



TRINIDAD AND TOBAGO

MINISTRY OF AGRICULTURE LAND AND MARINE RESOURCES



THE GROWBOX SYSTEM FOR VEGETABLES

A Producer's Manual



EXTENSION TRAINING AND INFORMATION SERVICES DIVISION





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A Producer's Manual

Produced by the Extension Training and Information Services Division

*Produced in support of the Growbox Project
An initiative of the Ministry of Agriculture Land and Marine Resources*

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**I was about to say “good luck”, but I will not.
If you follow the guidelines in this manual, you will produce a
successful crop!**

What is the Growbox System?

The Growbox system refers to the production of crops in an enclosed box-like structure using a special mixture inside the box to grow the crops. The material used inside the box does not contain soil. Fertilizers are added to the mixture to provide the plants with their nutrition.

A wide variety of short-term crops can be grown successfully in a growbox. This manual will take you through the process of building a growbox and planting two crops that are easy to grow - lettuce and patchoi.

Soon though, you would be able to move on to other high-priced crops - and reap the full financial benefits of using this system!



Crops normally grown in the Growbox System

- *Lettuce, Patchoi, Sweet Pepper, Celery, Chive, Tomato, Cabbage, Cauliflower*

Crops that are just as easy to grow and higher priced too!

- *Jalapeno and Lebanese Peppers, Bell Sweet Peppers, Beets, Ginger, Salad Tomatoes, Broccoli, Purple Cabbage*

Some Advantages of the Growbox System

When compared to the traditional system of growing crops in the soil, the growbox system is better in several respects:

- It is ideal for places where the soil is poor in quality and planting space limited. It can also be constructed on paved surfaces.
- It is fairly easy to understand.
- Boxes can be situated around the home or close to home. This is important for security of crops.
- Boxes can be tended adequately in early mornings and late evenings. You can avoid work in the hot sun.
- There are little or no weeds in the growbox. You spend less time weeding and little money on weedkillers.



- There is less use of harmful pesticides. This means safer food for the family.

There are some Disadvantages

- The major disadvantage of the growbox system however, is the start up costs. It is somewhat costly to establish a growbox. Nonetheless, with careful management costs can be recovered and profits made in a relatively short space of time.

Tip: *There is potential for development into a successful small business*

Size of the Growbox

- A growbox could be any size, depending on the space available for its construction and your requirements for fresh vegetables.
- If you intend to produce for home use, a smaller box is needed than if you intend to grow and sell your produce.



Standard Size Growbox

- All the materials that will go into a box are calculated on the basis of a standard size growbox.
- A standard size growbox is 30 feet long, 5 feet wide and 8 inches deep.
- This box holds 100 cubic feet of material and occupies 150 square feet.
- You can build a box one-half this size, one quarter, one-third, twice the size, or any other size - but you will have to work out the quantity of materials needed based on a standard size box.
- The length of the box you could make in your backyard or community space could vary depending on the space available to you.
- You could make your box 5 feet, 10 feet, 20 feet, 30 feet or even 50 feet long.



- The width of the box (5 ft) is more or less fixed. This width allows you to reach into the box comfortably from each side without stepping into the box. If the 5 feet width is uncomfortable for you or you simply do not have the space, a smaller width, possibly 4 feet, could be used - but remember a standard size box will now be longer!

Choosing the Spot for your Box

Shade

- Avoid shaded areas. Place in open areas where crops can get at least six hours of continuous sunlight.

Security

- Secure from theft as well as household pets (dogs, cats) and poultry (fowls, ducks). They love to dive into boxes and scratch away.

Flat area

- The area should be flat. If your base is not flat, water and fertilizers added will drain to one side and cause uneven growth or no growth of crops in some areas.

Base

- The base of the box is normally the bare ground, cleared of all weeds, rubble, stones etc. However, a box can be constructed on a concreted or pitched area.

Drainage

- The area should be free draining. All excess water must drain away freely after the box has been watered and quickly after rainfall.

Back or front of my home

- Anywhere! Place boxes at the back of your home, the side, or even the front, in which case you may have to remove part of your lawn or flowering plants.

Easy access

- Place where you have ready access to it at all times and you can easily bring in your construction materials, fertilizers, water and get your crops out easily.

Materials and Equipment needed

Have all your tools and equipment on hand before you start your construction.

Some items needed for the growbox construction - you may borrow these:

- Cultivation tools (forks, shovels, strong rake)
- A wheelbarrow, a line level, a square and a hammer.
- Nylon line or twine, 30 metre (100 ft) long.
- Plastic buckets.
- 4 wooden stakes each about 3 feet long.
- A broomstick or similar piece of wood.
- Plastic sheeting (if to be used).

These items are needed during growth of crops:

- A reliable water supply.
- A garden hose.
- Water drums: one for each growbox.
- A watering can.
- Gloves for handling fertilizers.
- A sprayer for pesticides
- Some fertilizers and pesticides



Construction of the Growbox

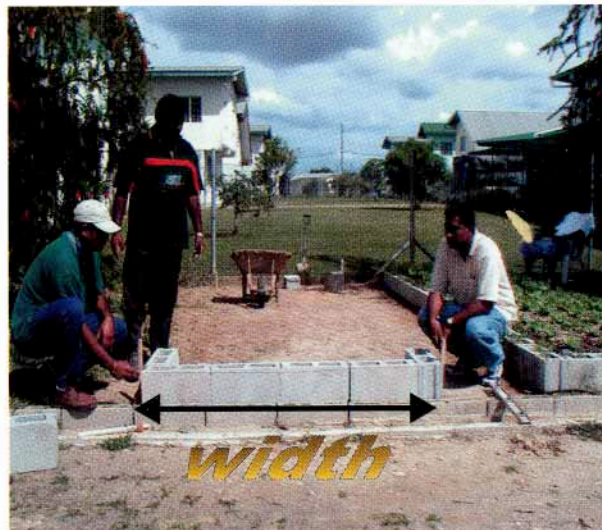
You will need 54 blocks that are each 6 inches wide by 8 inches high by 16 inches long (commonly called a “6 x 8 x 16” foundation block) for a standard size box.

Follow these steps in constructing your box:

- Clear the area of all rubble, weeds and other unwanted material. Clean a wide area, so that the surroundings will also be clean after you have constructed your box.
- Using the tools available, level the base where the box will be constructed.
- Using your pickets, square, level, tape and lines, mark out your area for the placement of the blocks. Recall this is 30 feet long by 5 feet wide for a standard size box. Of course, you may mark out your own length and width depending on the space available to you.



- The lines should be square and level with an 8 inch clearance from the base all around to accommodate the height of the block (6 ins wide x **8 ins high** x 16 ins long).
- Start placing the blocks along the width. Place the blocks on the outside of the line with its top edge under and slightly touching the line.
- For a standard size box, you will have to put down 4 blocks along each width and 23 along the length.
- To get a measure of 5 feet inside the box, you should assemble the corners of the box as shown in the photo. It is a “one in one out” pattern. This is not necessary if your box is a different size.



Tip: *If your blocks do not reach the level line in some places, you could make up the required height by putting some sharp sand below them as a base.*

- The blocks are placed touching each other and are **not cemented together**. The space allows for free drainage of excess water.
- If you are building another box alongside this one, you must leave 18 inches to 2 feet of space between the boxes.
- If your box is being constructed along a fence, then remember the width of the box should be less - about 3 feet wide. This should be sufficient for you to reach the back of the box comfortably.
- If you suspect your area has soil borne diseases, then line the base of the box with plastic sheeting.

Tip: *When completed double check! double check! that everything not only looks square and level, but is actually square and level.*



Mixture for inside the Box

The soil-less mixture that goes into the box is made up of:

**3 parts of well-rotted bagasse,
1 part of sharp sand,
5 lbs of limestone and the fertilizers**

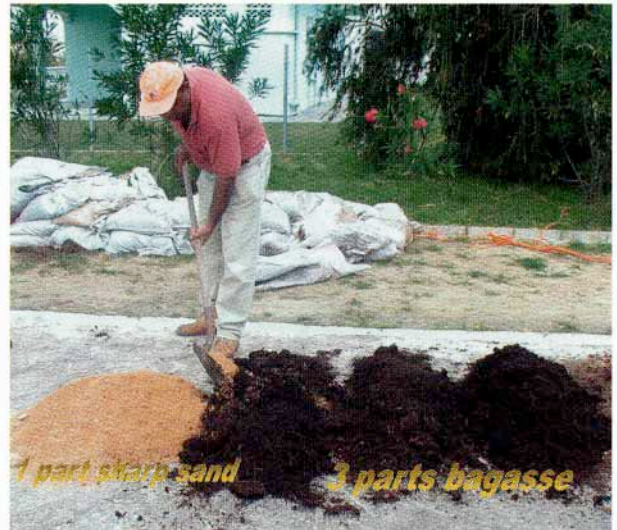
- A standard size box will require 30 wheelbarrows of bagasse and 10 wheelbarrows of sharp sand.
- Since it is possible to buy bagasse and sharp sand in “feed” bags, you will need about 60 bags of bagasse and about 20 full bags of sharp sand.

To the bagasse and sharp sand mix, fertilizers and limestone are added to provide food and good growing conditions for the seedlings that will be planted. This mixture is now called the growing medium.

- For a standard size growbox, add to the bagasse and sharp sand:

**6 1/2 lbs of 12:24:12 fertilizer
1 lb of Urea
1 lb of 9:6:46 fertilizer
2 lbs of Magnesium sulphate; and
5 lbs of limestone**

These are called the pre-plant fertilizers



Preparation of the Mixture

- Spread the bagasse on a clean area close to the box. Spread the sharp sand on top of it.
- Weigh all fertilizers and limestone. Using covering for your hands, sprinkle them evenly over the bagasse and sharp sand mixture.
- Before filling the box spread 5 lbs of limestone evenly on the soil inside the box. **This is only needed if your box is on the bare soil and not lined with plastic.**



- The materials are mixed thoroughly and then barrowed and/or shovelled into the box.
- After filling the box with the materials, level it to the height of the blocks using a piece of wood. Do not stand on the mixture or compress it in any way.
- Fill the holes at the top of the blocks at the same time if you plan to plant in the available spaces.
- Finally, wet the mixture in the box thoroughly. You know it is sufficiently wet when water starts to drain out of the sides and base. **Do not use water directly from the mains. Use water that has been standing in a container for at least 4-6 hours.**

Tip: Chlorine in tap water may affect the quality of crops



YOU ARE NOW READY TO PLANT YOUR VEGETABLES!

Seedlings

If you want to produce the best crop possible, you must start with very good seedlings.

- Good lettuce and patchoi seedlings have a glossy green appearance, no more than six leaves, white or mostly white roots, white bases and are free from pests and diseases.

Different crops require different spacings in the box. We shall do lettuce as an example.

Planting Lettuce

The following instructions are for planting the Trinity, Mignonette green, Mignonette bronze or Romaine varieties. These varieties will be planted at a spacing of 10 inches between plants on all sides. A standard size box will hold approximately 200 plants.



- Using your tape measure and chalk, mark off 10 inch intervals on the short side (4 block side) of the box. **You must however, make the first mark 5 inches from the inner long side of the box.** The second mark is made at 10 inches from this mark or 15 inches from the side of the box. The third mark will be again 10 inches from this mark or 25 inches from the side of the box. Continue this process. And your last mark will be 5 inches from the other inner long side of the box. In all you would make six marks as shown in photo.



Along the length of the box (longer side), follow a similar procedure.

- Make the first mark 5 inches from the inner short side of the box and make a mark every 10 inches thereafter. You should end up with 35 marks.
- Do the same on the opposite side of the box.



- Get a piece of wood (a 5-foot long broomstick works well) and make markings on it that correspond to the markings for the short sides.
- With the help of an assistant, or by yourself if able, move the marked stick between the marks made on the long sides as shown in photo. The seedlings will be planted next to the marks on the stick.
- Make the holes for planting over the entire box. These should be about 2-3 inches deep and not more than 2 inches wide. This is sufficient to accommodate the base of the seedling that will come out of the tray. A short piece of broomstick about 6 inches long works well.



- Place one seedling in each hole and draw some of the media up against the base of the stem and gently “firm-up” with your fingers.
- **The roots alone should be in the soil-less mixture with the base of the plant and leaves standing proudly above the mixture.**



When the entire box is planted, everything should be neat and in straight lines. The straight lines are necessary to help you fertilize easily and the neatness makes your project pleasing to the eyes and the envy of your friends!

Tip: *Ensure that none of the planting medium gets into the centre of the plant.*



- Finally, water the seedlings in the box thoroughly using water from a tank or drum. Stop when you see excess water running out between the spaces in the blocks. It is now well watered!

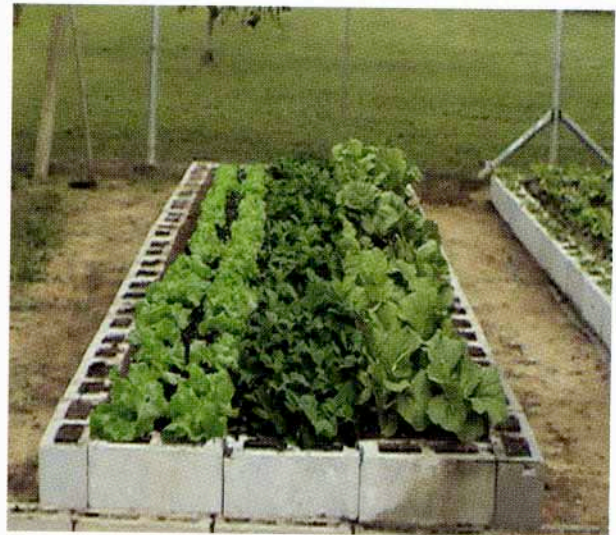
Tip: Always plant in late evenings. This gives the seedlings time to settle in without the stress of the daytime hot sun.



Several Crops in One Box

It is quite possible to plant several crops in the same box. Plant the vegetables that you need for home use.

- You must however, use the recommended spacings and fertilizers for each crop.
- Plant chives, celery and other seasoning herbs in the spaces at the top of the blocks.
- Plant crops at different dates so that you have a continuous supply of fresh vegetables.



Managing your Crops

Once your crop has been planted you need to:

- Observe your crops daily
- Water as needed
- Fertilize regularly
- Monitor for any pests or diseases
- Top-up boxes occasionally
- Harvest timely

Observations

- You must ensure that the plants do not wilt and there is sufficient moisture in the box at all times.
- You also have to look for first signs of any pests or diseases, as well as the general growth and progress of the crop.



Tip: Keep records of planting dates, variety of crop, fertilizers and pesticides used, all monies spent, value of harvested crops and other records as necessary.

Watering

- Bagasse dries out quickly, so keep a close watch on your boxes and water your crops as needed. Under no condition should you allow your crops to go without sufficient water or else the delicate roots will “dry-up” in the heated bagasse. **Remember, do not use water directly from the taps. Use only water that has been standing (drums or tanks) for at least 4-6 hours.** Simple irrigation systems could also be constructed.

Watering in the dry season

Each standard size growbox will require one barrel (45 gallons) of water each day in the dry season.

- Water about three times per day, that is, morning, midday and evening.

Tip: To avoid problems due to fungus, avoid watering in late evening or night.



- Boxes can be watered using a watering can or a hose that gets water from a tank and possibly a pump.

Watering in the rainy season

- Watering should be done only if there are long dry spells in the rainy season.

Topping up

Bagasse breaks down overtime in the box and you will need to restore the box to its original capacity by “topping up”.

- Top-up with bagasse alone, since sharp sand does not break down. This may be necessary after about 4 to 6 months.

Tip: To know if your box is adequately watered, stick your fingers down about 2 inches in the bagasse mix. If it comes out moist you have sufficient water. If not, you need to apply water.



Growbox systems operated as small businesses



Pests and Diseases

Mole crickets live in the soil and cut the stems of seedlings below the surface of the mixture.

- If you suspect your area is infested with mole crickets, treat your growbox mixture with a soil insecticide just before you plant your seedlings. If your area is not prone to mole crickets, you should still look for the tell tale signs during your daily observations.
- You may encounter spots or browning on the lower leaves of the lettuce. This is more likely to occur in the rainy season. If your crop is almost ready for harvest, you may not need to spray any chemicals to control. If however your crop is in early stages of growth, you may need to apply a fungicide at the correct rate. Consult the Extension Officer for further advice on pest and disease control and management.



Tip: *Spray directly the undersides of the leaves.*

Look out for **leaf miner** damage especially on patchoi. These are tiny insects making trails on the upper surface of the leaf as in photo. You may need to:

- Apply an insecticide if the plants are still young and many leaves and plants are affected.
- If plants are almost at harvest stage or only few plants are affected, it may not be necessary to apply insecticides.



***Tip:** Make your own notes in the pages provided at the back of this manual, about various pesticides available for use and rates of application.*

Natural Pesticides

- There are natural pesticides available for use. These are ideal if you are health conscious and quite appropriate if you have a small growbox system.
- Some natural pesticides can be made from Marigolds, Neem, Garlic, Wood Ash, and Peppers. Further information is provided at the end of this manual.

Tip:** Pesticides are natural or chemical agents used to kill plant pests and diseases. **Less is best.** Try to use as little pesticides as possible in the production of your crops. **Use all pesticides at the recommended rates.

Pesticides are Dangerous

Here are some guidelines to follow for the safe handling of pesticides:-

- *Only purchase pesticides in labelled containers.*
- *Choose the right pesticides for the job.*
- *Buy and use the least toxic pesticide.*

When Using Pesticides:

- *Carefully follow all instructions on the container.*
- *Wear protective clothing, mask, and eye protection when spraying.*
- *Choose a calm, wind-free time of the day to spray.*
- *Do not spray near children and pets. Keep them away from sprayed areas.*
- *Follow the restricted time for re-entering an area after a pesticide has been applied.*

After Using Pesticides:

- *Wash hands and face thoroughly. Wash all clothing used.*
- *Keep **all** pesticides locked up, out of sight and reach of children and pets.*
- *Keep the pesticide stored in its original container - do not transfer a pesticide to a food or drink container.*
- *Store pesticides away from food, including pet food and livestock feed.*
- *Dispose of empty pesticide containers and unused pesticides properly.*

In Case of Poisoning:

- *Contact your Doctor or nearest health centre immediately if a pesticide comes in contact with your skin, is inhaled or swallowed.*
- *Carry the pesticide container with you if you have to visit a doctor or health facility.*

Use Extreme Care Always!

Fertilizing your Plants

Bagasse and sharp sand have little or no nutrients, therefore you will need to supply the plants with all their nutritional requirements by using fertilizers.

Fertilizing Seedlings

- If you have purchased your seedlings and you have to keep them for a few days before you transplant them, seedlings may be watered daily with a weak fertilizer solution.
- **Mix 1 gram of 20:10:10 fertilizer in 1 litre of water and wet your plants. Water the entire plant and soil!**

***Tip:** 1 gram per litre of water works out to be approximately 1/2 teaspoon of fertilizer in a 2 litre (soft drink) bottle.*



Crops as they Grow

In the wet season, apply the salt dry or “dry salt”, whereas in the dry season, it is preferable to “wet salt” that is, dissolve the fertilizers in water and apply.

Recommendations for lettuce and Patchoi

Dry Salting

- Prepare a mixture of **3 lbs 12:12:17:2 fertilizer and 1 lb calcium nitrate.**
- Mix well and apply 3 gm to each plant, seven days and 14 days after transplanting.

Tip: 5 grams of fertilizer is approximately one full cover of most plastic soft drink bottles.



Wet Salting

- **Mix 9 oz of 12:12:17:2 fertilizer and 3 ozs of calcium nitrate in 45 gallons of water (one barrel).**
- Use this to water your plants in the boxes twice each week for two weeks after transplanting, giving each plant one (1) litre of solution at each watering. You must continue to wet your plants with water even though you do “wet salting”.

Harvesting

Your lettuce should be ready for harvest about 28-30 days after you planted them. Patchoi will take about 20-24 days to be ready for reaping.



Using a sharp, clean knife cut the plant at the roots just below soil level. Turn over and trim off the bottom leaves if they are diseased and shorten the stem. Wash in clean water and rinse in a solution of one teaspoon of bleach in one gallon of water. Pack in a clear plastic bag and store in cool conditions, e.g., the chiller in the refrigerator or sell as soon as possible.



Information for other Crops

Fertilization of Non-Leafy Crops e.g., Tomato and Pepper

Dry Salting

Prepare the fertilizer mix as follows:

5 lbs of 12:12:17:2

4 lbs of 9:6:46 and

1 1/2 lbs of urea

9 lbs of calcium nitrate and

5 lbs of magnesium sulphate

- Mix well and apply 2 lbs to the plants in a standard size box immediately after transplanting.
- Two (2) days later, apply 1 1/2 lb of urea to the plants in a standard size box. From the 5th day after transplanting and once per week thereafter, apply 2 lbs of the mix per box until the flowers and fruits appear. Thereafter, apply 2 1/4 lbs per box.

Wet Salting

In the early stages 1lb of the above mix in 45 gallons of water can be used to wet one standard size box.



Summary of Fertilizer Requirements

The table below details the Fertilizer Formulations for leafy and non-leafy or fruiting crops.

	Type of mix	Crop type	Ingredients	Bulk Mix (lb)
A	Pre-plant	All	12-24-12 9-6-46 Urea Magnesium Sulphate Limestone	6 1/2 1 1 2 5
B	Weekly Feed	leafy	12-12-17-2 Calcium Nitrate	3 1
C	Weekly Feed	Non-leafy	12-12-17-2 9-6-46 Urea Calcium Nitrate Magnesium Sulphate	5 4 1 1/2 9 5

Source: Simon Bedasie, Agronomist, Research Division, Centeno

Useful Information

1. Costing your Grow Box Enterprise

Factsheet by W. Ganpat, available at the Farmers Training Centre

2. Making Natural Pesticides

Source: Fuglie, L.J. 1998 Producing Food without Pesticides. CTA/CWS Publication.
Course Handout available at the Farmers Training Centre

3. Varieties and Spacings for Vegetables in the Growbox System

K. Sooknanan, Farmers Training Centre
Course Handout available at FTC

NOTES

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