



Envirotalk



GOVERNMENT OF BERMUDA

Ministry of Environment, Planning and Infrastructure Strategy

FALL 2011

VOLUME 79 No. 3

PROMOTING APPRECIATION, ENHANCEMENT AND CONSERVATION OF BERMUDA'S ENVIRONMENT

WELCOME

to our Fall edition of Envirotalk.

In this issue –

- **Jessie Hallett**, a Bermuda Zoological Society Research fellow, tells us about the recovery of turkey-wing mussels.
- **Abayomi Carmichael** shouts at Bermuda to start growing up, in a vertical gardening challenge.
- In 'Beds, Paths and Beyond...How does your Lawn grow?', **Aaron Lutkin** gives advice on lawn care in Bermuda.
- **Claire Jessey**, Entomologist, talks to us about the citrus leafminer, a wide-spread pest which is currently damaging our citrus.
- Check and see what is worth planting this fall in our Fall planting calendar.

Please contact:

Caroldey Douglas (Tel: 239-2307 or e-mail: cdouglas@gov.bm) with ideas for future articles.

Kimberly Burch (Tel: 239-2322 or e-mail: kmburch@gov.bm) to be added to the subscriber list.

TURKEY-WING MUSSELS ARE RECOVERING SLOWLY IN BERMUDA, BUT DON'T FEAR FOR YOUR PIES YET!

It wouldn't be possible to make a traditional mussel pie without the turkey-wing mussel, *Arca zebra*. These attractive brown and white striped shells get their name because they are shaped somewhat like a turkey wing. The turkey-wing mussel is the most abundant bivalve in Bermuda's waters, and is most commonly found in Harrington Sound. These animals are found along the east coast of the United States from North Carolina to Florida, through the West Indies and as far south as Venezuela. Turkey-wing mussels grow slowly to a maximum size of approximately 80 mm, and are thought to reach 10 years old! Mussels, which are a favourite food of hogfish and octopuses, feed by filtering plankton and algae out of the water, enhancing water quality. Turkey-wing mussels spawn during the summer, first in June, and then a second time in early September. Larval mussels attach to corals, rocks, and other shells on the sea bottom, often forming large 'bundles' of mussels and other animals. Turkey-wing mussels are commonly found in Harrington Sound, in part because this area supported large populations of the branching ivory bush coral (*Oculina* sp.) that provided a substrate for settling larvae. Turkey wing mussels may be efficiently collected by free-divers because of their tendency to aggregate in these bundles.

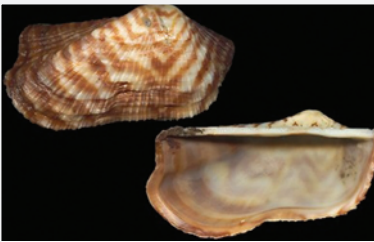


Figure 1. *Arca zebra*. In the wild, the shells are often encrusted with algae and animals, so the stripes are not as visible.

Turkey wing-mussels have endured a great deal of harvesting pressure in Bermuda over the past 40 years. Historically, they have always been caught recreationally, particularly for mussel pies. Between the 1970s and 1994, however, Harrington Sound was heavily dredged for mussels. Six commercial fishermen had licences to dredge the entire Sound, save for a small protected area east of the Aquarium. Together, these fishermen

caught approximately 500,000 mussels every year, causing populations to plummet. Besides the impacts of declining mussel populations, dredging also destroyed the coral colonies on the seabed in Harrington Sound. Without an abundance of coral colonies and old mussel shells for larvae to settle on, it was very difficult for mussel populations to recover.

By 1994, dredging had ended, because all six fishermen had retired. For 15 years, only recreational fishing was allowed, but in 2008, mussels were thought to be abundant enough to allow two commercial harvesters to

be given permits to free-dive for mussels. This adds up to a harvest of 30,000 to 50,000 mussels per year, which is only a small amount compared to quantities taken by dredging. The last survey of turkey-wing mussel populations in Harrington Sound was done in 1988, by Dr. Samia Sarkis (a research scientist currently working with Conservation Services), while dredging was still occurring. These surveys found that mussel density was low, and there was very little recruitment of young mussels occurring. Large, fecund adults were also rare. These surveys gave a good idea of how the fishery was affecting the population, but there have been no studies to determine whether mussels have recovered at all since 1994.

During the summer of 2010, Dr. Joanna Pitt from Environmental Protection and I re-visited the 1988 survey sites in Harrington Sound to see exactly what the seabed looked like, and how the mussel populations had changed after a 16 year respite from dredging. We discovered that the seabed is recovering, with clumps of ivory bush coral scattered across a few of the sites we looked at. An in-depth survey of a former dredging site revealed that mussel density had increased significantly since dredging had ceased. These recovered sites were found at depths below those that free-divers can reach, so it appears that, in the absence of any harvesting pressure, mussels are growing and reproducing. We also conducted an in-depth survey at a shallow shoreline site that was not dredged in the past, but which is currently exploited by commercial and recreational fishermen. Here, mussels were much scarcer, and smaller, than at the deeper site, indicating that current harvesting pressure is negatively affecting the population.

This summer, we have also been investigating another aspect of turkey-wing mussel ecology:



Figure 2. A shell slice, showing growth lines inside the shell.

growth. Much like trees have annual rings, from which their age can be determined, so do many bivalve shellfish species throughout the world. We have determined that the turkey-wing mussels in Bermuda also lay down visible rings, but—presumably because Bermuda’s climate is different from temperate

areas where these mussels have been studied previously—it is unclear whether the rings are produced according to an annual schedule. To investigate the characteristics of the rings, we cut slices out of mussel shells and then observed them under the microscope, where the rings were clearly visible. Now that we know we can easily measure the rings, we need to determine the time frame over which the turkey-wing mussels lay down these rings, which will then tell us the ring's utility as a tool for ageing Bermuda turkey-wing mussels. Further investigation, including the marking of shells at different time intervals, should help clarify this.

Investigating ring development and turkey wing mussel growth will help determine how old mussels are when they are being harvested, and at what age they mature. The ultimate goal of these studies is to make sure mussel populations in Bermuda are healthy, and determine whether it is necessary to further regulate the fishery. We certainly see signs of improvement, and we hope to ensure that Bermudians can continue making (and eating) mussel pies for years to come!

Jessie Hallett

MSc candidate, University of York, UK

Dept. Environmental Protection

Bermuda Zoological Society Research Fellow

GROW-UP BERMUDA

People in Bermuda need to grow up. Well, vertically to be specific. With limited growing space at our homes, schools and perhaps even office buildings, there is a growing movement we need to explore and experiment with called vertical gardening. This is not a new concept but it is one manifesting an increasing array of innovations by common folk like you and me. At its heart is the use of vertical space rather than horizontal. In many cities across the US, you can find green walls in various forms: plants grown in some fashion so as to obscure the wall behind them. Some are quite decorative, others intricate enough to spell out the name of the institution that sponsors them. I haven't yet though seen one with edibles embedded in the mix. This is the focus of this short article.

Daily we see news stories about rising commodity prices, record droughts, floods, cyclones, heat waves and more in far off food producing places. Be it Australia (record floods), China (drought), the US (floods and heat waves), Russia (wildfire)...there is no shortage of conditions that are threatening the steady supply of food to the world. Bermuda is increasingly reliant on imports for food — nearly all that we consume is imported. Few, if any of us, have a living memory of a time when we needed to eat and food was

not there. Yet, it is this backwards mentality that can easily lull us into a calorie deprived sleep. With these climatic and manmade events bringing increasing uncertainty to the reliability of the food supply chain, it is incumbent upon us to consider, even small ways, to store ourselves up.

This is not to mention the other benefits: freshness, cleanliness, better nutrition and the satisfaction that comes from the process of transforming a seed to a meal — or at least supporting directly a local person who helps make that happen. One small way we can do that is to grow our own foods in a small vertical garden. There are many iterations of this concept that you can find with a quick search on the web. In its most grand form, some have conjured up images of 50-storey buildings with climate-controlled greenhouses on each floor. This article will talk about a very simple variation: a wall-mounted shoe holder garden.

You will need a hanging pocket type shoe holder; you know — the ones designed as space savers so you can hang shoes on the back of a door. I have experimented with cloth and plastic ones and so far the plastic seems to be more durable. Ideally find one with metal grommets in the holes. You will also need to durable (think strong and rust proof) screws to mount the shoe holder to a wall and a drill with proper sized bits to make some pilot holes. Another lesson I learned the hard way is a means to secure the bottom of the hanging garden. I use a piece of 1 by 2 (wood) across the width of the hanging garden just above that last set of pockets. This limits the damage from high winds which can otherwise get behind the garden and begin to toss the plants, media, everything, out of it if it sways. Not good! By the way, I suggest a south-facing wall, (or as close as you can) as a mounting location.



Next you will need some fertile well-draining potting mix and some seeds. Each pocket will be filled to an inch or so below the top, after the hanging garden is mounted to the wall, (full instructions are given at the link at the end of the article from the Instructables website). The types of plants I suggest growing in the first instance are herbs that you use in the kitchen or at least want to try. Thyme, parsley, oregano, basil, and

dill are all candidates. Lettuce, chard, spring onions, even beets and dwarf tomatoes could work, the possibilities are endless. If you do opt for the plastic shoe holder, definitely add a drain hole or two with a simple tack or pin at the bottom of each pocket. Many of the plants described will grow quite well in partial shade, hence the vertical orientation isn't a problem. It is amazing to watch the pockets fill out from empty space to obscuring the shoe holder and even the wall. Easy pickings close to your garden — without even having to bend over is another great benefit. The occasional weed seed will get into the pockets but I'd say 99% less of an issue than at ground level. While it isn't a solution to all potential food supply problems, I'd highly encourage you to give it a try.

Grow up!

PS: This is not the end of what we need to explore about vertical wall gardens, merely a beginning...

<http://www.instructables.com/id/VERTICAL-VEGETABLES-quotGrow-upquot-in-a-smal/?ALLSTEPS>

Abayomi Carmichael

BEDS, PATHS AND BEYOND...HOW DOES YOUR LAWN GROW?

Lawns can bring great pleasure to both young and old alike. They provide padded surfaces for children to play on and give older generations a recreational area for social gatherings. However, excessive traffic from these activities is not the only thing a lawn may have to put up with; it also has to contend with various pests, diseases and intrusions by invasive weeds.

To control pests, diseases and weeds, people often resort to using pesticides, but this may not give the best result. The use of pesticides may provide a short-term solution to a problem, but the cumulative long-term effects can be detrimental to both plant and man. Rather than depending on pesticides, people should focus on lawn maintenance as this has substantial effects on the groomed appearance of a lawn and the overall long-term health of the grass.

The key to a good lawn is to select the correct variety of grass for the site, e.g., the amount of shade, pH, salt and traffic the grass will be subjected to. The most commonly used grasses in Bermuda are St. Augustine, Bermuda grass and Zoysia.

St. Augustine (*Stenotaphrum secundatum*)

St Augustine grass is possibly one of the most popular lawn grasses in

Bermuda because of its versatility as a good shade grass with excellent salt tolerance. It is also adapted to a wide range of soil types. St. Augustine has a fast growth rate, which allows it to recover quickly from damage. The rapid growth rate does however contribute to a buildup of plant matter called thatch. If watering and fertilization are mismanaged, this spongy mass must be removed periodically, with a rake, depending on the size of the area.

One way to help reduce thatch and compaction is to aerate the soil. Aeration is the process by which many holes or cores are removed from the soil, usually by an aerating machine. Aeration is required particularly for compacted soil to allow oxygen, water and nutrients to reach the roots of the lawn. The most appropriate time to aerate St. Augustine grass is in the early summer when it is actively growing. Aeration can also be carried out on all grass types, to help optimize growth.

St. Augustine grass can be a heavy feeder and as such, should be fertilized primarily with nitrogen, which is identified by the first number in the nutrient analysis which can be found on the fertilizer container, e.g., 10-0-0 or 20-0-0. The other two numbers relate to phosphorus, primarily involved with flower production, and potassium with root growth. These other two nutrients are less important for St. Augustine. The nitrogen fertilizer should be applied during the spring in the active growing period. Do not fertilize during the dormant winter months as the nutrients will not be actively absorbed.

The most frequently used cultivar of St. Augustine in Bermuda is most likely 'Floritam'. A major advantage is its tolerance of chinch bugs. Small changes to the maintenance of your lawn can effectively control this pest, such as, reducing the amount of nitrogen your lawn has access to, mowing the grass to the correct height (3 inches in sunny areas and 4 inches in shaded areas) and controlling thatch buildup.

Bermuda grass (*Cynodon dactylon*)

Bermuda grass produces the finest lawn and grows extremely fast in the spring and summer months. Bermuda grasses grow on a wide range of soil types and also have good tolerance to salt spray. These grasses withstand wear better than most grasses and if injured, recover rapidly.

Bermuda grass also responds well to fertilizing; however it requires more steady and consistent applications for a longer period of time, as opposed to St. Augustine. A slow release fertilizer (12-4-8) applied according to the directions, from April through September would be recommended.

Zoysia grasses (*Zoysia* species)

Zoysia has a slower growth rate, which can be a major drawback when establishing a lawn. After establishment this becomes an advantage as mowing is required less frequently. Zoysia is adapted to a wide range of soils and has good tolerance to shade and salt spray. It has excellent resistance to wear and tear and makes an extremely dense sod which reduces weed invasion.

Although Zoysia also needs to be fertilized like its counterparts, it needs to be applied less frequently. Application from May through August is recommended with a 12-4-14 or 12-0-12 fertilizer or similar product.

In summary:

When fertilizing, it is important to read the application instructions as well as the suitability of the fertilizer for the grass before applying. In all cases it is best to water in fertilizers if possible or time application just prior to it raining.

One of the best ways to achieve a thriving and weed-free lawn is to employ good mowing practices. This requires equipment that is properly maintained (including sharpened blades), the proper height of cut and consistent mowing. Grass should be mowed often enough so that you do not remove more than one-third the length of a grass blade at each mowing. This is not just a rule of thumb; it is a guideline that relates to the strength and health of the grass.

By simply adapting your maintenance regime and being more vigilant with maintaining your equipment, over time your lawn's health and resistance to pests and diseases will improve, eliminating the need to use potentially harmful pesticides for their control. A healthy, chemical-free lawn will probably have some weeds and insects, but it will function well.

It is not hard to have a healthy lawn that is also healthy for people, pets and wildlife. Since there are concerns that pesticides used for lawn care can adversely affect both environmental and human health, is maintaining a perfect lawn using potentially harmful pesticides worth the risk?

Aaron Lutkin

Department of Environmental Protection

CITRUS LEAFMINER (*PHYLLOCNISTIS CITRELLA*), A PEST FROM THE PAST REARS ITS HEAD AGAIN.

Citrus tree owners are reporting that their trees are being heavily damaged by an insect pest known as the citrus leafminer (*Phyllocnistis citrella*).



Citrus leafminer larva with trail. Photo by Kimberly Burch.

The citrus leafminer is a small moth with an immature larval stage that damages citrus leaves by making feeding mines leading to leaf distortion and yellowing. The epidermis of the leaf often ruptures, leading to an increase in water loss through the leaf surface. A very high infestation may lead to the insect mining into the outer layer of the fruit skin causing brown winding trails, although the fruit remains undamaged and safe to eat.

This pest was first reported in 1998 and surveys carried out at

that time revealed that the citrus leafminer could be found in orchards island-wide. As the importation of citrus plants are prohibited and all propagating material is strictly regulated, it is likely that someone smuggled either a citrus seedling or cuttings, or perhaps fruit into the island without declaring it to H.M. Customs on arrival. As a result of a single person's thoughtless actions we have one of the most damaging pests to citrus on the island.

In 2000, the then Department of Agriculture and Fisheries, now Environmental Protection, collaborated with a leading researcher in this field from the University of Florida to import an encyrtid endo-parasitic wasp (non-stinging), *Ageniaspis citricola*, that was known to be extremely effective in controlling the citrus leafminer.



Extensive citrus leafminer damage to growing tips. Photo by Kimberly Burch.

This wasp established easily in Bermuda and did indeed prove itself to be an effective control for this citrus pest. Very few reports were received of citrus leafminer being considered a notable pest from 2001 onwards. Occasionally a lag in the wasp population would allow a few leaves to be damaged by the citrus leafminer, but the situation was usually rectified quickly as the wasp populations increased.

However, this year, for an unknown reason, and for the first time in more than 10 years, the citrus leafminer population appears to have increased dramatically and damage levels are similar to when the pest was first introduced to the island and was spreading without control. Samples of leaves indicate the absence of the biological control wasp for the first time since its introduction.

The Department of Environmental Protection is investigating this situation and is working to determine why the biological control agent is no longer controlling the pest satisfactorily.

Unfortunately, until biological control is re-established, relying on insecticides is not a viable option because the larvae are protected within the leaf epidermis. 'Systemic' insecticides that may control leafminer on ornamentals (a different pest) are not appropriate for use on citrus as there are concerns that the chemicals could end up in the fruit and therefore be consumed. Spraying 'contact' insecticides (which are not absorbed into the leaves/fruit) such as oil or Neemix (contains a botanical pesticide Neem) on new growth flushes to protect them from CLM is possible but sprays would need to be timed accurately to provide optimum control and this would require close monitoring of the citrus trees. These chemicals may only have a limited effect for the above mentioned reasons and can be very expensive.

Useful websites:

<http://www.ipm.ucdavis.edu/PMG/r107303211.html>

http://entnemdept.ufl.edu/creatures/citrus/citrus_leafminer.htm

Claire Jessey

*Plant Protection Officer, Department of Environmental Protection
(Entomologist)*

PLANTING CALENDAR – WHAT TO PLANT IN THE FALL...



VEGETABLES

September

Beans, Broccoli, Brussels Sprouts, Cabbage, Carrots, Cauliflower, Celery, Chard, Cucumber, Eggplant, Kale, Leeks, Mustard Greens, Parsley, Pepper, Potatoes, Radish, Rutabaga, Tomato, Turnip.

October

Beans, Beets, Broccoli, Brussels Sprouts, Cabbage, Carrots, Cauliflower, Celery, Chard, Chives, Cucumber, Eggplant, Endive, Kale, Leeks, Lettuce, Mustard Greens, Onions, Parsley, Pepper, Potatoes, Radish, Rutabaga, Spinach, Squash, Strawberries, Thyme Tomatoes, Turnip.

November

Beans, Beets, Broccoli, Brussels Sprouts, Cabbage, Carrots, Cauliflower, Celery, Chard, Chives, Kale, Leeks, Mustard Greens, Onions, Parsley, Potatoes, Radish, Rutabaga, Spinach, Squash, Strawberries, Thyme, Tomatoes, Turnip.

FLOWERS

September

Celosia, cosmos, gazania, globe amaranth, impatiens, marigold, salvia, snow-on-the-mountain, vinca and zinnia.

October

Ageratum, antirrhinum, aster, aubrieta, begonia, bells of Ireland, candytuft, carnation, centaurea, chrysanthemum, cineraria, dahlia, dianthus, geranium, gerbera, gypsophila, impatiens, larkspur, lathyrus, nasturtium, nicotiana, pansy, petunia, phlox, rudbeckia, salpiglossis, salvia, statice, snow-on-the-mountain, spider flower/cleome, star-of-the-veldt, stock, sweet william, verbena and viola.

November

Ageratum, antirrhinum (snapdragon), aster, aubrieta, begonia, bells of Ireland, candytuft, carnation, centaurea, chrysanthemum, cineraria, dahlia, dianthus, geranium, gerbera, gypsophila, impatiens, larkspur, lathyrus, nasturtium, nicotiana, pansy, petunia, phlox, rudbeckia, salpiglossis, salvia, statice, snow-on-the-mountain, spider flower/cleome, star-of-the-veldt, stock, sweet william, verbena and viola.

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