



The Martinez Airlift Pump: Lifting Water with Air

by Terry Stratton¹

¹University of the Nations

Youth with a Mission (YWAM), Hawaii, USA

[Editor's Note: The contents of this article have been adapted, with permission, from the innovations of Glenn Martinez of Olomana Gardens Hawaii. The author of this article, Terry Stratton, along with his wife Cyndi and Science & Tech department head Vernon Byrd serve as full-time volunteers at the University of the Nations, Hawaii. The team has over eight years of experience with the campus Natural Farm Training Center that includes building, operating, and teaching about aquaponics and airlift pump configurations for small to medium scale aquaponics systems in Hawaii, and internationally in community development settings. The following article aims to introduce the airlift pump concept and provide a basic overview of design set-up. Several additional resources have been included and further questions can be directed to Terry Stratton t.stratton@uofnkona.edu.]



Figure 1: Aquaponics system running on an 'Airlift' water pump at the Natural Farm Training Center, University of the Nations, Hawaii.

Introduction

Water pumps have long been a key component of the small-scale farm and are valuable labor-saving devices that offer a variety of practical applications. Pumps of different types are regularly used for water storage & filtration, irrigation, aquaculture systems, and more. While convenient and useful, pumping water does come at a cost – from the necessary consumption of energy, to the regular maintenance of moving parts. However, new developments in appropriate pump technologies offer options that can save money, increase reliability, improve longevity of equipment, and offer certain other benefits that to be presented in this article.

What is an Airlift Pump?

A conventional water pump uses mechanical rotation to directly pressurize and move water. In contrast, airlift water pumps take advantage of the relatively lighter density of air to lift water. Until recently, airlift pumps were only good for lifting water 10 - 15 cm at most, however Glenn Martinez from Hawaii has since shared with the international community easy-to-build designs that can readily lift water 2 to 3 meters in height. In certain configurations, these airlift designs can lift water much higher, even as high as 30 meters out of a subterranean well. This article will focus on just one of his fundamental configurations, referred to as the 'pipe-in-a-pipe' airlift pump (Figure 2). This configuration has been used most often to lift anywhere from 400 to 2000 liters of water per hour to a height of 1 to 4

Featured in this AN

- 1 The Martinez Airlift Water Pump
- 5 Do All Parts of the Chaya Plant Contain Cyanide?
- 6 Cyantesmo Paper for Detecting Cyanide
- 8 ECHO Asia Job Opportunity
- 9 Recent ECHO Asia Articles
- 10 Ways to Stay Connected

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

ECHO Asia Impact Center
PO Box 64
Chiang Mai 50000 Thailand
echoasia@echocommunity.org
www.ECHOcommunity.org

Airlift Water Pumps
Advantages
Improved Safety
Electrical components are separate from water source
Aeration of Water
Especially useful in aquaculture/aquaponics systems
Minimal Maintenance
No moving or mechanical parts
No Clogging
Sediments and solids can be lifted with water simultaneously
Capable of Dredging Tanks
Sediments and solids can be lifted with water simultaneously
Potential Energy Saving
It can be cheaper to run an air compressor than a mechanical pump
Air Compressor Location
Can be operated away from water source (reducing theft and/or exposure)

meters, making it a very useful technology for a wide array of systems. As readers will note, this technology brings particular benefits to aquaponics systems, which is the intended use of these particular designs.

The ‘pipe-in-a-pipe’ airlift pump takes advantage of the fact that air injected underwater will expand as bubbles as it rises to the surface, with a 10% increase in volume from a depth of 1 meter. By confining the bubbles inside of a small diameter vertical pipe, these bubbles will act like a piston, or a syringe plunger, lifting portions of water upward as they rise. The physics involved would fill many technical papers, but the net effect is a strong upward current of water and air. The Martinez design works on the theory that larger bubbles, rather than a cloud of small bubbles, are most efficient at lifting water.

The Story Behind the Innovation

Glenn Martinez, the innovator behind the ‘pipe-in-a-pipe’ configuration of the airlift pump, has been involved for many years in teaching, designing, and building of aquaponics systems at his Olomana Gardens farm in Hawaii, as well as internationally in development settings. He also regularly consults on aquaponics project designs, and several years ago was designing an aquaponics system

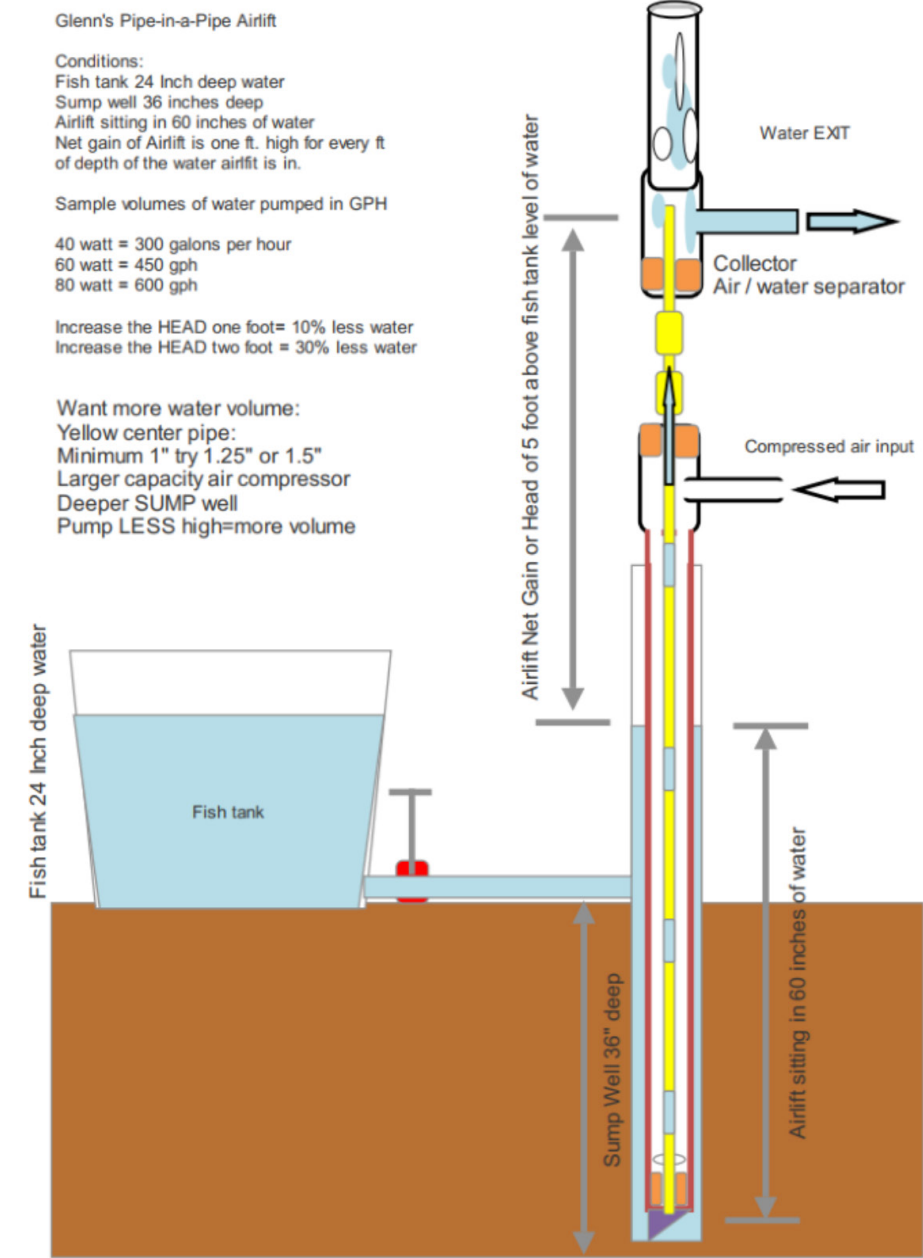


Figure 2: Design specifications of an example Martinez ‘pipe-in-a-pipe’ airlift water pump configuration. Credit: Glenn Martinez of Olomana Gardens Hawaii.

for a local school where it was going to be expensive to supply electricity. To make the system more affordable he invented (or as Glenn likes to say ‘rediscovered’) a way to lift the water from the fish tank up to the aquaponics grow bed with an innovative air pump configuration. Instead of running electrical conduit in a deep trench across the schoolyard, all that was required was a shallow ditch for the air pipe, quickly dug by the students. In the ditch, a 1-inch PVC pipe was installed, connecting the system to the small 60-watt air compressor located across the way in a lockable classroom. As it turned out, the airlift pump that Glenn came up with had multiple advantages for aquaponics systems and other

situations where inexpensive and reliable methods of lifting water are needed.

Advantages of Airlift Pumps

Safety

As the story above illustrates, a conventional water pump requires that electricity be located close to the water source. Electricity and water, as we well know, can be a dangerous combination, especially where children are present. Safety, in regard to electricity in water, should be mitigated and taken seriously in any setting. The Times of India reported that as many as 30 people are killed

Table 1: Examples of Airlift Pump Configuration and Output at UofN Kona.

* Volume Output of Air Compressor	**Depth of Water in Well	Diameter of Interior Lift Pipe	Head Height	Water Volume Output
30 L/min	0.7 m (28 in)	0.5 in	0.9 m (3 ft)	160 L/hr (42 gph)
45 L/min	1.4 m (55 in)	1 in	1.1 m (3 ft 6 in)	1100 L/ph (290 gph)
80 L/min	1.5 m (60 in)	1.25 in	1.5 m (5 ft)	1200 L/hr (317 gph)
100 L/min	1.4 (55 in)	1.25 in	1.8 m (5 ft 11 in)	900 L/hr (238 gph)

***Liters per minute roughly corresponds to the wattage of the pump - a 110 volt, 80 watt pump delivers about 80 liters per minute of air.*

***Well water depth is the below ground-level water plus the above ground level water which is equal to the depth of water in the tank that the well is connected to. In a flood and drain system this depth may fluctuate so the output of the pump will fluctuate.*

every day in India by electrocution. One intern working on our projects in the Philippines recently asked us for advice when he was shocked twice with a conventional pump; he simply didn't have much experience working with electrical devices, including how to arrange extension cords so they remained dry in the rainy season. Ground fault interrupt (GFI) circuits, if they are available, can decrease risk but tend to trip at inconvenient times and require monthly testing. As an alternative, the compressor for an airlift pump can easily be set up at a safe distance from the water to eliminate this potential hazard, decreasing risk substantially. Community development workers may find this particular feature of airlift pumps to be especially beneficial for promoting safety.

Aeration of Water

One of the great advantages of an airlift water pump is its ability to aerate water as it lifts it. This can be a highly beneficial feature when incorporated into fish production systems, or other scenarios where water quality conditions will benefit from more dissolved oxygen. In some small-scale aquaponics systems with low fish stocking density, the airlift pump alone will provide enough dissolved oxygen to supply the needs of the fish. Used along with a conventional aeration pump and airstones, an airlift pump can provide extra dissolved oxygen and security against the loss of fish from low dissolved oxygen levels.

Reduced Maintenance & Increased Reliability

Submersible water pumps and conventional external pumps are prone to clogging and need periodic cleaning including disassembly. Additionally, the sand and grit that they draw in will eventually wear out components, often necessitating replacement of the pump. The Martinez airlift pump design will not only handle small abrasives but debris nearly as large as the diameter of the inner pipe (1 to 1 1/2 inches). This means that small fish, clumps

of algae, uneaten fish food, etc. are simply carried up and out through the pump. In one of our aquaponics systems, we conducted a trial in which we dumped 20 kg of coffee grounds into a tank to test the ability of the airlift to function without clogging; impressively, it passed through with no challenge. The ability to handle gravel and other debris is demonstrated in [this video by Glenn](#).

At the same time, the air compressor, the most expensive component of the airlift pump, is immune to anything about the water. Freshwater, saltwater, and sludge-laden water are all the same to this pump, as it sits separate from the water source. Additionally, in the case that a conventional submersible pump empties the tank, it will quickly suffer permanent damage from overheating – an air compressor in an airlift pump will just keep on running, ready for the water to return.

Diaphragm air compressors, which are ideal for airlift pumps, are also very easy to repair. Typically, all it takes is a screwdriver to replace diaphragms that wear out every few years. This is simple and much less expensive than replacing an entire conventional pump. Also, changing or moving a compressor can be as easy as unscrewing and reattaching a garden hose.

Other Advantages of the Airlift Pump

In some locations, a water pump is vulnerable to theft or vandalism. Since a 1-inch PVC pipe or length of larger diameter hose offers very little resistance to airflow, an air compressor can be located at a distance, locked separately in a building or storage box.

Airlift pumps may also save money by using less electricity. We replaced one 200-watt submersible pump with an 80-watt air compressor to run an airlift. The lower power requirement makes a solar panel powered system more feasible. Glenn has configured conventional pump systems with air injection to make dramatic cuts in the cost of lifting

water 8-10 meters high. We don't have any experience with it yet, but we've seen that [DIY airlift pumps can also be configured to pump subterranean wells](#) where the resistance to blockage and ease of repair characteristics would be especially valuable.

'Pipe-in-a-Pipe' Airlift Pump Design

Larger volume airlift systems are possible and can be accomplished with different sized air compressors with appropriately sized pipes. Our 110-volt compressors range in size from 35 to 110 watts. Compressor selection is determined by several factors including the height the water needs to be pumped and the desired water output volume. The typical aquaponics 'pipe-in-a-pipe' configuration only needs an air compressor capable of generating an initial 5 psi (35 kPa) then be able to run continually at around 2 psi (14 kPa). The compressors that run our aquaponics systems produce in the range of 30 to 100 liters of air per minute. You can see from the chart below that the final water volume output of the pump depends not only on the size of the compressor but several other variables (Table 1). The 100 L/min compressor doesn't deliver the most water because it is pumping higher out of a shallower well.

We aim to turn over the volume of our fish tanks at least once every two hours and these pumps have been more than adequate for that. Pond supply stores or larger aquarium supply outlets may carry the preferred diaphragm style compressors (or alternately, piston air compressors) for this application.

Critical Design Considerations

The Intake Pipe

In describing one of the key feature of the 'pipe-in-a-pipe' configuration, Glenn Martinez had the following tip:

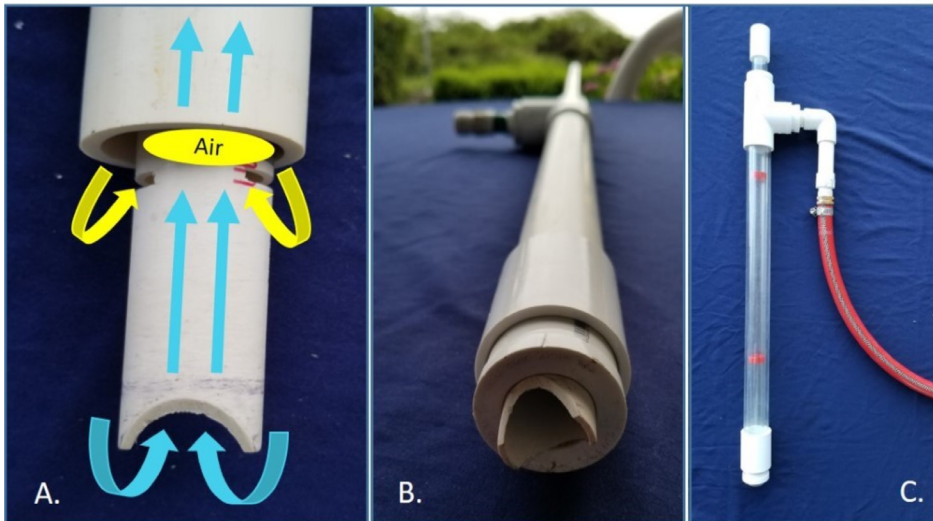


Figure 3: Critical design consideration for the intake portion of the pump, located at the bottom of the sump well. (A.) Air intake 'slots' were found to be more effective than many drilled holes - yellow arrows represent air while blue arrows represent water. (B.) The curved bottom will prevent clogging of the intake pipe. (C.) Configuration of the air 'inlet' assembly.



Figure 4: Martinez 'pipe-in-a-pipe' airlift pump configuration for use in a small-scale gravity-flow aquaponics system. This photo was taken on site at the Natural Farm Training Center, Hawaii. Note: Air compressors should always be placed above the high-water level, so no water drains into them when the power goes off.

"The latest version of the 'pipe-in-the-pipe' configuration does away with drilling many small holes. The conventional wisdom was that the many tiny air-bubbles displaced the density of water, thus the lighter water 'floated up'. However, on a recent trip to the Philippines we did not have the tiny drill bit or small drill motor. I only had a hacksaw, so I simply made two cuts, opposite each other in the interior lift pipe. The cut was made the single thickness of the hacksaw blade and about 1 inch above the bottom opening of the larger exterior pipe (Figure 3A)."

It turns out that when the compressor is turned on, that the water between the outside

casing pipe and the interior lift pipe is "pushed down" until it reaches the two opposing slits in the interior pipe. The air enters each slit (directly opposite each other) and literally cuts the water like a knife. After cutting the water, the air burst rises upward, lifting the water in the interior pipe all at once. This slug of air lifts all of the water in the interior pipe and comes out as one slug of water. After that first burst of air releases, thus clearing the interior pipe of water, additional water rushes in to fill the bottom of the 'pipe-in-a-pipe' pump. Once moving, the water in the interior pipe is 50%

air and much lighter, so the air compressor has an easier time pumping the water.

The inner pipe is open to the source water and is cut at an angle to prevent it from being completely blocked (Figure 3B.). The bottom space below the two air slits and between the inner and outer pipe can be sealed without the use of the coupling and bushing pictured here (e.g. with a fabricated plug) but this method is convenient if the parts are available. With this approach the inner "stop" on the bushing has to be filed away to allow the inner pipe to slide all the way through while still preserving an airtight seal. The same goes for the other bushing at the top of the outer pipe.

Application for Small-Scale Aquaponics

A typical application of the airlift pump, as is the case at our Natural Farm Training Center in Hawaii, requires lifting 500 to 1000 liters of water per hour, available for gravity flow through an aquaponics system (Figure 4). In this case, the airlift pump is an excellent option, aerating the water as it is lifted into the tank above. We have labeled this set up for better understanding of the practical arrangement of the various airlift pump components

This airlift is pumping about 900 liter/hour from an IBC tank to a height of 1.8 meters to a clarifier. The vertical 3-inch PVC pipe is fed water by a 'T' connection to the IBC tank (Figure 3). This 3 inch pipe has a cap on the bottom and serves as a kind of 'sump well' for the actual 'pipe-in-a-pipe' pump. This well pipe, with the 'pipe-in-a-pipe' airlift inside, extends 80 cm below ground level (1.5 meters depth would have been better as the volume output of the pump would have increased and we could probably have used a smaller air compressor). The airlift itself is made from a 2-inch outer pipe and a 1.25-inch inner pipe. Water is pumped up and diverted into the tank while air exits out the top.

Acknowledgements & References

Many thanks to Glenn and business manager Natalie Cash for the generous contributions of time, tools, and materials for our teaching program at the Natural Farm Training Center, Science & Tech Dept., YWAM, University of the Nations. We are also grateful for your willingness to share these findings with ECHO and its Network around the world.

Martinez, G. Olomana Gardens Aquaponics Manual. available: <https://www.olomanagardens.com/shop/aquaponics-manual/>



Do All Parts of a Chaya Plant Contain Hydrocyanic Acid?

by Stacy Swartz¹ and Tim Motis¹

¹ECHO, Inc. North Fort Myers, Florida, USA



Figure 1: Coarsely chopped chaya plant parts (top) and bag placement (bottom). Note the Cyantesmo test strips placed in bags. Credit: Tim Motis and Stacy Reader

Chaya Cooking Trial

Leaves of tropical crops like chaya (*Cnidoscolus aconitifolius*) and cassava (*Manihot esculenta*) contain cyanogenic glycosides, toxic substances that release hydrocyanic acid (HCN; also referred to as cyanide or prussic acid) when cells are crushed. Consuming these plants without cooking them can cause cyanide poisoning, with effects that vary depending on cyanide levels and how long a person or animal has been eating that plant. An information sheet from the New Zealand Food Safety Authority describes cyanogenic glycosides in plants and their effect on human health. To determine if a plant is safe to consume, a simple cyanide screening test using Cyantesmo paper is very helpful.

Cyantesmo paper can be cut into short strips and placed in a sealed bag or container along with plant material, to detect the presence or absence of HCN. If the paper turns blue, HCN is present. The color change is not specific enough to indicate parts per million; however, smaller concentrations of HCN will result in a lighter shade of blue than higher concentrations. [See EDN 130 for more information on how to use Cyantesmo paper.](#)

In September of 2015, we found that it took between 15 and 20 minutes of boiling time to no longer detect HCN in chaya leaves. Since that time, ECHO Asia Technical Advisor Karis Lotze noted that both petioles and green

Chaya Plant Part Experiment				
Time Boiled (min)	Leaves	Petiole	Stem	Roots
Fresh				
10				
15				
20				
Boiled for recommended time (20 min), then lid put on (residue check)				

Figure 2: Results from second experiment determining safe cooking times for chaya petioles and stems. Roots are not consumed, but show lower cook time for cyanogenic compound removal.

stems are also consumed in parts of Asia. She asked, "Is HCN present in the petioles and green stems? And if so, how long do these plant parts need to be boiled in order to be safely consumed?"

To answer Karis's questions, we repeated the 2015 trial in June 2017 with the addition of chaya petioles, green stems and roots. (Roots are not commonly consumed or recommended for consumption, but we included them in order to understand plant allocation of cyanogenic glycosides throughout plant tissue.) Eighty grams each of fresh chaya leaves, leaf petioles, and green stems were chopped up and placed in quart-sized Ziploc® bags as shown in Figure 1. Due to limited quantity, only forty grams of fresh chaya roots were chopped up and used.

To determine for how many minutes each plant part needs to be boiled in order to be safely consumed, eighty-gram samples of chaya leaves, petioles and green stems were

boiled separately in one liter of water for 10, 15, and 20 minutes. Forty-gram samples of chaya roots were boiled in one-half liter of water for each time interval. For prolonged boils, extra water was added as necessary to keep roots covered with water. After boiling, samples were placed in Ziploc® bags with test strips.

Results shown in Figure 2 (page 6) confirm the previously determined safe cooking time of 20 minutes for chaya leaves. Results show that chaya petioles and green stems also require a boil time of 20 minutes to remove cyanogenic compounds. Although fresh roots indicated high concentrations of HCN release, a 10-minute boiling time reduced cyanogenic compounds substantially in root material.

Some ECHO staff members recommended checking the cooking water, to determine if the water is safe for consumption after boiling chaya plant parts. We repeated the trial, again using 80g of chaya leaves, petioles and green

stems boiled in one liter of water and 40g of chaya roots in one-half liter of water. After boiling for the recommended 20 minutes to remove cyanogenic compounds from each plant material, we brought the remaining water back to a boil, then removed the pots from the heat source. We fixed lids with two strips of Cyantesmo paper using clear tape, and put them on the pots. Papers were left on the lids for 17 hours before the color was checked. Results show that only water used to cook chaya leaves still contained trace amounts of cyanogenic compounds. This trace indication may have come from leaf residues stuck to the pot.

References

Ravindran, V., E.T. Kornegay and A.S.B. Rajaguru. 1987. Influence of processing methods and storage time on the cyanide potential of cassava leaf meal. *Animal Feed Science and Technology* 17(4):227-234.



Cyantesmo Paper for Detecting Cyanide

by Tim Motis¹

¹ECHO, Inc. North Fort Myers, Florida, USA

Introduction

Some tropical crops contain cyanogenic glycosides, toxic substances that release hydrocyanic acid (HCN; also referred to as cyanide or prussic acid) when cells are crushed. Consuming these plants without cooking them can cause cyanide poisoning, with varying effects depending on cyanide levels and how long a person or animal has been eating that plant. Cassava roots and leaves contain cyanogenic glycosides, so people whose diets are heavily dependent on cassava are especially at risk. Traditional methods to process and detoxify cassava roots include fermentation, prolonged soaking and boiling. Chaya leaves also contain cyanogenic glycosides; it is best to cook chaya leaves before eating them, to boil off the HCN rather than ingesting it. ECHO has previously written about cyanide in food plants (see the Further Reading section at the end of this article).

To determine if a plant is safe to consume, either by humans or livestock, a simple cyanide screening test is very helpful. At the 2014 ECHO International Agriculture Conference in Florida, Dr. Ray Smith provided ECHO with sample strips of Cyantesmo paper for screening plant material for HCN. A 2.5 cm (1 in.) strip of this paper is all that is needed to detect the presence of cyanide in a sample of plant material. Cyantesmo paper is available in a 5-m long roll for 49.50 US dollars from CTI Scientific (item 90604). One roll supplies enough 2.5-cm long paper strips for 200 tests. The paper does not have to be

kept in a freezer, although Smith recommends that it be refrigerated.

Steps in Carrying Out a Test

Dr. Smith supplied a set of instructions written by himself and Drs Cindy Gaskill and Michelle Arnold (all at the University of Kentucky). Those steps, outlined below, are reprinted with permission from Dr. Smith.

1. Collect a large handful of leaves to be tested. (Note: if testing plant material to be used for animal forage, such as the leaves of Johnsongrass or sorghumsudangrass, collect the whole plant that the animal will likely consume. Young shoots are the most toxic.)
2. Tear leaves/forage into small pieces; also mash the plant material to cause addi-

tional plant cell injury. (You are simulating how plant material turns "mushy" when fresh leaves and stems are chewed.)

3. Place the sample into a heavy-duty quart-sized zip-lock baggie (if these are not available, find a similar-sized container that seals well) containing a 2.5 cm (one-inch) strip of Cyantesmo paper taped to the inside of the bag toward the top (tape the paper at just one end of the strip; if tape covers the entire strip, you don't get color change). Use gloves [e.g., disposable latex or nitrile gloves] in handling the paper. The bag should be approximately half full. Keep the plant material from directly contacting the paper strip, so that you can easily evaluate the strip for color change.



Figure 1: Photo of leaves that were chopped (left) prior to boiling (right) Credit: Tim Motis

4. Some plant juice should squeeze out when you mash the leaves. If the sample material is dry, you will need to add about 15 ml (1 tablespoon) of water to the baggie—enough water to dampen the material.
5. Seal the baggie and place it in a warm area, such as on the hot hood of a vehicle directly in the sun. Often, just placing the baggie in direct sunlight will heat it enough to release cyanide gas, if the latter is present in the plant material. This field test should be performed outdoors in a well-ventilated area.
6. Wait 10 minutes, and then evaluate the color of the test strip.
7. If the strip turns dark blue, the sample is positive for cyanide. If the strip is the same very light green color as before adding the sample, the sample is negative for cyanide. Any blue color change indicates that some cyanide is present.
8. This test is simply a screening test to determine whether or not cyanide can be generated from the sample being tested. The exact concentration of cyanide cannot be accurately measured using this method, but a sample that quickly turns the strip dark blue indicates that the plant could pose a significant risk for cyanide poisoning. As long as the sample is damp “to the touch” when placed in the baggie, a lack of color change in the test strip after 30 minutes means the sample poses minimal risk of cyanide poisoning.

Note: The shade of blue can darken over time, indicating that trace amounts of cyanide are

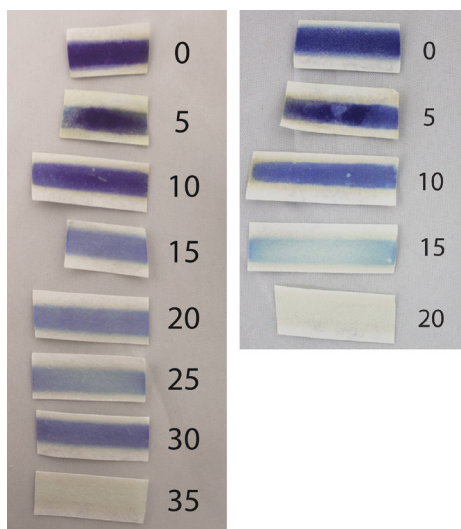


Figure 2: Color of Cyantesmo test paper after exposure to chopped leaves of cassava boiled from 0 (raw) to 35 minutes and chopped leaves of chaya boiled from 0 (raw) to 20 minutes. The numbers in the photo below indicate the number of minutes that chopped, green leaves were boiled.

being generated. Test strips should be evaluated after 30 minutes, if possible, to detect trace amounts of cyanide.

Multiple samples (3 to 4 is probably the most practical) should be tested to get a good representation of the field or source.

Disposal: The sealed baggie can be discarded in the garbage, or the baggie can first be opened and ventilated outdoors in a well-ventilated area. Do not breathe the fumes from the baggie, as cyanide gas could be released as soon as you open it. Emptied and rinsed clean baggies can be reused as long as they still seal well. The paper itself should not be handled without wearing disposable gloves.

A Simple ECHO Trial

Methods

To gain some first-hand experience using Cyantesmo paper, I (Tim Motis) followed the steps above for cassava (‘Negrita’) and chaya (‘Estrella’) leaves. I probably collected more leaves per sample than necessary (filling a whole bag versus half a bagful). Also, I chopped the leaves (Fig. 2) but did not mash them, since I would not normally mash chaya leaves before boiling them for a meal. Each sample consisted of enough leaves to fill a quart-size ziplock bag, amounting to 85 g of fresh leaves. I inserted a piece of Cyantesmo paper into each bagful of leaves, waiting at least 10 minutes before I removed the test strip to take photos.

After testing raw chaya and cassava leaves, I collected, chopped, boiled and then tested additional samples—a fresh batch of leaves for each 5-minute increment of boiling time. At the end of each boiling period, I emptied the pan of leaves into a strainer placed underneath a faucet in a kitchen sink, passing cold water over the leaves to immediately remove the heat. I increased the boiling time until cyanide was no longer detected, for a total of 8 batches of cassava leaves and 5 batches of chaya leaves (Fig. 1).

Results

With raw cassava and chaya leaves, the strips turned a dark blue color almost immediately, a strong indicator of the presence of cyanide (Fig. 2). For both crops, the shade of blue lightened considerably between 10 and 15 minutes of boiling time. However, it took 15 minutes longer for cassava than for chaya to reach the point where no blue color could be seen on a test strip.

Discussion

What does this mean? The results indicate that cassava leaves are safe to consume after 35 minutes of boiling time, and that chaya leaves can be eaten after 15-20 minutes of boiling. These results are hardly definitive, since only one sample was prepared for each boiling time. Still, these observations are comparable to other research findings. The 15-20 minute time frame for chaya is consistent with research showing that a boiling time of 15 minutes lowers HCN content to safe levels (RossIbarra and Molina-Cruz 2002). Also, many people boil chaya leaves for 15-20 minutes to reach a preferred level of tenderness. Where cassava leaves are eaten in West Africa, the young tender leaves are typically pounded and then boiled for up to 30 minutes (FAO 1999). The combination of pounding and boiling effectively reduces cyanide in the leaves to safe levels. In this experiment, the test strip after 30 minutes of boiling was surprisingly dark, which could have something to do with the ratio of older to younger leaves (assuming they differ in cyanide levels) in the sample.

Practical Uses for this Test

Cyantesmo paper could be used for a number of applications. The same series of boiling times could be tried for leaves from different varieties of cassava, which naturally tend to have differing levels of cyanogenic glycosides. Alternatively, the paper could be used to test how well cyanide is removed with other methods of food preparation, such as drying or frying. I have not tried it yet, but the paper should also work for assessing HCN released from mashed or cooked cassava roots. The test paper could also be used to determine the presence of cyanide in animal feed, by comparing HCN levels in different plant materials and resulting from different feed preparation methods.

References & Further Reading

- Food and Agriculture Organization (FAO). 1990. Oke, O.L. (edited by J. Redhead and M.A. Hussain). Roots, tubers, plantains and bananas in human nutrition. FAO (Rome). available: <http://www.fao.org/docrep/t0207e/t0207e08.htm>
- Food and Agriculture Organization (FAO). 1999. Bokanga, M (edited D. Mejia and B. Lewis). Cassava: Post-Harvest Operations. FAO (Rome). available: <http://www.fao.org/3/a-au998e.pdf>
- Ross-Ibarra, J. and A. Molina-Cruz. 2002. The Ethnobotany of Chaya (*Cnidoscolus aconitifolius* ssp. *aconitifolius* Breckon): A Nutritious Maya Vegetable. *Economic Botany* 56:350-365.



Job Opportunity at ECHO Asia

**ECHO Asia is looking to grow our staff capacity at the seed bank!
We are now accepting applications for a new position:**

Seed Technology Specialist

The primary purpose of this position is to provide technical know-how in:

- selection,
- propagation,
- breeding,
- cleaning,
- saving and
- storage

of regionally important crops of Asia through combined laboratory and field work within the ECHO Asia Seed Bank operations.

This role includes ‘information and quality control’ and conduct of applied research on seeds to drive practical seed technology innovations in conjunction with the research and extension goals of ECHO. In her/his capacity as technical specialist on Seed Technology, this employee will support trainings, workshops and learning events of ECHO Asia. This position is a support role to the function of the Seed Bank Supervisor.

To see the full job description, go to our “conversations” page on [ECHOcommunity.org](https://echocommunity.org)

To apply, please send cover letter and CV to Daniela (DJ) Riley at driley@echocommunity.org.


In Case You Missed it...

...click the links below to read past Asia Note Articles!

ASIA NOTE #43

[Mycorrhizal Fungi - Our Tiny Underground Allies](#)

[Tomato Grafting in Southeast Asia: A Useful Technique for Rainy Season Production](#)



Edited by Patrick Truitt, Daniela Riley & Eduardo Salas

Mycothizal Fungi - Our Tiny Underground Allies

by Adnan Chah

Department of Natural Resources Ecology & Management
Chattahoochee State University, GA, USA

Figure 1: Two tomato plants are shown. The plant on the left is labeled 'Without mycorrhizas' and has a small root system. The plant on the right is labeled 'With mycorrhizas' and has a much larger, more developed root system.

Featured in this AN

1

Mycothizal Fungi - Our Tiny Underground Allies

5

Tomato Grafting in Southeast Asia: A Useful Technique for Rainy Season Production

10

Recent Asia Note Links

11

ECHO Asia Upcoming Events

12

Subscribe to ECHO Asia's YouTube Channel

13


Ways to Stay Connected

ASIA NOTE #42

[Making On-Farm Pig Feed: Farm Generated Formulas vs. Commercial Feed](#)

[Integrated Pest Management on the Island of Bali](#)

[Coffee Drying 'Bunk Beds' for Vegetable Production](#)



Edited by Patrick Truitt, Daniela Riley & Eduardo Salas

May 2020 | Issue 42

Featured in this AN

1

Making On-Farm Pig Feed: Farm Generated Formulas vs. Commercial Feed

5

Integrated Pest Management on the Island of Bali

7

Coffee Drying Bunk Beds for Vegetable Production

8

Recent Asia Note Links

9

ECHO Asia Upcoming Events

10

ECHO Asia Covid-19 Response

10

Words of Gratitude & Solidarity from the ECHO Asia Director


11

Call for Articles & Insights

ASIA NOTE #41

[A Snapshot of the ECHO Asia Small Farm Resource Center & Seed Bank](#)

[Black Soldier Fly System of the Frangipani Langkawi Organic Farm](#)



Edited by Patrick Truitt & Daniela Riley

March 2020 | Issue 41

Featured in this AN

1

A Snapshot of the ECHO Asia Small Farm Resource Center & Seed Bank

7

Black Soldier Fly System of the Frangipani Langkawi Organic Farm

10

ECHO Asia Upcoming Events

11

ECHO Asia Career Opportunities


12

Call for Articles & Insights

ASIA NOTE #40

[State of Land in the Mekong Region - Brief](#)

[Highlighted Resources from the Asia Agriculture & Community Development Conference](#)



Edited by Patrick Truitt & Daniela Riley

November 2019 | Issue 40

Featured in this AN

1

State of Land in the Mekong Region - Brief

9

Highlighted Resources from the Asia Agriculture & Community Development Conference

12

Research Update: Heavy Metal Update in the Golden Triangle

13

Upcoming events in 2020 at the ECHO Asia Farm

15

New Seedlings Available

16

Opportunities from the Network

15

Call for Articles & Insights

Asia Notes Issue 44

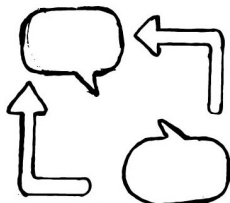
.....

9

Ways to Stay Connected... (and Contribute)



Please do remember that a “Development Worker” membership entitles you to 10 free trial packets of seed per year! 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 bulk seeds for sale, and our [seed bank catalog is available online](#).



Please also know that besides being written in English, our [ECHO Asia Notes](#) are translated and available for free download in Thai, Khmer, Burmese, Mandarin, Bahasa Indonesia, Vietnamese, and Hindi languages.



If you have never joined us for an event, please consider doing so- there are several events happening in 2020 and we would love for you to join! Please go to the [events page of ECHOcommunity.org](#) to learn more.



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!

Email us at echoasia@echocommunity.org!

