

ONE HUNDRED YEARS!

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This year, we celebrate the 100th Anniversary of the Cooperative Extension Service. The signing of the Smith-Lever Act by Congress in 1914 is where it all began. The purpose of the Cooperative Extension Service was to *“aid in diffusing among the people of the United States useful and practical information on subjects relating to agriculture, uses of solar energy with respect to agriculture, home economics, and rural energy, and to encourage the application of the same, there may be continued or inaugurated in connection with the college of colleges in each State, Territory, or possession..”*

“Cooperative agricultural extension work shall consist of the development of practical applications of research knowledge and giving of instruction and practical demonstrations of existing or improved practices or technologies in agriculture, uses of solar energy with respect to agriculture, home economics, and rural energy, and subjects relating thereto to persons not attending or resident in said colleges in the several communities, and imparting information on said subjects through demonstrations, publications, and otherwise and for the necessary printing



and distribution of information in connection with the foregoing...”

Our role is to transfer research-based information from the University of Hawaii and other Land Grant universities to the communities. In some instances, it was to generate relevant research-based information that the community can then use. In Hawaii, where we have so much diversity in climate, in soil, and also in the cultures that embrace Hawaii, the work never ends and is more important today than it was 100 years ago when our leaders envisioned a need for this Act. I’m honored to have worked for the Cooperative Extension Service for 33 of those 100 years in providing research-based education to support our communities.

WHAT CLIMATE CHANGE?

On Molokai, sometimes it’s difficult to comprehend global warming when some parts of the island appear to be getting colder and wetter, but these mood swings are characteristics of changing weather patterns that could easily go the other way. The weather extremes are a

concern, with not only hotter and dryer weather, but also high winds and torrential rains.

In California, an example of a really, really hot summer arrived last year, and models are predicting that this is what most summers will look like by the end of this century. While part of the solution is in mitigation – reducing and preventing greenhouse gas emissions, we need to be focusing on adaptation strategies as well, according to Max Auffhammer, associate professor in the UC Berkeley's Department of Agricultural and Resource Economics.

What are we going to do about this global issue in Hawaii when we're just a speck on a fly on the back of an elephant? In his inaugural speech, President Obama said the failure to respond to climate change 'would betray our children and future generations.' An increase in 2 degrees Celsius or 3.6 degrees Fahrenheit is enough to cause major, major disruption in the way we live, and could negatively impact billions of people on the planet, according to Andrew Guzman, UC Berkeley law professor.

According to Guzman, physical infrastructure that we take for granted, such as farm and water delivery systems, "aren't built for the stresses of climate change, and some of those systems might not withstand them." Guzman believes climate change could wreak havoc on the California's massive water supply system, but could also trigger major political instability in many

parts of the world as nations fight to survive through a water shortage. Examples include Pakistan, in their struggle with India to gain more water from the Indus Valley could possibly lead to a nuclear showdown.

The political solution to climate change has stalled out. Instead of taking the Chicken Little response of 'the sky is falling!' leaders have taken the ostrich approach of 'burying their head in the sand' or passing it off as a radical idea with no scientific basis. Politics is not going to do the trick, at least in the near term. This situation has been termed 'planetary-scale paralyses'.

Keeping cool also has its costs in urban areas where residents are increasing the use of air conditioning, in water pumping for both agricultural and urban use, and also in increased ground transportation during summer months. Farmers will have to find ways to cope with rising temperatures and increasing water scarcity.

Last year, India's power system blew out, largely due to the load of irrigation pumps, leaving 670 million people without electricity in the world's largest electrical blowout. Increases in temperature make crops thirstier, and in some cases while shut down the plants internal system due to extreme heat similar to an overheating automobile. In many areas, farmers can turn to irrigation, but many areas of the U.S. and the world depend on dryland agriculture, and the accumulation of

water from winter melting, to sustain farm production during summer months.

But many farm areas rely on ground water that will set in motion cascading effects. Ground water pumps require a lot of energy to operate, more than air-conditioning units. As temperatures rise, farmers in the Corn Belt, for example, may shift north. This will involve the relocation of farms, families, and communities. This is already happening in France, where some areas can no longer grow grapes for wine production due to high temperatures. England is now becoming an expansion area for the growing of grapes due to climate change.

Hawaii's location on the edge of the tropics is a case in point. Hawaii's climate can be considered sub-tropical without the humid jungle-type climate due to our prevailing northeast trades and cooler than normal winters. As a result of global warming and increasing temperatures in Hawaii, tropical diseases presently not in Hawaii will become an increasing threat, and could have dire consequences here.

Presently, many disease-carrying mosquitoes are already established here but weather conditions are less than ideal for the diseases, but increasing temperatures could spawn the introduction of these mosquito-borne diseases such as the malaria, dengue fever, West Nile virus, yellow fever, and others. These changes will not only affect the human living environment, but

the whole socio-economic structure in a state highly dependent on tourism.

One of the most important adaptation strategies for agriculture globally is the development of heat-tolerant and disease-resistant varieties of crops. Hawaii could position itself as the leader in this area, even independent of genetically-modified seed production.

BIOSECURITY

Biosecurity is a set of preventive measures designed to reduce the risk of introduction into Hawaii of infectious diseases, quarantined pests, invasive alien species, and living modified organisms.

I cannot overemphasize the need to be vigilant in addressing this omnipresent threat. Each year, approximately 10 to 15 new **major** insect pests are accidentally introduced onto Oahu. On top of this, many other seemingly unimportant pests are also accidentally introduced, but we may not fully understand their impacts at that time.

Oahu's major ports of entry, including harbors, airports, and military installations are the main entry points for these pests, but they can also be sent through mail systems. It's believed that the arrival of over 1000 40-foot containers each day carrying most of Hawaii's food, supplies, and materials are a major source of invasive pests since there's insufficient personnel to adequately inspect these containers. Once in Hawaii, there's no strategy or

regulatory trigger to prevent the introduction of invasive species onto the neighbor islands, since there's no interisland quarantine inspection system at ports of entry. TSA focuses on weapons, and is not concerned about invasive plants and insects.

The latest disaster is the arrival of the **Coconut Rhinoceros Beetle**, which moved around undetected for almost 1 ½ to 2 years before it was discovered through a routine survey by University of Hawaii and USDA Plant Protection and Quarantine (USDA-PPQ) officials. The Coconut Rhinoceros Beetle is one of the largest beetles to invade Hawaii and was discovered in an area surrounding Joint Base Pearl Harbor-Hickam. By that time, it was found in a one mile radius around the base. Red flags were raised in 2007 when the beetle was first found in Guam, an island half the size of Molokai where a major U.S. military base covers half the island. It was only a matter of time before it would hitch a ride on a direct flight to Hawaii.

A dreaded and destructive insect of coconut, the Coconut Rhinoceros Beetle is found in many areas of the Pacific, south Asia, India, Africa, and the Middle East. The beetle life stages include egg, larvae, pupae, and adult. Eggs are whitish brown, 1/8-3/16" first oblong but growing into a rubbery circle in 4-5 days. Eggs will hatch in about 12 days and go through three larval stages or instars, maturing into large C-shaped larvae of 2 3/8 to 4 1/8" long.

The pupae stage will live in soil or organic matter near trees for about 20 days, and will form into a cocoon. Adults will stay in cocoons for another 11-20 days to allow their exoskeleton to harden. Females can lay 70-140 eggs and will deposit them in logs or in heaps of organic matter. Adult beetles can range in size from 1 3/16" to 2 1/4". A distinctive horn curving backward is found on both male and female beetles, but the male horns are larger. Under ideal conditions, three generations can be produced in a year. Decaying coconut wood is a preferred breeding area for this beetle.

The most damage is done during the adult stage by boring into the crowns of healthy coconut palms and penetrating from 3 to almost 20 inches into the cluster of leaves at the top of the tree. They bite through the unopened leaves and will most often injure the main rib of fronds. It will then bore outward again, emerging from the base of a central frond in the crown. The adult beetle will feed on sap produced by the injury. Mature fronds often have patches of missing foliage like they've been cut with a scissors to make V-shaped patterns in the fronds, and also holes in the midribs.

Beetles will also feed on breadfruit, mango, kamani, and hala, but coconuts are its preferred host. It has a large host range and, in the absence of the plants list above, will feed on sugar cane, ironwood, taro, banana, pineapple, agave, and many species of ornamental

palms, possibly the native Loulu palm. Natural enemies include rats, pigs, and mongoose, and may also be attacked by certain ant species and other beetles. There's also a fungus and a virus known to be fatal to this beetle. For more information on the Coconut Rhinoceros Beetle, you can view this publication: http://www2.ctahr.hawaii.edu/adap/ASC_C_LandGrant/Dr_Brooks/BrochureNo8.pdf

There are instances where some islands have been spared the introduction of a major invasive pest years after the pest has been well established in other parts of Hawaii. A good example is on Molokai, where Papaya Ringspot Virus is not found, and where Banana Bunchy Top Virus has been eradicated and hasn't established itself, although there's hot spots on the island that need to be closely monitored due to the growth characteristics of the plant itself. Through the efforts of CTAHR and the Molokai-Maui Invasive Species Committee (MOMISC), and especially a concerned and vigilant community, efforts to keep some of these major pests out of Molokai have been successful, but we cannot let our guard down.

The Big Island of Hawaii has its own set of serious pests that haven't reached Molokai since establishing itself there. Three major pests of concern include the coffee bean borer, the coqui frog, and the small fire ant. Suspected entry points into Hawaii are believed to be nurseries importing new plant materials

from areas where these pests are found, and also farm workers and imported coffee. The coqui frog has been intercepted on Molokai at least four times, including one that hitchhiked on a car chassis, which is one of their favorite modes of travel, to Halawa Valley! The small fire ant has been moving around the Big Island in compost, plants, and soil, and has finally reached Maui and Oahu, but with the lack of an interisland quarantine system, it's only a matter of time before these major pests reach Molokai.

There are horror stories and 'deer in the headlight' situations of lost opportunities in eradicating a new pest in Hawaii due to poor coordination and decision making, and a lack of funds and an implementation strategy. Without a strong pro-active quarantine policy, and an adequately funded implementation plan, we will continue to face major threats to our crops, our native ecosystem, and also our physical landscape.

In the meantime, the community will need to be self-regulating by practicing common sense and not bringing in plants and animals from other islands. We need to look at ways of treating plants at the Kaunakakai Wharf as the last ditch strategy to control in the introduction of serious pests, such as a heat treatment chamber.

Seeds are the preferred method of plant movement to prevent the introduction of farm-related pests to new farm areas. Another method of plant movement is

treated scion wood for fruit trees such as avocado and mango. ***The most important point to be made is we cannot depend on anyone but ourselves to prevent the introduction of pests because every prevention and intervention system is not working.*** It's fortunate that on Molokai we have the presence of 'ninjas', invisible people who see plants and insects arriving on the wharf and at the airport, and report it to the right people on the island such as MOMISC. ***Only WE can protect OUR island, and everyone needs to do their part!***

Rotating Your Crop

I'd like to make a bold statement that the majority of commercial farmers in Hawaii don't practice crop rotation. By not rotating our crops, we create our own problems that can be the cause of our own demise. Monoculture is the simplest form of farming because you only have to understand all aspects of one crop, so you can grow it well if you choose, but in the process, you create insurmountable problems for you, the farmer, and your crop.

The key word here is 'create'. The farmer creates his own problems, such as spotted wilt virus on tomato and lettuce, papaya ringspot virus on papaya, and root-knot nematodes on many crops to the point where we can no longer grow the crop in certain areas of the state. Then we need to come up with costly and time-consuming solutions which may not fit into our

farming ethic, including genetically-modified crops.

Man is his own worst enemy and doesn't learn from the natural systems around him. We're driven more by short-term horizons such as markets and by land tenure, and not by focusing on soil health and management. In creating a crop rotation system, a more holistic approach needs to be embraced, and all of the pieces of the puzzle need to be taken into consideration equally. There are short, medium, and long-term considerations in planning a crop rotation strategy.

Markets are a short-term consideration, and can get very complicated if you're growing an array of crops. Crop rotation can break pest cycles which can be very costly to control over the long run, and can foster the proper use and recycling of soil nutrients without depleting some of them. In Hawaii, we've seen the impacts of not implementing crop rotation. It's more the norm not to implement a rotation system, and by doing this, we end up like a dog chasing his tail, wondering why we're in a situation that we ourselves created.



Planting Kalo, an inspired mural by Solomon Enos at Kooka Kalihi Valley Farm. Kalihi, Oahu

A crop rotation system utilized for decades in Kula was the lettuce-tomato rotation, and this was a disaster resulting in millions of dollars in crop losses over the long-term. The problem was that both crops were susceptible to Spotted-Wilt virus, once referred to as the AIDS of the plant world because it killed its host. This rotation eventually led to the demise of both crop industries on Maui that hasn't yet recovered. The other crop that's experiencing a similar problem due to the lack of a crop rotation is head cabbage.

Head cabbage is grown most of the year in Kula, so the pests are always there constantly evolving and building resistance to pesticides to the point where a three-pesticide regime must be followed in order to prevent pesticide resistance. Farmers have also had to shift to a new cabbage variety that's more tolerant to insect damage. A tougher, more insect-resistant variety, Scorpio, is being grown, but what they gave up was a very sweet cabbage variety, Tastie. Some farmers have resorted to flattened head varieties from

Japan that's more adapted to Hawaii's conditions, including heat- and insect-tolerance.

Farming in Hawaii is 'a different animal' so we may have to retrofit strategies for a 'pono' farming system, but some basic concepts still apply. Here's a list of crop rotation concepts or strategies taken from three important books on the subject, and I know there's more:

1. *The rotation must adapt itself to the farmer's business.*
2. *It must adapt itself to the soil and fertility problem.*
3. *The fertilizer question also modifies the rotation.*
4. *The kind of soil and climate may dictate the rotation.*
5. *The labor supply has an important bearing on the character of the rotation course.*
6. *The size of the farm and whether the land can be used for pasturage are also determinants.*
7. *The rotation must be planned with reference to the species of plants that will best serve one another, or produce the best interrelationship possible.*
8. *Deep rooted crops must follow shallow rooted crops.*
9. *Alternate between crops with high and low biomass.*
10. *Follow a legume crop with a high nitrogen demanding crop.*
11. *Grow the same annual crop for only one year.*
12. *Don't follow a crop with a closely related species.*

13. Alternate between leaf and straw crops.
14. Use crop sequences that aid in controlling weeds.
15. Use longer periods of perennial crops on sloping land.
16. Grow some crops that will leave a significant amount of residue.

Although some of these guidelines may not fit into your farming system, it's a good idea to incorporate as many of these guidelines in your farming system as possible. We need to create more GAPs or Good Agricultural Practices as we refine crop rotation systems for Hawaii.



Molokai red gold can grow a wide variety of crops

Red Gold

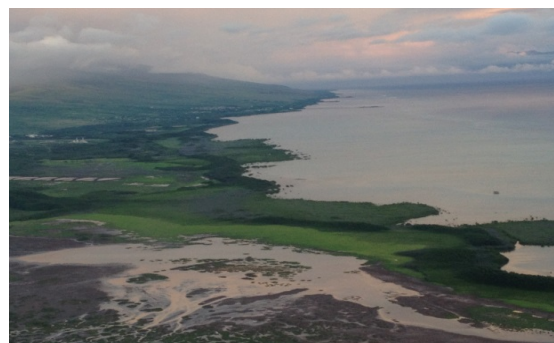
In Hoolehua, we're either dealing with mud or dust, and rarely in between. The constant wetting and drying of soil creates a tenuous environment for those organisms living in soil, and we have to nurture them during those droughts in order to keep them alive and even thriving. Creating stability in our soil takes planning, and a better understanding of all the moving parts.

Our soil has the ability to dry quickly after a rain, but it's those saturated situations when the soil is sticky and muddy that it's hard to maneuver through. I recall a neighbor shaking his head after having to drive through the mud tracks I left outside my driveway on the main road after a heavy rain. I told him, "Welcome to Hoolehua!" This is a rural farming community, and you have to accept this; this is not Honolulu with clean streets. That nuisance that muddies up the road is irreplaceable and worth its weight in gold.

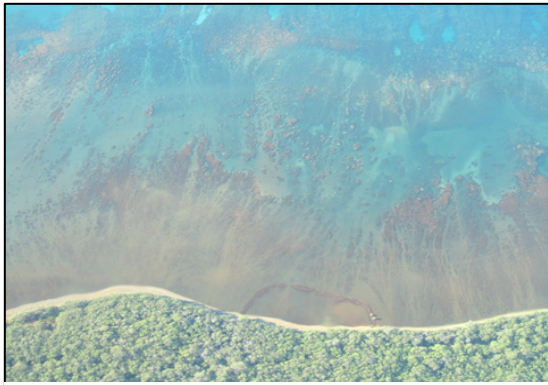
The Pala'au coastline in south central Molokai, below the farming area of Kualapuu and Hoolehua

We've had some massive downpours early this year just as the USDA was preparing to announce a drought declaration for Maui County. These extremes have a long-term impact on soil quality and quantity on the land, and also in near shore areas. Some say it's natural for soil to flow into the ocean after a heavy rain, and that it enhances the fisheries habitat because fish will respond to fresh water and spawn as a result. Nutrients entering the ocean will also be absorbed by limu which will flourish as a result.

There's a yin and yang to everything and it really depends on how you look at. But what is really happening to the land and what is the impact there? The top 1" of soil is the richest in terms of



organic matter and nutrients due to the breakdown of its vegetative cover, and we see this in open fields or in undisturbed areas. This nutrient cycle involves trees that take up nutrients from deep in the ground and drop it on the surface in the form of leaves and branches where it breaks down and is made available to plants, including the one that produced it.



Molokai's central south coast barrier reef system impacted by farming and other human activities

I used to laugh when the Department of Transportation gang would scrape the side of the road, and haul the soil up the road. There's a silver lining in everything and I looked at it as a way of reversing the effects of soil erosion by taking the soil back up the hill only to have it come down again. In other words, they were just buying time, but the other problem they created was removing the vegetative cover, so now the remaining soil on the side of the highway was more susceptible to erosion due to a direct hit from water droplets, especially the big ones.

During that rainy month, instead of using rubber boots to harvest our crops, we used slippers. I had the job of washing

slippers with a couple inches of mud stuck to the bottoms. When it got to this point where it was hard to walk with it, I would just leave it in the field and grab another pair of slippers, but soon I ran out of clean slippers so I had to gather them up and wash four pairs. What I noticed while shooting it down with a high pressure hose was the pure mud came off easier than when the soil was mixed with chopped up grasses and other organic matter. This is what happens on the ground as well. Soil, especially when mixed with organic matter can resist erosion better than soil without organic matter.

The key to responsible soil management is to maintain a vegetative cover, especially in the rainy season. This vegetative cover cushions or breaks the fall of water drops to minimize the digging action of raindrops while its roots hold the soil together. When you lose soil, you lose it forever, especially from your homestead. Another homestead may benefit from your soil downhill from you, but overall it's a loss. If you're in an arid area, you may have to plant a vegetative cover in the spring that stays there through the summer. Another strategy is planting cover crops or ground covers that can keep the soil protected and microbes thriving.

On Molokai, if you look at the fishpond systems or even our south shore barrier reef and how much soil has settled on the bottom of our shallow reef system, it's enough to make you cry. Some of this soil also contains toxins including

pesticides and petroleum-based compounds toxic to ocean organisms from former pineapple production and other farming activities, and also human activities such as pesticide treatments on house structures, especially along the coast.

Bottom feeders such a mullet and moi will consume this in the process of foraging for food, while herbivores will pick it up as well through the ocean flora they eat. Crabs will also pick it up when they feed on dead fish. When we eat these organisms, we bring these toxins back to the shore, and it's an endless cycle. What we do on the land WILL affect what's happening in the ocean, especially the near-shore population of fish, crustaceans, and limu.

Compound this with the overpopulation of deer, and you have an ecological disaster waiting to happen. I've been telling people that if we don't take care of the deer problem, then Mother Nature will take care of it in the form of epidemics or zoonoses. It's only a matter of time before our brown ocean will be an everyday sight. Hawaii has some of the highest erosion rates in the nation, and it's only getting worse.

USING OUR HEADS

We are taught at an early age to use our heads and think about what we do before we do it, so we don't do stupid things that could hurt us now and in the long run. When I was young and made a stupid mistake, which was quite often, my father would say, "If you had brains,

you'd be dangerous!" I had to ponder on that statement for many years before I kinda understood what he meant. I think he was saying that if I had more brains, I would do more stupid things. It's not really brains we lack when we make rash or stupid decisions, but a lack of common sense or our inability to rationally dissect a problem and come to a bloodless solution.

I read an interesting book on breakthroughs in neuroscience revealing that we use a very small percentage of our brain to accomplish all that we need in order to survive. The author talks about a near tragedy in his life when his father, who was a college professor, experienced a stroke that left him paralyzed and unable to walk.

The author was busy pursuing a career as a neuroscientist, a specialist on brain functions, so he left the vital task of caring for his paralyzed father to his



Taking water from one river source and distributing it through an entire valley to grow wetland taro required ingenuity and inspiration, and a lot of common sense!

brother, a psychiatrist who lived in Mexico. His brother didn't know how to deal with this crisis, but believed that his

father needed to ‘crawl before he could walk’, so he encouraged his father to crawl around the house by using the wall as support to move from room to room. His brother also had his father tending to a garden by crawling around, and his neighbors were appalled by what they considered a neglect and abuse of his father.

But soon, his father was moving around without the use of the wall, and before long he was walking around the house. Before long, he was back teaching at a university. Then, at the age of 82, his father decided to hike the mountains of Ecuador, and it was there that he died on the mountain doing what he enjoyed. When Americans die in foreign countries, autopsies are regularly performed in the U.S. as a normal procedure. The autopsy revealed that 85% of his brain was badly damaged and non-functional. In the recovery phase after the stroke, his brain had rewired itself to perform the many life functions and he was essentially operating on 15% of his brain! Most of us use less of our brain for every day functions.

So what does this have to do with farming? We’ll, we need to use a bigger portion of our brain and be more progressive in our thinking. We need to walk through our plans before we implement them. We need to farm smart, and have our antenna fully extended to know what’s going on. We need to be aggressive in our weed control and in building up our soil.

Also, we need to think outside the box when creating new products from the crops we grow, and develop innovative ways of selling them. We need to understand the science behind things, and see the full picture and find the path that allows us to accomplish our goals. And we have to do it before we get too old when our brain still wants to do things, but our bodies cannot execute.

WEATHER PREDICTIONS

I had intended to write a weather prediction for this summer, but I’ve given up on that idea after watching the weather over the last month. Important attributes of climate change include erratic, unpredictable, and extreme swings in weather. On Molokai, we’ve



The Sweetpotato Hornworm is a destructive and erratic pest of sweetpotato, and can be identified by its dorsal horn. Population swings are due to cold weather impacting on its natural enemies.

had intense episodes of rain earlier in the year, followed by sustained destructive winds. We can usually look at the past season as prelude of the upcoming season, but this year is an anomaly. And it’s still cold in May, but it’s going to be a cooker real soon!

There's so much biomass out there from this record-breaking rain, probably more than we've had in the last 25 years, so there's a concern when everything dries up that the fire potential will increase along with the increase in insects, rodents, and deer. But then again, it might rain all summer! Recently, we've been having more than our share of strong winds affecting both the root systems of trees, predisposing them to disease, and decreased flower set. How will it affect our summer farming weather?

Farming is about managing risk, and constantly assessing the situation. We need to be vigilant in managing our farms and building resilience in our plantings by controlling the things we have control over, starting with soil health and nutrition. There are advantages and disadvantages of being the only one farming in an area. Isolation means that you can have better control of pest problems. However, if you're the only green spot surrounded by a desert, soon every hungry animal, big and small, will be at your doorstep. Weeds will only grow where there's water. Insects will only remain on green plants, and once they dry up, they move on. Every animal is searching for water in a drought, including birds, mice, mongoose, and deer, not to mention feral cats and dogs. You can use water to trap some of these animals to prevent them from damaging crops and irrigation systems.

Although knowing what you're up against helps you to prepare, it's what you do about it that really matters. Protecting your investment also means determining how much time and money you can afford to spend on prevention and intervention. You cannot be complacent, just kick back, and let problems take care of themselves. Staying on top of things, and not taking things for granted is where you want to be. Being concerned will keep you on your toes, if you expect to pull off a decent crop. You have now been forewarned!

Pondering Weeds...

Most of the time, we don't have to find weeds. They dominate our existence as farmers, but what we do about them that really matters. I'm dealing with more than my share and haven't seen so many weeds in my life as I've seen



A whole lotta spinach and a little bit of weeds is where you want to be.

earlier this year. I firmly believe that prevention is so much easier than intervention. Weeds have a knack for survival and perpetuating themselves, and have evolved all kinds of mechanisms to do so. Here's a poem written for the mainland, where weeds are only a problem less than 9 months of the year, but you get the gist of the message:

*Since the best way of weeding
Is to prevent the weeds from seeding,
The least procrastination
Of any operation
Of noxious vegetation
Is a source of tribulation.
And this, in truth, a fact is
Which gardeners ought to practice,
And tillers should remember,
From April to December. (And many
months more in Hawaii!)*

Well, that's it for this month. Expect the unexpected, and stay ahead of the curve. If things are going great, it only means that something unexpected is about to happen...

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