Handbook on **Nutrition Home** Gardenin

Assisting Communities in Creating Environmental and Nutritional Development (ACCEND) Project

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In collaboration with

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TABLE OF CONTENTS

Foreword Preface Introduction	ii iii iv
Nutrition Home Garden	1
Advantages of a Nutrition Home Garden	2
Essential Elements of a Nutrition Home Garden	3
Equipment Needed	4
Planning for a Nutrition Home Garden	4
Soil Preparation	5
Water and Soil Management	6
Traditional Knowledge and Indigenous Wisdom	7
 Application of Traditional Knowledge & Indigenous Wisdom in Nutrition Home Gardens 	10
Seed Conservation	11
Mitigation of Challenges in the Dry Zone	13
Mitigation of Challenges in the Wet Zone	13
Preparation of Organic Fertilizer and Insect Control Methods	14
 Jeevamuthrutham	14 15 16 17 18 20 20
Pests and Disease Control	21
 Identification and control of pests Types of damage caused by pests 	21 22
Crop Ailments	24
 Identification of fungal disease	24 24 25 25 26
Additional Organic Control Preparations	27







FOREWORD

Ancient agriculture in Sri Lanka was very much in tune with nature, and the natural cultivation methods were sustainable and environmentally friendly. In line with the Buddhist background of the country, farmers of the past used such methods and adhered to auspicious timings rooted in a strong foundation of ancestral knowledge, experience, and a traditional belief system.

After Sri Lanka was colonized, plantation crops were introduced to the country. Until plantation crops began to spread in the country, Sri Lanka had more than sufficient lands to cultivate food crops. With the advent of large-scale plantation crops, lands available for food crops became limited. With the arrival of large numbers of foreign laborers to work in the plantations and the rapid increase in population, the demand for food crops increased. As a result, food items were imported, and the self-sufficient lifestyle of the locals were disrupted. From that point onwards, various measures were taken to meet the increasing demand for food.

New crop varieties and agricultural inputs such as chemical fertilizer and agrochemicals that were introduced with the revolution in the 1960s have, to a great extent, helped reach these targets of meeting the said demand. By now, the country has become self-sufficient in rice and maize. The goal is to be self-sufficient in major crops such as green gram, black gram, chilies, finger millet, cowpea, groundnut, sesame, soya, potato, big onions and red onions.

However, in our attempts to reach these goals, our carelessness and irregular practices have had detrimental effects on the environment. Compared with other countries in the South Asian region, Sri Lanka is known for its heavy usage of agrochemicals and chemical fertilizers.

Activities by farmers who prioritize maximum income over comparative profit with the fertilizer subsidy have exacerbated the situation. The initial impact of irregular farming by humans is felt by the environment around us. Water pollution, extinction of fish species, extinction of useful insects, amphibians and birds, development of resistant diseases and pests, and increased atmospheric temperature are some detrimental outcomes of such activities.

The general practice of most farmers is to administer fertilizer and pesticides at will rather than administering fertilizer based on the requirement of the crop or administering pesticides when pests start causing a potential economic loss. As a result, they waste money while adding large quantities of fertilizer and pesticides to the environment. This book will be instrumental in encouraging farmers to move away from such irregular farming practices and to encourage them to engage in environmentally friendly organic agriculture. I highly appreciate the support extended by the European Union, ADRA and Oxfam through the ACCEND project to publish this book.

A.H.M. Abeyrathne

Commissioner General Department of Agrarian Development



ii

PREFACE

Assisting Communities in Creating Environmental and Nutritional Development (ACCEND) is a 57-month project run jointly by ADRA and Oxfam since 2017. Funded by the European Union and implemented in the three districts of Matale, Nuwara Eliya and Monaragala, the project benefits over 300,000 individuals in 55 estate and rural communities with the objective of improving their health, hygiene and nutrition. This is to be achieved by strengthening the communities and public institutions through a mutually accountable service delivery system in water, sanitation, health and nutrition.

The purpose of the Nutrition Home Garden (NHG) activity was to contribute towards the reduction of malnutrition in children under age 5 in vulnerable communities. The NHG activity promotes organic food production within a 20'X20' garden and provided technical guidance in organic cultivation, essential gardening tools, seeds, and plants. A total of 1500 home gardens were established in the three districts under the project.

The ACCEND project defines the NHG as "a well-developed farming system that combines physical, social and economic functions of the space surrounding the family house, maximizing on the available natural resources while incorporating organic farming techniques to produce a variety of safe (free from agrochemicals) and nutritious foods to meet the non-staple dietary needs of a family all year through." The focus of the Nutrition Home Garden is "FOOD FIRST". It includes sufficient plant varieties of vegetables, fruits, roots, tubers, legumes, medicinal herbs, spices, and, if possible, farm animals, bees, and fish to contribute towards healthy eating choices. A well-planned and utilized NHG will help improve the family's nutritional status and also serve as a model for the community. The knowledge shared through the technical trainings provided by the project on organic home gardening is condensed into this handbook to help the reader design a systemic garden where the focus is on nutrition.

On behalf of the ACCEND project, ADRA and Oxfam, I would like to express my appreciation towards the EU delegation for making this handbook possible.

I hope you will find this resource enriching in contributing to better health and nutrition for your household and community.

Visaka Wickramarachchi *Project Director – ACCEND Project* ADRA Sri Lanka



iii

INTRODUCTION

The Nutrition Home Garden (NHG) activity, one of the main health interventions under the ACCEND project, started in the year 2017 in 10 selected Grama Niladhari Divisions of the Wilgamuwa Divisional Secretariat Division to improve the nutritional status of children under the age of 5 years and to ensure food security, protect soil fertility, and conserve biodiversity through the promotion of organic farming.

Two-hundred families that had children under the age of five identified by MOH as being underweight and had an interest in organic farming were selected as beneficiaries of the program. Under the project, the families were provided with seeds, tools, and training on organic farming methods, and engaged in continuous follow-up to ensure continued interest and skill improvement of the beneficiaries.

As a result, many people in this Divisional Secretariat Division are reaping the nutritional benefits of the increased availability of local fruits and vegetables in their communities. The families that engage in organic farming testify to the environmental sustainability of this activity. By administering organic fertilizer and pest control methods introduced to them by the organic farming consultant of the project, instead of administering agrochemicals, they have proven that successful cultivations can be maintained through such means.

This handbook is the result of two years of engagement, study and practice with project staff and Mr. Laleendra Yasamal, the organic farming consultant and the author of this book. It was a privilege to be a part of the team that contributed to this endeavor.

iv

Rasika Fernando

Project Manager (Wilgamuwa DSD) – ACCEND Project ADRA Sri Lanka



NUTRITION HOME GARDEN

An area of cultivated land surrounding one's home is called the 'home garden'. In the past, the gardens in Sri Lanka were full of medicinal plants, fruit trees, jackfruit and breadfruit trees, spice plants such as pepper and cinnamon, vegetables, cereal crops, yams, green leaves and flowers. This enabled the ancient people to maintain their food security and food sovereignty. The three main components of the farming system tied with the Sri Lankan agricultural heritage were the paddy fields, *chena* cultivations (traditional cultivation carried out in rainfed lands) and the home gardens. Home gardens played a vital role, even in paddy cultivation and *chena* cultivation in producing and conserving the seeds needed. These activities would be carried out collectively by all members of the family in the household, creating a robust family unit that is united and in good health.

Note: Please refer to Page iii: Preface for ACCEND Project's definition of a Nutrition Home Garden (NHG).



Figure 1: Impact of the use of organic fertilizer and chemical fertilizer on soil



ADVANTAGES OF A NUTRITION HOME GARDEN

- 1. Availability of nutritious and safe food (fruits, vegetables, herbs, greens, etc.).
- 2. Ability to recycle bio-degradable waste from one's household.
- 3. Potential to reuse plastic bottles and bags creatively and productively in the home garden.
- 4. Improved social and mental wellbeing of family members.
- 5. Provide opportunities for physical activity for family members.
- 6. Enhanced creativity among members of the family; ability to spend their free time productively; improved team spirit among family members.
- 7. Positive impact on the economy of the family.
- 8. Transference of the knowledge and experience of the older generation to the younger generation.
- 9. Children gain experiences useful to their school education.
- 10. Potential to try new technologies.
- 11. Ability to record and analyze rainfall patterns, food consumption and expenditure patterns of the family, etc.
- 12. Ability to gain experiences on responsibility and accountability (on decision making, team spirit, empathy).
- 13. Positive impact on conserving the soil biodiversity.
- 14. Positive impact on soil conservation.
- 15. Contribution in reducing climate change.
- 16. Support to promoting crop diversity and food security.
- 17. Contribution to enhancing the country's food security.
- 18. Supporting the conservation of local seed varieties for the future.





ESSENTIAL ELEMENTS OF A NUTRITION HOME GARDEN



Figure 2: An example of a Nutrition Home Garden

- Vegetables
- Yams
- Medicinal plants
- Spices
- Green leaves
- Fruits
- Flowers

- Bee box
- Bio fence
- Water sources
- Fertilizer unit
- Plant nursery
- Chicken coop for eggs





EQUIPMENT NEEDED

- 1. Foot wear (Shoes/ boots)
- 2. Gardening fork
- 3. Rake
- 4. Garden shears
- 5. Mammoty
- 6. Bucket
- 7. Polythene bags/ pots
- 8. Gloves
- 9. Wheelbarrow
- 10. Watering can
- 11. Knife



Figure 3: Home gardening tools

PLANNING YOUR NUTRITION HOME GARDEN

- 1. Inspecting the geographical features of the land,
- 2. Apply soil conservationmethods,
- 3. Water conservation and management in place,
- 4. Identifying the level of nutrients in the soil,
- 5. Proper management and utilization of natural resources,
- 6. Planting crops that suit land and environmental conditions,
- 7. Choosing suitable places for a plant nursery and fertilizer unit,
- 8. Planning for pest and disease control,
- 9. Creating a bio fence, and
- 10. Planning to establish animal husbandry units.





SOIL PREPARATION

1. Studying the geographical features of the land

Existing slopes, mounds, etc. in the land can be levelled to prepare raised ground beds, supported raised beds, and containerized beds for your plants.

2. Soil conservation



Figure 5: Canopy-layering of crops

3. Identifying the soil strength



Figure 4: Preparing beds according to existing *geographical features*

Mulching, canopy-layered cropping, creating soil mounds and drains are ways used to prevent soil erosion and to protect soil from heavy rainfall.

Building rock barriers and wooden stick barriers

The following exercise can help you identify soil hardness to help prepare your soil.

- i. Take soil from your garden, mix it with some water, and press lightly into the coconut shell to form a 'kom pittu' (soil mound).
- ii. Take one measure of soil and mix it with one measure of rice hull and a sufficient quantity of water. Press it lightly into the coconut shell to make a 'kom pittu'.
- iii. Take one measure of soil and mix it with two measures of rice hull and a sufficient

quantity of water. Press it lightly into the coconut shell to make a 'kom pittu'.

Observation:

- Drop each soil mound from the same height. The first kom pittu should remain a solid • mound.
- The second kom pittu will break into a few pieces
- The third *kom pittu* will break into much smaller pieces.

This test helps you identify the type of soil in your garden and the degree to which it can be loosened with rice hull: for better water and oxygen absorption and drainage, supporting root growth.







Figure 6: "Kom pittu" (soil mound) test



slow down the speed of water flow on the soil.

WATER AND SOIL MANAGEMENT

During rainfall, water flows rapidly in strong currents from higher ground to lower areas of the land. This can result in soil erosion and wash away essential nutrients in the soil. When water flows rapidly over bare ground, there is no time for the soil to absorb water, causing in

soil dehydration during dry seasons. The following recommendations can be applied to overcome this issue which can otherwise have unfavorable consequences to your cultivation:

- Making soil mounds and stone barriers in different places in the garden to slow down the water flow and give the soil time to absorb it.
- Make gutters in the gardens with the dimension of 3ft height and 2 ft width (ensuring they are not a hazard to children and adults) to allow rainwater to accumulate and release gradually into the soil.
- Mixing carbonized rice-hull and other organic material into the soil and loosening it to enhance water absorption into the soil.
- Substantial tree canopy coverage in the garden can reduce the speed of raindrops falling on the soil, facilitating better absorption of water and reduction of soil erosion.
- Rainwater harvested from the roof can be used for cultivation during the dry season.
- Creating a small system of ponds to collect water in pools with proper steps taken to prevent mosquito breeding.









Figure 7: Methods of preserving soil moisture





TRADITIONAL KNOWLEDGE AND INDIGENOUS WISDOM

Interventions made using traditional knowledge and indigenous wisdom enabled farmers in ancient times to overcome nutrient deficiencies in soil, control pests and minimize damage by wild animals to their crops.

To prevent fungi from developing in the soil and damaging it during times of heavy rain, farmers in the olden days used to sow finger millet seeds together with mustard seeds. When finger millet and mustard seeds start growing together, the sulphur that is added to the soil from the roots of mustard plants will control the growth of fungi in the soil. Furthermore, mustard, and sunflower plants add the highest amount of sulphur to the soil while they are blooming. Therefore, burying mustard or sunflower plants during that time can also be helpful to prevent fungi.

Planting a watermelon seed or a chili seed together with a mustard seed will ensure that crops grow alongside mustard plants, and the roots of the mustard plant will contribute to controlling fungi in the soil and helping the crops grow. This scientific technique can be incorporated into your home garden.

In addition to this, it was believed that using the farming calendar and engaging in agricultural activities such as making a fence, preparing a plant nursery, making beds and sowing on *Sinha karana* and *Divi karana* days in the farming calendar will minimize damages from wild animals (e.g. elephants, wild boar, peacocks, monkeys, etc.).

Details of how ancient wisdom about the waning and waxing moon that can be used when engaging in home garden cultivation to identify which dates and times are suitable for various activities in your cultivation are given below.

Note: Some methods may not have been be scientifically proven; however, they are included here for your reference.



Figure 8: Moon cycle



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The above Sinhalese poem identifies fifteen stages of the moon. Each stage is assigned an animal.

	Waxing moon	Waning moon
1. Pelawiya	Lion	Boar
2. Diyawaka	Boar	Elephant
3. Thiyawaka	Elephant	Rooster
4. Jalawaka	Rooster	Leopard
5. Wiseniya	Leopard	Goat
6. Setawaka	Goat	Cow
7. Sathawaka	Cow	Lion
8. Atawaka	Lion	Swine
9. Nawawaka	Swine	Elephant
10. Dasawaka	Elephant	Rooster
11. Ekoloswaka	Rooster	Leopard
12. Doloswaka	Leopard	Goat
13. Theleswaka	Goat	Cow
14. Thuduswaka	Cow	Lion
15. Pasaloswaka	Lion (Poya Day)	Swine (Amawaka)



- Agricultural activities were carried out only on *sinha karana* (lion) and *divi karana* (leopard) days.
- The day after the full moon day is identified as 'awa palaweni' day in the poem above. Accordingly, each day can be identified by following the poem. The day after the amawaka day is identified as pura eka day.

How to know if the dry season is nearing its end:

- When the roots of dead flame lily plants begin to re-germinate, it is nature's signal that the rains are coming. Rain starts in different areas when the flame lily plants sprout 5-8 leaves. Farmers make sure that their soil is prepared and ready for planting by that time.
- 2. Heavy rains begin when the flame lily plants begin to bloom. The soil is waterlogged during this time.



Figure 9: Flame lily plant

There is less oxygen for the roots. With a high pH level, the soil is acidic. Ancient farmers called this period the *tiththa* (bitter) period. Planting seeds or saplings during this time will result in the death of such plants as the roots will not activate properly. Plants are prone to fungi diseases. (Usually, no planting is done during this time.)

- 3. Planting crops that strengthen nitrogen in the soil (e.g. long beans, green gram, groundnut) as a mixed crop will ensure that the soil does not lack nitrogen and that it has a living roots system.
- 4. Plants such as vetiver, marigold, holy basil and citronella grass can be planted as insect repellents.



Figure 10 - Insect repellent flowers and plants (Vetiver, Marigold, Holy basil, Citronella)

5. When spiders start making webs in the horizontal direction, this signals that there will be no rain. However, when the spiders make vertical webs, it signals the coming of the rains. Therefore, mulch must be removed and preparations to let the excess water drain from the land must be made. Fungicidal measures must also be arranged.



Figure 11 – Vertical Spider webs





Application of traditional knowledge and indigenous wisdom in Nutrition Home Gardens

The agricultural practices of our ancestors were implemented parallel to the natural cycles. They used natural changes in the atmosphere to their advantage:

- 1. Effects of the sun and the moon (scientifically, this means gravitational pull and light needed for photosynthesis),
- 2. Natural wind and rainfall patterns,
- 3. Leveraging the natural changes in soil from area to area, pH level in soil, pH level in water, climate and weather patterns, and
- 4. Engaging in sustainable agriculture by paying heed to geological features unique to each area and water supply sources.

Crops were planted only on appropriate days to minimize damage by wild animals and insects and to prevent diseases in the soil such as fungi from destroying the roots and seeds. The days suitable for planting were identified by following the calendar in the poem given above. This calendar follows the lunar cycle. In other words, ancient farmers had a regular calendar that would guide them for as long as there was the sun and moon. Preparing soil, making the fence, planting the nursery, and planting saplings and seeds only during *sinha karana* and *divi karana* days was a secret method adopted by them.

Indications of rain and dry spells from the birds

 Lapwings usually lay their eggs in dry areas of irrigation tanks towards the end of the dry season. If the lapwings have laid their eggs on the bund of the dam, it signals that there will be a lot of rain and the tank is going to be full during the rainy season. If the lapwings have laid their eggs somewhere in the middle of the dried-up irrigation tank, it means that there will be less rain and farming is going to be difficult.



Figure 12 – Lapwing bird

2. Weaver birds and other birds that nest in the vicinity of rivers and streams can also give an indication of the level of rainfall that will be received that year. If they have made their nests high up in the trees, it is a sign that there will be heavy rains. In that case, appropriate crops need to be planted to avoid rain-induced losses. If these birds have made their nests in the lower bushes, it signals the coming of a drought.



Figure 13 – Weaver bird



SEED CONSERVATION

These factors need to be taken into consideration in seed conservation:

- 1. Production of high-quality seeds
- 2. Seed preparation, and
- 3. Storage of seeds

1. Production of high-quality seeds:

To produce seeds of high quality,

- Suitable plants must be identified as mother plants and maintained;
- The healthiest and most robust plants from the cultivation must be selected to produce seeds. Seeds will be extracted from the fruits of these trees;
- Selected mother plants must be maintained well to produce quality seeds; and
- Two varieties of the same crop should not be planted close to each other when you plan to extract seeds from those plants.

Examples:

- i. Planting two varieties of maize in close vicinity of each other will result in pollination between the two varieties. Then, high-quality seeds cannot be produced.
- ii. Planting two varieties of chili in close vicinity of each other will result in pollination between the two varieties. Then, high-quality seeds cannot be produced.

2. Seed preparation:

After selecting the right mother plants and maintaining them, the following must be considered when seeds are prepared from its yielded crop.

- It is best to use the second and third harvest from the mother plants to ensure the quality of the seeds extracted.
- The first harvest from the mother plant should not be used as seeds.
- Harvest from the last stages of the mother plant should also not be used as seeds.

The selected fruits must be allowed to mature and ripen, and in some cases, dry (e.g. long beans, ash gourd, eggplant). When the stem of the fruit dries, the fruits can be harvested and seeds can be prepared.



- i. Fruit from tomato, cucumber, eggplant and muskmelon have a fleshy outer layer around the seeds. Such seeds can be soaked overnight, making the fleshy layer easy to remove with your fingers.
- ii. Then, the seeds must be placed on a piece of clean cloth or white paper and dried for about three days before storing. You can allow the seeds to dry in a shaded location





for about three days. Seeds should not be directly exposed to strong sunlight as this may damage the seeds. However, seeds can be allowed to dry in 80% sunlight for one day, if necessary. Drying the seeds using proper methodology will prevent fungal infections.

Why is it not a good idea to dry the seeds directly on the floor?

Instead of drying your seeds on the ground, use a rack or some other structure to hold the seeds. If placed on the floor during the drying process, the seeds may attempt to sprout. This damages the seed and weakens the ability to sprout later when planted. Seeds require three main inputs to start



growing. If any one of these inputs is received, *Figure 14 – Main factors affecting seed germination* the seed will try to sprout. Therefore, preparing and storing seeds must be done with extreme care and attention to prevent this from happening.

iii. Storage of seeds

The following tips are important to store the seeds correctly once they have been harvested and prepared:

- Store in a cool, dry place
- Ensure the location is safe from fungi
- Prevent any damage from insects

When storing your seeds in a cool, dry place, the containers of seeds should be kept approximately 6 feet above the floor. If the containers are transparent (glass/ plastic), cover them with newspaper or place them in a box to avoid light (sun) to maintain the quality of the seeds. Seeds can also be stored in the refrigerator.



Figure 15 – Storage methods (Refridgirator, tight storage container and hang-drying)

The ingredients below can be used when storing the prepared seeds to help control fungi and insect damage. In addition, silica packets can also be used for moisture control.

- Dried margosa leavesDried lime leaves
- Vetiver root
- Citronella grass
- Turmeric powder
- Wood ashes





MITIGATION OF CHALLENGES IN THE DRY ZONE

Overcoming shortage of water and excessive dryness of soil:

- Using a soil medium that contains a mixture of organic material, carbonized rice-hull, and raw rice hull can loosen the soil to accommodate more moisture in the soil.
- Furthermore, drip irrigation and spray irrigation solutions can be used.
- Nets can be used to give shade and as protection against insects.
- During monsoon:
 - Prevent soil erosion digging drains, building soil barriers, mulching for soil conservation
 - Maintain tree canopy through multi-story cropping raindrops will fall on the branches and the momentum of raindrops will reduce.



Figure 16: Using minimal water for cultivation during dry season

MITIGATION OF CHALLENGES IN THE WET ZONE

- Damage due to heavy rains can be avoided with the use of poly-tunnels and covering with polythene
- Damage from dewdrops can be avoided through cultivating inside secure structures
- Using vertical space for cultivations (as the ground may be waterlogged)
- Keep fungicides ready at hand as there could be a lot of fungi damage.
- Using platforms and raised beds for cultivation
- Using hanging pots for cultivation





Figure 17 - Minimizing harm from the rain in wet zone



PREPERATION OF ORGANIC FERTILIZER AND INSECT CONTROL METHODS

The following organic liquid fertilizers and methods promote healthy microbes in soil and support earthworms to boost soil and plant health:

- 1. Jeevamrutham
- 2. Fish tonic
- 3. Cow Dung tonic
- 4. Fruit tonic

- 5. Spoiled-rice liquid
- 6. Carbonized rice-hull
- 7. Organic Compost (bin)

Spraying these liquid fertilizers diluted with appropriate ratio of water on the soil, foliage and branches of the plants will provide plants with necessary nutrients, promote microbe growth and control pests. In addition to fruit and vegetable plants, these liquid fertilizers can also be used in paddy cultivation as it can bring many benefits.

Preparation of Liquid Fertilizer

1. Jeevamrutham

Materials:

•	Fresh cow dung from native cattle	2kg
•	Urine from native cattle	1L
•	Gliricidia leaves	2kg
•	Sugar or jaggery	2kg
•	Quality compost (or dark soil from the forest)	2kg
•	200 L plastic barrel	1

Instructions:

Fill half of the barrel with water and add cow dung, cow urine and gliricidia leaves. Mix well using a wooden stick. Next, add sugar and high-quality compost and mix well. Fill the rest of the barrel with water. Place barrel away from direct sunlight and rain. Place two wooden sticks across the mouth of the barrel and place the lid on top of it. (Cover the mouth of the barrel with a piece of mosquito net to prevent entry of insects and promote oxygen circulation). Three times a day, use a wooden stick to stir the mixture well (or keep a fish tank oxygen aerator running 24 hours). After 5 to 7 days, strain the mixture and store it in a bottle. One week before planting, add this mixture to the beds and cover with mulch. The beds are ready for planting after 7 days. This fertilizer can also be added to the beds mixed with water at 1:5 ratio once a week. This mixture can be used for soil treatment and serves as growth promoter and pest controller.





Figure 18 – Jeevamrutham preparation

2. Fish Tonic

Materials:

•	Sea fish or fish off-cuts	2kg

• Plastic barrel with water 200L

Instructions:

Chop the fish into small pieces and add to the barrel with water. Fill the barrel to the brim and keep the lid off. Cover the mouth of the barrel with a mosquito net to prevent flies from getting in. Place the barrel away from direct sunlight and rain. Place two wooden sticks across the mouth of the barrel and place the lid on top of it. Two to three times a day, use a wooden stick to stir the mixture well. There will be a strong odor for about 5 days, so it is better not to keep the barrel inside the house. To control the smell, chop a pineapple with peel (500g/ 600g) and add it to the barrel on the first day. When the barrel is not fully closed, oxygen from the environment will enter into the mixture and nutrients will be produced. After 21 days, strain the mixture and combine one part mixture with 10 parts water (1:10). Add it to the leaves, plants and soil in the evening or in the morning before 7 a.m. using a spray bottle. This boosts growth and controls pests. It is a good stimulant for vines.







3. Cow Dung Tonic

Materials:

- Fresh cow dung 4L buckets x 4
- Gliricidia leaves 4L buckets x 8
- Gandapana leaves 4L buckets x 8
- A handful of Drumstick leaves
- Yoghurt cupful of quality compost
- 200L plastic barrel

Instructions:

Fill half of the barrel with water and add the above ingredients. Mix well using a wooden stick. Fill the rest of the barrel with water. Mix again and keep the barrel away from direct sunlight and rain. Cover the mouth of the barrel with a piece of mosquito net. Place two wooden sticks across the mouth of the barrel and place the lid on top of it (so that the mixture gets sufficient oxygen). Two to three times a day, use a wooden stick to stir the mixture well. After 30 days, strain the mixture and add water (1:10 ratio) to prepare a spray mix that can be sprayed on the leaves and soil in the morning or evening. This fertilizer is a growth booster, soil treatment and pest controller.







Figure 20 - Cow dung tonic Preparation

4. Fruit Tonic

Materials:

- Ripe banana
- Ripe papaya
- Ripe pumpkin
- Sugar or jaggery 1.5kg

•	Eggs	1
•	Water	10L
•	20L plastic container	1

Instructions:

Peel the banana, papaya and pumpkin. Chop them into small pieces and add to a plastic container with sugar. Mix well. Add the egg and 10 liters of water and mix well. Close the lid and keep it for 45-50 days. Strain the mixture. Add 1 L of the fertilizer with 20 L of water and spray it on soil and foliage in the evening. This can boost the growth of the crop. It also acts as a pest control agent.

1.5kg

1.5kg

1.5kg







Figure 21 – Fruit Tonic preparation

5. Spoiled-Rice Liquid

Allow leftover/cooked organic rice from the pot to spoil. Once the rice is spoiled, add one cup of rice to 5 cups of water in a plastic container and keep the container lid open. You can cover the mouth of the container with a piece of mosquito net. After 24 hours, squeeze and strain the mixture. Add 7 L of water to 1 L of spoiled rice water and administer it to the foliage and soil of the cultivation. Adding this fertilizer to the beds a week prior to planting the saplings will improve the soil. This mixture can control pests (especially the fall armyworm and the mealybug). This mixture can also be used to cure all diseases that afflict the curry leaf trees. When added to soil, this mixture supports earthworm growth and microbial growth which loosens the soil.

- Spoiled rice water kept for longer than a week should be mixed with 10 liters of water before spraying.
- Provides nutrients necessary for paddy cultivation.

All the liquid fertilizers mentioned above can be made in 5 L containers. The quantity of ingredients must be adjusted accordingly. If you want to make a larger quantity of the spoiled rice water, cook 2 kg of rice and let it spoil. Mix the rice with water in a 200 L barrel and cover the mouth of the barrel with a mosquito net. This can be utilized after a week.





19

Figure 22 – Spoiled rice water preparation



6. Carbonized Rice Hull

Carbonized rice hull is made by partially burning dry rice hull using embers/fire. This burnt residue can be mixed with regular fertilizer mix and kept aside for 2 weeks before mixing it in the soil. This is a very good soil fertilizer and conditioner as it contains Phosphorous (P), Potassium (K), Calcium (Ca), Magnesium (Mg), micronutrients vital to growing crops and helps control excessive acidity. It also helps loosen the soil to improves soil water absorption and soil air circulation.

7. Compost Bin Preparation

In a shaded area away from the roots of any trees:

- 1. Mark a circle with a diameter of 4 feet.
- 2. Take gliricidia sticks with a height of approximately 5 feet and stick them in the ground, in the shape of the marked circle. The gap between gliricidia sticks should be about 2 inches. Keep a gap big enough to insert the mammety in one place.
- 3. Take a few supple gliricidia sticks and tie them around the vertical sticks to form a ring to sturdy the bin.
- 4. About 2 feet away from the bin, lay coconut husks around the diameter of the bin.
- 5. Add organic material such as the trunk of banana plants to the bottom of the bin. Keep adding leaves collected from sweeping the compound, food waste from the kitchen and fresh foliage as well.
- 6. After adding everything to the bin, press down firmly with a wooden stick. If the mixture appears too dry, some water can be added to maintain moisture.
- 7. If the gliricidia sticks that make up the bin start to grow branches, break such twigs off and add to the bin.
- 8. You can plant green leaves and other crops among the coconut husks laid around the bin.
- 9. Once the leaves and waste begin to degrade, use the mammety to scrape the compost from the gap that was kept open for this purpose.

What can be added to the compost bin?

- 1. Leaves collected from sweeping the compound
- 2. Dried leaves
- 3. Fresh leaves and branches
- 4. Trunks of banana plants

Figure 23 - Making the compost bin

- 5. Straw
- 6. Weeds and grass that are cleared from the compound
- 7. Cow dung, goat and chicken droppings





PEST AND DISEASE CONTROL

Any pest or insect becomes destructive when the pest population increases. If several generations of the pest have developed in a home garden, the damage to the crop could be extensive. Diseases also spread in the same manner. Some trees are hosts for specific insects or diseases.

If the limited space in the home garden is occupied by a mixed cultivation, it becomes harder for pests to depend on host plants and harder for their longer-term sustenance. On the other hand, constant checking and taking immediate treatment and action at the sight of any potential outbreak is very important for prevention. Appropriate organic treatments can be used to achieve successful results.

Furthermore, the nutritional status of the plants in your home garden is very important. Therefore, it is good to be attentive towards the nutrient needs of the plants. A home garden has a variety of plants that have varied nutritional needs. Therefore, adding nutrients to the soil should depend on the specific needs of each plant variety. When planting different crops, attention must be focused on the needs of each plant variety (so that it will not create any competition).

It is equally important to have the ability to identify the type of pest or disease properly so that appropriate treatments can be administered. There are three types of damage caused by pests:

1. Identification and control of pests

- a. Pests that feed on sap
- b. Pests that feed on leaves (feed/damage leaves)
- c. Pests that puncture fruit/ shoots

By observing the damage, it is possible to identify whether the issue is caused by pests or a nutrition deficiency. Then, proper treatment must be administered to get effective results. Assuming that all damage is due to pests and arbitrarily administering pest control products will not yield the expected results. It is important to diagnose the situation accurately and administer the proper treatment.



2. Types of damage caused by pests



Figure 24 – Types of damages caused by pests





- Pest insects Eats large pieces of leaves, blooms, shoots; may appear as if large pieces are peeled or scratched off; eats roots.
 E.g. Aulocophora spp./ Epilachna spp Mylabris spp./ Fleabeetle
- Pest caterpillars Damages leaves, fruits, trunk
 E.g. Spodoptera spp, Helicoverpa spp, Brinjal Shoot and Fruit Borer
- Pest bugs Bugs puncture leaves, fruits, shoots.
 E.g. Dysdercus Cingulatus; Riptortus spp; Brinjul Lace Bug
- 4. Larvae Swelling in the stems, swelling in the trunk, horizontal splitting, low growth, wilting, death

E.g. Okarapetiole maggot/ Gall Fly

- 5. Aphids Bores into the tree and drinks sap
- 6. Mites Drinks sap from the surface of the tree
- 7. Leaf Miners Eats the top and bottom parts of the leaves
- 8. Frankliniella Bores into tree tissue and drinks sap
- 9. Bemisia Tabaci Bores the tree and drinks sap
- 10. Melon fly Bores into fruit and lays eggs
- 11. Mealy Bugs and Scale Insects Bores into tree tissue and drinks sap
- 12. Leafhoppers Bores holes in leaves, drinks sap
- 13. Black cutworm Cuts young saplings
- 14. *Meloidogyne spp*. Low growth, rotting, dull color in leaves, low yield

Identifying these pests correctly and administering the above-mentioned liquid fertilizer and organic pest controllers will keep pests at bay. In addition to that, making the roots, trunk, leaves and fruit taste bitter to the pests will control them. Predatory animals can also control pests.





CROP AILMENTS

1. Identification of fungal disease

Arial parts of the plant may get powdery mildew, leaf rust, Anthracnose, fruit rotting and leaf spots

- The main symptom observable in trees would be yellow, brown and black spots appearing in leaves and fruits
- Fungus and mildew grows on it
- Roots at the base of the tree become thin, grow brown and have white fungus grown on it
- Leaves turn yellow; root growth slows down
- Parts begin to rot and die/ weaker saplings die
- Yield is reduced and crops die

Controlling fungal diseases

- Controlling soil moisture by ensuring that water is properly drained from the soil
- Exposing soil to sunlight and removing mulch
- Airing the soil
- Administering appropriate organic fungicides
- Adding burnt ash to the soil

2. Identification of bacterial disease

- a. Bacterial wilt
- b. Bacterial rot
- a. Bacterial wilt
 - Leaves start to wilt within a day while they are still green in color
 - Dead plants

Controlling bacterial wilt

- Turning the soil and solarizing the soil by exposure to the sun for 3 weeks
- Adding more organic material to the soil
- Sterilizing the nursery



b. Bacterial rot

Bacterial rot causes water-soaked spots and interior tissues beneath the spots to become mushy and discolored. It is accompanied by a strong, pungent smell.

E.g.: Cabbage (base of the leaves, trunk), tomato (fruit), chilli, capsicum (fruit becomes soaked and filled with water), leeks, water spinach leaves

Controlling bacterial rot:

- Improving water drainage, allowing more sunlight
- Uprooting and burning all infected plants.

3. Identification of viral and phytoplasma disease

Main symptoms of a viral disease

- Necrotic spots, abnormal dark green and light green mosaic and mottling of leaves, growth distortion, stunting, ring patterns or bumps on plant foliage
- Similar characteristics can be seen in fruits
- Dead plants

Symptoms of phytoplasma disease

- Yellowing leaves, stunted and rolled foliage
- Unripened shoots and fruits
- Loss of fruit/harvest
- A "witches' broom" appearance of the plant

Controlling viral disease:

- Covering the plants to prevent insect vectors
- Uprooting and burning infected plants
- Using healthy planting material

4. Management of Nutrients and Pests

- 1. Mixed crop cultivation
- 2. Crop rotation (Figure 25)
- 3. Cultivating resistant crops
- 4. Maintaining crop health



Figure 25 – Sequence of plant groups that can be rotated



- Using physical preventive measures (Covers/removal)
- 6. Repellent crops and substancesE.g.: marigold, citronella, vetiver, holybasil or fumigation using the same
- 7. Keeping birdbaths to attract birds
- Being attentive to the most suitable times for planting.

Using insect repellents:

Planting the following plants in various places or alongside the beds

- Marigold plants
- Zinnias plants
- Mexican mint plants
- Kappetiya plants
- Citronella grass
- Vetiver
- Lantana flowers
- Chrysanthemum
- Holy basil
- Mustard

The above organic and traditional treatment methods can also help to add nutrients and to manage pests.

5. Control of damage by fungi

1. Bordeaux mixture: -

5 liters of water Copper sulfate 10g Lime 50g Crush copper sulfate into a fine powder. Mix it in 1L of water. Mix lime with 1L of water.

Mix the two solutions together with the remaining 3L of water. Administer to cultivation and soil.



Figure 26 – Types of nutrient deficiencies in plants





- 2. Sprinkle soluble sulfur (on the soil/plant)
- **3.** Spray garlic water mixture
- 4. Mix 10 grams of copper sulfate with 7 liters of water and spray on soil and plants.
- 5. Spray Neem (Kohomba) extract (from seeds, leaves or bark) on soil and plants.
- 6. Plant mustard seeds, and when they start blooming, plough them and turn the soil.
- 7. Plant a mustard seed with your crop seeds.
- 8. When sunflowers bloom, plough them and turn the soil.

Additional Control Methods

Neem Extract Preparation

- Powder 50g of neem (Margosa: *Kohomba*) seeds and mix it with 1L of water. Keep it in a dark place for 12 hours and administer it to the cultivation (1:5 mixture ratio). Helps control fungi, worms, caterpillars, insects, crickets, borers, mites.
- 2. Powder 1kg of neem seeds and mix it with 4L of water. Keep it in a dark place for 3 days and spray on the cultivation (1:5 or 1:8 ratio).

Neem Leaves

- 1. Ferment Neem leaves and Indian Beech (*karanda*) leaves (young leaves) with fresh cow dung for 14 days and spray on the cultivation (1:5 ratio).
- Chop 1kg of Neem bark into ½ inch pieces and mix it with 3L of water. Keep it in a dark place for 3 days and spray on the cultivation and soil (1:5 or 1:8 ratio).

Turmeric and Cow Urine Mixture

- 1. Administer turmeric and cow urine at a 1:2 ratio to the cultivation to control caterpillars.
- 2. Ferment 1L of cow urine for 14 days in the sun and administer.
- 3. Bury underground a bottle of cow urine from the cap-down to reduce its strength and administer to the cultivation. This controls Frankliniella, caterpillars, mites.

Dashaparna Mixture

Take 10 or 8 leaves from Chinese chaste tree, Indian lilac, Malabar nut, Indian Beech, Ricinus, Soursop, Common nettle, Frangipani, *Kalawel*, Mexican mint, Holy basil, Lantana plants and pound it





all together and extract the juice. Mix 90ml of the juice with 5L of water and spray on the cultivation. This helps in stimulates crop growth and serves as an insect controller.

Red Onion Extract

In a clay pot, boil 2L of water and add 2 well-mashed red onions. Cover the pot with a piece of cloth and tie it tightly around the mouth of the pot. Keep for 24 hours and strain. Mix the blend with 20L of water and spray on the cultivation. This helps in controlling ants, crustacean insects and mites.

Soursop Leaf Extract

Pound 500g of soursop leaves and add it to 2 L of water. Boil the mixture until it reduces to ½. Strain and mix with 2 L of water when cooled. This helps in controlling whiteflies, aphids and mites.

Kalawel (Dalbergia Lanceolaria) Extract

Mix 20 ml of *Kalawel* extract with sugar. Soak strips of cloth with this mixture and place them alongside the border of the cultivation and inside the cultivation. This mixture helps in controlling the melon fly.



The ACCEND projects defines the NHG as:

"A well-developed farming system that combines different physical, social and economic functions of the space surrounding the family house, maximizing on the available natural resource while incorporating organic farming techniques to produce a variety of safe and nutritious food to supply the non-staple dietary needs of a family all-year through. The focus of the Nutrition Home Garden is "FOOD FIRST" and includes sufficient quantities of vegetables, fruits, root, tubers, legumes, medicinal herbs, spices, and if possible, farm animals, bees and fish to contribute towards healthy eating choices. A well-planned nutrition garden will improve the nutritional status of the immediate family and serve as a model for the surrounding community."

The goal of the project is to add to the knowledge possessed in communities and help design a systemic garden whose focus is on nutrition. This handbook aims to equip the reader with the tools needed to achieve this outcome.

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