INNOVATION

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"It was late in the morning, the sun was up, and we had been hoeing for what I thought to be a very long time. I stopped to look back at what we had accomplished and said to my mother, "Look at all we have done!" Mother did not respond. Thinking that she had not heard me, I repeated what I had said a little louder. She still did not reply. Raising my voice a little higher, I repeated again. Finally, she turned to me and said, "Edward, never look back. Look ahead at what we still have to do!"

Edward Dube – Zimbabwe, Africa

In farm production, there's always too much to accomplish and so it's easy to fall behind in your production schedule. We can all use some innovation to make our work more efficient and productive. ***Innovation* is defined as *the introduction of something new; a new idea, method or device, a novelty***. We think of computers, new cameras, or smartphones as examples, but innovation can be as simple as a production map on the wall of your office or shed that keeps you focused and efficient. Innovation can make our farm jobs less time-consuming, from planting to harvest and beyond.

Agriculture is constantly evolving with new innovations, some earth shaking and some insignificant, but is very important to the one benefitting from it. The bottom line is we have to look ahead at what we still have to accomplish in farming and constantly looking at ways of doing it smarter. Your brain will last a whole lot longer than your muscles, so you have to find ways to maximize brain power, and if you don't use it, you lose it. What if you could sit down and weed and also harvest while you push yourself along right over the top of the crop like the picture above? Hook up some music and off you go.

TOOLS OF THE TRADE

Two important areas for the small farmer are new labor-saving devices and seed varieties. Small farm technology is sorely lacking in the US, but is starting to change. Also, the quality of U.S. hand tools is something to be desired.

Six-tine hand cultivator - Gerry Hebert, Kawanui, Kona

This change is coming from other parts of the world and also U.S. organic growers who are developing tools that fit their bed system, including multi-row

seed planters, walk behind push cultivators, bed lettuce harvesters, hula or stirrup hoes, and knife weeders. Some of the tools are new, while others are take-offs from old tools which have been revived. Eliot Coleman of Harborside, Maine comes up with all kinds of tools because his operation is designed around hand tools with a walk behind tractor. Wire weeders, collinear hoes, and broad forks help maintain his fields. I know we have some 'outside of the box' thinkers among us who can combine tasks, or invent things that make life on the farm so much easier; we just have to put our thinking caps on.

The Europeans are geared to small farm production than the Americans and are centuries ahead of us in designing and building farm tools. The German tool company Schwarzwaldschmiede or SHW started in 1267, and they had a lot of time to fine-tune their designs. Their workmanship is superb, and their tools are made to last. The Dutch company Dewit, started in 1898, and makes a swan neck hoe with a half-moon blade that's one of my favorites.

SHW chopper/row maker, DeWit half moon/swan neck hoe DeWit diamond scuffle hoe, and Rogue chopping hoe

The French company Bahco, known for pruners, shears, and hand saws, has a lifetime guarantee. Ammann AG and also Glaser, formerly Real, are two Swiss tool companies who make nimble, light weight tools. At one time, 'Made in Japan' meant inferior quality. No more. Japan has some of the best knives, refined through centuries of making samurai swords and knives with layered steel. Some of my favorite cutting shears are made by Kamaki, and come in stainless, Teflon coated, and spring steel. Its name sounds Hawaiian, which makes it easy to remember.

I would be remiss if I didn't mention an innovative, sustainable American farm tool company. Rogue Tools is made in the Missouri Ozarks by a family company. They recycle old farm disc blades used on disc harrows, and fashion them into rock solid hoes. These are tempered steel and made to last. Both my wife and I have one, and these are for attacking weeds that fight back when you try to dig them out. More small American companies are putting Yankee innovation to work for the small farmers creating wheel hoes, and some neat tools. There's more to come as the organic revolution continues to grow.

Tools are an extension of you, and can make your life so much easier if used in the proper way. A tool that makes your jobs efficient and effective is worth its weight in gold, and this means not having to re-do the same job. Taking good care of your tools is also important, and is something I'm still learning to do. A dull tool can increase your effort by 15%, so keeping them sharp is important. Storing tools in a dry place, and keeping them clean is the key. This also means oiling the wood, and washing or scraping the business end after each use. In Hawaii, high humidity encourages the growth of fungi that can rot wood handles in a short time, so don't leave your tools in the field. They like a dry, warm place to sleep just like you!

ERGO-WHAT?

An area of science called ***ERGONOMICS*** is the study of workplace design. Your office may be your field or packing area, and comfort, efficiency, and safety is important. It looks at how you use your body and will help you design tools to minimize damage especially to your lower back. The Europeans are light years ahead of us in tool design, and also have centuries of experience behind them. You can look at this area from the micro, such as a simple planting or harvesting tool, like the one above, or the macro, like large implements attached to your tractor.

Repetitive jobs can wear on key parts of your body. The old style of hoeing and weeding involves pounding a tool on the ground, sending shock waves through your body, and over time, can adversely affect especially your lower back. The idea of sliding a tool across the soil minimizes these shock waves. Tools such as scuffle or hula hoes are a good example. Tongan farmers on Molokai use heavy sliding hoes to control weeds and are designed so blades are almost parallel to the ground. Another example of innovation in ergonomic tool design is the trigger handle attached to the end of a straight handle on a sliding hoe. A straight handle on a hoe creates an awkward angle for your wrist, predisposing it to unneeded stress.

Tobacco transplanter used to plant sweetpotato cuttings or 'lau' - Hienie and Becky Mokuau, Late-1970's

Sweet potato harvesting technology in Hawaii was developed through a partnership between CTAHR and farmers by adapting existing farm machinery to this crop. The first implement was a tobacco transplanter to plant 'lau', a 12-18" long 'seed' stem of the sweet potato vine used to propagate sweet potato. Each 'lau' is fed into rotating fingers that plant the lau in the ground. The second is a hiller, constructed with a tool bar and two large disks that pull the soil toward the center, and over the plants. This is done about 5-6 weeks after planting to protect stems from weevil damage, and also allow tubers to swell above ground level. Cultivators are also attached on the tool bar to remove weeds between rows.

The third implement is a sugar beet digger that digs the sweet potatoes out of the ground unto a chain conveyor dropping it back on the ground. A more recent and evolving innovation in Hawaii include a grading line to grade sweet potatoes from the digger. Attaching the two last pieces of equipment would be the key. Another piece of equipment is a washer to make washing much easier. Over 20 years ago, I did a labor assessment of sweet potato production and determined that over 38% of the labor cost

was after digging the potatoes from the ground, including washing each individual sweet potato all the way to putting them in the box. Through the efforts of field trials and cost of production analyses, we were able to convince sweet potato growers to invest in washing and grading machinery.

Carrot Washer at Intervale Farm Incubator, Burlington, Vermont

There are some efforts to mechanize dryland taro production, and some of machinery used for sweet potato production could be modified for this purpose. Existing seed planters have been modified and are being used to plant taro. Hilling taro plants may be a challenge since they have to be performed before plants get too tall where tractors cannot travel over the tops of plants without damaging them. Next season's planting material or huli will need to be removed somewhere between mowing tops and digging. The digger would then go in and dig or possibly dig and haul the corms out of the field. Washing, grading, and packing would then follow.

These are the steps required in mechanizing a crop, but even a very small farmer with a couple rows of a crop can follow this line of thinking, and insert innovation and planning to keep labor costs down. Identification of high labor phases in the crop production process is a start. These can include planting, weeding, and harvesting, and focusing on decreasing the time involved in each step. Washing and packing can get laborious, especially when working with small vegetables such as baby carrots. A small, simple piece of equipment can make a world of difference.

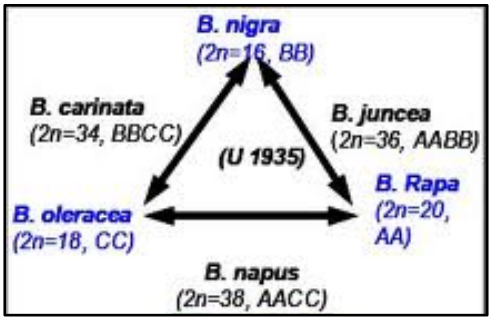
I still remember a friend of mine who used to harvest edamame or edible soybeans on Oahu. He would harvest the whole plants and haul them into his barn. He mounted a metal V attached to a table that he used to strip the pods and the leaves from the plant, and also used a fan to separate the leaves from the pods. Placing the plants in the V, he pulled the plants back and everyth ing would be removed from the stem.

Midori, a variety of Edamame, edible soybeans

Using gravity, the pods and leaves would fall to the ground. On the way down, a fan would blow the leaves to one side and pods would fall in the box on the ground, ready for market. The leaves were then returned to the field. This is ingenious, yet simple, farming in the comfort of your garage complete with pupus and cable television.

GO GREENS

Greens are the craze, whether eaten fresh, juiced, stir fried, and used in soups and main dishes, and we can never have enough in our diets. Of these, the Brassica family of vegetables reigns supreme, and include mustards and crucifers or cole crops, known as powerhouses of nutrients, some containing over 40 antioxidants, including cholesterol-lowering, detoxifying, and anti-inflammatory properties. This large family of vegetables provides maximum nutritional and protective benefits especially when cooked, and are high in Vitamins A, B, C, and K.



It's even more amazing when you realize that this large vegetable family believed to have originated from a common ancestor! This family can be broken down into at seven species, many of which can cross-breed.

The most popular members of this family in the U.S. are the heading types including broccoli, cauliflower, head cabbage, and Brussels sprouts. Innovations in plant breeding have recently produced cauliflower with yellow, orange, and purple heads selected for increased nutrient and antioxidant content. More recently, crosses between Brussels sprouts and head cabbage has produced open mini cabbages the size of a Brussels sprout called flower sprouts. Broccoli can cross with kale to produce a bro-kale, and one example is the cultivar Purple Peacock (below) in which the whole plant can be eaten.

Purple Peacock (Red Russian kale X Bonanza broccoli)

One group is the Chinese mustards including Pak Choy, Kai Choy, Won Bok, Choy Sum, Kai Lan, and others. Within this group, some are mostly grown for their leaves and stems while some, such as Won Bok will form a head. Usually stir fried, added to soups, and also pickled, this group found its way to Hawaii via Japan, Korea, and China. Popular in Hawaii for generations, they were only popularized in US over the last 15-20 years. I still remember giving a slide presentation on Oriental Vegetables in 1990 at the Annual Farm Conference in Santa Rosa, California, and attendees where asking me, "What are those vegetables?" Today, they're the craze. If you visit Chinatown in Honolulu around lunch time, and see what the store workers are eating, it's usually a bowl of rice, a piece of pork or chicken, and steamed Chinese mustards.

Another group includes the leafy greens, including collards, kale, and mustard greens. Many members of this group found their way to the U.S. via Africa, and the Mediterranean. First brought with African slaves to the southern states, they became an important part of their unique cuisine. Collards and mustard greens are the most heat-tolerant of this family, while most kale requires a cold snap to increase sweetness and remove bitterness.

However, a few kale varieties are adapted to Hawaii's warmer climate, including Lacinato or Dinosaur kale. Lacinato is very popular in Hawaii is and used to make green shakes. Another is Tronchuda Beira or Couve Tronchuda, Portuguese kale also called Portuguese cabbage, and brought to Hawaii by Portuguese immigrants in the late 1890's. Grown as a perennial in Hawaii, they can also be propagated by cuttings and will produce for several years. They are an important addition to soups, including Portuguese bean soup. I used to think that the Walking Stick Kale was the same as Portuguese kale, but it's not. There are also colorful kale varieties used as ornamentals.

Putting On Our Thinking Caps

About 3 years ago, I visited the island of Taiwan at the invitation of a colleague of mine who was originally from Taiwan. We did a 12-day whirlwind tour of many agri-businesses and farms. What an eye opener! Above all, I was able to see and experience the amazing strength and resilience of the Taiwanese farmer. Through floods and typhoons, they endure and find new ways to deal with their farm challenges. We would give up with the floods alone! Since pesticides are expensive, but metal and other materials are affordable, they will erect a metal-framed, mosquito net-like covering over the entire field to control insects. They will bag individual fruits of guava and mango with a paper sack to control the fruit fly, and can afford to do this since the fruits sell for a premium.

We rode a high-speed train with tracks a couple hundred feet above the towns that gave us a birds-eye view of the countryside, and took us from the north side of the island to the south in a couple of hours what would take 8 hours by automobile. We slept in a different town each night and visited many farms growing orchids, guava, mango, pineapple, tomato, long beans, eggplant, rice, herbs, and taro. We saw farmers growing microbes similar to the Korean System, developing compost and blood/bone products, and watched an organic movement evolving. I was also given seeds that we can't find in the U.S. such as daikon, pumpkins, and lettuce. The weather is similar, and I have high hopes for these seeds.

One of the high points of the trip was a stop at a small pineapple farm in the south with a reputation for the sweetest pineapple in Taiwan. Since Taiwan is closer to the Equator than us, the weather can get very humid, windless, and very hot. When you combine the three, you have yourself a stressful situation for even the most heat-tolerant crop like pineapple. The farmer was experiencing a lot of sunburn on the pineapples affecting his bottom line, so he came up with a great idea. He visited a cap factory nearby, and bought all the reject rims of these caps. He put these rims on each pineapple, with the

crowns sticking out of the top. It looked like all these heads in the field, and it worked! You just gotta use your thinking caps! Taiwan farmers also grow papaya, both large watermelon types and also the smaller Sunrise Solo, a UH variety.

We also visited the Banana Research Institute where breeding for resistance to diseases of banana was a major focus. Their main variety is "Williams, also known as Giant Cavendish. Their system of banana production is very different from ours because it's focused on supplying the high-end Japan market. As a consequence, they can develop a focused and high-input production system. They do this by planting clones produced by the Institute, harvesting for only one season, and plowing the field under in order to stay away from diseases and also synchronize harvests.

Panama Wilt, *Fusarium oxysporum*, is considered one of the most destructive diseases of banana worldwide. This fungal disease clogs up the vascular system, turning it brown, and inhibiting uptake of food and water, causing plants to wilt and die. The disease can remain in the ground for 30 years once infected, and is a major threat to all banana producing areas. In Africa, where banana is an important staple eaten as a starch, this is a major threat to subsistence farmers.

In the 1950's, tens of thousands of acres of the banana variety, Gros Michel were destroyed in South America and the Carribean, prompting to the industry to find a resistant variety. Also affected was the Bluefields banana. The variety resistant to this disease was the Cavendish variety, including Williams, Grand Nain, and other selections. The Chinese or Dwarf Cavendish, grown in home gardens in Hawaii is also resistant to this disease.

However, the strain or race of this disease found in Southeast Asia, Race 4, is an especially virulent and destructive strain and the Williams variety is susceptible to this disease. It has already decimated thousands of acres on banana in Malaysia, and was recently found in the Middle East, in Jordan. If accidently introduced to South America, it would wipe out all of the banana plantations there.

Since this is a high-end market for Taiwanese farmers, the Japanese are very particular and demanding about the products they buy. A new, improved 'Williams' banana with increased resistance to Panama Wilt was developed by the Institute, but is a half-inch shorter than the main variety they grow. The Japanese won't accept the shorter banana. If you pay a pretty penny for a gourmet product, you can demand whatever you want.

A RETURN TO OUR ROOTS

In Taiwan, I saw fields of rice surrounding farmer's home even near cities. But what was even more eye-opening was what they were growing around their homes. TARO chunks mixed with rice porridge or gruel is a breakfast staple. There was a taro research station on the island, and many of their varieties have similar corm colorations as the Chinese taro variety we grow in Hawaii, Bun long, white with purple strings. I

wondered why they grew taro, so my friend explained about the native Taiwanese who live on the mountainous east coast.

The native people are darker than the Taiwanese who are newcomers with their roots in mainland China. The natives actually look Chinese-Hawaii, and are a slimmer build. They hunted pigs in the mountainous regions, and would take a small food pouch strapped over their shoulder, and held to their side. In the pouch was nothing but a chunk of taro; their only food when going pig hunting! The first Polynesians are believed to have originated from this area, and native Taiwanese are believed to be their relatives. This is probably where they learned to grow taro in paddies or lo'i. Some believe the Polynesians were the ancient people of China and surrounding areas, and were pushed off the continent by another wave of settlers, probably the Han or the Mongolians.

Watch for Falling Papaya! Taiwan Papaya Red 15, Left – Female, Right - Hermaphrodite

On an island near Taiwan, the author of the book, 'Guns, Germs, and Steel', Jared Diamond talks about visiting there and hearing this pounding of wood on wood that seemed to permeate the whole island. Turns out the women were making tapa from mulberry bark, similar to the making of kapa in ancient Hawaii. We can actually track cultures by the tools they used and even the design of the tools. Tapa beaters and poi pounders are just a few of them.

Many of these cultures have other things in common, such as their staple, the food they eat, and even the crops they grow. Their cultural traditions may even be similar. But another commonality of island people is their bond to the land, and an understanding of finite resources. There's a limit to everything, and there's only so much water and so much land, and we have to *malama* the land so it will *malama* us.

GETTING READY

As we plow into a New Year, let us not forget what is important in our lives; family, friends, helping others, working hard, and being pono. We need to remember the reason for the season, and have an attitude of gratitude each day. We should focus more on what we have, than what we don't have. From our homestead to yours, Happy Holidays, and Have a Productive and Bountiful New Year!!