

MANUAL OF LOW/NO-SPACE AGRICULTURE -CUM- FAMILY BUSINESS GARDENS



Thilak T. Ranasinghe

**MANUAL OF
LOW/NO-SPACE AGRICULTURE
-CUM-
FAMILY BUSINESS GARDENS**

Thilak T. Ranasinghe
B.Sc. (Agric.) Hons, M.Sc., Ph.D.

2009

RUAF Foundation, International Network of Resource Centres on
Urban Agriculture and Food Security

International Water Management Institute

MANUAL OF LOW/NO-SPACE AGRICULTURE -CUM- FAMILY BUSINESS GARDENS

Thilak T. Ranasinghe

ISBN: 978-955-51671-0-9

First Published: 2009

Publishers and Disclaimers

Publishers

This publication has been prepared with support from the “Cities Farming for the Future Programme” implemented by the International Network of Resource Centres on Urban Agriculture and Food Security (RUAF Foundation, www.ruaf.org), of which the International Water Management Institute is not only a full member but also the regional coordinator of the RUAF-CFF Programme in South Asia, (IWMI, <http://ruaf-asia.iwmi.org>), with funding from the Dutch Ministry of Foreign Affairs (DGIS, The Netherlands) and the International Development Research Centre (IDRC, Canada).

Disclaimers

The views and opinions expressed in this manual do not necessarily state or reflect those of RUAF or IWMI, and should not be used for advertising or product-endorsement purposes.

RUAF, IWMI or the author does not warrant or assume any legal liability or responsibility for the completeness or usefulness of products or processes mentioned in this manual.

**MANUAL OF
LOW/NO-SPACE AGRICULTURE
-CUM-
FAMILY BUSINESS GARDENS**

Contents

Dedication	vii
Foreword	viii
Acknowledgments	ix
Preface	x

PART ONE

TECHNOLOGY DEVELOPMENT IN LOW/NO-SPACE AGRICULTURE (L/N-SA)-CUM-FAMILY BUSINESS GARDENS (FBG)

I. Family Business Gardens (FBG) with Low/No-Space Agriculture (L/N-SA) in Urban Agriculture (UA)	02
I.1. What Is Urban Agriculture (UA)?	02
I.1.1 Broader Definition	02
I.1.2 From Simple Home-Gardening to Micro-Farming Ventures	03
I.2 The Conceptual Approach of FBG in Utilizing L/N-SA	04
I.2.1 Core of the FBG	04
I.2.2 Idea of the FBG	05
I.2.3 Home-Gardening Versus FBG	06
I.3 Implementation Process of the FBG in L/N-SA	07
I.3.1 Aims of the FBG	08
I.3.2 Expectation of the FBG	08
I.3.3 Process of the FBG	09

1.4 Components of the FBG that Promote L/N-SA	10
1.4.1 Family Nutrition	10
1.4.2 Technology Adoption	11
1.4.3 Crop Management	12
1.4.4 Post-harvest Technology and Value Addition	13
1.4.5 Landscaping and Housekeeping	14
2. Cultivation Structures for Optimizing Urban Space in L/N-SA	15
2.1 Cultivation Structures Suitable for Land Space	15
i) Cultivation Tower	ii) Cultivation Frame
iii) Cultivation Pyramid	iv) Cultivation Wall
v) Cultivation Arch	vi) Cultivation Bangle
vii) Cultivation Mat	viii) Cultivation Umbrella
ix) Cultivation Cage	x) Cultivation Consortium
xi) Cultivation Envelope	
2.2 Cultivation Structures Suitable for Building Space	38
i) Cultivation Tat	ii) Cultivation Ladder
iii) Cultivation Rack	iv) Cultivation Net
v) Cultivation Cradle	vi) Cultivation Holder
vii) Cultivation Tripod	viii) Cultivation Bag (Standing)
ix) Cultivation Shell	x) Portable Cultivation Tower
xi) Cultivation Trolley	
2.3 Cultivation Structures Suitable for Airspace	61
i) Cultivation Bottle	ii) Cultivation Lantern
iii) Cultivation Antenna	iv) Cultivation Bag (Hanging)
v) Air-Scape with Edible Matter	
3. Role of Cultivation Structures in L/N-SA	72
3.1 Factors Contributing to Maintenance of Cultivation Structures	72
3.1.1 Selection and Placement of Structures and Plants	72
3.1.2 Preparation of Growth Media for Cultivation Structures	74

3.1.3 Protection from Pests and Application of IPM Strategies	75
3.1.4 Concern on Cost-Benefit Factors	76
3.2 Advantages of the Use of Cultivation Structures	78
3.2.1 As a Way of Life	78
3.2.2 In Developing Individual Homesteads	79
3.2.3 Towards Better City Administration and Management	80
3.3 Entrepreneurship Development in L/N-SA	80
3.3.1 Marketing Hints for Cultivation Structures	81
3.3.2 Marketing Hints for Compost/Growth Media	81
3.3.3 Marketing Hints for Nursery and/or Potted Plants	82
3.3.4 Marketing Hints for Fresh Produce and/or Processed/Preserved Food Products	82
3.3.5 Marketing Hints for Land and Air-Scaping with Edible Plants, Micro-Irrigation and Other Related Services	83

PART TWO

TECHNOLOGY DISSEMINATION IN LOW/NO-SPACE AGRICULTURE (L/N-SA)-CUM- FAMILY BUSINESS GARDENS (FBG)

4. Significance of Urban Agriculture (UA) with L/N-SA in Urban Development	86
4.1 Importance of UA for Urban Lives	86
4.1.1 To Address Health-Related Issues	86
4.1.2 To Be Sensitive to Poverty-Related Issues	87
4.1.3 To Work on Environmental Improvement Goals	87
4.1.4 To Develop Farming Systems for Future Generations	88
4.2 Opportunities for L/N-SA in UA	88
4.2.1 Building-Scapes without Land Availability	88

4.2.2 Private Landscapes with Limited Availability of Land	90
4.2.3 Common-Property-Scapes with the Involvement of the City Administration	91
4.3 Policy Initiatives and Advocacy Programmes Promoting UA in Sri Lanka	92
5. Popularization of L/N-SA with Age Stratification and an Urban-Rural Continuum	95
5.1 Socio-economic Applicability with Age Group Differences	95
5.1.1 Motivating Children (Pre-schoolers and Schoolchildren)	95
5.1.2 Associating with Youth (Individuals Versus Groups)	96
5.1.3 Working with Adults (Gender Specifications and Senior Citizens)	97
5.2 Urban to Rural Differentiations/Connectedness	98
5.2.1 From Space Concerns to Water-Saving Techniques	98
5.2.2 Towards Increased Nutritional Security	99
5.2.3 Poverty Reduction through Livelihood Improvement	99
5.3 Application of Novel Strategies in Reaching Target Groups	100
5.3.1 Mass-Media to Work on L/N-SA	100
5.3.2 Group Methods to Work on L/N-SA	102
5.3.3 Individual Methods to Work on L/N-SA	103
6. References	105
7. Annexures – Website Details	106

Dedication

This work is dedicated
to urban and peri-urban communities
and
agricultural extensionists
of
Sri Lanka
who contributed to take
the concept of the
Family Business Garden (FBG)
with
Low/No-Space Agriculture (L/N-SA)
into the
urban and peri-urban
communities across
the world.

Foreword

This Manual on Urban Agriculture deals with an idea and practice whose time has come to be made widely known. Its theme is of fundamental urgency for all. It cross-cuts spatial divides. It invites the attention of policy makers and entrepreneurial communities. It offers a strategy for raising production at the base of society and for mobilizing unused and under-used labour in the family. Hence, it is equally at home in the villages and the towns, in cities and metropolises, and in the hills and the valley slopes. It is integral to improving the quality of life in the less-privileged areas of towns.

It has been written for a wide spectrum of potential users. Creative and entrepreneurial individuals, householders and environmentalists, politicians and media persons will find it of immense interest. While its material is technically sound its outreach is to everyone. The prose is simple and clear. Its vision and role are to facilitate the entry of agriculture to hitherto unexplored spaces all around us. They are integral to our living spaces. The breakthrough is quite strategic.

It is vital to emphasize that it is all derived from, and validated by, years of practice on the ground. Hence, it is a compendium of lessons learnt from the author's first-hand experience with the large number of micro growers and practitioners.

May it reach its eager audience waiting for innovations—cost-effective and short-term in the world's communities and officialdoms!

Susil Sirivardana

Associate Coorrdinator—South Asian Perspectives Network Association (SAPNA)

[Former Commissioner, National Poverty Alleviation “Janasaviya” Programme, Sri Lanka & Former Chairperson, National Housing Development Authority, Sri Lanka]

04 May 2009

Acknowledgments

The production of this Manual of Low/No-Space Agriculture (L/N-SA)-cum-Family Business Gardens (FBG) was funded by the Resource Centres on Urban Agriculture & Food Security (RUAF) Foundation through IWMI, Sri Lanka. I am therefore very much thankful to Dr. Priyanie Amerasinghe, Regional Coordinator, South & Southeast Asia Office, RUAF, Hyderabad, India who coordinated all related aspects in publishing this manual and gave her critical comments and suggestions on its contents.

Special thanks are due to Ms. Marielle Dubbeling, Dr. Robert Simmons and Ms. Saba Ishaq for their initial contacts made with the FBG practice at the grassroots level in western Sri Lanka and creating a link with IWMI/RUAF, India office from then onwards. This link with RUAF has produced results with various types of awareness creations across the world.

I wish to thank all the country dwellers as well as international community/organizational representatives who contributed to advance the FBG-cum-L/N-SA. I also acknowledge the inputs of Messrs. Upul Mendis, Sunil Peiris, Nimal Jayathilake, and U. Wickramasinghe, and Mesdames Carmalin Fernando, Renuka Gunasinghe, Geethani Swarnalatha, Nishanthi Jayawickrama, Anusha Gunathilake, Damayanthi Perera and D. Samurdhi Ranasinghe.

I am indebted to those who assisted me now and then in developing FBG-cum-L/N-SA in the arena of urban agriculture in various ways in my capacity as the Director of Agriculture (Western Province) Sri Lanka, 1991-2007 and as a freelance consultant on UA.

Thilak T. Ranasinghe

20 July, 2008, Colombo, Sri Lanka

thithura@slt.net.lk

Preface

In a broader sense, the manual expects to impress upon the urban dwellers the necessity of developing and disseminating technological aspects of the concept of the Family Business Gardens (FBG) and Low/No-Space Agriculture (L/N-SA). Professionals, non-professionals or policy makers who contribute to nutritional/food security in situations of restricted resources can also be regarded as a secondary target audience of the manual. The manual highlights that the urban populations can contribute to sustainable development of cities, through economically viable outputs of UA, i.e., vertical agricultural cultivation for producing edible matter and making use of the diversity and creativity found in cities for micro-agro-entrepreneurship.

The first part of the manual deals with the practical technology-development aspects of the concept of the FBG and L/N-SA. First, it briefly explains definitions of some innovations that help sustainable urban development. Second, it provides practical know-how in simple terms in introducing different types of cultivation structures for diverse spaces available in urban areas (e.g., land space, building space and airspace). Third, it explores the role of cultivation structures with specific reference to the provision of sustainable micro-agro-entrepreneurship for livelihood improvements in urban areas.

The second part reveals not only the importance and potentials of UA but also some novel practical and policy experiences gained in promoting UA in Sri Lanka. The manual also reveals the experiences in multiplying UA development initiatives in the context of a conceptual form to larger extents and also to an urban-rural continuum.

The manual does not dwell on fertilizer application, micro-irrigation systems, pest-control methods, integrated pest-management techniques, commercial compost preparation and related specialized-cum-technical processes in detail. Information on these technological aspects is freely available in the printed and electronic media (see annexure for some sources).

The intention of the manual is to promote and impart simple ways of preparing creative cultivation structures, suitable for any surrounding, whether urban, peri-urban or rural with limited space and resources.

Thilak T. Ranasinghe

NINE TENTHS OF EDUCATION IS ENCOURAGEMENT...

Anatole France

PART ONE

**TECHNOLOGY DEVELOPMENT
IN
LOW/NO-SPACE AGRICULTURE (L/N-SA)
-CUM-
FAMILY BUSINESS GARDENS (FBG)**

I. FAMILY BUSINESS GARDENS (FBG) WITH LOW/ NO-SPACE AGRICULTURE (L/N-SA) IN URBAN AGRICULTURE (UA)

In 1994, 45% of the world's population lived in cities and this ratio would rise to 65% by 2025. The fastest change occurs in the developing world where urban populations grow at 3.5% annually (Eawag 2007).

Urbanization and agriculture are two of the most important global phenomena. As human population and consumption levels continue to increase there is a need to develop convenient and attractive methods in introducing Urban Agricultural (UA) initiatives for the urban development agenda. The development of Low/No-space Agriculture (L/N-SA) within the Family Business Garden (FBG) concept is one of the good innovations available in the urban agricultural development arena.

I.I What Is Urban Agriculture (UA)?

I.I.I Broader Definition

The meaning of UA is not confined to the cultivation of a few vegetables and fruits for daily use or a few flower plants in the home garden. On the contrary, it broadens to entrepreneurship of different crops and livestock production and/or agricultural product management processes.

Urban agriculture can be identified as the agricultural entrepreneurship carried out in urban and suburban areas or within municipal limits. Various methodologies are employed to bring about agricultural diversity related to factors such as production, processing and marketing. The key attempt here is to maximize limited land space, water availability and recycling of food and non-food materials in the process of sustainable development.

This diversity of UA could be achieved through proper management strategies such as production, processing and marketing of horticultural crops, medicinal crops, livestock, aquaculture, floriculture, forest plants and the like.

A recent definition used by many international organizations is as follows:

“Urban agriculture is an industry located within (intra-urban) or on the fringe (peri-urban) of a town, a city or a metropolis, which grows and raises, processes and distributes a diversity of food and non-food products (re) using largely human and natural resources (soil, water, genetics, air and solar energy), products and services found in and around that urban area and, in turn, supplying human and material resources, products and services largely to that urban area” (WASATWiki 2007).

I.I.2 From Simple Home-Gardening to Micro-Farming Ventures

In the urban context, as discussed above, thoughtful management of homestead cultivations or activities could be easily converted into micro-farming ventures. However, in the traditional urban planning process agriculture is regarded as an oxymoron in the urban development agenda. As a result and because of the present environmental concerns, urban planning paves the way to apply green concepts in promoting urban environments for sustainable development.

In the urban environment, apart from the objective of enriching nutrition of the family, home-gardening could be developed to the level of a main or additional income-generating source with effective extension and communication processes.

In this sense, different micro-farming engagements in urban, peri-urban, municipal or metro areas can be identified as agro-base ventures in the context of new development themes and policy frameworks instead of being treated as subsistence-level activities of agriculture. It is also recognized that urban and peri-urban agriculture creates career opportunities and builds stronger local economies by opening new ventures or jobs. On the other hand, the energy used to transport food from rural to urban areas would be decreased through micro-farming ventures of UA initiatives. Furthermore, UA promotes a more sustainable production of quality foods while reducing the need for preservatives, as the products do not need to be transported long distances. On the whole, UA can be used for food production or income-earning ventures so as to contribute to food security and food safety in two ways: first, it raises the food availability in cities and, second, it provides fresh vegetables and fruits to urban communities in the process of sustainable development.

There are similarities between rural and peri-urban or urban areas: for instance, the lack of nutritious food during off-seasons, the scarcity of water for use in

homestead cultivations, the variety of strategies adopted to collect (more often rainwater) and conserve water, the traditional pest-management practices, and the simple methods developed to process and preserve fruits, vegetables and the like.

There are considerable numbers of urban dwellers who are used to applying these agricultural techniques in varied scales under different urban conditions but many more urban dwellers lack the initiatives needed to adopt these techniques, specifically the L/N-SA techniques, to the urban situations. It is in this context that the invention of the FBG concept in contrasting the UA from rural agriculture took place in Sri Lanka, on the World Environment Day in 2000.

I.2 The Conceptual Approach of FBG in Utilizing L/N-SA

By tradition, home-gardening has been treated as a subsistence-level agricultural production system. However, times have changed and land and water are now precious resources, especially when lands are located in urban and peri-urban areas. By now, almost the same holds true for resource-poor areas in the rural world. The situation, therefore, is created to place due recognition on converting home-gardening into a profitable production unit for effective economic growth, particularly in the conceptual era of world development. It is in this context that the FBG concept was introduced to change home-gardens from the simple form to a capacity of micro-level agribusiness venture within the process of urban agricultural development. The utilization of different forms of L/N-SA is the key here.

I.2.1 Core of the FBG

The main thrust of the FBG concept is to convert the simple form of home-gardening into a source of family nutrition supply and a source of mental satisfaction based on sustainable agricultural entrepreneurship/s. The concept stresses here that there should be a proper mix of environmental agriculture and commercial agriculture in the process of urban homestead development. The primary goal of the concept is to integrate Indigenous Technical Knowledge (ITK) with an effective form of scientific knowledge available in different fields of sustainable urban development.

1.2.2 Idea of the FBG

The idea of the FBG is clearly and pictorially presented in the logo of the FBG in Figure 1.1 followed by the characteristic description of the logo flower/brand in Figure 1.2.

Each petal symbolizes a different strategy to reach within its reach, namely,

- i) family nutrition,
- ii) technology adoption,
- iii) crop management,
- iv) post-harvest technology and value addition, and
- v) landscaping and housekeeping,

all of which will be discussed later, in section 1.4.

However, each strategy is depicted in each petal of the logo-flower. The dual-stalk of the logo expresses the possibility of adopting environmental and/or commercial agriculture according to the wishes of the recipient of the concept. There is no age or gender barrier to be involved, active and creative for getting introduced to this concept. It could also be initiated through a single petal involvement or any number (two, three, four or five) of petals depending on economic, social, ecological and environmental surroundings of an urban dweller/family.

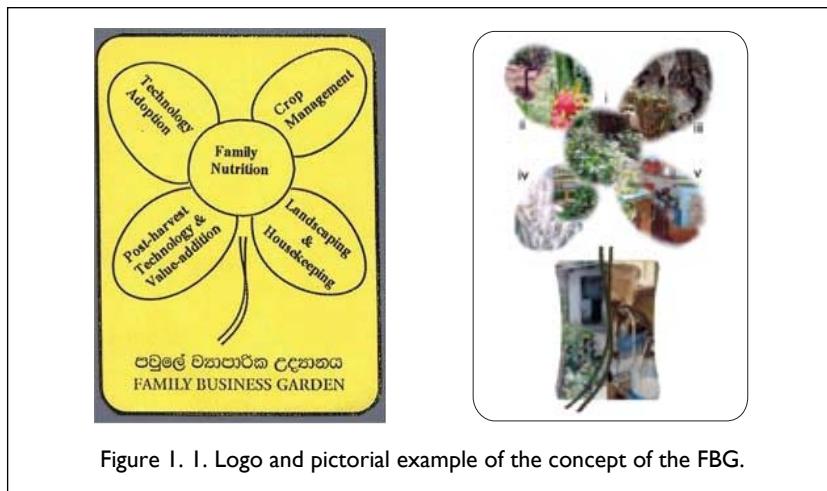


Figure 1.2. Characters of the FBG flower or brand.

Item	Face value	Core value
1. Main petal/ Receptacle	Circle and centre	Nutrition-centred/ good dietary habits
2. Other petals	Different in size and shape	Scales of interventions could be different
3. Petal fixation	Uneven distance	Interests are different from one to one
4. Petals and stalks	Detached	No fixed model
5. Stalk/s	Dual-curved stalk	Elasticity in approach
6. Why a flower?	Attractive and simple	From child to elderly and use of creativity

I.2.3 Home-Gardening Versus FBG

The following description (see Figure 1.3) shows the built-in basic differences between home-gardening attempts and conceptual entrance to the FBG practice.

Figure 1.3. Comparison between home-gardening and FBG.

Aspect	Home-gardening	FBG
HEALTH CONCERNS Nutrition value Mental health Landscaping	Yes and general Minimal Usually with flowers	Yes and specific Highly focused Land and air-scaping for edible plants
Housekeeping	Mainly kitchen	Total homestead
MANAGEMENT SKILLS Vertical cultivation Water and soil Medium Waste and shade Entrepreneurship	Not purposively Highly concerned Low or negligible Nil or minimal	Highly focused Highly stressed Prime theme
ECONOMIC SENSITIVITY Income Value addition Business plan Sustainable links	No or minimal sale No or low No concern Low or poor	Planned marketing Highly stressed Mainly stressed Networking

I.3 Implementation Process of the FBG in L/N-SA

In implementing the FBG concept priority is placed on “vertical cultivation structures” so as to maximize the limited space available in urban settings. Hence, opportunities are open for exchange of new knowledge, skills and experience in the development process of cultivation structures on a sustainable manner by overcoming technical and economic shortcomings.

I.3.1 Aims of the FBG

The FBG concept carries the following aims in developing UA initiatives in the context of sustainable urban development.

- i) To convert aspects of gardening into a theoretically based sustainable agribusiness concept.
- ii) To address some poverty issues in generating nutrition and income for food security.
- iii) To work with a better mix of modern science and indigenous technical know-how for sustainability.
- iv) To make contributions to improve socio-economic-health-environment spheres of urban development.

I.3.2 Expectation of the FBG

The FBG concept focuses on its expectations on the following areas of coverage in UA initiatives.

- | | |
|----------|---|
| Scope | - not only as family nutrition but also as an additional income source. |
| Approach | - a process not a content; there is no fixed model, it is flexible. |
| System | - technology development rather than technology transfer. |
| Means | - as commercial agriculture or environmental agriculture or both. |
| End | - physical as well as mental satisfaction in agro-entrepreneurship. |

The concept expects the above coverage in attempting to reach sustainable UA goals while working with resource-limited conditions for agricultural entrepreneurship in urban areas. It expects to induce creativity and flexibility rather than working with blueprint models of home-gardening. Furthermore, the FBG does not expect competition among urban dwellers but rather prefers novel creations, especially in L/N-SA, to advance the process of continuity in its adoption.

1.3.3 Process of the FBG

As indicated in its expectation, the concept itself contains a form of process in its nature and the practice at the grass-roots of urban areas. It always welcomes the wisdom of urban or peri-urban or rural people as well as of scientific advancements developed by the rest of the world. In consequence, the concept adopts a “Knowledge Management Process” to establish dynamic relationships among different stakeholders of urban development and rural-cum-overall development as well.

Figure 1.4 shows the ingredients (i.e., relations, patterns, principles and contexts), steps (i.e., capture, sort, store and reuse) and the flow of advancement (i.e., data, information, knowledge, wisdom and continuum) in adhering to the process of knowledge management of the FBG concept. The knowledge management process is executed with a consideration of qualitative as well as quantitative aspects in adding and editing the body of knowledge in L/N-SA. Conventional as well as Information Communication Technology channels are being used to strengthen the process while advancing the FBG concept in the UA arena.



CONTINUUM

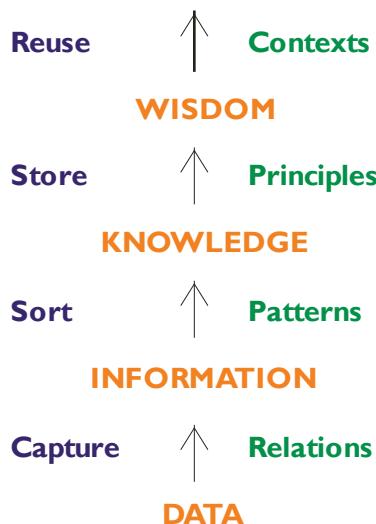


Figure 1.4. The knowledge management process of the FBG concept.

I.4 Components of the FBG that Promote L/N-SA

The components or strategies of the FBG always act in a flexible way as it works on a process rather than within a fixed model.

I.4.1 Family Nutrition

Safe and balanced meals are highly focused for healthy life. In attaining this goal the following steps are advocated.

- i) Find some space to cultivate a few favourite, nutritious vegetables, fruits, yams, spices and crops on family choice or preferences.
- ii) Go for vertical-space cultivation techniques by considering the importance, and assessing the value, of L/N-SA (see chapter 3 for details).
- iii) If family members are interested animal husbandry and apiculture could be preferably incorporated for additional protein supply.
- iv) Locally based crops and livestock suitable for natural and urban socio-economic environments are highly stressed with the practices related to Integrated Pest Management (IPM) so as to form a successful FBG and the sustainable production system of L/N-SA.



Figure I.5. A family nutrition-based FBG.

I.4.2 Technology Adoption

Production of economically viable crops or processing of some products for the market as a small or medium-scale enterprise is stressed here through proper technology adoption strategies. To this end:

- i) Select environmentally adaptable and marketable new crops/products rather than sticking to family preferred crops if produce or product is mainly for the urban market.
- ii) Available number of members of the family and amount of money that could be spent on strategies of technology adoption are major deciding factors in developing a business culture in an urban family.



Figure I.6. A simple technology-based FBG.

- iii) A proper integration of Indigenous Technical Knowledge (ITK) and modern scientific knowledge has to be critically considered in creating and developing L/N-SA for urban situations.
- iv) Use of economically feasible, socially acceptable, environmentally friendly and technically sound technologies is key for sustainable FBG and L/N-SA practices.

I.4.3 Crop Management

To gain long-term productivity, soil, water, pests, and ways and means of shade or light management are treated with high priority in the following manner:



Figure 1.7. An FBG with well-managed crops.

- i) The practice of recycling techniques of plant nutrients is recognized while advocating crop rotation, use of green/animal manure, compost, carbonized rice husk, organic liquid repellants-cum-manure, home-waste, and the like.
- ii) Proper soil and water conservation, utilization and management techniques are considered high priority in improving soil fertility levels on a long-term basis.

- iii) Use of rainwater harvesting techniques and reuse of grey water are highlighted with the application of micro-irrigation techniques for economic benefits while considering an integrated farming approach for the places where environments are wet.
- iv) Effective practices adopted to manage sunlight/shade in association with IPM techniques in L/N-SA are strongly stressed as space is restricted and expensive.

I.4.4 Post-Harvest Technology and Value Addition

The quality of the output of micro-agro-entrepreneurship practised in the FBG concept has to meet marketable standards to become a sustainable process in urban development. In reaching this end strategies to be executed are the following:

- i) Post-harvest management and product diversification by producing varied value-added products to meet changing lifestyles; choices have to be considered from the very beginning while studying prevailing acts and laws.
- ii) Forming into small groups is an economically effective solution and sustainable measure to gain profits from micro-level agro-entrepreneurship of L/N-SA in urban areas.
- iii) Adhering to local and international market standards and quality-certification systems is continuously stressed to meet existing challenges of globalized marketing networks.
- iv) Branding, packaging and presentation strategies in market dynamics should be taken into account in the process of adding value to L/N-SA and the sustainability of the FBG concept.



Figure 1.8. An FBG with food processing and value addition.

I.4.5 Landscaping and Housekeeping

The provision of an appeal to the FBG craftsmanship is generated and expanded through this component. It paves the way to build the social status of urban farming while weakening social marginalization of the urban poor against lifestyle changes. In developing these aspects and in improving esthetic aspects of the urban environment the following strategies are stressed:



Figure I.9. An FBG landscaped with edible plants.

- i) Physical as well as mental health development is considered an effective asset in entrepreneurship development. Strategies of L/N-SA in creative homestead development work not only to facilitate fitness but also to reduce mental stress.
- ii) Landscaping and air-scaping in the space around a homestead create a charming and pleasant environment while an organized way of housekeeping provides inner-space management assistance that leads to a high recognition of the urban agribusiness.
- iii) Landscaping and air-scaping of edible plants with L/N-SA provide sustainable micro-agro-entrepreneurship of UA in addressing gender issues while improving the status of women engaged in agriculture in urban societies.
- iv) Development and continuous evaluation of “business plans” are key in opening up of urban agricultural entrepreneurship with dignity, constituting a holistic way of developing the FBG concept.

2. CULTIVATION STRUCTURES FOR OPTIMIZING URBAN SPACE IN L/N-SA

2.1 Cultivation Structures Suitable for Land Space

i) Cultivation Tower

Importance

A cultivation tower is a vertical structure that can be used to maximize limited land space through L/N-SA; it has been a most popular cultivation structure within the FBG concept to date, especially in Sri Lanka. Also it is being popularized worldwide. Different types of crops can be easily cultivated in a vertical mixed cropping system. It helps improve crop sanitation and lower pest damages when compared to soil-bed cultivations. A cultivation tower can be used to establish a landscape with edible matter by growing flower plants along with food plants. A cultivation tower helps prevent damage caused by domestic pets whose access to plants is prevented by growing them higher up.

A cultivation tower can be classified basically into two forms: non-portable and portable (see Figure 2.1). The non-portable form can be subdivided into permanent and temporary. The portable form of a cultivation tower is described in section 2.2.X.

Figure 2.1. Cultivation towers

Temporary towers



Permanent tower



Materials Required for a Temporary Cultivation Tower

- * 4"- PVC pipe/Bamboo
- * PVC end-cap
- * Poly-sack/Polythene bags
- * 3 Wooden sticks
- * Topsoil – 2 part
- * Compost – 1 part
- * Coir dust – $\frac{1}{2}$ part
- * Rooted plants
- * Construction tools

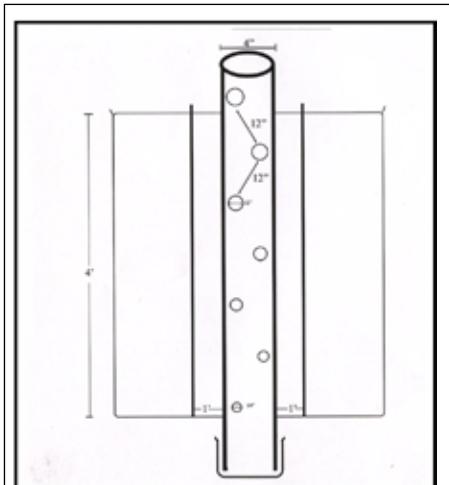


Figure 2.2. Longitudinal section of a cultivation tower.

Construction of a Cultivation Tower

- Step 1:** First and foremost prepare the PVC pipe: make holes spirally with the diameter of the holes ranging from 0.6 cm at the bottom to 1.2 cm at the top. Fix the end-cap at the bottom end of the perforated pipe (Figure 2.2).
- Step 2:** Fix the bottom-side of the pipe in the soil at the centre of the selected place to erect the tower. Then fix three equidistant wooden sticks at least 30 cm away from the central pipe.
- Step 3:** Insert the poly-sack bag from the top to bottom and seal firmly with soil at the outside of the tower. Fill the tower with topsoil, compost and coir dust in the ratio of 2:1: $\frac{1}{2}$. Do not fill the tower with compaction so as to maintain proper soil aeration and water translocation.

Step 4: Make holes on the vertical wall of the soil-medium-filled tower by creating “Inverted T” cuts by adapting a triangular system. Keep a distance of 30 cm or more as applicable in-between holes. Always use “rooted plants” in planting in the cultivation tower so that they can withstand wind and any other disturbances. Place shade-loving plants towards the bottom while planting tree-type crops on the top. Flower plants too can be planted to improve the beauty of the landscape.

Step 5: Provide water through the top of the PVC pipe and, if needed, make a necessary shade or protection to avoid any damage due to wind or direct sunlight or rain, just after planting.

Suitable Plants

Pod vegetables – Eggplant, chilli, capsicum, tomato, cabbage, radish

Leafy vegetables – Kan-kun, Centella, spinach, mint, Alternanthera

Management of the Cultivation Tower

- Top-up perforated pipe (or bamboo) every other day or as required.
- Fertigation can also be done through the perforated pipe.
- Use agronomic and physical methods in pest management.
- Train and prune plants whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- A permanent cultivation tower can be built with cement, or otherwise purchased as plastic or iron structures.
- Discarded containers/barrels can also be used to construct permanent cultivation towers in an appropriate manner by promoting recycling of house waste.

ii) Cultivation Frame

Importance

The cultivation frame is a simple vertical structure used to cultivate shade-loving crops above ground level but somewhat lower than a cultivation tower. Unlike the tower, only the top of the structure is used for planting of food crops and flowers. Recycled materials can be easily used to prepare cultivation frames and suited for sandy or ill-drained soils with no cost of construction. It can be built in an either single-plant or multi-plant type and also on a pot so as to be in a portable form (see Figure 2.3).

Figure 2.3. Different types of cultivation frames.



Single-plant type



Multi-plant type



Portable type

Materials Required

- * Coconut branches, bamboo strips or wooden pieces
- * Strings, wires or coir ropes
- * Suitable topsoil and compost mixture

Construction of a Cultivation Frame

Step 1: Cut the selected coconut branches, bamboo strips or wooden pieces into convenient heights. Then make holes in the ground to form a circular, oval or box appearance as required. Later, fix the pieces tightly on the ground to an angle so as to build a cone-shaped frame.

- Step 2:** With the use of strings, wire or coir ropes tightly tie the frame to avoid any strained-down soil when it is filled with soil.
- Step 3:** Add some gravel to the bottom of the frame. Fill the frame with a mixture of soil and compost at a convenient level leaving a space of at least about 8 cm from the top.
- Step 4:** Planting of the cultivation frame can be done with seeds, seedlings or cuttings as appropriate.

Suitable Plants

Any type of seasonal pod or leafy vegetable is suited for a cultivation frame. Yams can also be grown given much attention.

Management of the Cultivation Frame

- Use manual watering or drip irrigation as required.
- Use agronomic and physical methods in pest management.
- Train and prune plants whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- Regular observations have to be made, protection measures taken and these monitored to control termite attacks to the frame.

iii) Cultivation Pyramid

Importance

The cultivation pyramid is another attractive cultivation structure which generates the aesthetic value of the FBG or in the process of homestead development. It is a combination of a cultivation tower and a cultivation frame with some structural differences (i.e., an upside-down version of both structures). The youth who underwent vocational training in agriculture invented this structure in popularizing UA and L/N-SA. The number of plants can be increased

with the expansion of the width or diameter of the pyramid and also by increasing its number of floors. Fruit crops and vine crops can be grown with thoughtful combinations and proper management practices. Minimal weeding is required although it needs some horizontal space on the ground (see Figure 2.4).



Figure 2.4. Cultivation pyramids.

Materials Required

- * Bamboo strips or coconut branches in three sizes or a considerable number of bricks
- * Coir ropes or wires
- * Poles with relevant height
- * Cultivation media (topsoil: compost: coir dust – 2: 1: $\frac{1}{2}$)

Construction of a Cultivation Pyramid

- Step 1:** Select an appropriate location that has enough horizontal as well as vertical spaces to build the pyramid and demarcate the outer circumference.
- Step 2:** Clear the land properly and fix the bamboo strips or coconut branches firmly in the soil. If bricks are used, pack them firmly to create a stable layer that can bear the inside pressure of the cultivation medium.

- Step 3:** Fill the ground deck of the pyramid with a cultivation medium without applying too much compaction.
- Step 4:** Demarcate and create the next deck of the pyramid as done earlier and construct other decks so that the weight of the layer of bricks is bearable.
- Step 5:** Fix the poles outside the ground or bottom deck close to the planting holes of vine crops which are to be planted on the ground deck. Then connect the top of the poles with coir ropes or wires. This function of construction can however be postponed till vine crops produce tendrils.

Suitable Plants

Most of the pod plants and vines can be selected for the cultivation pyramid.

Ground Floor: Sunlight-loving creepers and vines that can be trained to utilize areal space – gourd family crops.

Middle Floor/s: Pod vegetables, Amaranthus, yams and leafy vegetables, Colocasia, radish.

Top Floor: Tomato, chilli, eggplant, fruits like star-fruit or *ambarella*

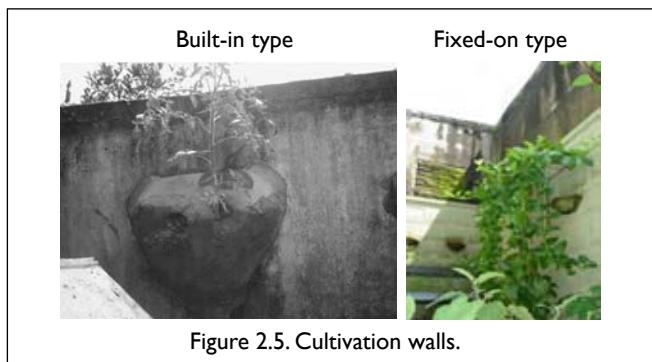
Management of the Cultivation Pyramid

- Rooted plants as well as seeds can be used for stand-establishment.
- Use manual watering or drip irrigation as required.
- Use agronomic and physical methods in pest management.
- Train and prune plants whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at maturity/proper intervals.
- Provide priority for training of vines and managing crops planted in middle decks to avoid shading and poor sanitation.

iv) Cultivation Wall

Importance

In the urban setting, most of the spaces of homesteads are covered with walls or surrounded by blind walls of adjoining houses. Cultivation walls provide access to make use of walls for additional use as well as an alternative way to popularize UA through L/N-SA. The walls built in an east-west direction can be profitably taken and converted into cultivation walls in different ways (i.e., built-in pot or fixed-on pot form) as, most of the day, walls receive sunlight. Cultivation walls can be utilized on a permanent or semi-permanent basis according to the emphasis and attention placed on the structure (see Figure 2.5).



Materials Required

Permanent Cultivation Wall (built-in):

- * Cement and sand
- * Wire-mesh
- * Waterproofing materials such as tar or fibreglass-paint
- * Cultivation media

Semi-permanent Cultivation Wall (fixed-on):

- * Clay or plastic hanging baskets designed to be hung on the wall
- * Stoppers or nails and wires
- * Cultivation media

Construction of a Cultivation Wall

- Step 1:** If it is a permanent cultivation wall, the assistance of a mason is required. It can be constructed as shown in Figure 2.5 or as any other design of construction.
- Step 2:** Before taking step 1 the application of waterproofing materials is essential so as to assure the durability of the existing wall. Wire mesh is needed to carry the cement projection for a long period of time and also carry the pressure of the filled cultivation media.
- Step 3:** Make sure to pierce a single hole underneath the projection/pot for drainage while paying attention to prevent overflowing on the wall.
- Step 4:** Once the permanent construction is completed and/or hanging pots are fitted to the wall, semi-permanent structures are used, and cultivation media (i.e., topsoil: compost: coir dust - 2: 1: ½) can be added into it.
- Step 5:** Rooted plants can be planted with care and measures taken to protect them from direct sunlight during the initial stage of planting.

Suitable Plants

Crops such as tomato, chilli, capsicum and leafy vegetables are suited in cultivation walls. If support poles are provided light-weight vein crops can also be cultivated. Flower plants too can be grown with food plants to create a beautiful view.

Management of the Cultivation Wall

- Use manual watering or drip irrigation as required.
- Use agronomic and physical methods in pest management. Train and prune plants whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- Care should be taken to clean the drainage holes of the cultivation wall structures. Pay attention to protect the wall from excess water, especially in rainy days.

v) Cultivation Arch

Importance

The cultivation arch is traditionally used in many homesteads as a simple and decorative structure with flower vines or ornamental leafy vines. In UA this practice could be extended with the incorporation of food crop vines into the arch by adding value under L/N-SA development strategies (see Figure 2.6). It promotes edible land-cum-air-scaping practices among urban communities within the context of FBG initiatives.



Figure 2.6.
Cultivation arch.

Materials Required

- * Iron or wooden poles
- * Wires or coir ropes
- * Fitting items or carpentry tools required to build the arch
- * Appropriate quantities of topsoil and compost

Construction of a Cultivation Arch

- Step 1:** Select a suitable place for the arch to be constructed considering the height and the availability of a footpath.
- Step 2:** Erect poles vertically on the ground allowing a height of at least 2 metres to the top end. Fix the horizontal or curved bars in creating the arch. The width of the arch is to be decided by the owner.
- Step 3:** Connect the poles with wires or coir ropes to form a mesh type mat so as to carry the weight of the vines.
- Step 4:** Dig 2-4 planting holes before the poles are erected. Add a mixture of compost and topsoil to the planting holes.
- Step 5:** Plant the selected rooted vines closer to the poles and supply the necessary support and train the vine to cling on to poles and wires.

Suitable Plants

Vine-type flower and food crops (e.g., cucurbits, spinach) are suitable for a cultivation arch. Seasonal and perennial (e.g., passion fruit, wing-bean) combinations of vines are best suited for a cultivation arch of edible plants if the arch is properly maintained with pruning practices.

Management of the Cultivation Arch

- Use manual watering or drip irrigation as required. Pitcher irrigation is also recommended with care and attention paid to prevent mosquito breeding.
- Use agronomic and physical methods in pest management.
- Train and prune flowers as well as food vines whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- Pay special attention to protect the arch from the wind.

vi) Cultivation Bangle

Importance

The cultivation bangle is an innovative structure initially developed with recycled materials by a middle-class urban recipient of the FBG concept. The basic principles of a cultivation tower are taken into account in developing this indigenous idea to form the creative structure. Several types of hard-wastes of a homestead can be reused through this structure along with a few new purchases (see Figure 2.7).



Figure 2.7.
Cultivation bangle.

Materials Required

- * PVC pipe or wooden post of 2-3 metres' length or as appropriate
- * Discarded plastic containers or basins in different sizes as required
- * Iron sticks each 20-30 cm long
- * Cultivation media (topsoil: compost: coir dust – 2: 1: ½)

Construction of a Cultivation Bangle

Step 1: Erect the PVC pipe or wooden post on the ground firmly at a convenient or accessible height.

Step 2: Pierce the centre of the discarded plastic basins or containers to fit the size of the posts or the pipes that go through them easily but tightly.

Step 3: Pierce the post or the pipe giving considerable space or height with a drill to place iron sticks at 90° which ultimately supply the stand for the containers as shown in Figure 2.7.

Step 4: Now place lower-level sticks and then the bigger-sized basin or container at the bottom stand of the pipe or the post 0.3-0.6 metre above the ground. Do the same to the top layer/stand and assure the firmness at every event. Make drainage holes at the bottom of each bangle.

Step 5: Fill the containers with cultivation media and place seeds or cuttings in those containers. The ground underneath the stack of bangles can also be used for cultivation specifically for leafy vegetables or shade-loving plants.

Suitable Plants

Leafy vegetables, shade-loving plants, small flower plants, strawberries and the like are suitable combinations for the cultivation bangle.

Management of the Cultivation Bangle

- Use manual watering or drip irrigation as required.
- Use agronomic and physical methods in pest management.
- Prune plants whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- Care should be taken to clean the drainage holes of the bangles and check the weight of the bangles regularly when using over the long term.
- Pay special attention to protect the cultivation bangle from the wind and other physical disturbances.

vii) Cultivation Mat

Importance

This creative structure of the cultivation mat can be used either horizontally or angularly according to the available land space in a homestead. This structure is mainly designed for creepers or vine crops which produce larger leaves but which usually do not produce tendrils (see Figure 2.8).

Materials Required

- * Wooden poles and sticks of different sizes
- * Coir ropes or wires
- * Topsoil and compost



Figure 2.8.
Cultivation mat.

Construction of a Cultivation Mat

- Step 1:** Demarcate the space available for the cultivation mat. Sometimes it is possible to construct a horizontal cultivation mat just above the shade-loving leafy vegetables such as Centella, or vine-type kan-kun varieties.
- Step 2:** Fix wooden poles vertically on the land and make a stage-type structure by horizontally placing and tightening other sticks to the poles at convenient heights according to the landscape and need.
- Step 3:** If it is an angular cultivation mat care should be taken to receive sunlight in building the stage-type structure. Thus, poles should be erected at different heights (i.e., those in the front as short and those at the back as tall) and facing to catch more sunlight during the daytime.

Step 4: Dig planting holes closer to the structure and fill with a mixture of topsoil and compost without damaging any plants underneath the mat, if present.

Step 5: Plant the selected cuttings or creeper-plants and guide the creepers to reach the mat with the assistance of a coir rope.

Suitable Plants

Spinach is the most suited crop for the horizontal cultivation mat. In addition, *thumba karawila* (spine-gourd; *Momordica dioica*), pole-beans and some dioscorea-yam varieties are suitable for the angular cultivation mat.

Management of the Cultivation Mat

- Use manual watering or drip irrigation as required.
- Use agronomic and physical methods in pest management.
- Train and prune creepers whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- Pay special attention to protect the mat from the wind.

viii) Cultivation Umbrella

Importance

The cultivation umbrella is an outcome of UA initiatives and the introduction of L/N-SA practices to urban schools in Sri Lanka. The invention has taken place at school grounds and further developed by the recipients of the FBG concept. It provides an aesthetic interest to work with land-cum-air-scaping edible plants with youth in the process of vertical space utilization in homestead development (see Figure 2.9).



Figure 2.9.
Cultivation umbrella.

Materials Required

- * Wooden or iron post and bars/ wooden strips
- * Iron wires in considerable amounts
- * Welding equipment and/or carpentry tools
- * Topsoil and compost

Construction of a Cultivation Umbrella

Step 1: Select a convenient place to put up the cultivation umbrella which should receive sunlight most of the daytime. More often, the garden-space in front of the entrance to the house is selected as it generates a wonderful effect on the home.

Step 2: Erect the main post in the centre of the cleared area of the ground. Then fix the umbrella made of iron or wooden strips to the post. Use wires to form a woven structure on the frame.

- Step 3:** Prefabricated iron or a wooden umbrella can also be fixed to the ground as above.
- Step 4:** Extra measures should be taken to keep the strength of the top frame if additional hanging items/structures are hung on to the umbrella.
- Step 5:** Dig two to four plant holes closer to the post and fill them with the mixture of topsoil and compost.

Suitable Plants

Creeper crops are suited and bottle-gourd provides an attractive view with fruits. Flowers or ornamental veins with food crops are useful in building a gentle landscape: e.g., wing-bean.

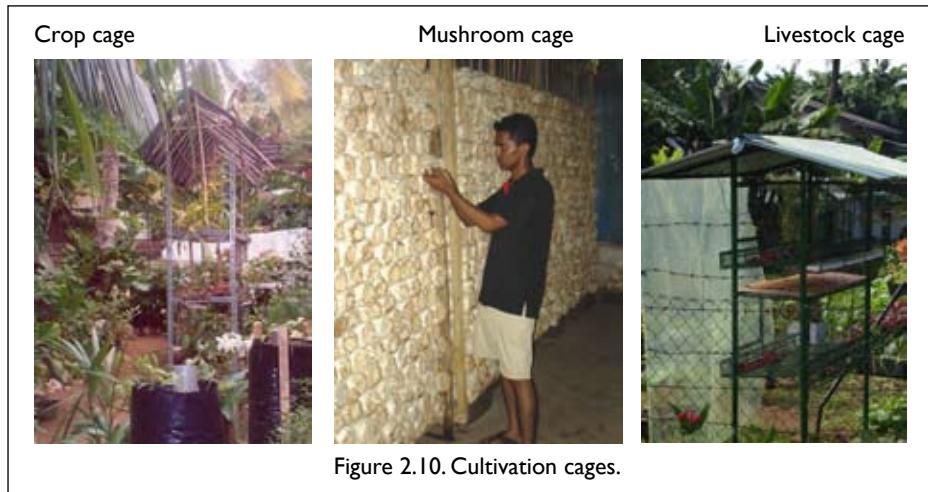
Management of the Cultivation Umbrella

- Use manual watering or drip irrigation as required. Pitcher irrigation is also recommended with care and attention paid to prevent mosquito breeding.
- Use agronomic and physical methods in pest management.
- Pots can be hung on the umbrella to add value to the view but extra care should be taken to maintain the strength of the frame and post.
- Train and prune creepers whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- Pay special attention to protect the umbrella from the wind.

ix) Cultivation Cage

Importance

The cultivation cage is a structure to maximize available limited space for cultivation of plants or rear small livestock (such as a battery-typed rearing system of poultry farming) under considerable protection or a controlled environment. The cage can be constructed according to financial resources and the sort of plants or livestock can be selected to manage under controlled conditions (see Figure 2.10). It is wise to begin with a low-cost investment like the cultivation cage and go for hi-tech mono-culture ventures like “green house” or “omega garden” levels later on. The high cash-crop or livestock culture can be practised with the use of a cultivation cage to earn additional income.



Materials Required

- * Material requirements differ according to the type of enterprise, level of investment and necessities addressed. In general, L-shaped iron-posts and/or other suitable transparent roofing materials are prime requirements.

- * Wire-mesh or netting materials, iron bars, tank facilities and the like have to be selected according to the crops or livestock selected for the enterprise.
- * Several decks have to be made in maximizing the utilization of vertical space; any other materials needed should be used to create a protected environment as the safety of the livestock has to be ensured.

Construction of a Cultivation Cage

- Step 1:** Select a suitable space to put up the cage according to the required enterprise (i.e., plants need sunlight while livestock need shade).
- Step 2:** Construct the cage with selected materials according to the recommended space requirements of plants/livestock species as well as to the engineering standards.
- Step 3:** Water supply, drainage and sometimes electricity supply systems should be handled with caution.
- Step 4:** Place plant/livestock ensuring there is adequate ventilation. Any other factors that hinder effective performance should be identified and dealt with on a case by case basis.
- Step 5:** Plant pots should be arranged to get the optimum combination to produce the required yields by considering canopy development and plant types. If livestock is placed the number of birds/animals is the key factor.

Suitable Plants/Livestock

Plants – Tomato, bell-pepper, lettuce, cabbage, mushroom, ornamental plants, flower plants

Livestock – Quills, poultry, rabbit, guinea-pig, bird-pets, fish

Management of the Cultivation Cage

- The total management practices depend and vary on the farming theme and are in the nature of a specialization of the enterprise.
- It is difficult to provide a specific list of functions for a standard management procedure for a cultivation cage.
- It is advisable to consult an appropriate service agent for additional instructions and special operations.

x) Cultivation Consortium

Importance

A cultivation consortium, as the name implies, is a collection of several cultivation structures that collectively join to form another vertical cultivation structure in an L/N-SA. It is a product introduced by RUAf members in Hyderabad, India at the training sessions in facilitating the diffusion process of the FBG concept in 2006. It provides access to utilize different creative structures in maximizing light and shade of the homestead. The cultivation consortium may contain several other cultivation structures which are detailed in forthcoming sections (see Figure 2.11).



Figure 2.11. Cultivation consortium.

Materials Required

- * Wooden or iron posts/bars
- * Wires and coir ropes
- * Cane, plastic or iron containers of different sizes
- * Other cultivation structures selected to use collectively to form the consortium
- * Cultivation media (topsoil: compost: coir dust – 2: 1: ½)

Construction of a Cultivation Consortium

- Step 1:** Select a suitable place to construct or place the cultivation consortium as it may also be constructed in prefabricated form. The availability of sunlight is a high priority for the cultivation consortium which contains many light-weight structures.
- Step 2:** Fix three wooden posts making an A-shaped frame. It is necessary to construct two of them and make a pair. Then join this pair with three long poles as shown in Figure 2.11.
- Step 3:** The horizontal pole or bar can be used to hang cultivation bottles, cultivation lanterns and cultivation hanging bags and the like.
- Step 4:** The bottom horizontal bars or poles make a deck for suitable containers and, if needed, wooden strips can be placed to carry the small-sized containers.
- Step 5:** A cultivation medium is used to fill containers and if it is possible shade-loving crops can be grown in the soil underneath the bottom deck of the cultivation consortium.

Suitable Plants

Plants can be selected according to the available intensity of sunlight and the most preferable are tomato, chilli, and leafy vegetables which produce good harvests. Creeper plants like gourds and flower vines are also suitable in creating pleasant surroundings: e.g., Alternanthera, sweet potato, radish and coleus.

Management of the Cultivation Consortium

- Use manual watering or drip irrigation as required.
- Use agronomic and physical methods in pest management.
- Extra care should be taken to maintain the strength of the structure and regular inspection is needed for long-term use.
- Train and prune creepers whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- Pay special attention to protect the consortium from the wind.

xi) Cultivation Envelope

Importance

The cultivation envelope is a very simple structure and is more applicable to a homestead where it has enough land area for cultivation. It is mainly a useful cultivation structure for leafy vegetables where water is seriously stressed. However, it occupies a complete surface area of horizontal land (see Figure 2.12). Thus, special attention is needed in selecting the structure. It is better suited for xeriscape culture of food production in peri-urban areas although not productive in waterlogged situations. It can be better utilized with vermin-culture for high output.

Materials Required

- * Sheet of polythene with appropriate gauge and size
- * Topsoil and well-rotten compost
- * Availability of vermin-compost provides added value



Figure 2.12. Cultivation envelope.

Construction of a Cultivation Envelope

- Step 1:** Select a land space where sunlight is moderately available throughout the daytime. A place with a little shade is well suited as this condition reduces evapotranspiration.
- Step 2:** Dig a shallow pit about 15 cm deep. The length and width of the structure depend on the requirements of the homestead owner.
- Step 3:** Level the bottom of this pit horizontally to avoid flowing water outside of the structure.
- Step 4:** Place the polythene sheet firmly so that each side of the border of the sheet touches the edge of the shallow pit. This helps envelope the shallow irrigated water for the use of plant growth for a long period of time.
- Step 5:** Add a mixture of topsoil and well-rotten compost to make a thin layer of cultivation media. If available, add vermin-compost slurry evenly on to the soil layer.

Suitable Plants

Leafy vegetables such as kan-kun, mint, Alternanthera and lasia are the best crops for the cultivation envelopes.

Management of the Cultivation Envelope

- Use manual watering as required. If drought occurs pay attention to increase the watering intervals.
- Add small quantities of topsoil or vermin-compost slurry where plants show any nutrient deficiencies.
- Use agronomic and physical methods in pest management.
- Prune branches of upper trees whenever necessary in managing shade/sunlight that the cultivation envelope receives.
- Harvest leaves at proper maturity/intervals.
- Pay special attention to protect the cultivations in the envelope when heavy rains are experienced.

2.2 Cultivation Structures Suitable for Building Space

i) Cultivation Tat

Importance

A cultivation tat provides an opportunity to explore the vertical space available around the house whether an apartment or a separate house. This gives some cooling effect to the inside reducing the intensity of sunrays as well as inducing a little breeze with evapotranspiration.

Apart from that, a cultivation tat creates a more lively-looking view to the geometrical shaped urban architectural structures (see Figure 2.13).

Materials Required

- * PVC gutters
- * PVC end-caps
- * Nylon ropes/strings
- * Cultivation media (topsoil: compost: coir dust - 2: 1: $\frac{1}{2}$)
- * Rooted planting materials



Figure 2.13.
Cultivation tat.

Construction of a Cultivation Tat

Step 1: Cut the PVC gutters into 30-45 cm long pieces and fix end-caps to each side to form a container (Figure 2.13).

Step 2: Make tiny (i.e., approximately $\frac{1}{2}$ cm in diameter) drainage holes at 30 cm intervals.

Step 3: Connect pieces of gutter-containers with nylon rope 60 cm apart. The number of containers depends on the available height of the location: patio, verandah, roof, balcony, etc.

Step 4: Fix the completed set of gutters to form a tat with the help of a suitable hanger that can carry the weight of a collection of cultivation media or soils.

Step 5: Then fill the containers with the cultivation media. Pay attention to better drainage conditions of each container. Use the rooted planting materials to have a viable establishment.

Suitable Plants

Leafy vegetables such as lettuce, kan-kun, mint, Alternanthera and Amaranthus are the best crops while small flower plants can also be grown along with leafy vegetables.

Management of the Cultivation Tat

- Use manual watering or drip irrigation as required.
- Use agronomic and physical methods in pest management.
- Train and prune plants whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- Pay special attention to protect the tat from the wind.
- Repotting and replanting should be done every 3 months as containers are not deep enough to hold plant nutrients or soil fertility for long periods of time.

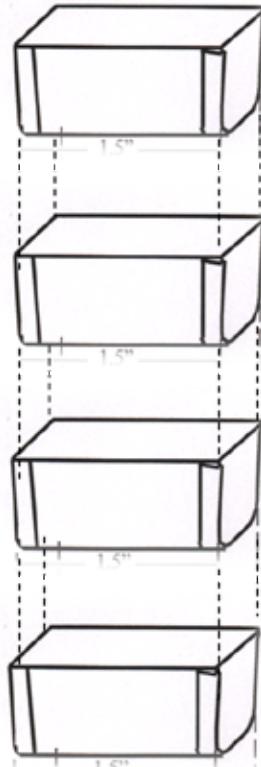


Figure 2.14. Line diagram of front view of a cultivation tat.

ii) Cultivation Ladder

Importance

A cultivation ladder is a useful tall structure where there is a very small floor space but enough vertical space with access to enough sunlight during the daytime (Figure 2.15). It is somewhat easy to handle and well protected from pets and any stray animals. The space underneath the cultivation ladder can also be used to grow shade-loving plants which can also be cultivated with the use of pots or bags if there is enough light.

Materials Required

- * "L" iron bars or wooden poles
- * PVC gutters and end-caps
- * Enamel paint
- * Cultivation media (topsoil: compost: coir dust – 2: 1: ½)
- * Rooted planting materials



Figure 2.15.
Cultivation ladder.

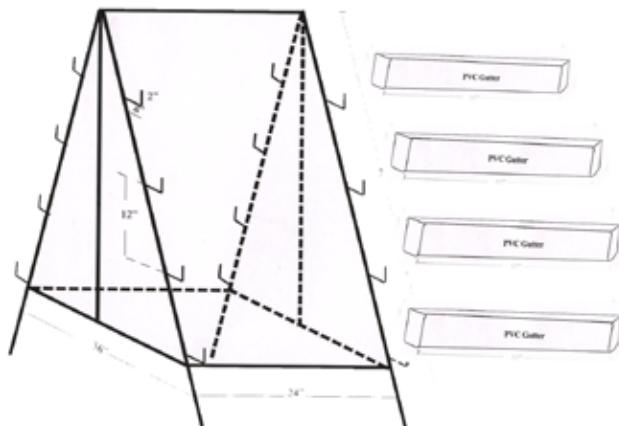


Figure 2.16. Line diagram of a 3D view of a cultivation ladder.

Construction of a Cultivation Ladder

- Step 1:** Cut the PVC gutters into 30-45 cm long pieces and fix end-caps to each side to form a container (see Figure 2.16).
- Step 2:** Make tiny (i.e., approximately $\frac{1}{2}$ cm in diameter) drainage holes at 30 cm intervals.
- Step 3:** Build an A-shaped pair of frames using an “L” iron or wooden poles and join them in a convenient manner. Holders are fixed to the angled bars/poles to hold the containers on both sides.
- Step 4:** Place the completed sets of gutter-containers to form a ladder on holders which can carry the weight of a collection of cultivation media or soils. It can be painted to get an attractive look.
- Step 5:** Then fill the containers with cultivation media and pay attention to better drainage conditions of each container. Use the rooted planting materials to have a viable establishment.

Suitable Plants

Leafy vegetables such as lettuce, Centella, kan-kun, Alternanthera and Amaranthus are the best crops while small flower plants can also be grown along with leafy vegetables.

Management of the Cultivation Ladder

- Use manual watering or drip irrigation as required.
- Use agronomic and physical methods in pest management.
- Train and prune plants whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- Pay special attention to protect the ladder from the wind.
- Repotting and replanting should be done every 3 months as containers are not deep enough to hold soil fertility or plant nutrients for long periods of time.

iii) Cultivation Rack

Importance

A cultivation rack is almost similar to a cultivation ladder but it is shorter. However, it is wider and has a wider angle. This structure can be used on land as well as on rooftops with low-cost materials such as bamboo, kitul palm (fish-leaf; *Caryota urens*) trunks, areca-nut tree trunks, etc. (see Figure 2.17). The structure can be classified in two ways: single-side cultivation racks and double-side cultivation racks. Double-side cultivation racks can be made out of iron or wooden bars/poles with considerable cost as discussed earlier and can be used on cement floors.



Figure 2.17. Cultivation racks.

Materials Required

- * "L" iron bars or wooden poles
- * PVC gutters-cum-end-caps/bamboo plant-cuts or kitul palm or areca-nut tree trunk cuts
- * Enamel paint
- * Cultivation media (topsoil: compost: coir dust – 2:1: $\frac{1}{2}$)
- * Rooted planting materials

Construction of a Cultivation Rack

- Step 1:** Cut the PVC gutters/tree trunks into 90-100 cm long pieces and fix end-caps to each side to form a container. Tree trunks should be prepared with enough depth to carry cultivation media to the plant roots.
- Step 2:** Make tiny (i.e., approximately $\frac{1}{2}$ cm in diameter) drainage holes at 30 cm intervals.
- Step 3:** Build an A-shaped pair of frames either using “L” iron or wooden poles and join them in a convenient manner. Holders are fixed to the angled bars/poles to hold the containers at both sides.
- Step 4:** Place the completed sets of gutter-containers to form a ladder on holders which can carry the weight of a collection of cultivation media or soils.
- Step 5:** Then fill the containers with cultivation media. Pay attention to better drainage conditions of each container. Use the rooted planting materials to obtain a viable establishment.

Suitable Plants

Leafy vegetables such as lettuce, Centella, kan-kun, Alternanthera and Amaranthus are the best crops while small flower plants with leafy vegetables can also be grown.

Management of the Cultivation Rack

- Use manual watering or drip irrigation as required.
- Use agronomic and physical methods in pest management.
- Train and prune plants whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- Pay special attention to protect the rack from the wind.

- Repotting and replanting should be done every 3 months as containers are not deep enough to hold soil fertility for long periods of time.

iv) Cultivation Net

Importance

A cultivation net is a simple structure that can be made out of low-cost materials or expensive items. It requires limited horizontal space, and any convenient height which can be effectively managed is good enough. The cultivation net is best suited for small balconies where enough sunlight is available. This structure is mainly designed for creeper vegetables (see Figure 2.18).



Figure 2.18. Cultivation nets.

Materials Required

- * Iron, wood, plastic or any other hard material is suited to construct a frame
- * Coir, any other ropes/wire (i.e., wire-mesh) or nylon net or else abandoned pieces of fishing-net
- * Welding or carpentry tools whenever applicable
- * Cultivation media (topsoil: compost: coir dust – 2: 1: $\frac{1}{2}$)
- * Potted creeper plants

Construction of a Cultivation Net

- Step 1:** Locate an available space to place the cultivation net. Get the appropriate measurements for the structure.
- Step 2:** Critically asses the required size of the net to be constructed (i.e., length and width).
- Step 3:** Cut the materials selected to construct the net accordingly. Then fix the rope or net on to the frame firmly but softly. The prepared frame should be fixed on to a suitable stand which resists wind and shock.
- Step 4:** Sometimes, it may be easy to create the cultivation net using ropes or a net just in-between two floors of an apartment or house which does not contain a frame.
- Step 5:** Then guide the potted-vines on to the net by providing the supports needed.

Suitable Plants

Vine-type flower and food crops (e.g., cucurbits, pole-beans, long-beans) are suitable for the cultivation net. A combination of seasonal and perennial (e.g., wing-bean) vines is best suited for a cultivation net, if it is properly maintained with pruning practices.

Management of the Cultivation Net

- Use manual watering or drip irrigation as required.
- Use agronomic and physical methods in pest management.
- Train and prune flowers as well as food vines whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- Pay special attention to protect the net from the wind.

v) Cultivation Cradle

Importance

A cultivation cradle could be treated as an agricultural educational toy which provides enjoyment for kids who are involved with L/N-SA in UA. It can be constructed to get a slight swing effect through proper craftsmanship. In a commercial scale, a cultivation cradle could be used to provide an aesthetic view if it is hung underneath the commercial hoardings put up in cities (see Figure 2.19). It can also be identified as a sort of hanging garden in traditional terms.

Materials Required

- * Iron, wood, plastic or any other hard material suited to construct a basket-cum-cradle
- * Coir or any other ropes/wire (i.e., wire-mesh)
- * Welding or carpentry tools whenever applicable
- * Cultivation media (topsoil: compost: coir dust – 2: 1: ½)
- * Potted plants



Figure 2.19. Cultivation cradle.

Construction of a Cultivation Cradle

- Step 1:** Prepare a box or rectangular container using iron or wooden bars/strips. Select suitable and durable strips if preference is given to wooden materials.
- Step 2:** Prepare a suitable inverted U-shaped stand to hold the box with potted plants.

- Step 3:** Then hang the box along the stand with ropes to get a swinging function.
- Step 4:** Load the box with potted plants. A mix of flower and food plants gives an attractive look and kids might like to place their “bunnies” for additional attraction.
- Step 5:** Provision of adjustable length to ropes of the swing provides opportunities to arrange the box to receive enough light throughout the day. If it is hung along a hoarding that gets enough sunlight during the daytime there is no need for adjustments.

Suitable Plants

Leafy vegetables such as lettuce, Centella, kan-kun, Alternanthera, mint and Amaranthus are the best crops. Small flower plants can also be grown along with leafy vegetables to form a micro-hanging garden.

Management of the Cultivation Cradle

- Use manual watering or drip irrigation as required.
- Use agronomic and physical methods in pest management.
- Train and prune plants whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- Pay special attention to protect the cradle from the wind.
- Repotting and replanting should be done every 3 months as small pots are not deep enough to hold soil fertility for long periods of time.

vi) Cultivation Holder

Importance

A cultivation holder is a different version of a cultivation cradle or cultivation tat as it does not have a swing effect at all. Sometimes, it looks like a pigeon-hole in an office but in this case holding only plants. It is a fixed structure and does not carry any flexible form of ropes or wires. A cultivation holder always goes with another stable wall or post and, as a result, there is no need to protect it from the wind. It is preferable to grow short-plant type leafy vegetables under moderate shade in a cultivation holder (see Figure 2.20).

Materials Required

- * Iron, wood, plastic or any other hard material suited to construct a basket-cum-holder
- * Wires or wire-mesh
- * Nails and welding or carpentry tools whenever applicable
- * Cultivation media (topsoil: compost: coir dust – 2: 1: $\frac{1}{2}$)
- * Potted leafy vegetable plants



Figure 2.20. Cultivation holder.

Construction of a Cultivation Holder

Step 1: Locate a proper place with sunlight to hang the cultivation holder to fix it on a wall or post.

Step 2: Measure the height and width available to fix the holder and calculate the number of boxes needed to create the holder.

- Step 3:** Boxes are prepared at convenient sizes using iron bars and wire-mesh with wooden strips. Select suitable and durable strips if wooden materials are preferred.
- Step 4:** Fix boxes to the two major bars/strips of the holder. Pay attention to the height of the selected crop and availability of sunlight for better results.
- Step 5:** Place the selected potted plants in the boxes so that short-plant crops are to the front and tall-plant crops are to the rear of the holder or towards the wall or post.

Suitable Plants

Leafy vegetables such as Amaranthus, Centella, kan-kun, and mint are the best crops. Small flower plants can also be grown along with leafy vegetables to form a micro-hanging garden.

Management of the Cultivation Holder

- Use manual watering or drip irrigation as required.
- Use agronomic and physical methods in pest management.
- Train plants and pluck leaves whenever necessary in managing shade/sunlight.
- Harvest leaves at proper maturity/intervals.
- Pay special attention by doing regular inspection to ascertain whether the plants get proper levels of sunlight so as to produce good leaf yields.
- Repotting and replanting should be done every 3 months as small pots are not deep enough to hold soil fertility for long periods of time.

vii) Cultivation Tripod

Importance

A cultivation tripod is similar to a cultivation ladder but requires very tiny land space in practising L/N-SA in UA. If it is accessible and manageable the height of the tripod can be increased to include many layers/decks. In practice, it is observed that three-layer cultivation tripods are popular and manageable among urban dwellers. The use of a cultivation tripod promotes recycling of “hard” waste in beautifying the vicinity of the “dead” corners of the homestead and dead ends of balconies (see Figure 2.21).

Materials Required

- * Iron, wood, plastic or any other hard-material poles and bars/strips suitable to construct a tripod stand
- * Clay, plastic or cane pots in different sizes and/or shapes and colours
- * Nails and welding or carpentry tools whenever applicable
- * Cultivation media (topsoil: compost: coir dust – 2:1: $\frac{1}{2}$)
- * Rooted planting materials



Figure 2.21. Cultivation tripods.

Construction of a Cultivation Tripod

- Step 1:** Select three iron or wooden poles suitable for creating a tripod of convenient length.
- Step 2:** Make a tripod with the use of poles while doing the necessary cuts and fixes.
- Step 3:** Create a suitable number of layers/decks by fixing wooden or iron bars/strips.
- Step 4:** Place containers on layers/decks according to the different sizes and make suitable colour combinations as required and/or appropriate.
- Step 5:** Plant rooted plants or cuttings by placing shade-loving crops in the lower-deck containers and sunlight-loving plants in top-deck containers. It is suitable to select short containers for leafy vegetables and tall containers for sun-loving plants.

Suitable Plants

<i>Pod vegetables</i>	– chilli, capsicum, tomato, cabbage
<i>Leafy vegetables</i>	– Amaranthus, kan-kun, Centella, mint
<i>Yams</i>	– radish, coleus, Colocasia

Management of the Cultivation Tripod

- Use manual watering or drip irrigation as required.
- Use agronomic and physical methods in pest management.
- Train and prune plants whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- Pay special attention to protect the tripod from the wind.

viii) Cultivation Bag (Standing Type)

Importance

A cultivation bag of the standing type is a traditional structure and is simple as well. It is an alternative for costly structures like cement, clay or ceramic pots and requires minimal cost and time for preparation. However, it is very popular as different types of bags are used in markets for packaging and transportation of food and other consumable household items. On the other hand, as it is available in different sizes, different plants can be raised and frequently used to prepare and manage the nursery preparation and management because of easy handling. A cultivation bag promotes recycling of “hard” waste materials for profitable L/N-SA activities in balconies of apartments or in any other restricted place. It is used as a secondary source in preparing many other cultivation structures such as the cultivation cradle, cultivation net, cultivation holder and the like. A cultivation bag can be easily used to raise yam crops under little care and management levels. Bags are flexible-cum-semi-permanent and hard containers or cement/clay pots, which can also go along with this categorization as a conventional permanent standing structure (see Figure 2.22).



Figure 2.22. Cultivation bags (standing type).

Materials Required

- * Polypropylene or polythene or poly-sac bags or discarded bags
- * Soil and/or cultivation media (topsoil: compost: coir dust – 2: 1: ½)
- * Planting materials selected for cultivation

Construction of a Cultivation Bag (Standing Type)

- Step 1:** Consider the canopy size and/or purpose of planting of the crop and the location where the soil-filled bag is to be placed.
- Step 2:** Select a convenient and suitable type of bag for the selected crop and pierce appropriate drainage holes in the bag.
- Step 3:** Fill it with soil or cultivation media while taking measures for proper drainage.
- Step 4:** Make sure that the bag is not completely filled with media and leave about 10 cm of the bag for careful handling whenever necessary.
- Step 5:** Plant seeds, seedlings or cuttings in the central area so as to allow even spread of the root system.

Suitable Plants

Cassava, dioscorea, Colocasia, curry-leaf plant, tempering-leaf plant, dwarf-banana, guava, star-fruit, citrus, okra, ambarella, sesbania, chilli, eggplant, beet-root, lettuce, and many other types of food crops, medicinal plants and flower plants can be grown in cultivation bags of standing type containers.

Management of the Cultivation Bag (Standing Type)

- Place the bag on a proper place where drainage will not cause any problem for other activities.
- Use manual watering or drip irrigation as required.
- Use agronomic and physical methods in pest management.
- Train and prune plants whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- When plants become tall and produce branches care should be taken to protect them from the wind and rains.
- If creepers are grown, necessary supports should be given for effective growth.

ix) Cultivation Shell

Importance

A cultivation shell is a small type of structure that can be used to cultivate some essential cash crops as small-scale cultivations with recycling of organic waste coming from the household. Although it does not have vertical structural features it can be placed either horizontally or vertically with the support of other horizontal or vertical stands or substrate preparations. It helps utilize a limited amount of water and is most suited under arid climatic conditions with xeriscape culture (see Figure 2.23). A cultivation shell provides opportunities to learn and practise agricultural development initiatives along with L/N-SA at pre-school ages. Thus, it makes children aware of UA through enjoyment in a wider scale and enables application of UA practices in the pre-school curricula in future educational systems. This structure can also be used indoors for flower decorations on tables, etc.



Figure 2.23. Cultivation shells.

Materials Required

- * Coconut shells/ husks, seashells or any other shell-like organic items (e.g., coir-products)
- * A suitable stand or substrate to keep the shells stable and firm
- * Soil and/or cultivation media (topsoil: compost: coir dust – 2: 1: ½)
- * Planting materials selected for cultivation

Construction of a Cultivation Shell

- Step 1:** Select suitable organic shells that are hard enough to carry plants for a considerably long period of time.
- Step 2:** Make tiny holes at the bottom of the shells to drain out excess water after irrigation.
- Step 3:** Select a proper place or prepare a suitable stand or substrate.
- Step 4:** Fill the shells with cultivation media at appropriate levels.
- Step 5:** Plant seeds, bulbs or seedlings in shells. Care should be taken to direct away any excess water that generates after the saturation of the substrate.

Suitable Plants

Bulb-type cash crops such as onion and garlic are suitable for small cultivation shells while turmeric, ginger and other small medicinal plants are suitable for large cultivation shells.

Management of the Cultivation Shell

- Use manual watering or drip irrigation as required.
- Use agronomic and physical methods in pest management.
- Harvest bulbs or leaves at proper maturity/intervals.
- Pay special attention by doing regular inspection to ascertain whether the plants get proper levels of sunlight so as to produce good bulbs or leaf yields.
- Pay special attention to protect the substrate which provides stability to the shells.
- Reuse shells for replanting as appropriate and by inspecting the condition of shells.

x) Portable Cultivation Tower

Importance

A portable cultivation tower is a micro-form of a cultivation tower but this form or structure can be easily taken from place to place (see Figure 2.24). Hence, it can be used outdoors as well as indoors while considering provision of light. A cultivation tower is the most popular structure in UA and L/N-SA to date and people with no land space can then turn to adopt this portable model with enthusiasm. Ease in handling and low cost of preparation give an opportunity for apartment dwellers to maintain these portable cultivation towers in attractive ways. As a result, readymade portable cultivation towers are available in Sri Lanka under commercial production systems which facilitate dissemination of L/N-SA among urban communities.



Figure 2.24. Portable cultivation towers.

Materials Required

- * Cement or plastic pot
- * 2" - PVC pipe at convenient length (e.g., 30-60 cm)
- * Non-translucent polythene sheets in appropriate sizes
- * 2.5 cm X 2.5 cm plastic coated wire-mesh
- * Cultivation media (topsoil: compost: coir dust - 2: 1: ½)
- * Rooted planting materials
- * Plastic plate

Construction of a Portable Cultivation Tower

Step 1: Make some tiny holes spirally on the PVC pipe and then place its bottom side in the pot with the aid of the cultivation media.

Step 2: Place the wire-mesh to form a barrel-shape tower and keep the polythene sheet in touch with the wire-mesh (Figure 2.25).

Step 3: Fill the barrel-shape tower with the cultivation media. To allow proper soil aeration and water translocation hard compaction should not be practised.

Step 4: Make inverted T cut-holes 10 cm apart on the polythene sheets through wire-meshes in a triangular shape.

Step 5: Planting is done with rooted plants while placing shade-loving plants towards the bottom and light-preferring plants towards the top of the tower. Place the constructed tower on the plate with suitable protection.

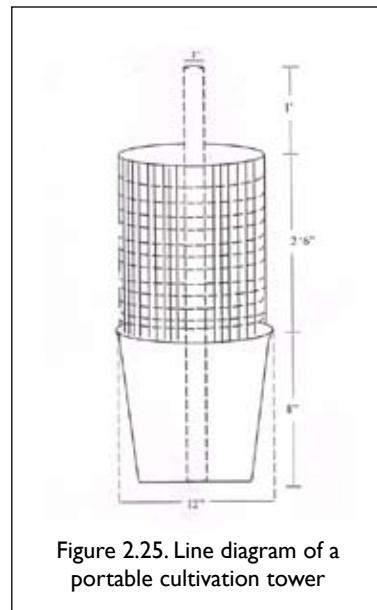


Figure 2.25. Line diagram of a portable cultivation tower

Suitable Plants

Due to its portable nature and handy size it provides access to selected small flower plants and leafy vegetables which are suitable options in crop selection. In this sense, lettuce, Centella, kan-kun, mint and Alternanthera can be planted along with some small flower plants.

Management of the Potable Cultivation Tower

- Top up perforated pipe with water as required.
- Fertigate through the perforated pipe.

- Use appropriate levels of sunlight in placing the tower outdoors for a better harvest and flowering.
- Use agronomic and physical methods in pest management.
- Train and prune plants whenever necessary in managing shade/sunlight.
- Harvest leaves at proper maturity/intervals.

xi) Cultivation Trolley

Importance

A cultivation trolley is a mechanically movable structure. It is also a collection of small cultivation structures suited for using restricted space in UA (see Figure 2.26). It is simple in structure because different structures are stacked in different decks of a trolley. As a result, a stack of cultivation structures is simply moved from one place to another so as to expose it to sunlight and for any other management requirements. Thus, urban housewives may be attracted

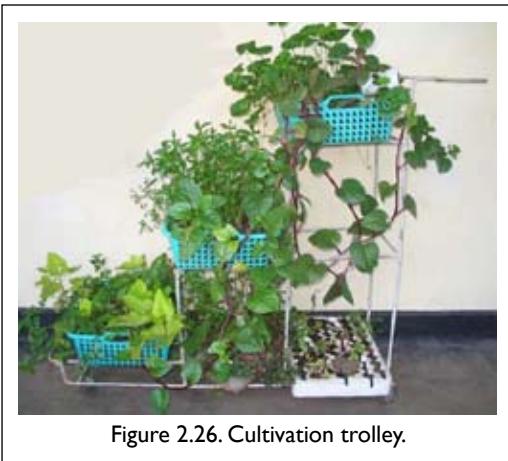


Figure 2.26. Cultivation trolley.

to it due to easy access to the plants to care for them in a convenient way or as they wish. However, a metal cultivation trolley demands an initial high cost for an average urban family. However, it paves the way for low-cost alternatives such as wooden or plastic trolleys in future development attempts of L/N-SA.

Materials Required

- * An old or unused trolley with 2-3 decks or furniture like a trolley on wheels

- * Selected small-sized cultivation structures suitable to be stacked on the trolley
- * Use trays or flat containers to pack plant pots or cultivation structures and also to collect any drainage water
- * Wires or threads as required

Construction of a Cultivation Trolley

- Step 1:** Find out proper sunlight-receiving locations of the house in the morning, noon and afternoon and mark these locations as stations for the cultivation trolley for the allocated time period of the day.
- Step 2:** Prepare the old metal trolley with required repairs or do any painting if necessary. Also if necessary adjust the decks in a zigzag manner to catch as much sunlight as possible.
- Step 3:** If an old metal trolley is not available construct a wooden or steel one with three decks. Make the decks so as to catch sunlight effectively from top to the bottom decks by fitting decks in different positions like zigzags as far as possible.
- Step 4:** Place the selected pot plants and cultivation structures considering the shade-loving nature and/or sunlight preferences for better growth performance.
- Step 5:** Attention should be focused to stop the trolley easily and firmly by checking the working ability of the stopper or always make sure to stop it steadily without inducing damages to other items at home.

Suitable Plants

Only small and bush-type crops are selected for trolley cultivations: e.g., lettuce, tempering-leaf plant, Centella, sweet potato (*Ipomea batatas*) and lasia. Creepers or vines are not recommended due to the difficulty in managing while moving inside the house.

Management of the Cultivation Trolley

- Place the cultivation structures in proper places where drainage will not cause any problems while moving.

- Use manual watering with great attention.
- Use agronomic and physical methods in pest management.
- Train and prune plants whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- When plants become tall and produce branches care should be taken to replace old plants with fresh planting materials.
- Repotting and replanting should be done every 3 months as small pots are not deep enough to hold soil fertility for long periods of time.

2.3 Cultivation Structures Suitable for Airspace

i) Cultivation Bottle

Importance

A cultivation bottle is a simple cultivation structure that facilitates recycling of common soft-drink containers for economically profitable micro-farming initiatives under L/N-SA practices in UA. It requires little vertical space and suits hanging spaces of the roof, balcony railings, wires, tree branches and the like. A cultivation bottle can be used either horizontally or vertically by making different cuts but it is best used vertically for better results (see Figure 2.27).



Figure 2.27. Cultivation bottles.

Materials Required

- * Discarded soft-drink mega-bottles (i.e., with capacity of 1 litre)
- * Nylon threads or wires
- * Black sheet: preferably black polythene
- * Cultivation media (topsoil: compost: coir dust – 2: 1: ½)
- * Rooted planting materials

Construction of a Cultivation Bottle

Step 1: With a small knife make inverted “T” cuts on the mega-bottle in a triangular shape. Two side pieces are created due to the cut of each place then turn inwards with a little force of a finger (Figure 2.28).

Step 2: Pierce a little hole at the bottom of the bottle and fill it with cultivation media.

Step 3: Cover the bottle with black polythene to provide darkness to the cultivation media for a better-rooted establishment. Then again make openings by cutting the polythene at every inverted “T” opening. This allows easy access to planting.

Step 4: Place the rooted plants through the cuttings made on the bottle that stands vertically.

Step 5: Hang the bottle on a suitable horizontal bar or tree-branch while assuring enough exposure to sunlight.

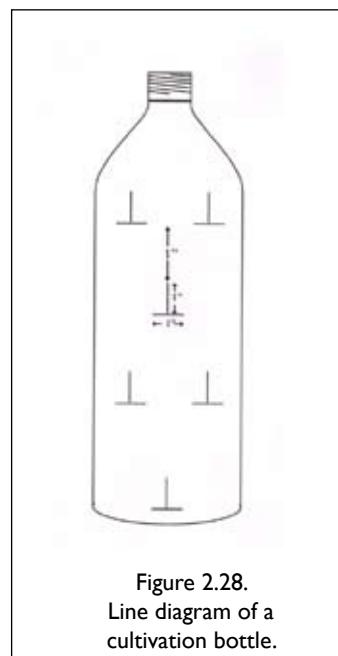


Figure 2.28.
Line diagram of a
cultivation bottle.

Suitable Plants

Kan-kun, Centella, mint, Alternanthera and small types of flower plants are suitable for the cultivation bottle.

Management of the Cultivation Bottle

- Use manual watering or drip irrigation as required.
- Liquid fertilizers can be applied if poor growth is observed.
- Use agronomic and physical methods in pest management.
- Train plants and pluck leaves whenever necessary in managing shade/sunlight.
- Harvest leaves at proper maturity/intervals.
- Pay special attention by doing regular inspections to ascertain whether the plants get proper levels of sunlight so as to produce good yields.
- Repotting and replanting should be done every 3 months as small pots may not be deep enough to hold soil fertility for long periods of time.

ii) Cultivation Lantern

Importance

A cultivation lantern is an attractive and innovative structure in L/N-SA as it can be used to decorate the veranda of houses as well as hotels or reception halls in cities through UA popularization movements (see Figure 2.29). The glittering effect generated by water-filled small-sized soft-drink bottles adds value to the cultivation lantern and promotes recycling of urban waste through economical usage. The controlled supply of water saves not only the water but also the time of the busy urban dwellers. It is popular among schoolchildren and also provides ornamental value to airspace of sky-rising buildings.



Figure 2.29.
Cultivation lantern.

Materials Required

- * Discarded small-sized soft-drink bottles
- * Plastic cup having a diameter of 25-30 cm
- * Pieces of wire or threads
- * Plastic or iron chain (if available only)
- * Cultivation media (topsoil: compost: coir dust – 2: 1: ½)
- * Rooted planting materials

Construction of a Cultivation Lantern

- Step 1:** Make three tiny holes at the bottom and towards the periphery of the plastic cup. Then send the wire or thread through these holes to create a cone-shaped wiring frame.
- Step 2:** Take the empty bottle and pierce a small hole on the cap of the bottle with a hot needle. It releases water by drips.
- Step 3:** Fill the bottle with water and tighten the cap. Then, place the bottle upside-down in the center of the cup and fix it tightly with the support of the cone-shaped wiring frame.
- Step 4:** Make another three holes on the outer layer and fix the chain onto the holes so as to hang beautifully in the airspace.
- Step 5:** Fill the cup with cultivation media and plant the selected rooted crops in the structure.

Suitable Plants

Amaranthus, kan-kun, Centella, and mint crops can be planted along with small-type flowers or ornamental plants.

Management of the Cultivation Lantern

- At regular intervals check whether crops receive enough water from the bottle. Top up if necessary.

- Liquid fertilizers can be applied if poor growth is observed.
- Use agronomic and physical methods in pest management.
- Train plants and pluck leaves whenever necessary in managing shade/sunlight.
- Harvest leaves at proper maturity/intervals.
- Pay special attention by regularly inspecting whether the plants get proper levels of sunlight so as to produce good yields.
- Repotting and replanting should be done every 3 months as small cups are not deep enough to hold soil fertility for long periods of time.

iii) Cultivation Antenna

Importance

A cultivation antenna provides access to practise L/N-SA in the airspace with creeper type/vine crops. It does not mean that a functioning television antenna is used for the purpose of cultivation. However, discarded antennae due to age or corroded effects can be easily recycled by converting them into cultivation antennae. On the other hand, it can also be built with suitable low-cost materials or even on a tree with hard-pruning and/or training techniques (see Figure 2.30). It creates a wonderful and natural sight within the built-in geometrical building scenery established in cities and towns.

Materials Required

- * A discarded television antenna with a post (i.e., approximately $2\frac{1}{2}$ m) or similar items available in the homestead
- * Large-sized thick polythene bag or cement pot and space for the post
- * Coir rope or wire
- * Good soil or cultivation media (topsoil: compost: coir dust – 2: 1: $\frac{1}{2}$)



Figure 2.30. Cultivation antennae.

Construction of a Cultivation Antenna

- Step 1:** If the land space available is restricted make a hole for the plant first and then fix a post close to it.
- Step 2:** If there is no land get a cement pot or a thick polythene bag filled with cultivation media and fix the post next to it.
- Step 3:** Fix the antenna on top of the post and/or create an antenna-like frame with the help of a wire and/or coir rope.
- Step 4:** Cut the coir rope or wire to an appropriate length and fix it from the hole for the plant/cement pot/bag to the antenna frame so as to allow the creeper crop to find the antenna easily.
- Step 5:** Plant the creeper plant after preparation of the bag/ pot/ hole and provide supporters to hold the guiding rope well.

Suitable Plants

Creeper crops such as passion fruit, wing-bean, loofah, snake-gourd and bitter-gourd are well suited for a cultivation antenna. Flower and/or edible leaf veins with colourful leaves are useful in building a gentle and attractive air-scape.

Management of the Cultivation Antenna

- Use manual watering as required. Pitcher irrigation (i.e., with a small clay pot) is also recommended, with care and attention given to the prevention of mosquito breeding.

- Use agronomic and physical methods in pest management.
- Tiny hanging pots which carry orchids can be hung on the antenna frame to beautify the view but extra care should be taken to ensure the frame and post have the required strength.
- Train and prune creepers whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- Pay special attention to protect the antenna frame from the wind.

iv) Cultivation Bag (Hanging Type)

Importance

A cultivation bag of the hanging type is an alternative form of a cultivation bottle but it can be used as an airspace decorative structure where land is restricted for UA. It has basically the same form of structure of the standing-type cultivation bag but is fairly small and can be hung well in the air. Differences in design, size and colour could add beauty to the structure although it is somewhat traditional in usage (see Figure 2.31). The modern “Grow Bags” that are used with drip-irrigation systems in hi-tech green-houses can also be included in this category. Although it is not popular as a cultivation tower, this structure is well compatible with apartments where no land is available to practise L/N-SA with low-cost of production.



Figure 2.31. Cultivation bags (hanging type).

Materials Required

- * A non-translucent polythene or thin plastic bag of an appropriate size and design
- * Pieces of wire or threads
- * Decorative materials (if required)
- * Cultivation media (topsoil: compost: coir dust – 2: 1: $\frac{1}{2}$)
- * Rooted planting materials which prefer light substrates for growth

Construction of a Cultivation Bag (Hanging Type)

- Step 1:** Select the bag and do some decorative work if needed. Check the strength of the bag.
- Step 2:** Pierce a little hole at the bottom of the bag and fill it with cultivation media.
- Step 3:** Pierce holes and create a handle by sending a wire or threads through the holes so that the bag could be hung firmly and vertically on a holding bar or wire.
- Step 4:** Create enough space and remove any barrier created by a handle or wire. It allows easy access to planting. Then plant the rooted plants selected for the structure.
- Step 5:** Hang the bag on a suitable horizontal bar/wire or tree branch while assuring enough exposure to sunlight.

Suitable Plants

Wing-bean, kan-kun, mint, coriander, tempering-leaf plant, orchids and ornamental ferns can be grown in cultivation bags of the hanging type.

Management of the Cultivation Bag (Hanging Type)

- Use manual watering or drip irrigation as required.
- Liquid fertilizers can be applied if poor growth is observed.

- Use agronomic and physical methods in pest management.
- Train plants/vines and pluck leaves whenever necessary in managing shade/sunlight.
- Harvest leaves at proper maturity/intervals.
- Pay special attention by doing regular inspection to ascertain whether the plants get proper levels of sunlight so as to produce good yields.
- Repotting and replanting should be done every 3 months as small bags may not be deep enough to hold soil fertility for long periods of time.

v) Air-Scape with Edible Matter

Importance



Figure 2.32. Different types of air-scapes with edible matter.

An air-scape, with edible matter is an innovative and decorative structure that suits restricted land space as well as rooftop gardening attempts in L/N-SA. It has the ability to create charming micro-climatic conditions within a land-restricted homestead either on the land or on a cemented rooftop.

Moreover, it facilitates generating a cooling effect as well as a micro-garden, with edible matter, that appeals to the physical and mental well-being of a family. One can design his/her own structure according to the expectations of family members so as to manage stress, which is often generated at the workplace or at home (see Figure 2.32).

Materials Required

- * Collection of selected cultivation structures discussed hitherto or other creative structures available
- * "L" iron or galvanized pipes of suitable length and strength to carry the total weight of different cultivation structures that are to be utilized
- * Welding or fitting tools/equipments for construction
- * Wires or ropes in appropriate quantities
- * Additional quantities of soil and cultivation media (topsoil: compost: coir dust – 2: 1: ½)
- * Selected hard/soft structures used for present-day landscaping

Construction of an Air-Scape with Edible Matter

- Step 1:** Select a proper place to put up the air-scape with edible matter, to maximize the available vertical space on the land or rooftop and also protect it from the wind.
- Step 2:** Find out a suitable form of design before doing any digging or drilling land/cement structures (i.e., plan of the structure should be in mind beforehand and it may be round, oval, rectangular, triangular or otherwise in shape).
- Step 3:** Once the plan is well designed put up the main posts up to a convenient height. One can construct tall structures but need to build ladders to reach every corner and all cultivation structures for good management at appropriate levels.
- Step 4:** Then connect the main posts and sub-bars or trusses to fix structures firmly and solidly. If hard landscaping structures are selected (i.e.,

garden bench, bird-bath, etc.) place these items first and then select living structures to be fixed. Use wire or ropes in appropriate ways to generate an aesthetic view and scenery.

Step 5: Place heavy structures on the land/floor and add soil or cultivation media. If micro-irrigation systems are selected for irrigation, get assistance from relevant agencies.

Suitable Plants

A mixture of various types of food and flower plants, vines and creeper crops can be used (i.e., as mentioned previously) in making and managing an air-scape, with edible matter, and the selection responsibility is in the hands of the family members who take charge of the establishment of this micro-garden structure.

Management of the Air-Scape with Edible Matter

- Use manual watering or drip-irrigation as required. Pitcher irrigation is also recommended for plants grown on land (but not on rooftops), with care and attention given to prevent mosquito breeding.
- Use agronomic and physical methods in pest management.
- It can be maintained to form a micro-forest-type garden to induce a cooling effect, paying continuous attention to crop management aspects.
- Train and prune flowers as well as food vines whenever necessary in managing shade/sunlight.
- Harvest fruits/leaves at proper maturity/intervals.
- Pay special attention to protect the structure/frame from the wind.
- It is a long-term structure and replanting of seasonal crops is essential with improved soil-fertility levels for a sustainable UA venture.

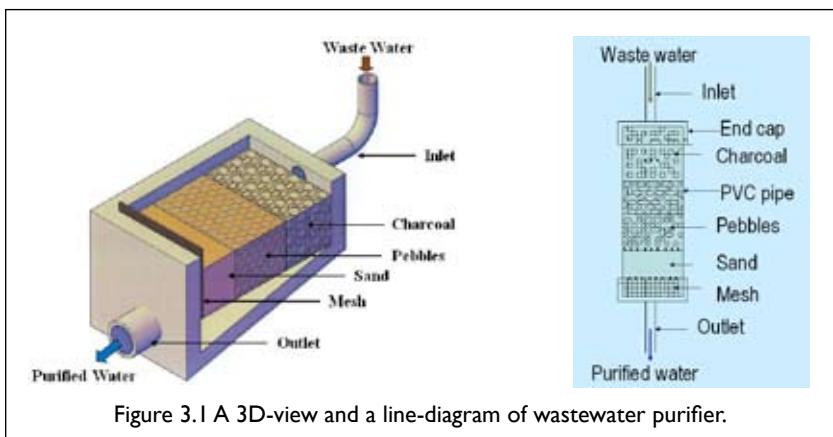
3. ROLE OF CULTIVATION STRUCTURES IN L/N-SA

3.1 Factors Contributing to Maintenance of Cultivation Structures

The proper maintenance of live cultivation structures is an essential part of L/N-SA so as to perform the prime role of utilizing restricted urban space through vertical creativity of UA. It depends on several factors and the most important aspects are discussed below.

3.1.1 Selection and Placement of Structures and Plants

Selection and placement constitute the prime-important aspect in the L/N-SA in urban agricultural entrepreneurship. This aspect consists of three major sub-aspects and each carries some considerations as discussed below.



Physical Considerations

- Availability of physical space is a decisive factor; a basic decision has to be made according to the qualities of each cultivation structure described in chapter 2.

- Availability of sunlight/shade has to be considered and, if possible, pruning of trees and change of hard items like iron or wooden structures have to be completed or selection of shade-loving plants adopted.
- Availability and quality of water will be the next concern. If it is limited or expensive one should go for rainwater harvesting. Also decisions have to be made whether to do manual watering or micro-irrigation.
- It is always advisable to locate water and shade-loving plants/frequently used spice-crops close to the kitchen and consider recycling of grey-water from the kitchen and bathroom with the construction of a “Wastewater Purifier” as shown in Figure 3.1.

Health Considerations

- Provide priority for the selection of medically recommended food crops to meet specific family nutritional needs.
- If there is a risk of soil and water pollution in the residential area due to heavy metal contaminations or related factors avoid the selection of structures such as cultivation pyramids and sometimes cultivation towers as these structures touch the earth.
- Give priority for crops that produce many edible items (e.g., leaves, flowers, pods and fruits from a single plant) to raise family nutrition level high with the restricted space: e.g., passion-fruit, sesbania, etc. Also select large-sized structures for perennials.

Technical Considerations

- Give priority to agronomically recommended crops for cultivation in order to minimize pest attacks. Select crops and cultivation structures which necessarily increase either land space or airspace and beautify the homestead.
- Select traditional crops/varieties as much as possible because they fairly and moderately resist common pest incidences than

hybrid ones. Later, select suitable cultivation structures accordingly and if the shade is high always avoid creeper crops.

- If the texture of the soil is highly sandy or the area frequently experiences floods avoid cultivation structures such as cultivation towers and cultivation pyramids as these stand on the land.

3.1.2 Preparation of Growth Media for Cultivation Structures

The key of homestead preparation of growth media is the art of making compost and/or organic manure at home. There are widely known ways in making compost at home or as commercial ventures, e.g., heap, pit or bin methods.

In addition to these methods, there is another L/N-SA method to produce compost in small quantities throughout the year in an urban setting, e.g., a live compost cone which is produced with low-cost materials as another form of vertical structure in UA.

Materials required are several (i.e., depending on the size of the cone): 150 cm long glyricidia sticks (according to preference they can be made of iron or wooden sticks) and coir ropes under cost-saving attempts. The glyricidia gives real form of a lively look as it contributes to environmental sustainability. Plant sticks as close as about 8 cm apart to form circles of a diameter of 40 cm. Then arrange the sticks to create a conical structure and tie them with coir ropes: at least three circles of coir-rope wiring are needed (see Figure 3.2). Make an appropriate small opening or door (e.g., 6 cm X 6 cm) at the bottom or ground level of the cone so as to get the decayed compost from the vertical live compost cone. Then add some old or decayed compost material to the bottom and thereafter add garden and kitchen waste on a daily basis. If possible, chop the waste items into pieces of 5 cm or less before adding into the cone in order to increase bacterial action as a wide surface is open for them to decompose the waste. Mixing of the materials in the cone facilitates the composting process. The glyricidia sticks later become trees whose leaves can also be used for composting while facilitating the greater recycling process of plant nutrition in a restricted urban space. The composted waste is used to prepare the cultivation media (topsoil: compost: coir dust – 2: 1: ½) in maintaining the cultivation structures in L/N-SA.

In addition, if possible, apply a culture of earthworms for a variety of purposes, which means vermi-culture and/or vermi-composting can be adapted as a home-based activity in preparing high-quality organic manure. This manure can be used as a growth medium for shallow cultivation structures such as cultivation envelopes, cultivation lanterns, cultivation racks, cultivation bottles, etc.



Figure 3.2. Steps in the preparation of a live compost cone and a site of compost demonstration.

3.1.3 Protection from Pests and Application of IPM Strategies

The prime aim of the L/N-SA is to use no, or minimum of, pesticides in cultivating crops in the cultivation structures. To practise this aspect, the basic principles of Integrated Pest Management (IPM) practices are advocated in advancing the FBG concept for years from the inception of its practice. Suitable and applicable methods to particular agro-ecological conditions are recommended for adoption by readers of this manual whose aim is not to discuss IPM at great length. The IPM strategies can be categorized briefly as follows.

- Cultural: Cultivation of trap/repellent crops, crop rotation, use of resistant varieties.
- Spiritual: Application of biodynamic or indigenous beliefs, etc.
- Physical: Manual picking of insects, regular touching of plants to inspect and remove affected portions/leaves/flowers/pods, and making use of physical barriers, installation of light traps, etc.

Mechanical: Covering flowers or pods with paper or polythene papers and making use of grease-applied coloured polythene strips to paste-cum-repel insects.

Biological: Use of pheromone traps, and methods to induce the presence of predators, and use of organic pesticides.

3.1.4 Concern on Cost-Benefit Factors

The practice of L/N-SA does not compete in terms of cash flow with other types of urban entrepreneurship like hotels, entertainments, garment industry, and the like that fetch foreign currency. Instead, there are many other benefits of L/N-SA that are not translated into income-generation: environmental improvement, habitat improvement of small creatures, improvements in health status of urban communities, reductions in mental-stress levels, etc. However, some cost comparisons are given in the L/N-SA practice so as to get an idea of reducing the cost of food baskets or increasing additional income at home (see Tables 1, 2 and 3).

Table I. Cost, yield and income analysis of a cultivation tat for one year.
[Four-piece tat of lettuce crop]
(Prices indicated in Sri Lankan Rupees: US\$1.00 = SLRs110.00 in 2007.)

Cost

Material	Square PVC gutter	PVC end cap	Nylon thread	Planting media	Planting materials	Replace cost, etc.
Quantity	6' piece [1½ x 4]	08	40'	12kg [10 times]	120	--
Cost	840	450	150	500	240	160

Total cost = SLRs2,340

Yield and income

Yield	[Total of 10 times of lettuce harvest in kg]	15
Price	[SLRs/kg]	200
Total gross income	[SLRs]	3,000

Total net income: SLRs3,000 – 2,340 = SLRs660

Table 2. Cost, yield and income analysis of cultivation tower for one year.
 [6' height and 5' diameter of tower with multi-crops]
 (Prices indicated in Sri Lankan Rupees: US\$1.00 = SLRs110 in 2007.)

Cost

Material	2" PVC pipe	2" end-cap	Wooden sticks	Polythene poly-sack	Planting media	Planting materials
Quantity	07' piece	01	04	03 m/two bags	500 kg	30
Cost	600	125	75	125	200	100

Total cost = SLRs1,225

Yield and income

Crop	No. of plants	Yield (kg)	Price (SLRs/kg)	Income (SLRs)
Capsicum	02	03	200	600
Brinjals	02	06	75	450
Spinach	10	20	50	1,000
Kan-kun	10	08	50	400
Centella	10	04	75	300
Alternanthera	10	05	60	300

Total gross income = SLRs3,050

Total net income: SLRs3,050.00 – 1,225.00 = SLRs1,825

Table 3. Cost, yield and Income analysis of a cultivation bottle for one year.

[1.5 liter bottle of kan-kun crop]

(Prices indicated in Sri Lankan Rupees: US\$1.00 = SLRs10.00 in 2007.)

Cost (in SLRs)	
i) Base cost [empty bottle and replacement cost]	40
ii) Cultivation media	60
iii) Liquid manure/fertilizer	50
iv) Planting materials [4 times]	20
Total cost	170
Yield [20 times of kan-kun harvest in four quarters] kg	04
Price/kg	50
Income	200

Total net income: SLRs200 – 170 = SLRs30

3.2 Advantages of the Use of Cultivation Structures

Urban agriculture (UA) is becoming part of the landscape, with architectural designs mainly through roof-scape developments, urban waste management and, finally, as part of the way of life. City dwellers from a variety of backgrounds can incorporate progressive lifestyle changes into the fabric of their diverse daily lives: the latest food habit variation of the “Bite-Sized-Dessert” that creates demand, for example, for small quantities of different types of dessert. L/N-SA assists city dwellers to make their homesteads truly sustainable places of biological value.

3.2.1 As a Way of Life

There are several advantages in utilizing L/N-SA as a way of life in urban spaces. These are as follows:

- L/N-SA shows a vision of healthy products and a regeneration of nature in city life.
- It invites a new way of interaction between micro-producers and urban citizens in residential areas.

- It can be started at any time of the year and cultivation structures can be rotated around the homestead by covering the blind or unused spots of the garden.
- It shows creative and different ways of gardening and/or micro-entrepreneurship.
- It requires minimum space, time and water but provides biotic resource recycling and waste management opportunities.
- It needs no, or minimum, tilling and weeding to accept it as a leisure activity but it is a source of healthier life.
- It provides fresh food in small quantities throughout the year and shows the way to cope with situations of food crises.
- It can be maintained with joy to yield mental fitness while reducing stress levels.
- It develops social cohesion which is much needed for human development goals of the twenty-first century.

3.2.2 In Developing Individual Homesteads

Family points of view:

- It builds opportunities to decorate the homestead with vertical living structures not only on land but also in airspace.
- It develops a cooler, greener and cleaner micro-climate and an environment within the restricted urban space.
- Selected cultivation structures can be used for outdoor as well as indoor live and low-cost ornaments in place of conventional and expensive cement/ clay/ ceramic/ metal structures.

Social points of view:

- Cultivation structures in L/N-SA provide access to exchange goodwill along with an exchange of nutritionally valuable live-structures among urban communities.
- It develops an aesthetic value of the city and creates access to urban agro-tourism opportunities: i.e., agro-streets, agro-apartments, agro-condominiums, etc.

- It helps reduce urban air and sound pollution at least to some extent if it is adapted in a larger and collective form.

3.2.3 Towards Better City Administration and Management

- L/N-SA in UA helps feed urban populations in a micro-context but essentially provides basic medicine-cum-sanitation for a city with crises such as heavy-metal contaminations, waterlogged conditions, etc.
- L/N-SA finds sites for its presence not only in urban homesteads but also in hotels, institutions, recreational places, shopping malls and land allotments in expanding the vision of recycling urban waste for better products.
- L/N-SA with cultivation structures paves the way to do UA in problem places like polluted lands, waterlogged lands and high-rising buildings in developing land and airspace through vertical production techniques.
- L/N-SA that heavily advocates the use of cultivation structures in advancing the concept of the FBG generates new access for micro-agro-entrepreneurship and develops novel opportunities for UA.
- L/N-SA opens new vistas in technical, ecological, social and economic improvements that can be used to generate revenue on waste management, landscape and air-scape development with municipal administration and good governance.

3.3 Entrepreneurship Development in L/N-SA

L/N-SA itself is an attractive venture in UA and it creates access to unlimited opportunities with the dynamic nature of lifestyle changes of urban societies. Thus, the knowledge management process of L/N-SA helps expand the entrepreneurship development process through the delivery of marketing hints to micro-agro-entrepreneurs.

The common hints for most enterprises are given below followed by specific hints for cultivation structures, compost/growth media, Nursery and/or potted plants, fresh produce and/or processed/preserved food products and, land and air-scaping with edible matter, micro-irrigation, and other related services.

- Go for knowledge and skill development training and do get feedback on sold items/products. It is always better to provide after-sales services for a firm establishment.
- Go in search of access to capital, inputs, technology and marketing tactics and market research methods.
- Go after quality standards, regulations, business acts and other law enforcement processes to remain within a long-term business-development process.
- Go hand-in-hand and with a networking process with organizations in government bodies and business organizations to strengthen the production activities.
- Go for initiatives of handout designs or brochures and distribution in respect of product popularization.

3.3.1 Marketing Hints for Cultivation Structures

- Go for different ways of creativity to meet the diversity of consumer preferences.
- Go for basics of agronomy and plant morphology in selecting different plants for different structures.
- Go for recycling of waste materials so as to produce them at low-cost and to facilitate environmental regeneration.
- Go for quality rather than quantity in the production process so as to assure sustainability of entrepreneurship.
- Go in search of niche markets and, at the initial stage, select roadside stands to make aware of the enterprise and canvass on the benefits of cultivation structures in UA.

3.3.2 Marketing Hints for Compost/Growth Media

- Go for non-polluting raw materials and well-maintained quality of the media texture.
- Go for finished products of well-rotten compost, free from heavy metals, printed papers or industrial waste and harmful pests.

- Go for special standards or organic certification processes for a constant market demand.
- Go for attractive packaging materials and store with care to prevent adulteration or spoilage.
- Go for issuing of instructions on how to use and gain maximum benefits out of the product.

3.3.3 Marketing Hints for Nursery and/or Potted Plants

- Go for the most needed vegetable crops of day-to-day use at homes for major meals or dessert preparations.
- Go for attractive presentation forms of containers while considering the cost factor and the demand for the products in L/N-SA.
- Go for assurance of firm establishment while transporting after sales as nursery plants and seedlings are sensitive to shocks and jerks.
- Go for enough hardening processes of plants for sunlight which produce pods/fruits before taking to the sales-stand.
- Go for proper labelling of crop varieties and/or species and providing instructions on handling and managing the plant in cultivation sericulture/field bed/green house.

3.3.4 Marketing Hints for Fresh Produce and/or Processed/Preserved Food Products

- Go for popular brands and line extensions available in the market places where these products influence the choice of urban customers.
- Go for private labels at the inception of the enterprise with moderate price levels. Also make use of the “U-Pick” marketing strategy for fresh produce if possible.
- Go for co-branding by being associated with other successful enterprises or brands if there is high competition or rejections experienced at the urban marketplace.

- Go for resuscitative actions through promotional programmes to reduce spoilage and also diversify the product for new market trends after having recognized the situation through market research.
- Go after quality and uniqueness of the product as consumers want to stay with a brand and hold on to it.

3.3.5 Marketing Hints for Land and Air-Scaping with Edible Plants, Micro-Irrigation and Other Related Services

- Go for dynamic delivery mechanisms by making regular improvements to the services provided as urban consumers want greater convenience in receiving services.
- Go for a unique and tailor-made delivery (i.e., produce + experience in special service techniques + friendly atmosphere) in constructing landscapes and air-scapes, with edible plants, or micro-irrigation layouts. By so doing a customer-centric retailing environment can be easily maintained.
- Go for simple and low-cost delivery messages, especially for low and middle-income earners because they are quite reluctant to invest in technology. However, once they are convinced of gardening with edible plants as a vital venture, they will make a total change in their perspective at once.
- First, go in search of waiting customers of the urban populations who are in need of services, and then turn for potential customers by executing promotional campaigns.
- Go for making use of “word-of-mouth source” as an initial propaganda work. Later, tackle non-traditional places like gas stations, information centres, hotels, parks and exhibitions and fairs as hot-spots to distribute handbills in expanding the horizon of your activities/services.

PART TWO

**TECHNOLOGY DISSEMINATION
IN
LOW/NO-SPACE AGRICULTURE (L/N-SA)
-CUM-
FAMILY BUSINESS GARDENS (FBG)**

4. SIGNIFICANCE OF URBAN AGRICULTURE (UA) WITH L/N-SA IN URBAN DEVELOPMENT

4.1 Importance of UA for Urban Lives

Two-thirds of the world's populations are projected to live in towns and cities by 2020. The population rise is seen in the developing world as well, where the number of urban dwellers has doubled within a short span of time.

Rural land is estimated to be converted to urban use at the rate of three to five times the growth of the urban population (UN-Habitat 2003). The United Nations Environment Programme (UNEP) reveals that three-fifths of the cropland in the world is now degraded, and with the population increases, worldwide crop yields could be cut by one-seventh by 2020. The World Bank foresees looming water shortages for agriculture, compounding the problem even further while one-third of the populations of the world live in river basins where they face water scarcity (Padma 2008). Meanwhile, one-seventh of the populations in the world do not get enough to eat and urban hunger is on the increase. As such, it is obvious that urban food security could partly depend on food grown more on local resources than on fossil fuel. FAO (1999) shows the importance of UA and suggests that up to two-thirds of urban and peri-urban households worldwide are involved in agriculture at least for their own consumption with occasional surpluses sold to local markets. The latest assessment on food shortages for the future further strengthens the case for UA.

4.1.1 To Address Health-Related Issues

Urban agriculture has multiple benefits. Due to urbanization, people not only experience dramatic lifestyle changes but also undergo much stress. As a result, it is observed that there has been an increase in the incidence of non-communicable diseases such as Type I and Type 2 diabetes, heart failure and cancer (MOHN 2007).

People who frequently (year-round) eat salads and raw vegetables are reported to run a lower risk (80%) of developing diabetes than those who consume vegetables occasionally. Research shows that those who cultivate crops in urban areas consume more vegetables more frequently but consume less sweets and soft drinks than those who do not cultivate crops in urban areas (Bellows et al. 2003).

More interestingly, working with outdoor plants benefits mental health, mental outlook and personal well-being of individuals. All in all, UA helps in both preventing illness and healing responses that, in the long term, reduce expenses on health care. In other words, to attain this end, UA tries to convert “fast-burning food consumption habits” to “slow-burning food habits.”

4.1.2 To Be Sensitive to Poverty-Related Issues

In 1988, about 25% of the urban population ranked among the category of “absolutely poor.” By 2000, this proportion had risen to about 56%. In 2001, a population of 924 million or 31.6% of the urban population lived in slums or irregular settlements without sufficient access to decent food, shelter or sanitation (Eawag 2007).

Urban agriculture contributes to urban food security through sharing food with friends, families and neighbours, facilitating community food security. It is found that growing vegetables in cities is positively correlated to a decrease in crime, trash dumping, violent deaths and mental illness which lead to persistent poverty of the underserved urban populations. Furthermore, UA helps reduce alarming levels of malnutrition and social marginalization through income-generation activities in areas which have been negatively affected because of industry-related jobs.

4.1.3 To Work on Environmental Improvement Goals

Urban areas usually threaten ecosystems through both direct habitat conversion and the exploitation of the resource base by the human population, habitat fragmentation, waste generation and freshwater pollution (Bellows et al. 2003).

Urban agriculture improves air quality and urban fringe-soils on a long-term basis. The use of waste in UA activities reduces pollution and enriches the soil while improving biodiversity and ecological sustainability. Urban agriculture is desirable for a city with low-income residents who can convert waste, which consists of 70% organic matter, which is more abundant there than in both rural wastelands and idle lands that can be converted to landscapes with edible matter (Smit 1996).

A city with UA contributes to form greener, cooler, healthier and more attractive urban centres worldwide. It reunites urban people with nature and biodiversity improvement towards a holistic development process.

4.1.4 To Develop Farming Systems for Future Generations

To reiterate, by tradition, “UA” is considered an oxymoron in the city development process. However, sustainable and greener development concepts offer new access to UA providing agro-based employment opportunities disproportionately for women and the elderly as well as youth in developing different types of farming systems adaptable to city farming. The UA programmes are designed to teach the youth skills and a lifetime hobby that provide exercises, mental stimulation and social interaction.

On the whole, UA broadens the economic base of a city, and feeds the processing and marketing sectors while making minimal demands on transport and infrastructure.

4.2 Opportunities for L/N-SA in UA

All of us have the same power to create a better world by harnessing our energies and changing our thinking. In applying them to practical situations, for instance in UA initiatives, we need to work on three goals:

- i) Get involved so that one can make a difference.
- ii) Get active so that one can himself/herself or with a group of people analyse the situation.
- iii) Get creative so that one can be confident of turning ideas into action.

The following opportunities are available for those who want to be creative, active and involved in developing productive UA entrepreneurship. They can also develop more and more opportunities. However, opportunities for L/N-SA (i.e., mentioned in sections 2.1–4.2) could be broadly classified into three categories according to the physical space available for micro-agricultural ventures in cities.

4.2.1 Building-Scapes without Land Availability

Several attempts have been made to grow floricultural crops in addition to food crops either inside or outside of homes/buildings in a city. In line with the utilization of available building space for city agriculture the following existing approaches can be shown as worldwide examples of building-scape developments.

- a) Container gardens: This means gardening initiatives with the use of different types of containers. Soil is used as the growing medium and it is suited for small spaces as well as spaces where water is restricted, or in waterlogged situations. It is also a way to improve existing gardening.
- b) Hydroponics: In hydroponics culture, nutrients and water are supplied directly to the roots of plants without soil. However, systems vary as aerated standing culture, nutrient-flow culture or central-flow culture. There are rotating hydroponics systems designed for convenience and simplicity and for indoor cultivation of plants under artificial indoor lighting conditions (e.g., Omega Gardens in Canada).
- c) Hanging gardens: Pots and baskets which can be hung on a couple of wires would make a hanging garden in building-scapes.

Plastic bottles, woven wicker baskets or similar items constituting a hanging garden will add aesthetic value and also help circulate air with its swinging action and aid in cooling the surroundings.

- d) Square-foot gardens: A square-foot garden is a unique and simplified method of gardening that can be adopted for varied limited space conditions and for all levels of experience without much hard work. The Square-Foot Gardening Foundation in USA explains that it requires only 20% of the space of a conventional “row gardening.”
- e) Balcony gardens: Balconies of houses can be used for gardening with containers as well as hydroponics boxes. They can provide a considerable amount of vegetables in a small space. This is a unique initiative aimed to show how people can adapt gardening methods constituting edible matter to suit their own lives and green their environment.
- f) Rooftop/Terrace gardens: A vegetative roof cover constructed on top of a conventional apartment or sloping roof is called a rooftop garden. It helps reduce run-off volume and peak-flow rates, while conserving and cooling the air. In addition, it restores the ecological and aesthetic value of a city in the long term.
- g) Agro-processing and value-added enterprises: Several opportunities are open to prepare food for the urban market. These are handicraft works, fresh and dried mushroom products, ornamental fish production and the like even though a city dweller lives in a sky-rising apartment. In making use of modern scientific opportunities one can practise tissue-cultured plants for sale and aeroponics culture (i.e., cultivating in air-sprayed nutrient chambers) as indoor urban enterprises.

4.2.2 Private Landscapes with Limited Availability of Land

Different types of home gardens, kitchen gardens or backyard gardens are categorized here for practical purposes. This is the traditional way; however, there are new ways of thinking worldwide in developing limited land areas for landscapes with edible matter through UA initiatives.

- a) Raised soil-bed cultivations: This type of cultivation is a traditional system and has a long history known in different forms like kitchen-gardens, backyard-gardens, walled-kitchen gardens, home-gardens and so on. The cultivations are mainly done on prepared soil beds and a novel nature of landscaping improves the appearance of modern-day gardens. It is highly productive as food crops, herbs and flower plants are produced for the family and guests.
- b) Living-structure cultivations: This means the use of a collection of vertical living structures to maximize available resources of a limited homestead so as to meet some family food needs. The creation of vertical living structures is promoted through the FBG concept in introducing the L/N-SA for UA practice. Various types of vertical living structures are discussed in section 2.
- c) Keyhole gardens: This land structure is popular in Lesotho in making use of wastewater for vegetable production during dry conditions. These are raised beds shaped like a keyhole and walled in by stones. They are 2 metres in diameter and raised to waist to chest-height to make them easy for the sick and elderly to work on. Gardens are composed of layers of soil, manure and ash. In the centre a basket made of sticks and straw holds manure and later vegetable scraps for compost and sometimes tin cans.
- d) Plant house/Green house/Organoponics cultivations: With the available land space a city dweller can practise hi-tech cultivation practices under control-environmental mechanisms. This can vary from a simple plant or net house to an automated green house (e.g., micro-irrigation, fertigation, temperature control, etc.) management in UA entrepreneurship. In the arena of organic farming, former hydroponics units have been converted by merging the principle of raised-bed gardening with hydroponics management to form “organoponics” in Cuba, since the mid-1990s. This became a system of UA farming for the rest of the world to follow.
- e) Barrel-/bin-assisted cultivations: Water-harvesting techniques with rain-barrels, different methods of composting (e.g., the use of organic house-waste with compost bins, vermi-composting in barrels) and vermi-bin-culture for liquid-manure preparations provide sustainable accesses to UA where private lands are available to some extent.

- f) Crop-livestock integrated cultivations: The intensive crop-livestock integrated approach to urban food production is one of many ways that urban dwellers are responding to the increasing animal protein demand. This synergy which promotes small-animal-cum-crop production (e.g., rabbits, chicken, goats, quails, turkey, guinea pigs, etc.) ultimately leads to the rational use of dwindling natural resources in urban areas.
- g) Aquaculture/Aquaponics: The culture of aquatic resources (e.g., fish and aquatic plants) under controlled conditions in a limited space is becoming an increasingly important source for human consumption as aquaculture in UA. Aquaponics is simply the combination of aquaculture and hydroponics. Here, the fish waste provides a food source for the growing plants, and the plants provide a natural filter for the fish.
- h) Agro-processing and value-added enterprises: Opportunities are open through many directions to urban dwellers who own some spacious land for practising plant nurseries, selling compost and fresh or processed products, and also for creating agro-tourist and eco-tourist ventures for income generation.

4.2.3 Common-Property-Scapes with the Involvement of the City Administration

Urban agricultural activities found in common or rented-out land given to the public are categorized here as most of the interventions are coordinated or supported by city administrations or institutions.

- a) Community gardens: Here a group of city dwellers come together to cultivate commonly owned land. However, these are diverse in their management aspects. They often publicly function in terms of ownership, intervention and management. Community gardens are typically owned by local government councils or non-profit organizations.
- b) Allotment gardens: Contrary to other community gardens here parcels or plots of land are cultivated on an individual basis by a group of people who have organized themselves as an association. However, the entire area of the allotment is managed by a committee of the association. This association leases the land from the city administration or a private owner. The members have to pay a small fee but they are allowed only to do gardening but not building houses. They have to abide by by-laws but they are entitled to certain democratic rights in the development of UA.
- c) Condominium gardens: A condominium can be a high-rise building, a town house, a semi-detached or even a fully detached complex. Usually, a building unit is owned

by a city dweller; other common elements including common land areas are owned by the municipal administration or property developer. The common land of a condominium can be converted into a source of UA enterprises, especially with the help of L/N-SA.

- d) Shared park gardens: These types of common interventions can be developed by residents and city administrations or property owners by merging parts of their leisure lands into larger shared yards, gardens or parks for UA development purposes. By so doing city governments can transform dysfunctional or neglected alleys for productive UA work and also incorporate this idea into new city development plans.
- e) Roadside and canal-side gardens: In a city there are some vacant lots and abandoned spaces between motorways, railways, channels and rivers which can be used for UA initiatives under restricted permission of city administrations. These initiatives help improve ecological and biodiversity aspects of urban areas. Also, these gardens lead to reduced flash floods and allow rainwater to percolate through vegetation and natural drainage. Increased vegetation will filter storm water and improve air quality in urban areas.
- f) School and institutional gardens: Urban school gardens are powerful tools for improving child nutrition and education. It is appreciated that the idea is expanding to pre-schools in Sri Lanka where the performance of kindergarten children in L/N-SA activities is evaluated. The extended attempts to involve public and private-sector institutions in UA activities are on the increase. Both these attempts have the potential to improve food security and human nutrition at household level through replication in the home, resulting in lower levels of municipal health-administration costs.
- g) Agro-processing and value-added enterprises: When there is active involvement of city/municipal administrations common property spaces as well as private property lots can be used for UA entrepreneurship for the betterment of city dwellers. It is advisable to include these strategies in the long-term city development plans which will facilitate enterprises such as bulk production of compost from city wastes, sales outlets for city gardeners, and agro- and eco-tourism ventures, etc.

4.3 Policy Initiatives and Advocacy Programmes Promoting UA in Sri Lanka

Sri Lanka provides a unique example in identifying and promoting UA through government, non-government and private-sector participation.

The novel aspects in inventing innovations and provisions used to deliver them with painstaking processes can be emulated by the rest of the world (i.e., urban agricultural development policy statements contained in the Policy on Agriculture and Livestock-Sri Lanka, 2003-2010 and National Agricultural Policy for Food and Export Agricultural Crops and Floriculture of Sri Lanka, 2007). Specific milestones in the policy and advocacy programmes were as follows:

The formulation and demonstration of a novel concept of the FBG led to recognizing the value of micro-level agricultural initiatives in Colombo, the commercial capital of Sri Lanka and the suburbs. On the World Environment Day in 2000, the then leadership of the Western Province Department of Agriculture (WPDOA) launched this concept through a practical demonstration introducing UA to the general public (Ranasinghe 2003). Since then attempts have been made to contrast UA with rural agriculture resulting in the birth of a specific focus on the agricultural development sphere.

Subsequently, in support of the provincial-level initiative which comprised field activities, the government formally recognized UA by formulating a policy statement under the banner “family food basket and environment improvement of urban communities,” in 2003. It reads as follows: Policy Statement-29 (MOA 2003:5) “Implement a special urban agriculture promotion programme designed to ensure supply of home consumption needs and environmental protection.”

In identifying policy access and visible UA activities the Spanish Red Cross Society launched a joint project with WPDOA in 2005 through the International Congress of Red Cross and the Sri Lanka Red Cross Society. The joint project was aimed at psychosocial development of Tsunami-affected people in the Kalutara District in the Western Province (Ranasinghe 2005), where the FBG concept was popularized. This was a unique step towards recognizing and promoting the FBG concept initiatives, for societal needs other than food security and income generation.

In 2006, the RUAf foundation joined hands with WPDOA in evaluating the progress made in the FBG concept, UA initiatives of the Gampaha and the Colombo districts and the policy access afforded by the Government of Sri Lanka. Under the RUAf-CFF Program these joint efforts promoted the concept of UA-FBG in India and the rest of the world at a multi-stakeholder forum.

The present government expanded the opportunity to work on home-gardening activities by amending the former policy framework (i.e., the Policy on Agriculture and Livestock-Sri Lanka, 2003-2010) giving high priority towards women in agricultural development, in 2007, as given in the following

policy statement: Policy Statement-17 Home Gardening (MOA 2007a:11) “17.1 Promote home-gardening and urban agriculture to enhance household nutrition and income. 17.2 Promote women’s participation in home-gardening.”

While developing a new policy on agriculture the government launched a special promotional drive on home-gardening to get the participation of different sectors/institutions so as to widen the involvement of the general public in the following arenas (MOA 2007b:3):

“Government Programme for Promotion of Home Gardening:

- a. Rural and urban home-gardens
- b. School gardens
- c. Home-gardens of schoolchildren
- d. Gardens and model farms in office premises
- e. Gardens in camps of security forces
- f. Private home-gardens of state officials
- g. Gardens in office premises of private institutions
- h. Home-gardens of public representatives”

In an effort to strengthen the government initiatives, a Multi-stakeholder Process for Action Planning and Policy Design (MPAP) process for UA was launched by the RUAF-CFF Program coordinated by IWMI with a view to institutionalizing a multi-stakeholder process for sustainable agriculture. Given the strong policy support, the Gampaha Municipal Council in the Western Province was selected for the pilot project on urban greening through UA, where the opportunities were provided under the leadership of the multi-stakeholder forum of the government, non-government and private-sector participation towards city development in 2007.

The government promotional programmes on UA-FBG initiatives have paved the way for other development sectors to think differently and participate actively in the UA initiatives of the process of holistic community development. The Ministry of Health promoted the concept of L/N-SA towards reducing incidence of non-communicable diseases among urban communities, especially promoting the aspects of nutritional value of home-grown vegetables and slow burning food types among parents of pre-school children (MOHN 2007). The Ministry of Education discussed and took steps along with the Ministry of Health to introduce Urban Agriculture and L/N-SA to the curricula of the formal education system as well as pre-school education development networks (personal communication and observation 2008).

5. POPULARIZATION OF L/N-SA WITH AGE STRATIFICATION AND AN URBAN-RURAL CONTINUUM

5.1 Socio-economic Applicability with Age Group Differences

In general, UA can be practised in simple traditional ways with a proper integration of ITK and modern scientific findings as well as with a more advanced manner by applying highly specialized techniques and systems. This sort of diversity and flexibility in UA provide access to the FBG concept while creating an interest in L/N-SA across different age groups, socio-economic groups and diverse professional groups in urban areas with greater expansion to form an urban-rural continuum.

5.1.1 Motivating Children (Pre-Schoolers and Schoolchildren)

Now child psychology, creative activities, aesthetic orientations as well as child nutrition, child health and physical education come first in pre-school education unlike in the past. Accordingly, cultivation structures in L/N-SA help children to learn the importance of nutrition and health in the early stages of their lives. Moreover, these structures provide opportunities to work on creative and aesthetic involvements of pre-school education. For instance, simple structures like cultivation bottles, cultivation shells and cultivation lanterns can be used to educate how to be friendly with nature and improve the environment through landscaping-cum-air-scaping with edible plants.

Schoolchildren, from the kindergarten to upper classes of school systems, already involved with outdoor practical agricultural work can be easily facilitated to be creative in the development of L/N-SA, such as air-scapes and landscapes with edible plants. Allotment gardening can also be popularized among schoolchildren with the selection of L/N-SA strategies in directing children towards income generation through micro-level UA entrepreneurship. The use of cultivation structures may help create access to increased provision for safety nets to ensure schooling despite economic hardships of families, specifically among low-income urban dwellers.

Moreover, children can think of creating new cultivation structures and tactical methods to reach urban dwellers in the study streams of soft-technology development.

It is revealed that lack of constructive activity contributes to juvenile delinquency retarding sociocultural and socio-economic development. The overall advantage of involving young children in L/N-SA, the concept of FBG, UA movements and ecological conservation is that they become avid environmental stewards for the rest of their lives.

5.1.2 Associating with Youth (Individuals Versus Groups)

Youth can become involved individually with L/N-SA through the development of entrepreneurship in UA. The vocational agricultural training opportunities and university short courses designed in association with field expertise of L/N-SA would help boost the participation of youth in new scientific developments in the fields of biotechnology and "nanotechnology." These attempts and knowledge-management processes in UA can be economically strengthened by channelling of micro-credit facilities through proper understanding of sustainable urban development.

Youth can also accept and work on L/N-SA through group activities as peer- or pressure-group involvement in networking of information, marketing and entrepreneurship-development ventures. The UA-cum-L/N-SA programme has been a way to accomplish many interlocking goals, e.g., naturalization, urban ecology, protection of native species, waste reduction, urban micro-entrepreneurship and the development of strong social networks in an urban community.

Youth groups can be regarded as developers of demand structures and also receivers of utilization mechanisms in a strategy of sustainable urban development. Participation in L/N-SA provides training and enterprising opportunities and serves to connect them with intra- and inter-country experiences in improving nature within and around the homestead, with household income, national economy, and personal and social satisfaction.

5.1.3 Working with Adults (Gender Specifications and Senior Citizens)

In the household, males are associated with financial needs while females are usually burdened with household chores. These roles defined through the development processes of norms, values and perceptions are to be changed towards a better world in advancing UA among urban societies.

Urban women can find good reasons to get involved in L/N-SA for food security as well as for family entrepreneurship through the family decision-making process. This can be facilitated through easing the traditional roles played by women of a household, e.g., replacing a water-lifting role through water-saving techniques or micro-irrigation systems, providing micro-credit to reduce risk in investing on land, labour and capital and diversifying produce and products through simple processing methods. These aspects are available and in-built to the FBG concept that, in turn, advocates the research and development process of L/N-SA.

Senior citizens are a class of persons that play a very important role in society. Collaboration of senior citizens on L/N-SA leads to easing their loneliness and conditions of stress while improving the mental and physical health status by being involved in diverse activities in harvesting, processing and marketing. L/N-SA will create a suitable location where everyone from pre-schoolers, schoolchildren, youth, women or men to senior citizens can learn about “vertical cultivation culture” at their homes, schools, working places and almost anywhere else around the world. Working with people from different backgrounds, dimensions, statuses and experiences on UA and L/N-SA teaches how to reap the benefits of communication, patience and respect for differences.

5.2 Urban to Rural Differentiations/Connectedness



Figure 5.1. Flexibility in advocating the FBG concept shows an urban-rural continuum for sustainable livelihoods.

The flexibility in adopting the FBG concept in areas with a limited resource base, promotion of family nutrition status and creation of new opportunities in micro-agro entrepreneurship have caused the establishment of an urban-rural continuum (Figure 5.1) while expanding opportunities for L/N-SA.

5.2.1 From Space Concerns to Water-Saving Techniques

In conventional terms, with landscaping architecture it is expected to make cities better places through the establishment of good connectivity and promotion of responsible use of groundwater through proper management of distribution, run-off, infiltration, seepage and the like in each and every area of municipal administration. In modern thinking, ecological sciences stress that cities should ensure growth and maintenance of living plants as much as possible in addressing food crises and environmental development in urban areas. In reaching these ends, L/N-SA sees one's homestead as a source of restricted resource for both production and management of income generation in urban areas.

In rural areas, water-intensive cash crops which demand high inputs like fertilizers, pesticides and other high-cost management systems/inputs have caused groundwater pollution, contaminated food and degraded soils. In addition, water is the main restricted resource in resource-poor rural areas.

As a result, L/N-SA paves the way to save water during drought, and in contaminated and degraded conditions by selecting appropriate cultivation structures such as cultivation bags, cultivation envelopes, cultivation towers and cultivation nets along with absorption of the FBG concept. These vertical farming structures further help reduce crop damages from stray and wild animals as these structures could be protected with close attention.

5.2.2 Towards Increased Nutritional Security

As discussed previously in this manual, L/N-SA provides access to good health and proper sanitation without any discrimination between the poor, the rich and the urban or the rural citizen. Overcrowded and/or unhygienic living conditions lead to poor nutritional standards in urban as well as rural communities. In contrast, L/N-SA directs the way to overcome nutritional barriers by adapting cultivation structures to increase the levels of essential micro-nutrient consumption and fibre intake even when drastic or hardship conditions are experienced in urban as well as rural areas. Leafy vegetables collected from cultivation structures increase nutritional value of food intake of the nutritionally vulnerable rural poor, during dry or drought periods. Again this shows the valuable theme of L/N-SA through the FBG concept that facilitates improved nutritional status as follows:

- A source of nutritional food that does not depend on the market source.
- A source of cash through sales for other family needs.

Lack of services such as education, health and environment may contribute to sustain decreased nutritional security. However, communication campaigns designed to reach pre-schoolers to senior citizens in rural as well as urban areas can rectify the situation through integrated attempts in sustainable development.

5.2.3 Poverty Reduction through Livelihood Improvement

Urban or rural, livelihoods relate to capabilities, assets and activities required for means of living, which is sustainable only if it can cope with, and recover from, stresses and shocks to lives in the process of self-development.

Nowadays, cities as well as villages suffer from various deprivations which result in poverty. In consequence, lack of access to land and employment, poor

housing and infrastructural conditions and lack of basic service provisions and social protection should be prime concerns in addressing poverty in rural and urban areas. Within these concerns L/N-SA contributes to enhance and maintain livelihood improvement strategies to reduce poverty in the following ways:

- L/N-SA creates additional working hours/days that lead to improving income levels.
- L/N-SA helps produce additional nutritious food such as vegetables, fruits, medicinal crops and livestock-rearing in restricted spaces in reducing human-health problems.
- L/N-SA contributes to develop self-esteem and happiness which strengthen social cohesion and minimize social exclusion of the poor.
- L/N-SA paves the way to open up access to new petty trading to improve income levels of rural and urban communities in UA initiatives, e.g., seed and planting material production, compost-making, ago-tourism, ecotourism, etc.
- L/N-SA shows how to convert inefficient use of personal time and money (e.g., violence, drug-addiction, bribes, etc.) into fruitful livelihood strategies.

5.3 Application of Novel Strategies in Reaching Target Groups

The FBG concept carries forward L/N-SA not only to establish creativity in UA but also to generate a better mix of communication of innovations in the knowledge management process across diversities found in urban and rural communities of the world.

5.3.1 Mass-Media to Work on L/N-SA

Posters, newspapers, magazines, stickers, the radio and the television are considered conventional mass methods in communicating innovations in the development arena. However, these methods can be extensively used under the latest and advanced developments in the field of Information Communication

Technology (ICT). The computer has expanded the use of many horizons for communication through digital and electronic versions.

Through the web-site, web-page, on-line publications and other mass communication e-methods, the Internet provides alternatives to printed matter such as newspapers and magazines, and contributes to networking and facilitating knowledge management process of the FBG concept and L/N-SA in a wider context. These aspects are to be strengthened in scaling up of communication and networking processes while working hand-in-hand with local and international organizations working on UA and allied fields of sustainable development.

Conventional posters, newspapers and magazines can be used with the digital form of presentations by adding value to publicity through various designing forms. Here again computers play a prime role in these presentations while creative advertisements in newspapers too help draw the attention of many target groups.



Figure 5.2. UA promotion hoarding is a new experience for the world.

The specially designed programmes which address practical aspects of UA, FBG and L/N-SA could be released as pre-recorded as well as live broadcasting, telecasting and webcasting ways so as to reach urban as well as rural communities. However, it was experienced that it demands money, experienced personnel and time in presenting them to the public for an affective acceptance of L/N-SA.

Another well-suited method in popularizing UA, FBG and L/N-SA in an urban context under mass media attempts is “roadside hoarding” and it provokes thinking of UA in spite of other sales advertising hoardings. It is a non-traditional method and allows the passersby to make contact with relevant stakeholders in developing further attempts of L/N-SA.

5.3.2 Group Methods to Work on L/N-SA



Figure 5.3. Novel experience of “extension street walks” in urban agricultural extension.

Demonstrations, farmer training classes and field days are used in the communication of innovations specifically in rural agricultural extension. In urban and peri-urban contexts, situations are somewhat different from rural settings, and people might not be familiar enough with agriculture resulting in lack of awareness in plant ecology and agriculture. Lack of sufficient time is another factor and the burden with a busy schedule of social engagements adds further restrictions to make an interest towards UA. Thus, new methods to reach employees through “office seminars” and “office training sessions” are radical ways to reach those people in

delivering messages of UA and L/N-SA for homes but with practice-in techniques for institutional vertical space development with nature.

The use of ICT in developing video compact discs with different programmes, films and pictures is another attempt that could be easily replicated with pre-schoolers and school children and all other target groups in the dissemination of innovations. Furthermore, e-forums, e-learning groups and e-dialogues are effective group methods in networking and sharing information and practices not only in L/N-SA but also in other aspects of UA through the ICT.

In adding an innovative method to the collection of group methods in the communication of innovations, the “Extension Street Walks” method was developed and practised in Sri Lanka in 2007 (Ranasinghe 2007). Its purpose was to reach the busy urbanites in a short period of time to explain the value of UA and the importance of L/N-SA so as to make an initial contact and build an interest to work on UA initiatives. The groups of extension agents visit urban dwellers, by selecting a particular street or road, on a house-to-house or business place-to-business place or office-to-office basis and find time to discuss the foregoing expectations with a few persons. Other service organizations welcome this strategy in delivering and/or marketing important programmes/messages to the general public. The method helps network the information of L/N-SA and the process of diverse experiences of UA and FBG in the process of urban development.

5.3.3 Individual Methods to Work on L/N-SA

At the inception of the FBG concept and formation of the creative cultivation structures the use of individual methods has greatly contributed to promote L/N-SA. Conventional individual methods demand time and heavy transport cost as visits are made to recipients but they are highly effective in adopting innovations. Demonstrations at private homesteads and office premises induce visits by persons to gain live-knowledge and know-how quickly and briefly as well as in a time-base and long tailor-made context.

However, different forms of individual ICT methods can be used in urban contexts as well as in rural settings and the urban-rural continuum can be evolved in a dynamic manner, specifically among youth and others, irrespective of differences in service deprivations, vulnerability and poverty with the arrival of cellular phone facilities, telephone conversation, e-mail communication, fax communication, short-message services (SMS), e-chat, video conferencing, etc.

Individual electronic methods can be used for troubleshooting and confirmation of ideas in the processes of L/N-SA, the FBG concept and UA without hesitation but with a genuine interest.



Figure 5.4. Individual visits by extension agents are expensive but highly effective at the initial stages.

Knowing is not enough, we must apply.

Willing is not enough, we must do.

Johann Wolfgang von Goethe

References

- Bellows, A.C.; Brown, K.; Smit, J. 2003. Health benefits of urban agriculture. Community Food Security Coalition. www.foodsecurity.org/
- Eawag. 2007. Waste resource in agriculture. Swiss Federal Institute of Aquatic Science and Technology (eawag) www.sadec.ch/
- FAO (Food and Agriculture Organization of the United Nations). 1999.Urban and peri-urban agriculture—A report to the FAO Committee on Agriculture (COAG). 25-26 January. FAO: Rome.
- MOA (Ministry of Agriculture). 2007a. *National agricultural policy for food & export agricultural crops and, floriculture of Sri Lanka*. Ministry of Agriculture Development & Agrarian Services. MOA: Battaramulla.
- MOA. 2007b. *National campaign to motivate domestic food production of Sri Lanka*. Ministry of Agriculture & Livestock. MOA: Battaramulla.
- MOA . 2003. *National policy on agriculture and livestock – Sri Lanka: 2003-2010*. Ministry of Agriculture & Livestock. MOA: Battaramulla.
- MOHN (Ministry of Healthcare & Nutrition). 2007. *Advocacy forum on improving nutritional status of pre-school children: Health Sector Development Project (Nutrition) 2007-2009, December, 18*. MOHN: Colombo.
- Padma,T.V. 2008. Can crops be climate-proofed? Agriculture & Environment: Features, Science & Development Network, www.scidev.net/en/agriculture-and-environment/
- Ranasinghe,T.T.2007. Potentials & promotion of urban agriculture (UA), New Trend in Agriculture – Special scientific presentation to the Organization of Professional Associations (OPA) Forum Committee.The Professional Centre: Colombo.
- Ranasinghe, T.T. 2005. From informal to formal acceptance: Leaps and bounds of urban agriculture in the development sphere. *The International Journal of Biodiversity Science & Management*, 1(1): 17-24.
- Ranasinghe, T.T. 2003.A novel living agricultural concept in urban communities: Family Business Garden. *The International Journal of Sustainable Development and World Ecology* 10 (3): 239-245.
- Smit,J. 1996. Farm the city. Our Planet 8 (4), www.ourplanet.com/
- UN-Habitat. 2003. Cities without slums:Appropriate land tenure approaches. Regional Seminar/ Workshop on Security of Land Tenure, 12-13, June, 2003, UN-Habitat. Nairobi. www.unhabitat.org/
- VASATWiki. 2007. New definition of urban agriculture. www.vasatwiki.icrisat.org/index.php/

Annexures-Website Details

Websites on urban agricultural development

1. www.ruaf.org/
2. www.cityfarmer.info/
3. www.cityfarmer.org/
4. www.fao.org/
5. www.urbanhomestead.org/

Websites on compost-making

1. www.compostguide.com/
2. www.treehugger.com/
3. www.the-organic-gardener.com/
4. www.homepage.mac.com/
5. www.urbanext.uicu.edu/

Websites on fertilizer applications in homesteads

1. www.paceproject.net/
2. www.homegardenertool.com/
3. www.oldhouseweb.com/
4. www.gardening.wau.edu/
5. www.umext.maine.edu/

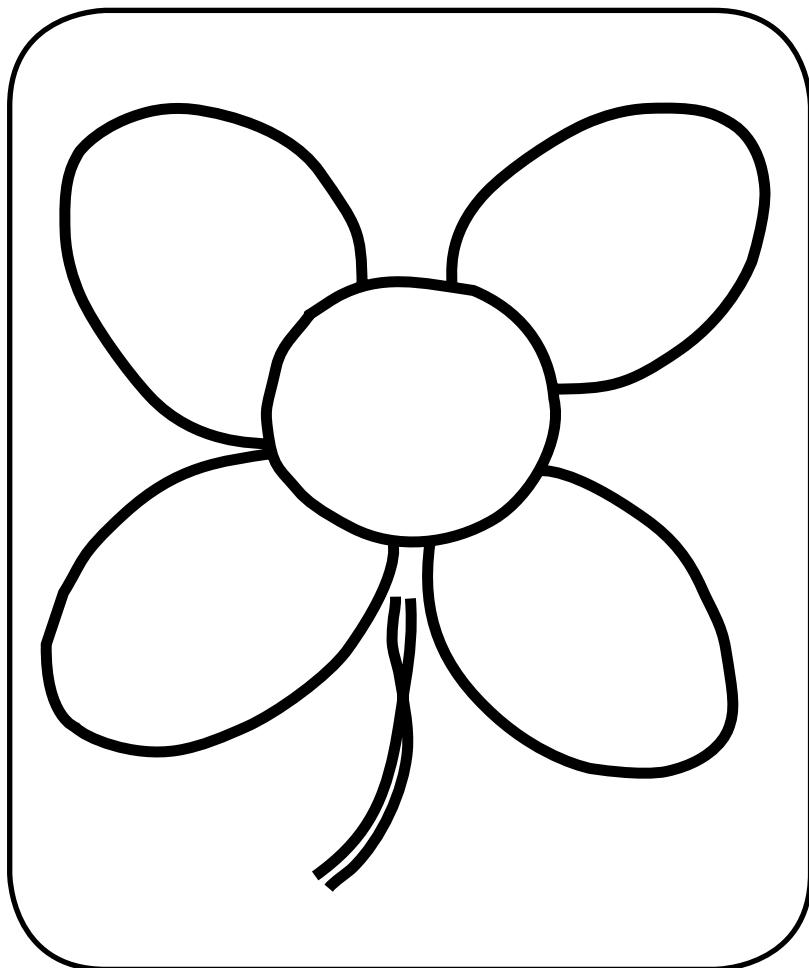
Websites on irrigation techniques in homesteads

1. www.greengardentip.com/
2. www.fairfaxcountry.gov/
3. www.musgroup.net/
4. www.wikibooks.org/
5. www.ext.colostate.edu/

Websites on Integrated Pest Management (IPM) in homesteads

1. www.ag.ndsu.edu/
2. www.vegipm.tamu.edu/
3. www.2.ctahr.hawaii.edu/
4. www.unce.unr.edu/
5. www.ipm.ucdavis.edu/

A GREEN MAIL TO YOU



CREATE YOUR OWN FAMILY BUSINESS GARDEN [FBG] !

About the Author

Dr. Thilak T. Ranasinghe has a capacity for presentations that are full of taste, substance and style, and they focus on a vital area of urban and rural livelihoods.



Dr. Ranasinghe, the pioneer of the practice of Urban Agriculture (UA) in Sri Lanka, is considered one of the foremost agricultural extension specialists in organizational development and trans-personal psychology; he has been responsible for many a success story and for redefining agricultural development. Dr. Ranasinghe was presented with the award for the Outstanding Officer in the Department of Agriculture, Sri Lanka for 2001 in recognition of his contributions to agricultural development in Sri Lanka. In addition, he received several credentials for Work of Excellence (2006) in appreciation of the work performed in discovering and promoting the family business garden (FBG) concept along with civil-society groups and several associations that worked with national as well as international NGOs. At the World Science Day Celebrations of the National Science Foundation, Sri Lanka he won the National Award for Popularization of Science in 2006 presented in recognition of his talents in using concepts of science and technology to improve the welfare of the people, and develop the economy, of Sri Lanka.

Dr. Ranasinghe has published a large number of research papers in national and international journals, made several extension research presentations and edited "Handbook on Crop Suitability of the Western Sri Lanka" in 2000. He holds an honours degree in Agriculture (1976), a Master's degree in Agriculture Extension (1984) and a PhD in Agricultural Policy and Management (1997). More than 30 years of successful and practical professional experience in rural, peri-urban and urban extension work has made him a top-level manager as well as a popular and influential writer in the field of development.