Natural Pest Control

Field Guide for Farmers in the East Caribbean on Natural Pest Control

Workshop Sessions
Facilitated by Thaddeus Constantin

October 2015

Caribbean Aqua-Terrestrial Solutions

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Workshops on Natural Pest Control & Bio-Fertilizers in Saint Lucia and Grenada

The present document contains the information from Workshops held on Natural Pest Control and Bio-Fertilizers in Saint Lucia and Grenada. Both Workshops had been facilitated by **Thaddeus Constantin** from the Research Department of the Ministry of Agriculture, Food Production, Fisheries, Cooperatives & Rural Development in Saint Lucia.

The Workshops had been organised by the Caribbean Aqua-Terrestrial Solutions Programme (CATS), operated by the German Development Cooperation, GIZ, and CARPHA's Environmental Health and Sustainable Development Department on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ) and CARICOM.

The CATS-Programme is operating a **Ridge-to-Reef-Approach** with a focus on good agricultural practices that will minimize negative impacts on marine biodiversity. Hence, natural pest control and bio-fertilizers play an important role in reducing the utilization of chemical pesticides, weedicides, and fertilizers on farms in the Caribbean.

The Workshops objective was to show farmers, which methods could be applied with natural and on farm material to respond to various challenges on the farms.

Several pesticides, bactericides, and fungicides had been produced as well as bio-fertilizers out of various materials.

Workshop Belle Vue, Saint Lucia

Tuesday, September 15, 2015

10:00	**On Farm Demonstration**:
	How to make compost tea and other alternative pest control on farm?
12:30	Lunch
13:30	**Industrial Scale APC Production**:
	Neem Oil Extraction
	Essential Oil Extraction
16:30	**End of workshop**

Workshop New Hampshire, Grenada

Saturday, September 19, 2015

10:00	**Natural Pest Control**
	How to make cold and hot extractions on farm?
12:30	Lunch
13:30	**Bio-Fertilizers**
	Compost tea, fish tea, and fermentation
16:30	**End of workshop**

Introduction to Natural Pest Control

Botanical Measures

- Repellents
- Contact poisons
- Stomach poisons
- Affects Sexual Function
- Affects the nervous system

Biological Measures

- Beneficial Microbes
- Repellents

Natural Pest Control	Materials
FUNGICIDE	• Bay leaf (hot and cold extraction) • Spice / Cinnamon leaf (hot and cold extraction)
BACTERICIDE	• Guava leaf (cold extraction)
INSECTICIDE	• Adelfa / Oleander leaf (hot and cold extraction) • Hot Pepper (hot and cold extraction) • Tobacco (hot and cold extraction) • Lemongrass (hot and cold extraction) • Garlic & Onion (cold extraction)
CONTROL OF NEMATODES	• Sargassum Seaweed
ALL PURPOSE TREATMENT	• Neem leaf (hot and cold extraction) • Compost Tea

BOTANICAL PESTICIDES STAGES OF PRODUCTION

PLANT SELECTION

Plants selected for the extraction process should be growing vigorously and show signs of good health. The plants to be used should be freshly harvested.

ESSENTIAL OIL EXTRACTION

There are many methods of extraction of the essential oils contained within the plant tissue.

1. **Crushing** – a mortar and pestle may be used to crush the plant parts increasing the surface area of the plant tissue and allow for a better extraction. This method is used with one of the previous ones.
2. **Boiling** – plant parts can be boiled for 30 to 45 minutes. This liquid is then cooled and filtered.

3. **Soaking** – plant parts can be soaked in water for 1 day or alcohol for a period of 1 to 28 days, in a cool dark place. They may then be filtered and used.

STORAGE

The solutions obtained from the extraction process should be labelled and stored in a cool dark area. These solutions should never be exposed to sunlight for extended periods.

SOAP SOLUTION PREPARATION (STICKER)

Half blue soap is taken and grated. This soap is then added to 2 litres of water and the mixture is shaken vigorously. It is then allowed to sit for 24 hours.

MIXING THE COMPONENTS

(to make five gallons of mixture)

1. 250 ml of soap solution (half a soft drink bottle)
2. One part of plant extract to zero to five parts water
3. For alcohol mixtures the extracts are used at concentrations of 50, 100, and 200 parts:
   - ✓ 10ml to .5 litres of water for 50 parts
   - ✓ 10ml to 1 litre of water for 100 parts
   - ✓ 10ml to 2 litres of water for 200 parts

BOTANICAL PEST CONTROL

Citrus oil (limonene, linalool) – are extracts from citrus peels primarily used as flea dips, but have been combined with soaps as contact poisons against aphids and mites. They evaporate quickly after application and provide no residual control.

Nicotine – concentrate is very poisonous if inhaled. Boil tobacco leaves and stems then let cool, add soap mixture and spray. Nicotine is a fast acting contact killer for soft bodied insects, but does not kill most chewing insects. It is less effective when applied during cool weather. Do not spray within 7 days of harvest. **This plant should never be used in a cold extraction since it can be a source of mosaic virus which affects many plant species.** The heat of the hot extraction will kill the virus and remove the risk of transmitting this pathogen.

Neem – It is derived from the neem tree that grows in arid tropical regions. Crush and boil leaves, seeds or bark, for an hour and let cool, then add soap

mixture. Extracts from the neem tree have been reported to control over 200 types of insects, mites, and nematodes. The neem spray solution should not be exposed to sunlight and must be prepared with water having a temperature between 50 and 90°F. The solution is effective for only 8 hours after mixing. Neem is most effective under humid conditions or when the insect and plants are damp. It has a low toxicity to mammals.

Neem seeds should be collected in the dry season and put to dry. The seeds can then be stored in a cool dry place for up to 1 year and be

used as needed. The oil from neem seeds is typically extracted using a cold press method. This is done by crushing the seeds and pressing them. The oil is then stored in dark bottles away from heat and light. This oil has a long shelf life and can be commercialized in this form.

Pregnant women should not handle neem.

Adelfa (Oleander/Neriumindicum) Leaves are soaked in water for 30 minutes then mixed with soap mix and sprayed. Hot extractions can also be done but the extraction is very toxic and should be treated as regular agrochemicals. Plant parts are boiled for 30 minutes and left to cool it is then mixed with a soap solution and can be sprayed. These mixture controls ants, flies, caterpillars and other insects. This cold extraction is not very toxic but should be treated with the greatest care. Full protective gear should be used in its application and a strict quarantine should be employed in the areas where it has been used for a minimum of three days. There should be a strict withholding period of seven days for produce sprayed with these mixtures. **Adelfa should also never be used indoors and around children.**

Red Pepper – Pound several red peppers in water and drain. Mix the solution with water and spray to target pests

Wood Ash – Spray wood ash around the plant roots to control root maggots in radish, onions, cabbage and other brassicas. Encircle plants with a 3-4inch wide trench, 1-2 inches deep and fill this with wood ash to discourage snails, slugs, and cutworms. This measure will however increase the level of

potassium in the soil and so should be used with caution.

Onion Brew – Thinly slice the roots, stems and leaves of aromatic herbs like garlic, onion, red pepper, noni and black pepper. Add water and store overnight. Add water and a small amount of soap. Spray to plants.

Garlic & Marigold Mix – Use 3-4 cloves of garlic, 2 handfuls of marigold mix, 2 pieces of onions and 3 pieces of red pepper. Slice all ingredients thinly, add water and boil. Cool off before use. Dissolve mixture at 1:5 ratio of water, always stir mixture while spraying.

Kerosene & Soap Spray – Mix ¼ cup of soapy water and ¼ tsp of kerosene to 1 litre of water. Use only when insect infestation is severe. Excessive kerosene in the mixture will damage or kill crops.

Sour Sop – Crush and boil sour sop seeds in water and let cool. Add soap mixture and spray. This mixture is useful against soft body insects.

Sting nettle - Boil leaves in water for 30 minutes and let cool. Add soap mixture and spray. This mixture is useful against soft body insects.

Clove Oil – Crush and boil cloves in water then allow to soak overnight. The extract should then be filtered and mixed with a soap mixture before use.

Jamaican Ackee Seed Extract – Crush and boil Jamaican ackee seeds for 60 minutes. Filter the mixture and add soap mixture before use. This plant extract is very toxic and should be treated with caution.

Guava – cold extraction - Young leaves are pounded and filled into a plastic bottle. Cover with alcohol (above 50%) and store in cool dark place for 28 days. The

alcohol extraction can be used for up to one year. Use one tablespoon of guava extract in 200 spoons of water. This mixture controls bacterial problems.

Mixtures/Herb cocktails – It is possible to mix various plants in one extraction without affecting or reducing the potency of these. The plant should always be selected based on the problem which the farmer seeks to control and also those that can be extracted using similar methods.

Examples:

Garlic, Onion, Peppers and Nonie can be combined in a cold extraction as an effective repellent for white flies, aphids and mites.

Neem, adelfa/oleander, peppers, cloves, tobacco, lemongrass, etc. can be combined in a hot extraction to control a wide variety of insects.

Mix adelfa/oleander leaves (wear gloves to remove leaves – highly toxic) with hot pepper, orange peel, bay leaves, neem leaves, and nettle. Use approximately 1 lb of leaves in 10 gallons of water. Crush and boil in hot water for 30 minutes. Turn off fire and let cool. Use within 48 hours.

BIOLOGICAL PEST CONTROL

Compost Tea – Add finished compost to a sack filling only a quarter of the sack. Tie the top of the sack with a string and hang into the drum. Add water to about three quarters of the drum. Add sugar at about 1 pound to every 10 gallons of water. Add an aquarium pump and airline. If no electricity is available on farm, the compost tea can be stirred manually three times a day.

The compost tea will be ready after 7 days. It can be applied foliar at concentrations of 10 to 50 percent and as a stem drench at concentrations of 50 to 100%.

Other biological measures are **Bug Juices** and **Bio-Pesticides**.

Soil Sterilization can be done via **Bio Fumigation** using cabbage leaves ploughed into the soil and covered, or via **Soil Solarisation** with clear plastic cover over wet soil for two days.

SARGASSUM SEAWEED

Sargassum seaweed contains all the nutrients that plants need to survive. Almost half of the seaweed's dry matter is made of beneficial nutrients, which plants can use. Seaweed also has noticeable impact on many soil borne pests and diseases. Sargassum seaweed in its various forms can serve as an excellent slow releasing organic fertilizer and assist with pest and disease control as it contains probiotics, which encourage the growth of healthy microbes in the soil. Sargassum Seaweed is also an effective nematode control.

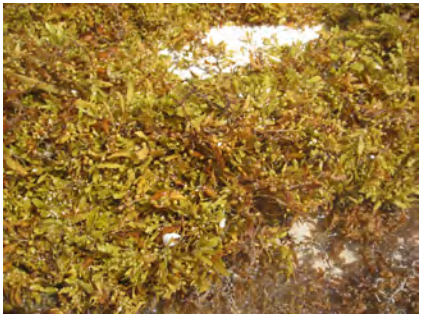
Seaweed uses:

- Solid Compost
- Mulch
- Liquid Fertilizer
- Extracts
- Compost Tea
- Fresh

How to use

Collection – The seaweed should be collected based on the needs and its destined use. The seaweed collected should be as free from sand as possible. This reduces the ability of the seaweed to compost effectively. There are a number of organisms, which grow in the seaweed that have agricultural potential. These should be collected only if the farmer has a use for them.

Cleaning – The seaweed will come with salt which can have very detrimental effects on the soil and plant health. Seaweed should be allowed to sit on the farm where it can receive rainfall. After a few days of rain it can be used.



In single applications, the salt will not pose a problem to the crop so the farmer can avoid the washing stage. Continuous use of un-cleaned seaweed will affect the cation exchange capacity of the soil. This will cause the soil particles to trap elements not making them available to the plants.

Composting – Sargassum seaweed will decompose very quickly when pilled or left in sacks. There are many composting methods and the method used should be selected by the farmer based on the peculiarities of their farms. This document will seek to explain three methods:

1. **Piling** – this type of compost consists of adding layers of seaweed 4 feet wide with layers of green grass, dry grass, pen manure, soil, feathers, blood meal, bone meal etc. The seaweed can be the main ingredient or not.

   STEPS

   - Spread a layer of seaweed 4 feet wide one foot high and the length desired
   - Add a layer of dry grass
   - Add a layer of green grass
   - Add a layer of manure
   - Add a layer of soil

   These layers can be repeated till the material is finished or the heap reaches a height of 5 feet.

   Water daily, check the temperature and turn when the temperature inside the heap decreases.

2. **Sack** – Collect the seaweed and place in a sack. Clear a shaded spot and pile the bags there. Let sit for two months. This compost will be free of grass seeds. It is an excellent potting mix, providing seedlings with an excellent substrate, all plant nutrients and protection from pests and diseases.

3. **Barrel** – Place a platform in a barrel about a foot from the base. Place cleaned seaweed in a sack and place over the platform. Water daily however don't add too much water since this will change the environment within the drum. Cover to protect from the sun. Collect the exudate from the bottom of the drum daily and

use at 10 to 20% in foliar applications and up to 50% in stem drenches. Keep the bag for up to two months and then replace with a fresh bag. The used seaweed left over can then be used as solid compost.

Bio Fertilizers – Place the seaweed in a fermenter. Add organic ingredients as needed. The ingredients will determine the nutrient content of the fertilizer obtained at the end of the fermentation. Add 1 pound sugar to every 10 gallons of water. Add yeast, soil with rotten organic material, compost or a culture of beneficial microbes. Close the fermenter, place the air lock and let sit. Based on the ingredients the fermentation period will vary. The fertilizer is ready when the contents of the drum have a sweet smell with a light hint of alcohol.

Soaking – this can be done by taking composted or partially composted seaweed and soaking it in water. The water level should be only an inch above the surface of the compost. Stir and allow it to sit for 3 hours. Drain all the liquid from the bucket, filter and use it in foliar and stem drench applications.

Applications – There are two ways of applying seaweed fertilizers in liquid form and solid form. In liquid it can be applied at 10 or 20% for foliar applications and 10 to 50% as a stem drench. In solid form it can be applied to the soil surface, it can be ploughed in or placed in the planting holes.

Mulching – Collect fresh seaweed and clean of the salt. Place this fresh but cleaned seaweed in thick layers over the soil. This material will decompose and should be repeated every three months for perennial plants like yams.

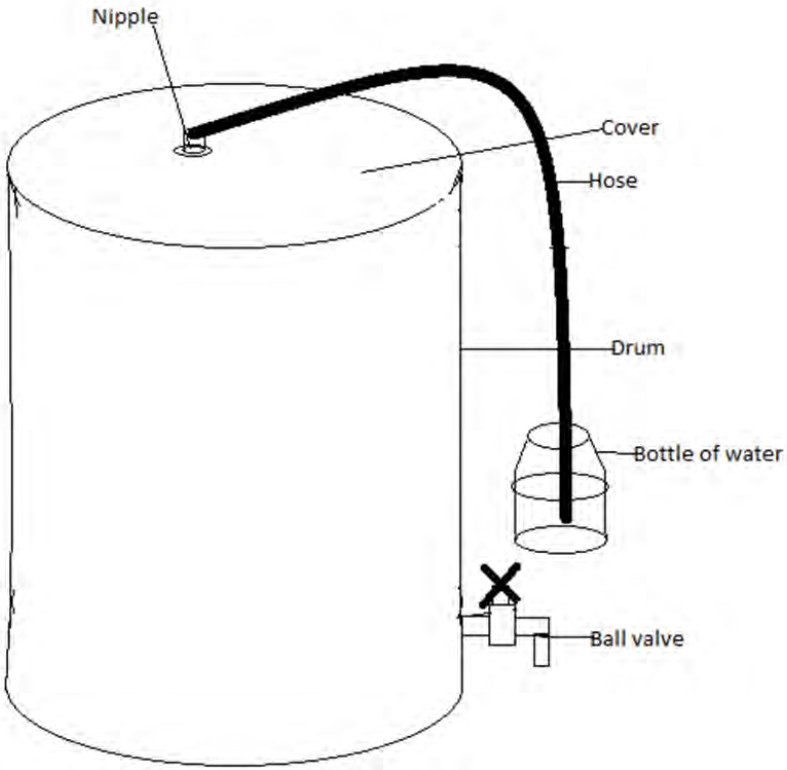
BIO-FERTILIZER PRODUCTION

MULTIPLICATION OF SOIL ORGANISMS

This culture can be used as a substitute for yeast for all the fertilizers presented below. It can also be add to compost heaps with problems and to speed up woody heaps.

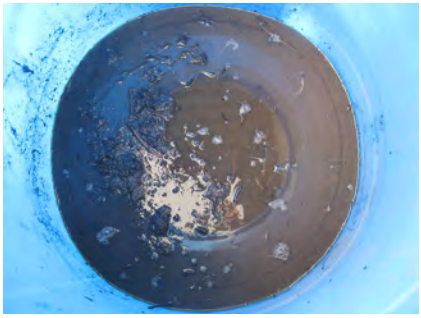
1. Choose an area below a tree which has never been sprayed.
2. Collect about 4 pounds of soil from the first 2 inches of soil.
3. Collect dry grass.
4. Using an old basin (with drainage holes in the bottom) mix the grass and dry soil.
5. Make a hole in the centre of the mixture and water.
6. Cover with plastic and place

BIO FERMENTER



in a cool dark place.

7. Check and water daily.
8. The culture is ready when a white or grey mold forms above the grass (14 to 21 days).
9. Add the culture (grass with soil) to the fermenter.
10. Add two buckets green grass and two buckets dry grass to the fermenter.
11. Add 1 bucket pen manure.
12. Add 1 pound of sugar per gallon of water to the mixture.
13. Add 20 gallons water to the fermenter and stir.
14. Cover the fermenter and place the air lock hose into a bottle of water.
15. Let sit for three months.
16. This mixture is ready when it smells sweet with patches of white grey or brown growths floating on the surface.
17. This culture can be stored for 1 year.



FISH TEA

1. Collect fish parts and store in a freezer till need. These can be all waste fish parts including scales, bones, heads, skin, stomach and flesh. (20 to 40 pounds for 25 gallons of water).
2. Using a cut 55 gallon drum boil over a wood fire.
3. Stir and add water as needed.
4. Boil the mixture for eight hours then let sit and cool.
5. Top up the mixture with water, stir and apply to the stems of the plants of interest.
6. The previous step can be repeated till the contents are finished or the area is fertilized.

This fertilizer should be used fresh within 24 hours due to its strong smell.

FERMENTED FISH TEA

1. Make a fish tea as described above or use the extra from a fish tea made.
2. Add the fish tea to a fermenter.
3. Add 10 grams yeast per 10 gallons of water and mixture.
4. Add 1 to 2 pound sugar to every 10 gallons of water to be used.
5. Mix the yeast in a bucket and let sit for 30 minutes.
6. Add chopped water grass, waste fruits or banana flowers to the fermenter.
7. Add the yeast and sugar mixture and top up the drum with water to ¾ of its total capacity.
8. Cover the fermenter.
9. Place a piece of cloth in the air lock hose and burry about 4 to 6 inches below the soil surface.
10. Let sit for 3 months. Check weekly by smelling the tip the air lock hose.
11. Them extract is ready after 3 months, the fertilizer should have a sweet smell when finished.
12. Foliar applications at 10%. Stem drench 10 to 20%.

This fertilizer can be stored for 6 months.

FERMENTED PIG MANURE

This technique can be used with any type of pen manure but specific reference will be made to the solid pig manure which does not go into the digester.

1. Collect solid pig manure from the separation chamber of your bio digester.
2. Add this manure to the fermenter till it is about half filled.
3. Add water and mix.
4. Add two buckets of water grass.
5. Add a bucket of dry grass.
6. Add seaweed or kitchen waste (egg shells and fish bones can help ensure that this fertilizer has all macro nutrients needed by the plant).
7. Add 10 grams yeast per 10 gallons of water and mixture.
8. Add 1 to 2 pound sugar to every 10 gallons of water to be used.
9. Mix the yeast in a bucket and let sit for 30 minutes.
10. Add the yeast mixture to the drum.
11. Stir and cover your fermenter.
12. Use a bottle filled with water as your air lock.
13. Checks by smelling the end of the hose avoid opening the fermenter.
14. Let sit for three months.
15. The fertilizer should have a sweet smell with a light hint of alcohol when it is done.
16. Foliar applications at 10%. Stem drench 10 to 20%.

COLLECTION OF ENTOMOPATHO-GENIC FUNGI

1. Collect 200 grams of soil from forested areas from around the island. These areas should have primary forest on them and have never been farmed.
2. Moisten the soil and add to a clear plastic bag, label the bags with the source of the soil.
3. Add two large insects.
4. Close the bag and let sit for 7 to 14 days in a cool dark place.
5. If your soil contains entomopats the insects will die and develop white, grey, pink, green or red growths of fungi on them. The site of the collection of the original soil should be considered as a collection site.
6. Take the culture to a finished compost heap and with the wind at your back and a face mask on open the bag and spread the contents evenly over the finished compost.
7. Mix the heap, water and let sit for 14 days to allow the entomopats some time to multiply.

WORKSHOP IN SAINT LUCIA

WORKSHOP IN GRENADA

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