# Soil Testing Stations Soil Management Policy

3 June 2014

## Purpose

To establish consistent principles and procedures that all GROW BIOINTENSIVE™ Soil Testing Stations (STS; EMS in Spanish) must follow to improve their soils in a sustainable manner, and to establish guidelines for information taught at STS teaching events

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**<u>Principles that all STSs must follow:</u>**

**Comunications:** All questions regarding the principles and information described below, crop and soil observations or concerns, and/or research projects should be sent to the Coordinator, normally via email. The Coordinator will involve the Soil Specialist, other staff members and/or additional consultants. If internet service is not available, phone and/or postal service can be utilized to contact the Coordinator based on the urgency of the situation, but email is always the best way.

**GROW BIOINTENSIVE™** - STSs must practice GROW BIOINTENSIVE™ agriculture, as it is defined in *How To Grow More Vegetables*, 8th edition, John Jeavons, 2012. An overview of the critical importance of this agricultural method is provided in Appendix 1.

**SOIL SAMPLING** - STSs must annually sample their soil as described in Appendix 2.

**SOIL TESTING** - The sample(s) must be sent to one of the soil testing laboratories as described in Appendix 3. Additional laboratories can be approved for use and added to Appendix 3 by the Coordinator in conjunction with the Soil Specialist. Approval of a laboratory is based on generating comparable results from parallel sample testing by a currently approved lab, and/or ISO 17025 accreditation status.

**ORGANIC FERTILIZER RECOMMENDATION, PURCHASE AND USAGE** - Upon receipt of the soil test results, the STSs must send their results to the Coordinator, who will send each STS an organic fertilizer recommendation in conjunction with the Soil Specialist. Organic fertilizer recommendations will be created by Grow Your Soil (www.growyoursoil.org) or any individual, service or organization deemed equivalent by Ecology Action. The STS must follow the recommendation, or communicate with the Coordinator any obstacles preventing them from doing so. The Coordinator will work with each STS as well as the Soil Specialist to find appropriate ways to improve their soil in as sustainable a manner as possible, including assisting STSs in locating alternative fertilizers.

**RECORD KEEPING** - STSs must record edible and biomass crop yields per bed, weight of crops sold, volume of compost additions per bed, weight, type and cost of all purchases inputs per bed, start and end dates of all growing seasons, daily temperatures and precipitation. These data must be submitted to the Coordinator within 30 days of the end of each growing season. The procedure and forms for recording data are given in Appendix 6.

**60-30-10** - STSs must grow at least 60% of their demonstration area in compost crops (based on the definition of compost crops in *How To Grow More Vegetables*), 30% in root crops and 10% in vegetable crops. All biomass from the compost crops should be used for compost production, and all compost produced should be returned and equally distributed to all beds in production.

**NUTRIENT LOSS PREVENTION** - STSs must make all necessary efforts to minimize soil nutrient loss, by keeping all of their beds in continuous production as much as possible, preventing soil erosion and excessive leaching of soil nutrients from their beds and their compost piles, and selling no more than 10% of the crops produced from the cultivated area.

**IRRIGATION** - STSs must make effort to ensure their irrigation water is not and will not cause excessive accumulation of salts in the soil.

**LOCAL RESEARCH** - STSs are expected to develop and carry out local research projects to address specific concerns or issues facing the local farmers served by the STS. This research will be conducted within the demonstration beds and/or at associated farms. *Research must be done carefully so that we do not make or share false conclusions.* Research may also need to be coordinated between more than one STS in order to get sufficient data to properly answer the research question. Before undertaking any research, STSs must complete a Research Proposal form, available from the Coordinator, and submit it to Coordinator for review. Research can only be carried out after the proposal has been approved.

**GLOBAL RESEARCH** - STSs are expected to participate in global research projects, such as the Limited Inputs project (described in the Limited Inputs procedure) and the Plant Indicators project (described in the Plant Indicators procedure), as the opportunity arises. All necessary equipment, funding, tools, purchased inputs such as fertilizers, procedures and forms necessary to carry out these projects will be provided by Ecology Action.

**Global research projects**

The Coordinator will work directly with the STS on all details of these projects, including the selection of crops and rotations needed for these projects, and will consult with the Soil Specialist on all issues relating to all related global research as needed to ensure ***quality assurance*** and theconsistent adherence to all research procedures.

## ***Teaching Guidelines for STSs***

***These are general guidelines to assist STSs in providing accurate, critical information to students at their teaching events***

### ***Sustainability***

*If we take more from the soil than we return, the soil will lose its fertility and not be able to support human, animal or plant life. For every pound of food produced, 6 to 24 pounds of soil are lost. This is largely due to farmer not replenishing the soil's organic matter, and not returning many of the nutrients that are lost when crops are produced. Nutrients are returned largely through the production and addition of fertilizers produced with non-renewable resources. Very little research is being done to discover how to maintain or improve soil fertility sustainably, using a minimum of inputs. Most systems of food production in the world are not sustainable, and we must work quickly to develop more productive and more sustainable farming systems.*

*GROW BIOINTENSIVE TM agriculture works as natural systems do, requiring very little energy and recycling much of its soils' nutrients, which are critical functions of a sustainable food production system. By using GROW BIOINTENSIVE TM principles, techniques and practical solutions with discipline and perseverance, it is possible to restore and preserve a soil's fertility. Doing this in an efficient, practical, profitable and repeatable way for its users is the STS' main goal. This knowledge will be priceless in the medium term because even when the peasants and native producers do possess an innate and invaluable knowledge, it has been partially lost and must be restored.*

*While returning crop biomass back to the soil is essential, safely returning the nutrients in human waste will ultimately be required to create a truly sustainable food production system.*

### ***Soil Fertility***

*Each soil is unique, with its own unique characteristics, functions, needs, shortages and excesses. These characteristics, such as its composition of nutrients, organic matter, texture, and structure, determine how well the soil can produce plants, resist nutrient leaching and erosion, receive and store water, and store nutrients, among other services the soil provides. All the above mentioned makes the soil similar to any other living being; each one is unique and has its own very complex personality. Because each soil is unique, we cannot treat all soils in the same way. We need to learn about the soil's characteristics, by sampling and testing the soil, and then give the soil the nutrients it lacks and not the nutrients it already has in excess. This is the reason why it is important to test soil and follow the fertilizer recommendation based on the soil test results.*

*One cannot expect abundant crops from a soil if it is not well nourished and lacks nutrients essential to plant growth. If a soil is deficient in a nutrient, that nutrient must be added to the soil to maximize the yields of the crops grown on that soil. Nutrients must be returned to the soil as much as possible to avoid being overly dependent on purchased fertilizers to maintain or improve soil fertility. In addition, the farmer must prevent wind and water erosion, and excessive nutrient leaching, as well as minimize the sale of soil nutrients when crops are sold.*

*Because many farmers do not have access to soil testing laboratory services, it is important that we learn to analyze soils based on observations of nutrient deficiencies in crops. More information can be found in Test Your Soil With Plants, and more information will be developed at STSs through the Plant Indicator global research project.*

*If soil testing and a fertilizer recommendation are not available to the farmer, then the best strategy is to add about 3 nineteen-liter buckets of finished compost per bed, which has been produced on the farm, prior to every growing season. Adding compost to the soil returns many of the nutrients to soil and there is no danger of adding excessive nutrients to the soil. Adding compost also replenishes the soil's organic matter level, which improves the soil's structure, nutrient holding capacity, ability to receive and store water, resistance to erosion and droughts, and ability to grow healthy, abundant crops that are more resistant to pests and disease, among other benefits. Healthy soils make healthy plants, which make healthy people. In addition, soil is alive, ideally with a huge diversity of micro- and macro-organisms, all of which depend on a steady supply of available organic matter in the soil. Because these soil organisms are steadily eating organic matter, the farmer must produce crops that generate compost that can be added to the soil to replenish the soil's organic matter supply.*

### ***Compost crops and compost production***

*Compost is the first thing that has to be considered when planning a garden because it is the basic local input for our beds. It is an organic fertilizer made of the crops remains and kitchen waste. Biointensive compost is made directly over the soil, ideally on top of your beds, and is mostly aerobic, though it can have small anaerobic areas on occasion.*

*Very probably during the first farming cycles you won't have enough green, immature vegetation or dry, mature vegetation from your beds to make sufficient compost. During this time, some materials may need to be imported to your soil, based on the unique characteristics of your soil, as determined by a soil test and fertilizer recommendation.*

*Because Biointensive compost is made from crop remains that come from the STS' beds, it will not add those nutrients which the compost or soil is missing. However, the compost will help to* *maintain the soil's level of nutrients and will add organic matter to improve its fertility. Compost improves the soil and does not have the potential to damage it.*

*Growing leguminous plants and harvesting them when they are at a 50% of their flowering period will add nitrogen to the soil, and will provide some biomass for creating compost. Nitrogen is the most commonly deficient nutrient in the soil. The use of leguminous plants in crop rotations, in addition to the production of compost crops and compost, are very low cost ways – almost free – to improve the soil's fertility in a safe way.*

### ***The Benefits of Compost to Soils and Crops***

- *Improves the soil structure, which improves the roots' permeability and absorption of water and nutrients, and prevents wind and water erosion*
- *Buffers against pH changes*
- *Promotes, feeds and supports life in the soil.*
- *Prevents leaching of nutrients.*
- *Helps soil receive and store water for crops*
- *Helps dissolve the minerals in the soil, make them accessible to crops*
- *Contains soil nutrients, most of which are released slowly for plant uptake*
- *Prevents toxicity of excessive soil elements to plants.*
- *Does not pollute the soil, water, air or food.*
- *Is not toxic for animals or human beings.*
- *Allows us to give back to the soil part of what we receive.*
- *Making compost is easy and free or very inexpensive.*

### ***Making Compost***

*Biointensive compost uses 4 elements only: green or immature crop biomass or kitchen waste, dry or matter crop biomass, soil from the bed (collected during double-digging), and water. The material for the compost should come from the beds in the garden, not from living fences or other places in or outside of the farm. During the first years, you may be able to build enough* *compost to apply 2 or 3, 19-liter buckets to each bed each year, but with dedication and patience in improving your soil, you may be able to generate 3 or 4, 19-liter buckets of cured compost per growing season.*

*With a fork, loosen a square meter surface, to allow drainage and interaction of the microorganisms in the soil with the compost pile. Then lay down a mesh work of dry, thick material, such as dry corn or sunflower stalks (do not use these materials in the other layers of the pile, as they take too long to decompose). On top of this layer, add a five-centimeter thick layer of dry material (3 buckets), then a five-centimeter layer of green material (3 buckets) and then a 1.25 centimeter layer of soil (1/3 of a bucket). Continue alternating layers until you have a pile that is around 1 meter high, and finish with a soil layer. Water each layer of material as you place it. The approximate proportion per volume of these materials is 45% of dry matter, 45% of green matter and 10% of soil, once the compost pile has been finished.*

*Note: Some green materials can be composted with worms, called vermicomposting. The final product of vermicomposting contains roughly 1/3 to ½ of the organic matter of Biointensive compost and is not generally recommended as a decomposition method that should be used regularly at STSs.*

### *Managing the Composting Process*

***Moisture:*** *The pile must be kept about as wet as a wrung-out sponge. When the pile does not have enough water, the microbes cannot decompose the materials. When the pile has water in excess, anaerobic microbes will populate the pile, and will be less effective at decomposing the pile and creating a good quality final product.*

***Temperature:*** *The pile's temperature should be monitored and should not exceed the 60ºC. If you have a compost thermometer, use it. If you don't, a practical way to measure the temperature is to bury a metal bar or machete diagonally into the pile and leave it there for around 10 minutes. Then, remove the bar or machete and touch the metal with the palm of your hand. If it's hot but bearable, the temperature is OK. If it is so hot that you cannot bear it, the temperature is too high and that means you used too much nitrogen (green material). To lower the temperature, you have to make breathing spaces in the pile (holes); if you don't do this, you will get a final product that is less volume and contains less nutrients and organic matter.*

*If the temperature of the compost pile does not increase, there may be too little green material, too little or too much water in the pile, or the ambient temperature may be too cold. You may need to rebuild the pile and change its composition and/or water content.*

***Time:*** *The decomposition process takes around three to six months, depending on the ambient temperature, the quality of the composting materials, and the skills of the farmer managing the pile. Compost is ready to be applied to the soil when the original materials cannot be distinguished, and when it is soft, dark brown and smells like the forest or freshly dug soil. Do not try to speed up the decomposition process through regularly turning of the piles, addition of excessive green materials, or commercial compost accelerators, as you will reduce the amount and quantity of your final compost.*

***Deep Soil Preparation***

*In GROW BIOINTENSIVE TM agriculture, the soil has the leading role. The techniques of GROW BIOINTENSIVE TM focus on increasing soil fertility and, in turn, producing an abundance of quality crops for both the producer and the soil. The deep preparation of the soil is vital to encourage good soil structure that allows air and water to enter the soil. A bed that breathes produces healthy crops; when oxygen circulates there's a kind of healthy breathing called oxidation instead of fermentation and reduction, which is common in compacted soils.*

*Double digging is a technique ergonomically designed to dig the soil 60 centimeters deep; it is recommended to get the proper tools such as a D handle fork to dig and a D handle spade, as well as a board to distribute the weight evenly and avoid compacting the soil. If you don't have these tools, you can use the ones that are available for you but only if you follow the technique's steps.*

*Single digging, double digging and triple digging are used according to the soil's conditions as many times as it is necessary until enough organic matter has been incorporated into the soil and a good structure has been achieved. Double digging is usually done once a year at the beginning of the main growing season; as a good structure of the soil is obtained, you can single-dig or dig to the depth of 5 cm with a cultivator. In this way the structure of the soil and the organic matter that you were able to incorporate are maintained and improved.*

*In order to get a more detailed description of single, double and triple digging, consult pages 7 to 24 of the How to Grow More Vegetables book and pages 20 to 24 of the Sustainable Garden book.*

*Notes:*

*• Soil should never be dug when it is excessively wet, indicated by muddy streaks left behind when you try to remove soil you have dug from the spade or shovel.*

*• Excessive digging of the soil, when the soil structure is good, should never be done, as it will cause soil organic matter to be lost at an unnecessary, excessive and unsustainable rate.*

***Suggested sources and readings to broaden the information***

*How to Grow More Vegetables 2012 edition, pages 39 to 56*

*The Sustainable Garden 1999 edition, pages 25 to 30*

*Grow your own materials for compost at home, Booklet 10*

*Grow your green fertilizer, Booklet 22*

*Biointensive Compost, Steve Rioch, Booklet 23*

*GROW BIOINTENSIVE™ Composting and Growing Compost Materials, Booklet 32*

*Test Your Soil with Plants2014 edition*

*Future Fertility*

## Appendix 1: Our Soil, Our Future

(*Or: What You Are About To Do Is Important*)

(John Jeavons, Two Week Farmers Course, January 2014)

You are about to embark on a journey.

While it will (we hope) be an interesting and enjoyable journey, it is not one without purpose. What you are doing is important, and what you will learn over the next two weeks can make a great difference in the way you live your life, the impact your life has on other people, and future of the world we all live in.

Before we begin, there are a few things you should know.

The main one is: **Current farming models are not sustainable.** The form of commercial agriculture currently practiced in most of the U.S. and much of the world uses natural resources at rates greater than they can be replaced. As a result, the world is facing a set of urgent challenges that are already impacting food security, economic growth, and environmental and social stability around the globe.

These include:

• **Food shortages.** *870 million people in the world do not have enough to ea*t (UN□WFP). UNESCO predicts that, due to global population growth projections of 2–3 billion people over the next 40 years, food demand will increase 70% by 2050.

• **Water shortages.** *Water scarcity already affects every continent*. It is estimated that by 2025 5.6 billion people will experience conditions of water stress. As conventional agriculture accounts for ~70% □ 90% of global freshwater withdrawals, food shortages will increase with water scarcity. And as water becomes scarce, food will also become scarce.

• **Loss of farmable soil.** *Across the globe, farms are losing the soil needed to grow food.* According to the IFAD, 12,000,000 hectares of agricultural land (topsoil) are lost and become virtual desert each year. It takes 500 years to grow an inch of topsoil in nature; six inches (3,000 years' worth) are needed to successfully grow food.

Some estimates indicate that at current rates of destruction, *all remaining land* will have effectively become desertified in as little as 58 years. You can also make the case that in as little as 32 years, all *farmable* soil will be gone.

**Humus** – known by soil scientists as soil organic matter (SOM) – is agriculture's "canary in the coal mine". Organic matter levels determine whether soil is fertile enough to produce food, to hold water, nutrients and minerals where a plant's roots can use them.

In 1972, when Ecology Action began its journey on a course of research to develop a truly sustainable agricultural model for nutritious food production from the smallest area possible, SOM levels were already low, averaging about 2% across the globe. Today, as a result of agricultural methods which continuously withdraw organic matter from the soil (in the form of crops and animals), *SOM averages about 1.2% worldwide.*

Most sustainable soil research is focused on returning the SOM levels to the 2% range. However, *at 2% SOM, the soil's carbon-sequestering, nutrient processing powerhouses – the microbes – are just waking up*. Additionally, most agricultural soils are compacted and deoxygenated to the point that the beneficial aerobic microbes can't live. To further complicate matters, most soils are also demineralized, lacking the calcium, magnesium, boron, sulfur, iron and other minerals in the necessary quantity and balance to grow crops. And each time a soil receives approximately 7.5 inches of rain (depending on soil texture, structure, CEC, which nutrients, and rate of rainfall), the bioavailable minerals and nutrients that *are* in the soil start to leach out of range of most plant roots.

All of these factors are making it increasingly difficult to get good yields, and to grow enough food with enough nutrients to feed our growing populations.

**Essentially**, the soils that produce our food are running on empty.

A healthy, productive, oxygenated soil that can hold minerals and nutrients where the plants can use them requires a **minimum** of 3% organic matter in the tropics, and 4-6% in temperate regions.

In his book *Edaphos: Dynamics of a Natural Soil System*, author Paul Sachs says that it is

only possible to build up soil organic matter in a stable way at a rate of 1/20th of 1% (0.05%) annually.

At this rate, with the current average SOM levels at 1.2% globally, it will take approximately 36 years to build up soils in tropical regions to the point (3% SOM) that they can hold water, nutrients and minerals. In temperate zones, which require 4-6% SOM, the process will take approximately 56 years.

*TO SUMMARIZE: Due to unsustainable agricultural methods, most soils have been depleted of organic matter, and cannot hold minerals or nutrients in the root zone, which is causing decreased yields. As a result, malnourishment increases, and over the* *course of the 36□56 years it will take to build up the required 3□6% SOM, 5.6 billion people □ a majority of people on the planet □ will experience starvation.*

*"No matter how far you have gone on a wrong road, turn back." – Turkish Proverb*

So… at this point, you may be wondering: **WHAT CAN WE DO?**

The answer to that question is: **we can do a lot.**

To start with, we can begin heading in the right direction, right now. And that's what this class is about. But it may require you to change the way you think about some very basic things.

**For example, fertilizer**.

The world is in a situation of severe shortages of phosphorus, potassium and other nutrients vital to the process of growing food. Ironically, because of this nutrient shortage, it would be a disaster if the world suddenly converted to all organic production – there simply isn't enough organic matter or nutrients to support the standard organic production methods at a level necessary to feed the world.

**This isn't a new problem** – the deserts of North Africa were once the Roman Empire's granary, until the soil gave out from over□farming. There are people alive today who remember the Dust Bowl era here in the US. Traditionally, when soil stops producing, farmers have simply moved on to new land, or extracted fertilizers from a new vein of ore. But with 7 billion hungry mouths to feed, no new land to farm, and no new frontiers opening up where we can safely and easily mine the nutrients we need, the situation has become urgent.

**Except** that we are (almost literally) sitting on a bonanza of cheap, readily available carbon, minerals, and bioavailable nutrients: **human waste**.

If growing food using Biologically Intensive farming methods, the waste products generated by one person annually – properly, hygienically, safely, and legally processed into fertilizer – contain enough nutrients to grow all the food for one person for one year. When you think about it, that means that if a person lives for 85 years, eating and flushing away nutrients for each of those 85 years, they have discarded a quantity of fertilizer sufficient to have fed 85 people (if they each recycle their waste products properly) for their whole lifetime.

However, because of the situation we find ourselves in, in terms of organic matter levels, and demineralization, we still have a situation of diminishing returns, nutritionally speaking.

*Imagine I'm someone living in Latin America, with soil organic matter at 1.2% and demineralization causing decreased yields. Fortunately, I'm able to import nutrients on a one-time basis to bring the soil back up to productive levels. So, during the first year, I grow and eat my crops, and process my waste into fertilizer. The garden receives at least 7.5 inches of rain, causing most of the surplus nutrients from the imported fertilizer to leach too far into the soil for the roots of my crops to reach, and I can't import more nutrients because they're expensive and scarce. However, I have my properly recycled human*

*waste, which came from food I grew in soil with sufficient nutrients, which I use as fertilizer, replacing the nutrients at acceptable levels for good production value. In year two, I grow and eat another crop, and process the waste, and it rains another 7.5 inches. By year three, the cycle repeats, but this time, the recycled waste can't entirely replace the lost nutrients because of leaching, and metabolism.*

*Partially offsetting this depletion is the fact that the R horizon in the soil (the bedrock) is slowly releasing additional nutrients into the soil. In addition, deep-rooting crops such as carrots, sorghum, maize, comfrey, alfalfa and trees can work to bring up some of the nutrients leached out of the soil by rain.*

*But over time, as the leaching of nutrients increases, even with the use of recycled human waste, deep rooted plants and the slow decomposition of the R horizon, we will continue to have an increase in diet and nutrient deficiency, with a corollary increase in disease and death. (But even death can contribute something to the restoration of the world's soils: recycling human bodies could provide a significant source of balanced and bioavailable nutrients to add to the earth, a legacy that will help future generations build a more sustainable and productive world.)*

The fact of the matter is that **until we bring the soil organic matter levels back up** to the point that they will hold water, nutrients and minerals – an estimated 36 years – **we will be fighting a losing battle**.

However, even if it will take time, it is a fact that **we *can* build the soil**, by adding the right amount of aeration, the right quantity of minerals and the right amount of organic matter to the ground we work.

And Biointensive farming*, when properly and methodically practiced as a **whole** system*, can produce an inch of fertile topsoil **60 times faster than nature**, in as little as 8.5 years. Up to 6 inches with adequate SOM levels can be grown in as little as 50 years.

The clock is running, and you've got 2 weeks to learn the basics.

So we'd better get started, right now.

Are you ready?

## Appendix 2: Taking Soil Samples

### Taking and sending soil sampling

Sampling and submission of the sample to the soil testing laboratory should be done at least 2 months prior to the start of the first growing season, in order to give enough time to receive the test results and fertilizer recommendation, and to locate and apply the fertilizers, since some pH changing fertilizers should be applied one month before the start of the growing season.

1. All tools used to take soil samples should be made of hard metal (preferably stainless steel) that is clean, and not painted or rusted, to avoid contaminating your samples. All containers, buckets and bags, must be clean and free of any contamination.

QuickTime™ and a
decompressor
are needed to see this picture.

2. For each 10 square meter bed in your center, take four samples in the pattern shown below:

QuickTime™ and a
decompressor
are needed to see this picture.

X

X

X

X

X

X

X

X

3. To take each sample, first dig a hole in the form of a “V” that is around 30 centimeters deep; the soil can be slightly wet, but if it is very wet, you should wait for it to dry before sampling it, if possible.

*Lateral View of the Soil*

QuickTime™ and a
decompressor
are needed to see this picture.

4. Then with a trowel, remove a part of wall of the V-shaped hole, to ensure that no impurities on the shovel will be included in your sample.

QuickTime™ and a
decompressor
are needed to see this picture.

5. After having cleaned one side of the hole, clean the trowel. Then, use the clean trowel to take a sample from the side of the cleaned wall. You should take the sample starting at the bottom of the hole and moving upward to fill the trowel. Take two trowels full of soil and place them into a clean bucket.

6. Repeat steps 3, 4 and 5 for the rest of the sampling points of the bed, for each of the beds at your center. Place all these samples into the same bucket.

7. Once you have collected the soil samples from all the beds into one bucket, thoroughly mix the soil in the bucket. To assist in the mixing process, you can pour the soil from a bucket into another clean container, back and forth several times, or you can simply mix with a trowel, shovel or other tool thoroughly, depending on the volume of soil you have to mix.

8. From the mixed soil in the bucket, you will take out 500 grams from different areas of the bucket and place this soil into a plastic, ziplock bag. This is your composite sample. Avoid touching the sample with your hands. For safety, tape the opening of the bag, and

place it inside another ziplock bag that is also taped shut. You may want to take a second composite sample that you will not send, but will store at your STS as a back-up sample in case the first composite sample is lost or damaged.

9. With a permanent marker, label the sample bag with the date, location, and name of the garden, farm or STS.

10. Place the bagged and labeled sample into a sturdy box, as well as form of payment and the completed sample submittal form. For international shipments, you must also include the soil permit within the box, as well as the soil label that is adhered to the outside of the box. All forms, permits and labels are available from the Coordinator and the Soil Specialist.

## Appendix 3: Shipment of Soil Samples

**Shipment of Samples for STSs in the Mexican Republic**

The authorized laboratory for the soil analyses is A&L (Laboratorios A-L de México, S.A. de C. V.), located in Guadalajara, Mexico.

When sending the samples, you must clearly specify that you require the Soil Fertility Diagnosis/Soil Analysis under the Mehlich III method plus the soluble salts physical test (or electric conductivity). The soil sample is 500 grams and the results are delivered in 9 working days. The sample will be sent via the available courier company to the following address:

Esmeralda #2847 entre Aguamarina y Cuarzo

Col. Verde Valle C.P. 44550

Guadalajara, Jalisco.

Tel. 01 33 3123-1823

The package has to specify the following: a) Fiscal information or the name of the person that requires the service, b) Name of the farmer, c) Name of the piece of land, d) Telephone number and e-mail address, e) Specify the two crops that will be established in the beds, f) Yield goal and g) Kind of analysis you are requesting.

Even when a donor will be paying for the analyses and the cost for their shipment – Mr. Antonio Ríos from Biocampo in Saltillo, Coahuila (arios@biocampo.com.mx) – in order to speed up the logistics it is recommended to pay directly in the laboratory and pay the courier company and then to request a refund via an e-mail in which you have to attach the proof of expenditure and a bank account to deposit the refund. Do not forgive to include Biocampo's fiscal data so that the invoice is issued to that company; otherwise, it will not be possible to refund the cost of the analysis.

The laboratory requests the payment in advance to Laboratorios A-L de México, SA de CV. The cost of the analysis is of $464 Mexican pesos plus the value-added tax. The cost of the soluble salts test is of $80 Mexican pesos plus value-added tax at the moment of the elaboration of this document, please do verify the laboratory's Web page (http://www.agroanalisis.com.mx) for possible changes. The amount has to be deposited to:

BANAMEX Sucursal 912 Cuenta 14797, CLABE 002320091200147971

## Shipment of Samples for STSs in Central and South America

The authorized laboratory for the soil analyses is A&L Eastern Laboratories, located in Richmond, Virginia, USA

When sending the samples, you will clearly specify that you are requesting the complete analysis (Complete Test SM3). The size of the sample is 500 grams.

The form with the data required by the laboratory can be downloaded from its Web page http://www.al-labs-eastern.com/showpdf2.aspx?spdf=3. The soil permits and labels will be distributed by the project's staff, and are available from the Coordinator and the Soil Specialist.

It is very important to put the soil permit tags on the outside of the box, and to include the "Permit to Received Soil" on the inside of the box. (both have to be legible and visible for the personnel of the inspection stations). In order to avoid any soil leakage, check that the plastic bags are perfectly sealed and use a sturdy box.

The sample will be sent through the available courier company to the following address:

A&L Eastern Laboratories

7621 Whitepine Road

Richmond, VA 23237

USA

The laboratory will send an email when they receive the sample, and will send test results by email in 2 to 4 working days.

Ecology Action will contact A&L Eastern Laboratories and agree in the form of payment (check or credit card). Ecology Action (or the Coordinator of the STS's) will provide a list of names and countries that will send soil samples. The Coordinator of the STS's will follow up each case. Ecology Action will cover the testing cost.

**If the STS has any difficulty following these instructions, please immediately contact the Coordinator or the Soil Specialist for assistance.**

**Shipment of Samples for STSs in Africa**

The authorized laboratory for the soil analyses is Crop Nutrition Laboratory Services (www.cropnuts.com), located in Nairobi, Kenya

When sending the samples, you will clearly specify that you are requesting the Complete Soil Analysis and % Soil Nitrogen (CNSA022 and CNSA024).

The form with the data required by the laboratory is available from the Coordinator and the Soil Specialist.

Ecology Action will cover the testing cost.

**Organic Fertilization Recommendations** will be supplied by Grow Your Soil or another organic fertilizer recommendation service approved by Ecology Action. All soil test results should be sent to Grow Your Soil via email (info@harvestmore.org) or postal service (Grow Your Soil, P.O. Box 4095, Ithaca, NY, 14852-4095, USA). Recommendations are sent within one week of receipt of the test results. Ecology Action will pay Grow Your Soil US$20 per recommendation.

## Appendix 4: Making an inventory of local available organic fertilizers

The STS must prioritize the growing of compost crops (including some legume crops), and production and additions of compost to return as many nutrients as possible back to the soil, and to replenish the soil's nitrogen and organic matter levels. Compost should be seen as the soil's main and most sustainable fertilizer. However, as a precaution, in case additional external nutrients and inputs are needed, it is necessary to identify local suppliers for organic fertilizers and make an inventory of locally available organic fertilizers.

The following organic fertilizers are the most commonly needed and recommended fertilizers. However additional fertilizers may be recommended based on the needs of the soil and the lack of availability of other fertilizers.

### Fertilizers

It is important for STSs to locate sources of fertilizers as soon as possible, in order to avoid delays in fertilizing and planting once the fertilizer recommendation has been provided. The fertilizers recommended must be acceptable by the organic certification requirements of the STS's country or, if no requirements are established by that country, the requirements of the USDA since we need to define what fertilizers are acceptable and unacceptable. The use of chemical fertilizers, commonly known as agrochemicals, that are not acceptable for organic certification cannot be applied at STSs or associated farms. Many of the types of organic fertilizers that could be recommended are listed in Appendix 4. No organic fertilizer should be applied unless the Soil Specialist has approved its usage and application rate.

Charcoal or biochar should not be used unless its cec, ph and nutrient content has been determined by a laboratory and has been approved for use by the soil specialist.

The fertilizers recommended will available as locally as possible, and ideally will be purchasable within the country of the STS and within 200 km of the STS. It is possible that exceptions will need to be made if the soil is deficient enough in a nutrient to cause significant decrease in many crop plants and no alternate fertilizers of known composition are available. Usage of fertilizers that are farther away than these specifications will be at the discretion of the Coordinator. All alternate fertilizers (not listed in Appendix 4) must be approved by the Soil Specialist based on having a published nutrient composition or there is reasonable certainty of its composition. The recommended fertilizers must also be affordable to the STSs and their average local farmer.

In addition, all recommendations will be made with the intention that fewer and fewer fertilizers will need to be imported or purchased over time, due to the fact that more and more of the soil's nutrients will be returned back to the soil, and losses of nutrients will be minimized. However, at this time, we cannot establish the annual rate at which fertilizer inputs should or must decrease, due to the lack of experimentation and supporting data. We strongly believe that it is possible that the need to import fertilizers can decrease over time in a GROW BIOINTENSIVE TM farm without a loss of soil fertility or crop yields, but we have never tested this idea thoroughly and conclusively. At this time, we cannot establish a rate of decrease that we know will be successful for all STSs. After we conduct our Limited Inputs experiment at 5 or more STS for 4 to 5 years, we may be able to establish a rate of decrease of fertilizer usage at STSs over time, and we will amend this Policy at that time.

Creating organic fertilizer recommendations based on soil test results is a science, as well as to a much lesser extent, an art. Because of this, the ability to make organic fertilizer recommendations can be taught, and the Soil Specialist intends to teach additional personnel associated with STSs how to make organic fertilizer recommendations. The time required to teach this skill will depend largely on the Trainee's educational background and motivation to learn this skill. Qualification for successful training and approval for making fertilizer recommendations for STSs and associated farms will be based on recommendations made by the trainee from previous soil test results and the approval of the Soil Specialist.

Appendix 5 describes how fertilizers should be added to the soil.

**Organic Fertilizers**

Alfalfa meal

Fish meal

Crab meal

Phosphate rock/ Rock phosphate

Soft phosphate (coloidal)

Wood ashes

Crushed granite

Agricultural lime ($CaCO_3$)

Dolomitic lime ($CaMg(CO_3)_2$)

Calcium sulfate ($CaSO_4$) (Gypsum)

Elemental sulfur

Magnesium sulfate ($MgSO_4$) (Epsom salts)

Ground egg shells

Composted animal manures

Bone meal

Blood meal

Potassium sulfate

Zinc sulfate

Manganese sulfate

Copper sulfate

Iron sulfate

Boron fertilizer

Worm Compost

Peat Moss

Various types of guano

Ground hoof and horn meal

## Appendix 5: Adding Fertilizers to the Soil

Natural fertilizers are applied by broadcasting them one at a time as evenly over the surface of the bed as possible. Use the different colors of the fertilizers to help you distribute them evenly over the bed. For example, if the soil is light colored, first apply compost or another dark colored fertilizer. If you soil is dark, then first apply a light colored fertilizer. Then, add a contrasting colored fertilizer so that it easier to see when it falls to the soil. Alternating dark and light colored fertilizers will help spread them evenly over the bed. If you have to broadcast less than 100 grams of fertilizer over a bed of 10 square meters, you can mix the appropriate amount of fertilizer thoroughly with some dry, fine soil that serves as a bulking agent. With the increased volume of the soil and fertilizer mix, it will be easier to apply the fertilizer evenly over the bed surface.

Once all the fertilizers and amendments have been applied, they are incorporated 5 to 10 centimeters deep into the soil with a digging fork, using a sieving or twisting motion. If you are applying agricultural lime, dolomitic lime or elemental sulfur, you will need to wait one month after the fertilizers have been applied and mixed into the soil before planting. If you are not applying any of these fertilizers, you can plant immediately.

To learn more details about these techniques, see videos whose links appear in the Ecology Actions Web page (video at Spanish: http://www.youtube.com/watch?v=zFESJpNLXYk and http://www.youtube.com/watch?v=slXs4vMqzbQ) , and How to Grow More Vegetables and The Sustainable Garden books.

## Appendix 6: Recording Data

The gardens' location, rain pattern, temperature, altitude, soil analyses, fertilizer, amendment and compost applications, crops in beds and their yields and other relevant information will be carefully recorded in forms by each STS. The procedures for completing and submitting these forms are described below.

Each STS and associated farms should submit to the Coordinator, via email or mail, the following forms:

- An annual garden plan design- part 1 and part 2- from the Ecology Action Basic Manual, Planning section (at least two months prior to the main season).
- Copy of the soil test result (at least two months prior to the main season).
- Data Report- Appendix 2- from the Self-Teaching Mini-Series #30, Fifth edition, October 2009, located in pages: ii and iii (after each growing season).
- Summary Yield Data- Appendix 3- from the Self-Teaching Mini-Series #30, Fifth edition, October 2009, located in pages: iv and v (after each growing season).
- Compost Pile Summary Report- Appendix 6- from the Self-Teaching Mini-Series #30, Fifth edition, October 2009, located in pages: viii (after each growing season).

Additional information needed- such climate characteristics, rain patterns, characteristics of the growing seasons- may be requested personally by the Soil Specialist and Coordinator.

It is recommended that each STS and Associated Farm have a "Garden Folder" where they can record the activities and maintain a printed version of all the garden information such as: map, temperature, bed crops, compost information, etc. Each STS is encouraged to have an electronic version of this information, if possible.

<u>Instructions for completing the forms:</u>

Detailed instructions for completing each form will be covered in workshops or the Soil Specialist, Coordinator or Staff can cover it directly with the STS manager.

*Note. Data Report - Appendix 2- from the Self-Teaching Mini-Series #30*

Please use the footnotes of the form to fill it.

Please do not forget to include **the type and amount of each** organic fertilizer applied in the section of amendments

Please use the section of observations to indicate the price of organic fertilizers and any difficulty to find them. That will be helpful to understand the affordability and accessibility of organic fertilizers in each STS or Associated farms.