AGROECOLOGICAL TRANSITION MANUAL FOR VEGETABLE PRODUCTION

Based on the experiences of Friends of Vaca Forest Reserve & San Antonio Green Growers Cooperative Society Limited (SAGGC), Belize

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1. Introduction

The Selva Maya, shared by Mexico, Belize and Guatemala, represents one of the most important ecological systems worldwide. It is considered as the most extensive tropical forest of Mesoamerica. Unfortunately, it faces major threats that compromise its viability and functionality in the medium and long term. Over the years, the advance of the agricultural frontier, deforestation, forest fires and unsustainable agricultural practices have been identified as the main causes of the loss of ecosystems, land degradation and pollution of the water sources and soil in many protected natural areas within the region.

In this context, on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ), the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, together with the Central American Commission for Environment and Development (CCAD), implements the regional project "Protection and Sustainable Use of Selva Maya"

In Belize one focus is the environmentally friendly agriculture. Such alternative methods of cultivation are being developed and implemented by farmers from the Vaca Forest Reserve (VFR) and the San Antonio Valley, in the Cayo District. Since it’s inception a series of workshops and trainings on agro-ecology, use of organic fertilizers and biofertilizers, as well as the preparation of biopesticides have been carried out, with the vision of gradually mitigating harmful agricultural practices, the effects of climate change and the use of agrochemicals. This meant transforming the farmers' production system, from the use of synthetic methods to the adoption of another more climate-resilient and environmentally friendly system. One of the most enriching experiences has been the implementation of the Field Schools methodology, in which farmers help other farmers identify problems that affect them and propose alternative solutions.

This **Agroecological Management handbook** provides information on the preparation of biofertilizers and organic pesticides, made with local inputs and available plant species, useful for agroecological management of pests during the production of vegetables. The illustrated information is derived from different experiences and practices implemented with the farmers of San Antonio Green Growers Cooperative Society Limited (SAGGC) and Friends of Vaca Forest Reserve (FVFR), who produce vegetables in a conventional manner and with cover structures.

The information in this handbook is expected to help reduce costs, improve production and be a tool for farmers in agroecological vegetable production, for the benefit of the local market and, therefore, for the sustainable economic development of the region.

2. What is Organic Agriculture or Agroecology?

Organic Agriculture or **Agroecology** is a productive approach that promotes healthy and safe food from an environmentally, socially and economically point of view.

Organic Production Principles

- Improve the biological diversity of the system **(functional biodiversity)**, through multicrops, crops rotation and integration of local biodiversity, including flowers, aromatic plants and medicinal plants.
- Ecological soil management by using organic fertilizers and green fertilizers, to increase the fertility and "health" of soil and plants.
- Promote the healthy use of water, soil and air, and minimize all forms of pesticides contamination
- Use of local supplies
- Integration of animal production with vegetable production, improving the nutrient recycling.
- Create life, no take it away

Benefits of Organic Agriculture or Agroecology:

- Soil fertility improvement year after year
- Pest and diseases incidence reduction
- Healthier environments are favored
- Landscape conectivity is enhanced
- Income diversification of farmers
- Health of the farmers who produce the food and families that consume these products is improved

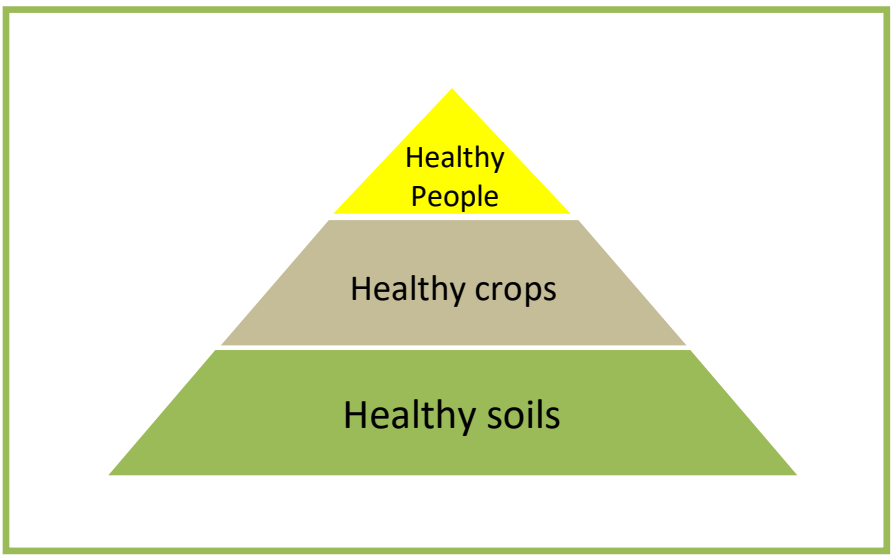


Figure 1. Results of agroecological production

3. The soil

Under the Farmers Field School (FFS) sessions, farmers learnt that it is their responsibility protecting the soil, since protecting it improves or maintain the quality of biodiversity that is present on it, impacting positively on the production of vegetables. (Figure 2).

Figure 2. Biodiversity within the soil

Soil is a living organism that is in constant transformation and it is a modifier of the atmosphere and habitat for microorganisms that take part in the decomposition and creation of habitat of other organisms. A teaspoon of soil is the habitat of millions of organisms.

We got to put attention on the three major components involved in the life and fertility of soil, which are: microorganism, organic material and minerals (Figure 3). It is very important to understand the interaction of these three components in the management of soil fertility and plant, in the agroecological approach.

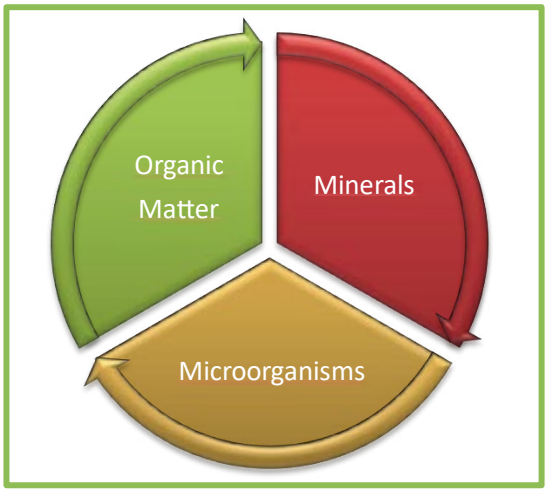


Figure 3. Components and relations in the life and soil fertility.

4. Biofertilizers

a) Efficient Microorganism (EM)

The EM corresponds to a large number of families from beneficial micro-organisms of virgin soils, mainly of mulches that are found in the soil of forests.

Function of Efficient Micro-organisms:

- Re-establish the biological balance of agricultural soil, lost by years of burning, application of agro-chemicals and erosion due to mismanagement of crops cultivated on slopes
- Decompose the organic material, making food available for the plants
- Avoid occurrence of diseases and pests
- Recycle nutrients for plants
- Fix nitrogen in the soil
- Degrade toxic substances (pesticides).
- Produce substances and natural components that improve the quality of soils

Preparation of EM in its solid form

Materials and supplies

- 2 bags of mountain micro-organisms (80 pounds)
- 1 bag of rice bran
- 2 gallons of molasses
- 1 plastic drum of 100 liters, with cover
- Water

Figure 4. Solid EM prepared at Mr. Melendez farm, FVFR.

Preparation

1. On a clean surface, mix the mountain microorganisms and the rice bran until it is homogenized.
2. Apply the molasses, previously diluted in water. Then, if necessary, continue applying more water until the mixture takes a consistency that when you press it in your hand no water drops. It is important to point out that no water should run out from your hand when mixture is pressed.
3. Once the consistency of the mixture is obtained, then begin to put the mixture inside the drum and compress. This is repeated until the drum is filled.
4. Close the drum tightly with the lid and clamp, without leaving spaces or air bags. Leave to ferment for 30 days.

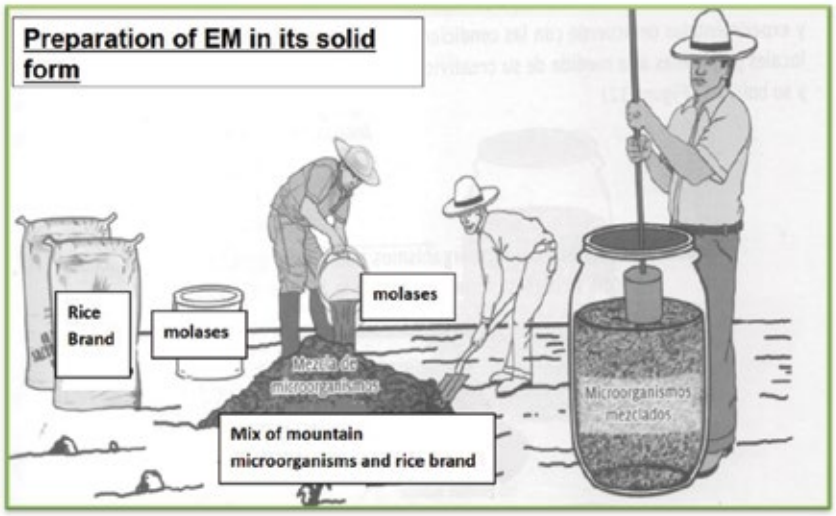


Figure 5. Preparing EM at Mena's farm, SAGGC.

Application of solid EM in bokashi or compost

In the elaboration of organic fertilizer like bokashi or compost apply one pound of the solid EM for every 100 pounds of the chosen fertilizer, which should be in its final stage of maturity ready to be applied to the soil. Ensure that the mixture is well homogenized.

1.1. Preparation of EM in its liquid form:

Materials and supplies

- 25 pounds of the solid EM
- One plastic drum of 55 gallons, with cover and breeder
- 2 gallons of molasses
- 2 gallons of milk or serum
- 120 -150 litres of water

Figure 6. EM in liquid form prepared at C. Serrano's farm, FVFR.

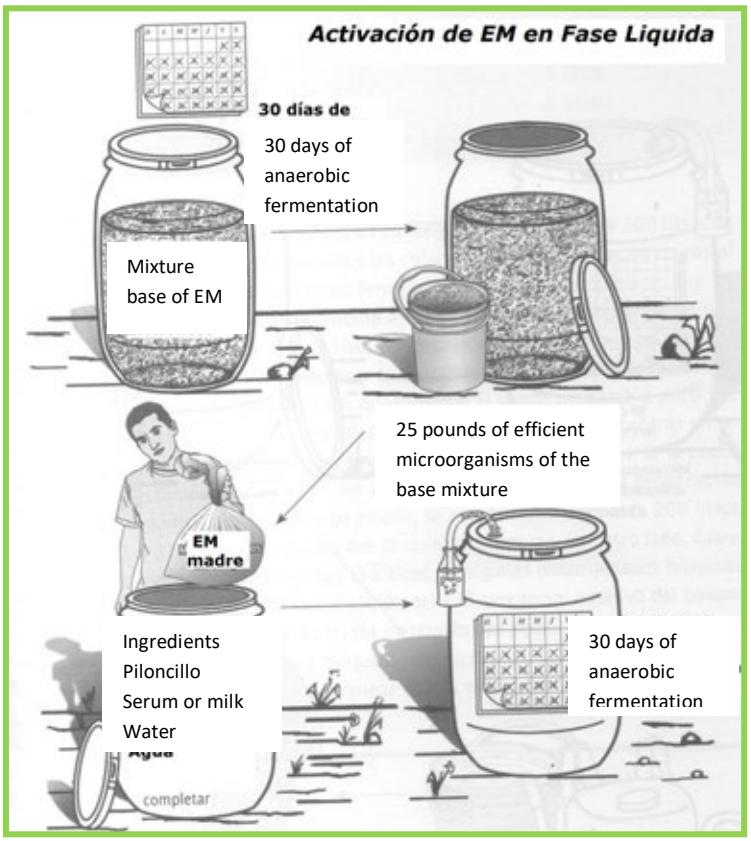


Figure 7. Activation of EM in liquid phase.

Anaerobic Preparation

Take 22 pounds of solid EM and insert it in a bag, preferable made of fiber, which would allow the exchange of liquid. At the same time apply water with molasses in the drum, as well as the milk or serum, then insert the bag with the prepared solid EM into the drum.

Cover and seal the drum, leaving only a hose with a bottle with water for the elimination of gases (Figure 7).

Leave it to ferment for 30 days in the semi shade. Once the product matures, it tends to have a pleasant smell of cider or chicha, and a soft orange to reddish colour.

Application of liquid EM

For a foliar application (from 10% to 20%), mix 2-4 litres of liquid EM in 18 litters of water. In fertigation apply weekly this same proportion: in a plastic drum of 200 litres dilute 20 litres of EM in 180 litres of water.

Workshop of the elaboration of EM solid form, in Roberto *Melendez Farm*, FVFR.

EM in liquid form ready to be used. Mrs Lynnette farm, FVFR.

Application of EM in animal feed

The EM has proven to be an excellent source of pre and probiotics as supplements in animal feed, for its high concentration of beneficial microorganisms that make more efficient digestion and prevent some diseases and parasites

The following doses of solid EM are recommended daily for one animal:

- Cattle: half of a pound
- Sheep and goat: 30 to 50 grams
- Chicken and turkey: 10 to 12 grams
- Rabbits: 8 to 12 grams
- Pigs: 30 to 50 grams

It is important to note that the product to be applied must have the correct conditions of maturity and preparation before including in the ration of the animals, otherwise you run the risk of having nutritional contraindications.

b) Super Magro (SM)

The Super Magro is a bio-fertilizer or organic fertilizer that comes from the decomposition of organic material (plant and animal) along with other components. A fermentation process occurs, and the result is liquid and solid matter. The liquid residue is used as a natural defensive and foliar fertilizer.

The added micronutrients are materials required for metabolism, growth and production of plants.

The Super Magro acts also as defensive of the plants since it contains a large number of micro-organisms, which provoke great competition and control between them. This allows the plant to increase resistance against the attack of pests and diseases.

Preparation: Step 1

1. In a plastic drum of 55 gallons put all basic ingredients:

- 80 pounds of fresh cow manure (2 buckets)
- 100 litres of water
- 1 liter of milk or serum
- 1 liter of molasses (dissolved in one liter of water)
- Stir it well and leave to ferment for 3 to 5 days

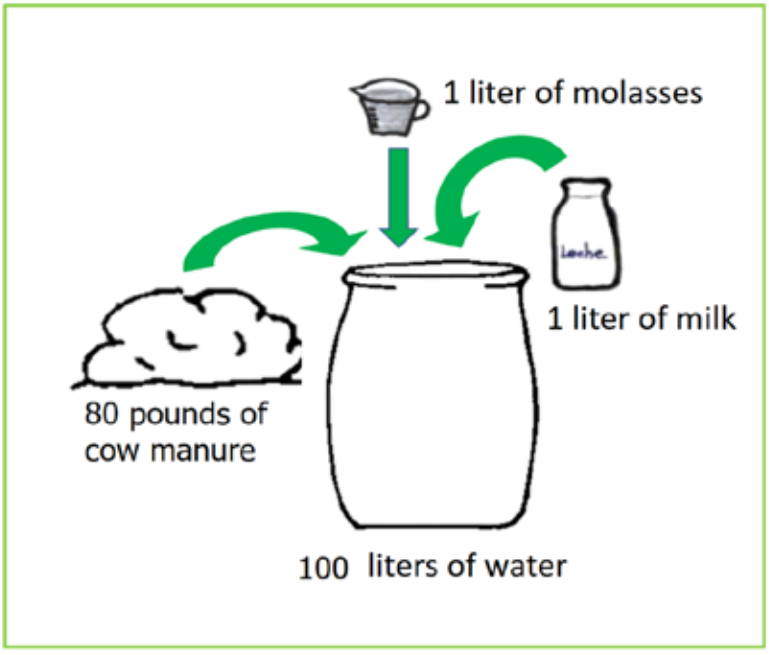


Figure 8. Super Magro ingredients

Step 2: Every three to five (3-5) days add the following:

- All minerals indicated on Table 2 (below), one by one, dissolved in 2 liters of water
- 1 liter of molasses dissolved in one liter of water
- 1 liter of milk or serum

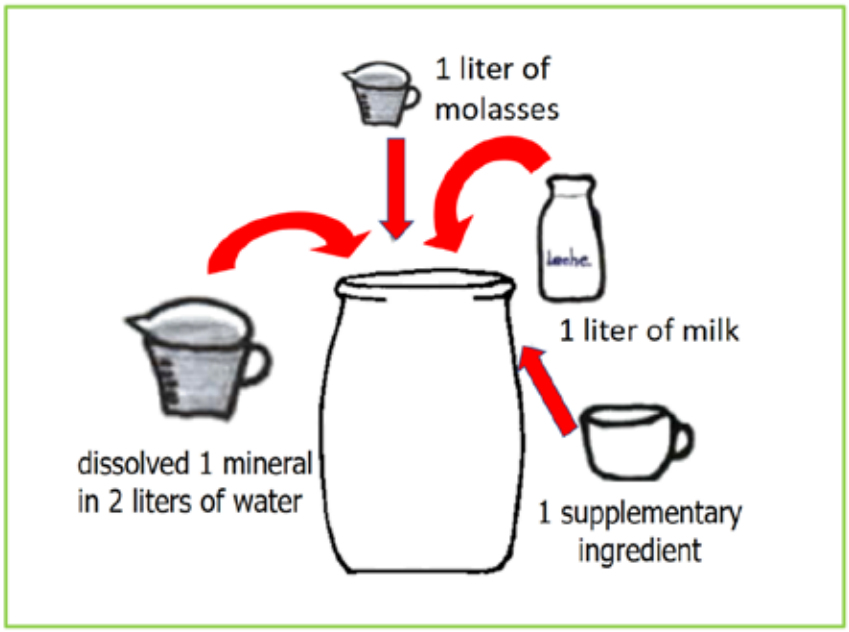


Figure 9. Supplementary ingredients of Super Magro

Stir and leave to rest for 3 to 5 days and then repeat step 2 until the list of minerals is completed. Once the last mineral is applied, leave to ferment for 15 days. After that the bio-fertilizer is ready to be used.

Table 1: Basic ingredients:

Ingredients	**Quantity**
Fresh cow manure	80 pounds
Water	140 litres
Milk / serum	9 litres
Molasses	9 litres

Table 2: List of minerals:

No:	**Minerals**	**Quantity KG**
1	Potassium Sulphate	1 kg
2	Zinc	2 kg
3	Magnesium	2 kg
4	Manganesium	0.3 kg

5	Copper	0.3 kg
6	Calcium	2 kg
7	Borax	0.3 kg
8	Iron	0.3 kg

This fertilizer is prepared in the presence of air (aerobic). In the drum the biological decomposition of the materials that compose it occurs, so we should see the removal of gases.

Application:

	Dosage	**For 10 litres of water**	**Application**
Leaf vegetables	1-2%	100 – 200 cc	Every 15 days
Fruit vegetables	2-3%	100 – 300 cc	Every 15 days
Fruits	2-5%	200 – 500 cc	Every 15 days

Sweet pepper crops where EM and Super Magro bio-fertilizers were used at Manases Canto farm, MGGC, San Antonio.

c) Bokashi

Preparation:

Materials required for the preparation of 10 bags of bokashi.

Quantity	Unit	Raw material or utilized product
10	Bags	Chicken manure or other manures
4	Bags	Rice husk or rice bran
40	Litres	Activated mountain micro-organism if available
4	Bags	Mountain micro-organisms (mountainous land)
3	Bags	Charcoal and ashes (mixed)
4	Gallons	Molasses
40	Litres	Clean water

Steps for its preparation:

Remember that this fertilizer should be prepared in a protected place from the rain and sun (preferable on clean or cemented surface).

- Spread 5 bags of manure then add 3 bags of charcoal well grounded
- Dissolve the molasses in one drum of water and dampen the mixture
- Add 2 bags of rice husks or rice bran and then spread two bags of mountain micro-organism.
- Repeat step 1 by adding the rest of materials
- Wet the materials and then mix with the molasses water. Turn it 2 to 3 time until the mixture when pressed with your hand it sticks and water does not flow
- On second day turn the mixture and spread it 50 centimeters high. On fourth day drop the mixture to 30 centimeter and then continue turning for 15 days.
- The bokashi will be ready in 21 days
- Use one pound per vegetable plant. Avoid direct contact with the roots.

Bokashi elaboration with SGGC during FFS, San Antonio.

d) Compost

Compost is an organic fertilizer made from the mixture of different types of waste. The main ones are green organic residues, dry organic residues and animal manure. At the time of processing the materials are deposited by layers repeatedly to complete a minimum height of 1.5 meters and 1.5 meters wide.

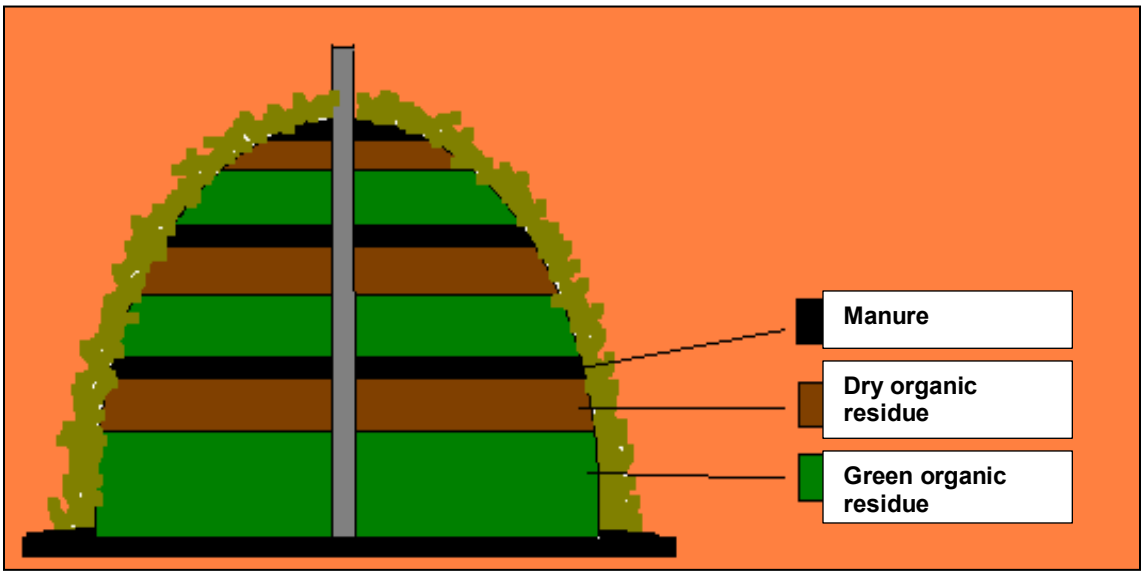


Figure 10. Layers layout of the mixture for the compost preparation

Materials

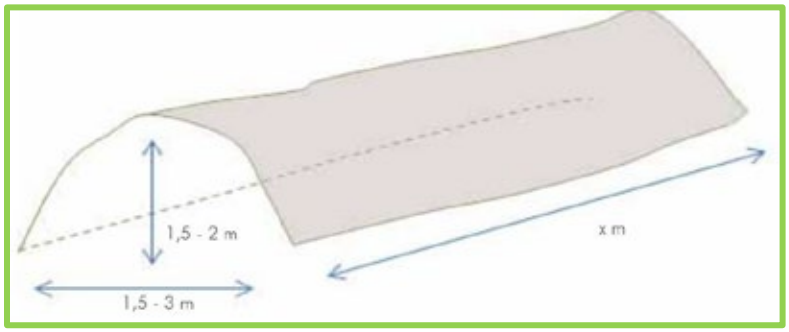
- 2 parts of green vegetables waste **(at least 8 bags)**: Pruning shrubs, grasses, banana plant stems, vegetable remains
- 1 o 2 parts of dry organic residue **(4 to 8 bags)**: dry leaf, sawdust
- 1 o 2 parts of manure (preference from cows or horses) **(4 to 8 bags)**
- ½ to 1 part of mountainous land **(2 to 4 bags)**

Important management

- Turn the pile every 3 to 4 weeks, for mixture to oxygenate and regulate the temperature
- It's important keep the balance between green and dry organic residue
- The whole process takes 3 to 4 months
- Implement the composting pile in an area where it is semi protected from rain and sun, for example under the shade of a tree.
- The preparation of the composting pile is made in **one day** with all the indicated and balanced materials, after that it´s not recommended to apply more materials

The final product look like black soil with a good smell (mountain soil) and it´s not possible to identify the original material from which it was made.

Figure 11. Soil from compost material finished.



Recommended size to implement a composting pile

Elaboration of compost with Mr. Carlos Serrano and Mr. Roberto Melendez in FVFR.

Application and benefits of compost

- Improve the biological, physical and chemical characteristic of the soil
- Whole and excellent soil improver
- Reduce the incidence of pests and diseases
- Application in vegetables productions is recommended 2 - 4 kg / 1 m^2
- Application in extensive crops (big areas) 7 – 10 ton / ha
- Recommended two applications per year

e) Biofertilizer NPK

This liquid bio-fertilizer is a good source of Nitrogen, Potassium and Phosphorus which can be applied to any crop.

Materials

- 1 drum of 200 litres
- 45 pounds cow manure
- 45 pounds chicken manure
- 45 pounds bat manure
- 1 gallon molases
- 1 pack yeast
- 1 gallon milk or serum
- 5 pounds of humus from the California red worm
- 4 pounds of neem leaf or other leaf with medicinal properties

Aerobic preparation

- Fill the drum with water
- Dissolve the cow, chicken, bat manure and the humus
- Dissolve the molasses and then add the milk and the neem leaves
- Stir it every 3 days
- Put two pieces of 2 x 4 inches on the mouth of the drum and then cover leaving space for air to circulate
- At the end of 35 day the bio-fertilizer is ready to be used
- Application: Use one litter for every 10 litres of water

Elaboration of biofertilizer NPK during workshop with San Antonio Green Growers Cooperative

Table 3: Average nutrient values in organic residuals

Material	%				C/N
	Organic material	N	P	K	
Cane sludge	79	2.10	2.32	1.23	22/1
Fresh caw manure	65	1.50	0.62	0.90	25/1
Poultry manure (dry)	54	1.70	1.20	1.00	18/1
Pig manure	45	2.50	0.60	0.50	10/1
Sheep/goat manure	30	0.55	0.26	0.25	32/1
Horse manure	17	0.42	0.30	0.70	24/1
Rabit manure	40	1.25	1.01	1.18	19/1
Peat moss	60	1.12	0.71	0.14	31/1
Bat guano	48	3.50	5.25	0.80	8/1
Cocoa-bean pulp	91	3.21	1.15	3.74	16/1
Poultry manure (fresh)	45	3.50	2.50	2.60	7/1
Rice straw	80	0.60	0.30	1.60	77/1
Rice husk	80	0.70	0.40	0.80	66/1
Banano leaves	85	1.50	0.19	2.80	32/1
Coffee pulp	90	1.80	0.30	3.50	29/1
Beans leaves	93	2.00	0.58	2.20	27/1
Vegetables	70	1.10	0.29	0.70	37/1
Orange bagasse	73	0.74	1.32	0.86	57/1
Dried grass	70	0.50	0.30	0.90	81/1
Tobacco stem	71	2.17	0.54	2.78	19/1
Corn straw	97	0.18	0.38	1.64	312/1

Source: Collective authorship (2010)

Table 4: Physical and chemical properties of the different animal sources used in organic agriculture

Sources	Elements content (%)												
	pH	EE dS cm^2	OM	N	P	K	Ca	Mg	Fe	Mn	Cu	Zn	Humidity
Sheep manure GF	8.3	7.76	75.4	2.30	2.28	3.86	1.73	1.04	0.1431	0.0124	0.0023	0.0155	24.6
Sheep manure L14	8.5	12.68	54.4	1.72	2.80	4.31	6.26	1.48	0.9493	0.0681	0.0090	0.0179	21.3
Chicken manure TLV	7.6	9.23	69.8	2.39	3.20	3.02	3.23	1.06	0.1647	0.0481	0.0058	0.0463	15.3
Chicken manure L14	7.1	8.61	76.8	2.42	2.45	2.58	1.80	0.81	0.2830	0.0487	0.0214	0.0224	28.4
Poultru manure PP	7.2	13.68	58.6	2.59	6.45	3.58	11.60	1.18	0.2549	0.0280	0.0428	0.0388	13.3
Poultru manure J	7.6	11.15	54.4	1.17	6.22	2.68	18.49	1.30	0.3735	0.1081	0.0627	0.0936	34.3
Poultru manure CCF	8.0	15.85	54.4	2.12	5.77	3.30	13.22	1.15	0.2857	0.1039	0.0549	0.0889	22.5
Poultru manure L14	7.2	11.59	62.8	2.47	3.78	2.35	11.32	0.87	0.3700	0.0406	0.0033	0.0218	16.6
Horse manure MDF	7.3	1.85	81.0	0.93	0.88	0.72	0.93	0.58	0.5047	0.0278	0.0029	0.0103	66.7
Caw manure P	8.8	5.51	72.6	2.03	1.91	1.97	2.81	1.10	0.3581	0.0253	0.0031	0.0115	52.8
Caw manure PB	7.2	0.85	37.7	1.52	6.83	0.12	8.80	1.70	0.7121	0.1126	0.0073	0.0695	57.9
Pig manure L14	6.1	0.95	29.3	1.40	4.42	0.08	6.50	0.42	4.2980	0.0937	0.0145	0.0977	53.6
Goat manure PB	8.9	5.91	78.2	2.22	2.12	3.28	1.83	1.41	0.1854	0.0405	0.0029	0.0140	14.1
Average	7.68	8.13	61.95	1.94	3.78	2.45	6.81	1.08	0.3800	0.0600	0.0200	0.0400	32.42
SE	0.22	1.36	4.41	0.15	0.55	0.38	1.53	0.10	0.0700	0.0100	0.0100	0.0100	5.21
VC	10.35	60.34	25.69	27.83	52.24	56.27	80.91	32.83	62.380	60.100	119.32	79.980	57.96

SE = Standard Error; VC =Variation coefficient; GF = Gamundi Factory; L14 = Los Catorce, Piedra Blanca; TLV = Taira, La Vega; PP = Pontón Plant; J = Jarabacoa; CCF = Cibao Chicken Farm; MDF = Manuel Díaz Farm; P = Portón; PB = Piedra Blanca; OM = Organic Material; EC = Electric Conductivity

5. Biopesticides

a) *Aloe vera* and wormseed (*Dysphania ambrosioides*) solution:

The *Aloe vera* pesticide controls worms and thrips in vegetable production.

Materials

- One pound of Aloe vera
- Two pounds of wormseed
- 14 ounces of washing soap (Zote)
- Five litres of water
- One bucket of 20 liters to mix

Preparation

1) Cut separately into small pieces the Aloe vera and wormseed, then mash or grind them and mix in 4 litres of water
2) The mixture is left to ferment for 3 to 5 days
3) Sieve the liquid to avoid problem with the spray pump
4) Prepare the soap solution in 2 liters of water and then mix with the Aloe vera and wormseed solution.
5) Apply 3 liters to every spray pump of 4 to 5 gallons.

Recommendation

Check the level of acidity in Aloe vera pesticides since it can cause burns in the leaves of crops. To assess acidity, testing is made in several plants, if after 2 hours no negative reaction is seen, the mixture is ready to be applied to the crop.

b) Onion (*Allium cepa*) and garlic (*Allium sativum)* solution:

- This solution is good for white flies and aphids

Materials

- 5 garlic and three onion preferable red.
- 14 ounces of the yellow soap and 10 liters of water
- A plastic drum with a capacity of 20 liters
- Stone or corn mill to grind
- Plastic bags

How to prepare it

1) Grind onion with garlic and place in 5 liters of water.

2) Dissolve the soap in 5 litters of hot water and then add all ingredient and leave for 30 minutes, then add 40 liters of water then sieve the solution.

3) Apply one liter for one spray pump of four gallons

Elaboration of onion and garlic biopesticide during workshop with San Antonio Green Growers

c) Marigold (*Tagetes erecta*) solution:

This product control nematodes, white flies and aphid

Materials

- One pound of marigold flowers and 3 liters of boiled water
- A large wooden spoon to mix

Preparation

1) Crush the flower
2) Place it on hot water
3) Mix until it cools down

Recommendations

It can be applied through the irrigation system or directly to the plant as foliar application. Use one liter of this preparation for every spray pump of four gallons.

d) Vinegar solution

This product controls thrips, spiders and aphids.

Materials

- 1/4 liters of white vinegar (250 ml.)
- 4 ounces of yellow washing soap
- 20 litres of water
- One bucket of 20 litres

Preparation

1) Dissolve in 20 liters of water 4 ounces of yellow washing soap
2) Add ¼ liter of white vinegar and mix.
3) Apply directly with a pump (you can apply all solution directly to your cultivation)

e) Hot chili pepper solution

Use**:** Insecticide. Larval inhibitor

Materials

- ½ pound of habanero pepper
- 3 ounces of yellow washing soap
- 3 liters of water
- 1 bucket to mix

Preparation

1) Crush/mash half pound of habanero pepper
2) Add 4 liters of water. Leave for 1 day
3) Dissolve 3 ounces of yellow washing soap in one liter of water and add to the mixture of habanero pepper
4) Apply directly to the plants

f) Herbal solution

Solution from herbs controls all pests that suck the sap of the leaves such as white flies, mites, trips and worms.

Materials

- One pound of one of these plants: peppermint (*Mentha spicata*), basil (*Ocimum basilicum*), rue (*Ruta graveolens*) or wormseed (*Dysphania ambrosioides*)
- Half pound of coriander *(Coriandrum sativum)*
- 4 ounces of manchineel (*Hippomane mancinella*)
- 4 liters of water

Preparation

Cut into fine pieces all herbs and boil them in the water for 15 minutes, then cool it

Recommendation:

Sieve the liquid and apply directly to plants. Apply early in the morning or late evening.

g) Garlic (*Allium sativum)*, onion (*Allium cepa*) and manchineel (*Hippomane mancinella*) solution

This solution controls mites, bacteria, fungus, insects and mildew.

- One pound of garlic
- One pound of onion
- Half liter of boil manchineel (use two stick to boil)

Preparation

1) Cut and blend separately the onion and the garlic
2) Boil two sticks of manchineel in one gallon of water and leave to cool
3) Mix the garlic and the onion with the manchineel
4) Fill the solution in a container and keep it for 48 hours
5) You can add 10 cc of oil to expand the life of the solution

Recommendation

Use half a liter of this solution to 18 litres of water and spray your plants.

h) Gliricidia (*Gliricidia sepium*) and neem (*Azadirachta indica*) solution: Control of white flies

Preparation

1) Shred 1 kg of gliricidia leaves and 1 kg of neem leaves
2) Soak leaves in 5 liters of water for 3 days
4) Strain
3) Add water to make up 20 litres of filtrate

Recommendations

- Spraying interval is 4-5 days
- Use one litre for one spray pump of 4 gallons

i) Yeast and beer solution: Control of snails

Preparation

1) Dissolve 1 table spoon of yeast in 100 ml of water
2) Fill any shallow container with the solution

Recommendations

- Bury up to the rim the recipient, near the plant
- Make some adaptations to cover the trap to avoid non-target pests from entering
- The snails drink, “get drunk” and drown inside the recipient
- Monitor the recipient and the trapped snails
- Change the solution when necessary, especially after rain

j) Neem leaf (*Azadirachta indica*) extract:

Preparation

1) Pound gently 1-2 kg of neem leaves
2) Place in a pot. Add 2-4 litres of water
3) Cover the mouth of the pot with a cloth and leave it for 3 days
4) Strain to get clear extract
5) Dilute 1 liter of neem leaf extract in 9 litres of water
6) Add 100 ml of soap. Stir well and then apply to plants

This extract controls aphids, grasshoppers, leafhoppers, locusts, plant hoppers, scales, snails, thrips, weevils and white flies.

- **Blossom end rot**

It is caused by lack of calcium. A foliar spray containing calcium chloride can prevent blossom end rot from developing tomatoes on mid-season. Apply it early in the morning or late in the evening; if sprayed onto leaves midday, it can burn them. Water plants regularly at the same time daily to ensure even application of water.

- **Blossom drops**
  - Flowers appear on tomato plants, but they fall off without developing the fruit.
  - Caused by high temperature or too much or too little application of nitrogen. Other reasons for blossom drop on tomatoes are insect damage, lack of water and lack of pollination.
  - What to do? Use neem oil for insecticides or use 4 teaspoons of Epsom salt and dissolve in one gallon of water to improve fruit set.

6. Multi crops or Associated crops

The multi crop system is an important approach encouraged by the Protection and Sustainable Use of the Selva Maya Project. The benefits of the associations of crops include reduction of pests and diseases incidence, increase the fertility the soil, improve and diversify the family income.

The following pictures are experiences of multi crops developed with farmers belonging to *Friends of Vaca Forest Reserve* and *San Antonio Green Growers*.

7. Conclusion

This manual was prepared for agricultural farmers who are dedicated to the cultivation of grains and vegetables and are transitioning into agroecological production. It is the result of the technical assistance actions implemented with farmers taking into consideration the use of appropriate technology in order to reduce land degradation, the use of toxic chemicals and produce vegetables that are healthy for human consumption and reduce contamination to the environment.

The manual also aims in providing the tools and methodology that incites the changes in farmer's behaviour by using appropriate approaches such as the FFS, which is a fundamental input in this field. The Selva Maya Programme from the German Cooperation (GIZ) hopes that this manual will serves its purpose for the production of agroecological produce that is environmentally friendly.

8. References

1. *Natural Remedies* for Pest Control by Dr. Carlos Itza
2. *Manejo de Plagas* by David Gomez and Marco Vasquez
3. *Manual Práctico, ABC Agricultura Orgánica* by Jairo Restrepo V 1 & 2

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