible wealth of field-based knowledge and best practices for anyone working with farmers and communities.

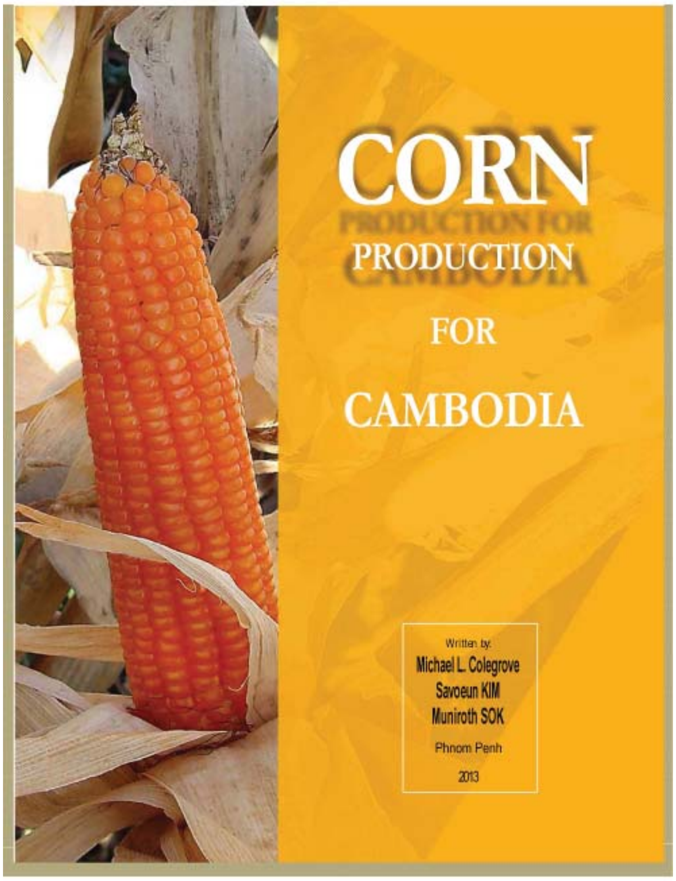
It includes: tips, techniques, and ideas from agricultural trainers from more than 25 countries on 5 continents; over 200 dynamics, games, tools, and ideas to use in training events; step-by-step processes to follow in Defining the Situation, Implementation, Follow-up, and Evaluation of participatory training programs; guidelines on how to include gender analysis in the program; ideas to help practitioners begin from the local and traditional knowledge of communities; and tools for great communication with individuals and groups.

It is for sale at the ECHO Asia Office and will also be available at the 6th Biennial Asia Conference in Chiang Mai! Permission requests should be addressed to: vetbooksusa@gmail.com

Corn Production for Cambodia, written by Michael L. Colegrove, Savoeun Kim, and Muniroth Sok, offers a comprehensive look at corn and its agronomics and economics in the developing world of Southeast Asia.

Although originally written for a Cambodian context, its 216 pages are broad-ranging and applicable to many corn-growing regions in the tropics and will be found to be a useful companion to anyone growing corn or working with those who are.

Available in print form from the ECHO Asia Office and will also be available at the 6th Biennial Asia Conference in Chiang Mai!



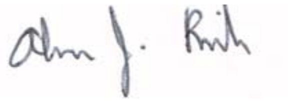
Call for Articles & Insights

We are delighted that you receive and read our ECHO Asia Notes. We hope that the information contained here within is useful to you and most importantly, useful to those whom you serve. I wanted to highlight a few things that you may find add value to your free membership to ECHOcommunity.org and can help you be more effective.

1. Please do remember that a "Development Worker" membership entitles you to 10 free trial packets of seed per year, so be sure to take advantage of this! If you would like more seed packets or larger quantities of some seeds (especially green manure/cover crops), we do have additional seed packets and bult seeds for sale, and our Seed Bank catalog is available online!
2. Please also know that besides being written in English, our ECHO Asia Notes are translated and available for free download on ECHOcommunity.org in Thai, Khmer, Burmese, Mandarin, Bahasa Indonesia, Vietnamese, and Hindi languages.
3. Additionally, we have a special place in the Asia section of ECHOcommunity for additional technical resources, free book downloads, and presentations from past ECHO Asia events and workshops.
4. If you have never joined us for an event, please consider doing so- there is our 6th Biennial Agriculture and Community Development Conference happening October 3-6 in Chiang Mai and our Asia Pacific Sustainable Agriculture Conference happening in the Philippines in February, 2018; other upcoming events will be posted to ECHOcommunity.org soon.

In addition to using our information, we strongly encourage you to provide feedback to us in order to better know how to serve you and help us to refine our resources and delivery. In the future, we hope to have an automated feedback system, seed evaluation system, and better monitoring and evaluation so that we can better equip workers. We encourage you to share success stories, lessons learned, insights, Facebook posts, etc. with us to keep us abreast about what you are trying and what is working in your context.

Additionally, if you have any ideas or would like to write an article for an upcoming ECHO Asia Note, we invite you to do so! Thank you for reading, and please do stay in touch!



Best regards,

Abram J. Bicksler, Ph.D.
Director, ECHO Asia Impact Center

ECHO
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