

Front Cover

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“Technology Package for Nutritional & Livelihood Security Through Homestead Farming”



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ICAR Research Complex for Goa

(Indian Council of Agricultural Research)

Old Goa - 403 402, Goa



**TECHNOLOGY PACKAGE
FOR
NUTRITIONAL AND LIVELIHOOD SECURITY
THROUGH
HOMESTEAD FARMING**

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FOREWORD

The West coast of India is characterized by a typical hot humid tropical climate supporting a wide variety of flora and fauna. The region is characterized by predominance of marginal and small holdings with dwellings spread across the cultivated fields having a variety of crops. Homestead farming is gaining importance in the present scenario of lesser availability of land for cultivation coupled with increased urbanization and consequent fragmentation of land holdings. Further, conversion of agricultural land to non-agricultural purposes is posing a serious threat to agricultural production. Keeping this in view, United Nations General Assembly declared 2014 as the 'International Year of Family Farming' which is being supported by World Rural Forum and over 360 civil societies and farmers' organizations. To commensurate this event, it is worth mentioning that the ICAR Research Complex for Goa is bringing out a Research Bulletin entitled "Technology Package for Nutritional and Livelihood Security through Homestead Farming".

The technical bulletin is based on the scientific studies of a NABARD sponsored research project by the Institute on "Upscaling of Homestead Farming in different Farming Systems of Goa". Under the Project, the existing homestead situations of the region were characterised and improvised homestead models suitable to different land holdings including their economics are suggested besides developing a model homestead garden at the Institute. Further, the details on the seasonality of vegetables, their disposal pattern, nutritional benefits and suitability of different crop cafeteria for different types of space under homestead farming situations are illustrated. Additionally, the critical steps involved in establishing the homestead garden are also detailed. The models presented in this bulletin will be quite useful in framing roadmap for scientific utilisation of the space around the house and forms a ready reckoner for the fresh gardeners.

It is noteworthy that this important publication is being brought out coinciding with the Institute's silver jubilee celebrations. This publication will serve as a comprehensive document of high production system package to provide relevant information to the researchers, extension workers as well as the farming community. Further, it also serves as a base for profitable homestead cultivation. I am sure that this Bulletin will serve as a reference material to all those who are involved in homestead gardening and will go a long way in improving the production and livelihood security of small and marginal farmers of the region.



Bhramar Bar Sethi
General Manager/Officer In Charge
NABARD Goa Regional Office, Panaji



MESSAGE

I am very glad to know that ICAR, Goa is publishing a Homestead Technical Bulletin which includes the cost of economics and package of practices. Innovation has been an integral part of dynamic agriculture development of our country. A judicious blend of traditional knowledge and advance technology in agriculture has made India not only self **sufficient** but also a potential player in global agricultural market. Agricultural research institutions have played a pivotal role in bringing about this transformation. ICAR, Goa has been in the forefront of the various innovations and best practices that have helped Goan farmers in improving their production and productivity.

NABARD has created Farm Innovation and Promotion Fund (FIPF) to support innovative projects in farm sector and also to promote those innovations through demonstrations and dissemination to the larger section of the farming community. The project " Upscaling of Homestead Farming in Different Farming System of Goa" was implemented by ICAR, Goa with financial support from NABARD under FIPF.

I congratulate ICAR, Goa and its scientists for their dedicated and focussed approach towards the project and sincere efforts towards publication of this booklet. I am sure, publication of Homestead Technical Bulletin will surely demonstrate the bankability of Homestead farming in Goa, increase the utilisation of unused space around rural houses and increase the vegetable and fruit production in Goa for consumption of local residents.

April, 2014

(Alok K. Sikka)

Bhramar Bar Sethi
General Manager/Officer In Charge
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PREFACE

Homestead gardening is gaining importance in the recent times owing to limitations of land and the continuously growing requirement of fruits and vegetables and the practical feasibility at the household level for cultivation of a variety of crops especially in the West coast region. Keeping this in view, ICAR Research Complex for Goa, during the period 2010-13 has undertaken a NABARD sponsored research project on Homestead gardening. Systematic survey was undertaken in selected talukas of Goa so as to identify the existing system of kitchen gardening. Research efforts were made to develop model homestead gardens at selected locations of the farmers and the data on different aspects were collected and compiled. The monitoring committee of the Project met at different periods and has given a periodical renewed direction to improvise the production and productivity from the system.

This technology package bulletin is a result of research work carried out at ICAR Research Complex for Goa under the project. The research efforts and the achievements have resulted in identifying three profitable homestead models suitable to different holding sizes for the benefit of growers, developmental agencies and the planners.

While bringing out this bench mark publication, we sincerely acknowledge the invaluable contributions rendered by various visionaries, research workers and scientists and Indian Council of Agricultural Research, New Delhi for encouraging the research on this aspect.

The co-ordination and help and financial support rendered by NABARD at different stages is gratefully acknowledged.

The conduct of various on-farm trials on the aspect over the period was possible with the co-operation of progressive farmers of Goa who deserves high appreciations.

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1. Introduction

Homestead is “a small scale, supplementary food production system, by and large for the household members”, it has the potential to produce high value crops including various spices and condiments. A typical home garden is an adjunct to the house, where selected trees, shrubs and herbs are grown, not only for edible fruits / vegetables, but also for medicinal, ornamental, socio economic and ecological benefits.

Homesteads exhibit a multi-tiered canopy structure somewhat identical to the tropical evergreen forest formations. Perhaps the forest like structure of tropical home gardens is derived from either the lack of a discernible planting pattern, or alternately, the result of deliberate planning to imitate the forest. The vertical stratification provides a gradient in light and relative humidity, which creates different niches for enabling various species/groups to exploit them. Mostly shade tolerant crops constitute the lower stratum, the shade intolerant trees the top layer, and species with varying degrees of shade tolerance in the intermediate strata. These multi strata systems are structurally and functionally the closest mimics of natural forests yet attained. The high structural and floristic diversity of tropical home gardens are perhaps aided by the biophysical environment, socio-cultural

factors and economic considerations.

The homestead systems have developed over centuries of cultural and biological evolution and represent the accumulated wisdom and experiences of farmer who have interacted with adverse environment, without access to external inputs, capital or scientific knowledge. Such experiences have guided farmers elsewhere too to develop sustainable agro ecosystems, managed with locally available resources and with human / animal energy.

Moreover, home gardens are suitable for resource poor situations and have economic advantages such as low capital and labour costs, increased self-sufficiency, risk avoidance and even distribution of labour.

The published inventories suggest that food crops, medicinal plants, ornamentals, fruit trees, multipurpose trees and fodder crops abound in the home gardens.

The households are spread out all along the West coast with a typical pattern of dwelling house having greenery around with a diverse flora and fauna. Farmers in the region traditionally have been cultivating a host of crops of seasonal, annual and perennial nature in the tiny land surrounding their dwelling. Along with the crop, animals and birds are also



View of a typical homestead garden in the West coast of India

reared for milk, meat and eggs making the homestead an integrated enterprise. The system has evolved because of the climatic conditions, the nature of precipitation and the soil conditions as also the low per capita availability of land. The homestead farming is unique since there is livestock-crop integration with flow of inter-activity resources making it an integrated production system.

A variety of crops are grown by the farmers in their homesteads that are of

seasonal (vegetables), annual (Tapioca, Banana) and perennial (Coconut, Arecanut, Pepper, Rubber, etc.,) nature depending on the climatic conditions. Given the scenario, the cropping intensity in the homesteads of the region tend to be higher than hundred percent. However the scale of the activities is limited due to the smallness of land holding and low resource. The farmers also work as labourers or engage in other activities to supplement their income.

2. Perspectives of the homestead farming

Homesteads represent one of the functionally most diverse land use systems around the tropics. They are known for stable yields, varied products, and continuous or repeated harvests directly (producing edible fruits, nuts, grain, rhizomes and tubers, leaves, flowers, etc.) or indirectly (facilitating enhanced and / or sustained production). All home gardens are also associated with various service functions such as site enrichment, micro climatic modification and nutrient cycling.

Considering the shrinking average land holding and also the requirement of in situ conservation of bio-resources and the commonly available homestead situations of West coast region, development of suitable technologies for homestead farming with a concept of encouraging the number of tertiary producers of such valuable bio-resources with far reaching utility through commercial means is the need of the hour. Some of the advantages of homestead farming are:

- The homestead farming increases whole farm productivities (land, labour and input)
- Ensures food and nutritional securities of the farm families throughout the year

- Reduces stress periods in the farm
- Increases the profitability of the farming enterprises
- Enhances the cash flows in the farm families.
- It provides the farmers a subsidiary source of income through potential crop/integrated enterprises.
- It increases and sustain productivity of existing systems of cultivation.
- It encourages maximum utilization of available family labour
- It creates an integrated business enterprise at micro level.

Further, the different kinds of benefits derived from homestead farming can be grouped as follows:

1. Social benefits:

Activities of homestead farming are labour intensive, which creates on-farm man days and most of it in the production process is contributed by the farmer himself and also his family members.

It gives year round availability of nutritious and seasonal food. Seasonal migration is reduced. Fodder and fuel shortage is also minimized.

2. Ecological benefits:

Soil health will be improved, per cent organic carbon increased and the fossil

fuel dependency is practically zero as all the variable inputs are produced within the farm.

The diversity is huge as various types of crops, creepers, climbers, strategic crops etc. are cultivated within the farm.

As large number of local crops are introduced, soil micro/macro fauna will be increased.

Each and everything is recycled within the system, it is actually a zero waste farming system.

As it is diversified, it is disaster resilient.

3. Economic benefits

The input cost is reduced, so net income increases.

As income is diversified that is from different sub-systems, risk is reduced.

The income has time wise and source wise diversified, i.e, the farmer is getting

3. Planning for Homestead farming

At present homestead farming is practiced in a haphazard manner, without any scientific base, which leads to poor returns. There are no other components except fruits and vegetables in many of the gardens at present. Therefore there is a need for scientific planning and establishment of homestead gardens, so that there will be more output per unit area. Also there should be integration with other components like animals,

income throughout the year from different sources, which reduces the dependency on a single system.

4. Health benefits

Fresh vegetables, fruits, spices in one's own backyard will make the citizens healthier.

Chemical and fertilizer consumption will reduce as compared to commercially grown increasing the nutritive value of the food stuffs.

Physical stress while moving in town will be reduced due to soothing landscape, shade during hot sunshine, improved air quality and increase in thermal comfort.

Pesticide free fruits and vegetables are obtained.

Aesthetic value, satisfaction of growing plants and eating fruit of plants which are self-grown.

mushroom, bee keeping, etc. so that the family is more self-sufficient and independent.

Generally the size of a garden depends on the area available in the house compound. Before the actual layout the available area should be properly fenced. The irrigation channel from the water source and path should be so planned and preferred that it covers the whole area of the garden. Bunds can be used for growing

root crops. The final selection of fruits and vegetables crops depends on likes and dislikes of the family. However, in order to furnish a constant supply and to avoid the glut, they can be staggered and planted on home scale. Important criteria will be choice of nutritious fruits and vegetables. Only those fruits and vegetable varieties should be selected which may have optimum performance and preference under local agro-climatic conditions.

Crop rotations for vegetables can be so worked out that at least 4-6 kinds of vegetables are always available. Each plot should have a separate rotation so that period of harvest in different plots does not overlap. The same area can be used in all the three seasons in a year. Suitable modification in the choice of plan of layout and selection of fruits and vegetables can be made in relation to the land available, adaptability of crop varieties, choice of family, etc.

The main aim in layout is the most economic utilization of space. Different root crops like radish, carrot, beet root and colocasia can be grown on the ridges separating individual beds or on both sides of irrigation channels. Cucurbits like bitter gourds, sponge gourd, ridge gourd and snake gourd can be grown on the fences in summer and rainy season. Perennial crops like drumstick, curry leaf plant and quick growing fruits like papaya and banana should be located on one side. Tall grown vegetables should

be grouped together. However, it must be borne in mind that the garden should furnish a constant supply but avoid glut of any one crop. When space is the limiting factor for selecting vegetables, some basic principles can be followed. Vegetables which are costly and not easily available in the market should be given priority over the vegetables which have shorter shelf life for upkeep of quality like spinach, mint, etc. Further, vegetables which produce a larger amount of edible material in proportion to the space occupied should be given priority. Before the actual implementation of the homestead farming, it is very essential to assess the existing situation and the resource potential so as to plan a system on scientific lines.

Important points to be considered while planning homestead farming:

1. Area allocation for each crop/component should be based on the requirement of light, canopy coverage, rooting pattern, nutrient demand, yield potential, family requirement and market demand during different periods of the year.
2. Generally, growing a mixture of different crops based on requirement of light in a multi-storied pattern like the tall growing species, medium statured ones, bushes and the surface creepers will utilise the solar radiation efficiently at different elevations.

3. Spacing of the fruit / perennial plants and vegetables should be as per the plant canopy. Closer spacing will result in lanky growth, reduction in yield and quality.
4. Glyricidia plants should be planted all along the boundary so as to serve as a live fence. The plant being legume also fixes atmospheric nitrogen and serves as a regular source for supply of green leaves for mulching the valuable fruit trees.
5. Mulching with green or dry leaves for fruits and vegetables checks weed growth, checks evaporation losses, lowers the soil temperature, increases the microbial activity and adds organic matter.
6. As grafts grow dwarf, yield early and give high yields with good quality, all the perennial crops / fruits trees should be planted by use of grafts only.
7. A cafeteria of medicinal plants should be a part of homestead farming. A variety of 10- 15 medicinal plant species like Neem, Tulsi, Coleus, Kalmegh, Lemon grass, Bryophyllum, Stevia, Amritvel, Sarpagandha, Aloe vera, etc., should be planted and maintained at regular intervals.
8. The organic matter content of the garden should be well maintained through recycling of wastes and bio-resources.
9. Vermicomposting unit should invariably be a part of the garden so that the unit gets sufficient organics on a continued basis at a reasonable cost.
10. Vegetable crops should be grown as per the season and preferably in rotation.



A view of the model homestead garden developed at the KVK of the Institute

4. Package for important homestead crops

The package of practices suitable for different crops in the Western region has been detailed below:

Table 1. Package of practices for different homestead crops of Western region

Crop	Varieties	Spacing	Planting time	Ma-nure	Fertilizers	Irrigation	Major Insect pests / diseases*	Expected yield
Coconut	Malayan Yellow Dwarf / Chowghat Orange Dwarf, Tall x Dwarf , Dwarf x Tall	7.5 x 7.5m	June	10 kg / palm / year	500:320:1200 g NPK / palm / year	Once in 6-8 days	Rhinoceros beetle, Mites	80-100 nuts / palm / year
Arecanut	Hirehalli dwarf, Mangala, Mohitnagar and local selections	2.7x 2.7m	June	15kg / palm / year	100:40:140 g NPK / plant / year	5-6days	Kole roga	25- 30 kg / palm/year
Black pepper	Panniyur-1, Panniyur-5, IISR Shakti, Thevum	Trailed on coconut / arecanut trees	June	5kg / pit / year	100:50:150 g NPK / vine	Once in a week	Slow and quick wilt	2 kg dried pepper / vine / year
Nutmeg	Konkan Swad, Vishwashree and Local Selections	7.5 X 7.5 m in the center of four coconut /under the shade / partial shade of arecanut gardens	June	10 kg FYM / plant / year	250:90:300 g NPK / plant / year	Once in a week to the field capacity	--	800-1000 fruits / plant / year
Cinnamon	Kokan Tej	3 x 1m	June	10-15 kg / plant / year	200:180:200 g from third year onwards	--	--	After 3 rd year in two harvests during May and November-- 0.5-1.0 kg dry quials / tree
Ginger	Varada, Mahima, Rio de geneiro	45 x 20 cm	May-June	3kg / sq.m	17.5:7.5:17.5 g NPK / sq.m	Irrigation for May planted crop and once a week during post-monsoon	Rhizome rot/ soft rot	3-4 kg / m ² Green rhizomes
Turmeric	Himachal, Pratibha, Prabha, Alleppey	45 x 20 cm	May-June	3 kg / sq.m	17.5:7.5:17.5 g NPK / sq.m	Irrigation for May planted crop and once a week during post-monsoon	Rhizome rot / soft rot	2.5-3 kg / m ² fresh rhizomes

Banana	Tissue culture Grand Naine / Local selections	1.8 x 1.8 m	June	20 kg / plant / year	400:200:400 g NPK / plant / year Zinc @ 40g / plant along with Borax @ 10g / plant	5-6 days	Bunchy top	20-30 kg bunch / plant
Mango	Amrapali, Mankhurad, Kesar	8 x 8 m	June	50kg FYM / plant / year	1500: 500: 500 g NPK / tree / year	No watering during November-December	Fruit fly	1500-2000 fruits / tree / year
Pine apple	Giant Kew, Queen, Mauritius	90 x 60 x 30 cm	June	--	35:13:4 g N, P ₂ O ₅ and K ₂ O / m ² / year	--	No major pests	1.5-2.0 kg Fruits / year / plant
Papaya	Red Lady and RCTP-1	1.8 x 1.8m	June	5 kg / tree	300: 250:400 g NPK / plant / year in four splits	Once in 10 days	Papaya ring spot virus	100 -300 kg / tree based on variety.
Jack fruit	Kokan prolific, Ceylone / Local Selection (Kappa type)	8x8 m	June	5 kg / tree	600:300:240 g NPK / tree / year	No irrigation	Rhizopus rot, Pink disease	15-20 fruits / tree of 5-20kg size
Guava	Allahabad Safed-49	10 x 10 m	June	25-30 kg / tree	400:150:400 g NPK tree/year	As and when soil is totally dried	Fruit borer	800-1000 fruits per tree (150-200 kg / tree / year
Bread fruit	Local Selection	10 x 10 m	June	30-40 kg / tree	400:150:400 g NPK tree/year	--	Fruit rot	75-100fruits / tree / year
Sapota	Kalpatti, Cricket ball, DHS-1, DHS-2,	8 x 8 m	June	30-40 kg / tree / year	400:160:450 NPK g / tree / year	When soil is totally dried	Stem borer	800-1200 fruits / tree / year
Acid Lime	Pusa Sharbati, Sai Sharbati, Tenali, PKM-1, Kasi, Pentala, Vikram	4x4 m	June	30-40 kg / tree	600:300:500 g NPK tree / year	Protective irrigation as and when required	Citrus decline	1000-1200 fruits / plant / year
Aonla	Krishna, Kanchan, Chakaiah and Local Selections	5 x 5 m	June	10-15 kg/tree	300:200:250 g NPK / tree	--	--	100-125 kg/ tree/year
Drum stick	PKM-1 Dhanraj	4 x4 m	June	20 kg / tree	300:150:250 g NPK / tree	-	--	250-300 pods / tree
Curry leaf	Local	1 x 1 m	June	10 kg/ plant	150:75:100 g NPK / plant / Year	Protective irrigation as and when required	--	10kg leaves/ tree/year
Bhendi	Parbhani Kranti, Arka Anamika	45 x 30 cm	June / February	250 kg / 1000 m ²	10:5:5 kg N P K / 1000m ²	Once in 4 days	Yellow Vein Mosaic	1.5-2.0 tonnes / 1000 m ²

Chillies	Pusa Jwala Local Selections	30 x 30 cm	June / November	250 kg / 1000 m ²	10:5:5 kg N P K / 1000m ²	Once in 4 days	Leaf curl	Green -0.9 to 1.2 tonnes / 1000m ² Dry-150-200 kg / 1000m ²
Brinjal	Arka Nidhi, Pusa Purple cluster	75 x 60 cm	June / November	250 kg / 1000 m ²	10:5:5 kg N P K / 1000m ²	Once in 4 days	Bacterial wilt	2.5 to 3.5 tonnes /1000m ²
Onion	Pusa Red Arka Laleema	30 x 10 cm	November	250 kg / 1000 m ²	10:5:5 kg N P K / 1000m ²	Once in 4 days	Smut	2.5-3.0 tonnes /1000m ²
Vegetable cowpea	Local Selection	45 x 45 cm	November	250 kg / 1000 m ²	10:5:5 kg N P K / 1000m ²	Once in 4 days	Aphids and Jassids	1.5 tonnes / 1000m ²
Pumpkin	Local Selection Pusa Naveen	2 x 1 m	June	250 kg / 1000 m ²	10:5:5 kg N P K / 1000m ²	---	Pumpkin beetle	2.5-3.0 tonnes / 1000 m ²
Bottle guard	Local Selection	2 x 1 m	June	250 kg / 1000 m ²	10:5:5 kg N P K / 1000m ²	-----	-----	2.5-3.0 tonnes / 1000 m ²
Cucumber	Sheetal, Local Selection	2 x 1 m	June	250 kg / 1000 m ²	10:5:5 kg N P K / 1000m ²	Once in 4 days	-----	2.5-3.0 tonnes / 1000 m ²
Ridge gourd	Konkan Harita, Local Selection	2 x 1 m	June	250 kg / 1000 m ²	10:5:5 kg N P K / 1000m ²	-----	Fruit fly	1.5-2.0 tonnes /1000 m ²
Snake gourd	Konkan Sweta	2 x 1 m	June	250 kg / 1000 m ²	10:5:5 kg N P K / 1000m ²	-----	Fruit fly	1.5-2.0 tonnes /1000 m ²
Bitter gourd	Coimbatore Long	2 x 1 m	June / November	250 kg / 1000 m ²	10:5:5 kg N P K / 1000m ²	-----	Red beetle, Fruit fly	1.2-1.5 tonnes /1000 m ²
Little gourd	Gholwad Alibag	2 x 1 m	June / November	250 kg / 1000 m ²	10:5:5 kg N P K / 1000m ²	Twice in a week	Powdery mildew	1.0-1.2 tonnes /1000 m ²
Amaranthus	Local Selection	10 x 10 cm	June / November	250 kg / 1000 m ²	10:5:5 kg N P K / 1000m ²	Twice in a week	-----	1.0-1.5 tonnes /1000 m ²
Cluster beans	Pusa Nava Bahar	45 x 30 cm	June / November	250 kg / 1000 m ²	10:5:5 kg N P K / 1000m ²	Twice in a week	-----	1.0-1.2 tonnes /1000 m ²
Radish	Japanese White	45 x 10 cm	June / November	250 kg / 1000 m ²	10:5:5 kg N P K / 1000m ²	Twice in a week	-----	1.5-2.0 tonnes /1000 m ²
Elephant foot yam	Gajendra Local Selection	1 x 1 m	May June	250 kg / 1000 m ²	10:5:5 kg N P K / 1000m ²	Once in a week	-----	3.0-4.0 tonnes /1000 m ²
Mint	MAS-1, MA-2, Hybrid-77	45 x 45 cm	June- July	1.0-1.2 kg / m ²	16:5:5 g / m ² NPK	Twice in a week	Termite, cat worms, hairy caterpillars menthe rust, powdery mildew etc.	2.5- 5.0 kg / m ²

Coriander	Co-1, Co-2, Co-3 GAU-1, etc	30 x 20 cm	May-June or October	1 kg / m ²	10:4:4 g / m ² NPK	7-10 days interval	Fusarium wilt, Powdery mildew, stem rot, Root rot	0.14 to 0.2 kg / m ²
Marigold	Pusa Narangi Gaiinda, MPU-1, Pusa Basanth Gaiinda	60 x 45 cm	June-July Sept-Oct Feb-March	2 kg / m ²	12.5:10:10 g / m ² NPK	Twice in a week	Aphids, Mites, Leaf hoppers, Powdery mildew, stem Rot, Leaf spot and Blight	1.1-1.8 kg / m ²
Jasmine	<i>Jasminum sambac</i> - single Mogra, Double Mogra Co-1, Co-2	1.25 x 1.25 m 1.8 x 1.8 m	June to November	15 kg / plant	120: 240 : 240 g NPK per plant in two splits during January and July	2-3 times a week	Bud and shoot borers Blossom Midge Leaf Blight, Fusarium wilt, Rust	0.5-0.6 kg / m ²
Crossandra	Arka Ambara Arka Kanaka	60 x 30 cm	July to October	2.5 kg / m ²	3.3 : 6 : 6 g NPK / plant	Twice in a week	Scales, white files, Aphids, Fusarium wilt	0.2 kg / m ²
Chrysanthemum	Co-1, Co-2, MDU-1, Red coloured, etc	30 x 30 cm	June- July	2.5 kg / m ²	12.5 : 12 : 2.5 g NPK / m ²	Twice in a week	Thrips, aphids, leaf eating caterpillars, Root rot, Leaf spot	2 kg / m ²

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5. Subsidiary components in homestead farming

Depending on the resources available in the garden, family requirement and the market demand, the following additional components can be integrated:

1. Backyard poultry
2. Goat rearing
3. Rabbit rearing
4. Dairy
5. Piggery
6. Mushroom cultivation
7. Vermiculture units
8. Bee keeping
9. Plant nursery

A. Backyard poultry rearing

In most of the homestead farms, although backyard poultry can easily be practiced, many of the farms does not venture into it. Even if they practice, the birds are of local type, poor in weight, egg laying type and they are reared by free range system and are not properly cared. Up-gradation of local birds with introduction of Gramapriya breed of dual purpose nature, i.e. for eggs as well as for meat is more beneficial to the farmers to generate additional income. The breed is also suitable for back yard



Vanaraja– A high yielding breed of poultry in the homestead of Chandrakant Gaonkar (Chodan)

rearing and can be easily maintained with kitchen and other farm waste. In the study conducted, it was observed that 100 per cent of the eggs produced were consumed by the households, thus enhancing the overall nutrition of the farm family. Poultry manure with the richest source of nutrients was also available for recycling of nutrients into the fields.

B. Goat rearing

Goat is a prolific breeder with a capacity to increase the herd size within a short span of time. Improved breeds of goat like Osmanabadi with higher fecundity and growth rate can be maintained even in the backside shelter of the homestead with ease. Since goat eats all types of leaves, the loppings of the commonly available trees may be used for feeding the goats. However, care has to be ensured to not to let loose the animals so as to avoid damage to the homestead garden.

C. Rabbit rearing

Rabbit is a small and pretty animal with its meat as delicacy. Since, they feed on grasses they are complimentary to the system. As they are also prolific breeders with lesser generation interval and normally give high litter size, their rearing will be more profitable. Improved breeds like Soviet Chinchilla

and Newzealand White are widely adoptable and can be reared in cages in raised platforms. Care has to be taken for prevention of any outbreak of diseases through regular vaccination.

D. Dairy

Rearing of milch cows is the easiest way of converting wastes into resourceful products. Improved breeds of dairy cows like Jersey X Sindhi cross, Holstein Friesian, Gir, etc. are widely adopted and can give better profits. Cultivation of improved varieties/hybrids of forage grass and legume mixtures on farm bunds and using for dairy on a regular basis can bring down the production cost of the dairy with enhanced profits. Balanced feeding with regular check up of the animal for infertility problems can bring greater dividends.

E. Piggery

In areas where there is a demand for pork and sausages, the pig rearing will be highly successful. The pigs under good management can bring in higher profits with increased body weight gain in shorter periods. Improved cross breeds like Large White Yorkshire X Local with higher litter size and growth can be maintained even with household kitchen waste and can form a source of income for the house hold under emergency situation of cash requirement.

F. Mushroom cultivation

Production of Oyster (paddy straw) mushrooms can be practiced in almost all the homesteads without much problems. The major ingredient for mushroom production viz paddy straw is normally available with the farm households. The mushroom spawn (seed) is normally available with most of the places and the production can be taken up on a wooden stand with provisions for protection from sun light and upkeep of the humidity. As this is a short duration enterprise, the intermittent returns can be established through tying up with a regular market outlet.

G. Vermicomposting

The supply of fertilizers in the rural areas and their cost is increasing day-by-day. Continuous use of chemical

fertilizer is also affecting the soil quality and the productivity of land. Recycling of available bio-resources and on-farm production of vermicomposting also helps to provide required essential plant nutrients to homestead farms. Besides, use of organic manures also improves the water holding capacity of soil and thereby reduces the water requirement of the crops.

H. Bee keeping

Due to a variety of flora under homesteads with varying flowering periods during different months of the year, bee keeping can easily be practiced. Initial colonization of the honey bees requires proper identification of site, installation of proper bee hives and attracting the queen honey bee. The nectar yielding plants can also be



Vermicomposting Unit in the Homestead Garden of Ramdas Chafadkar(Savoi- Verem)

planned as a regular source of food for the honey bees. Care has to be ensured to avoid desertation of colonies by the honey bees. Due to the medicinal value of the honey, the family can be benefited with proper planning.

I. Plant Nursery

Assessing the local needs of planting material and planning for graft progenies in important crops of demand can fetch

greater dividends.

A small area in the homestead with facility for protection from the direct sunshine and rainfall with availability of irrigation can better be utilized especially for rare plants to earn more income.

The seasoning in production can better be planned depending on the crop so as to have continuity in production during different months of the year.

6. Establishment of Homestead systems

1. Design and layout of the garden

A. Land shaping

The farmers need to level and smoothen the shape of the land so that raised portion of the plot is excavated and the soil so excavated can be used to raise a section of the low lying land to make it suitable for growing vegetables throughout the year. Since, the farmers are intensively oriented on economic, social and nutritional benefits of homestead farming in the long run, necessary measures for soil conservation, rain water harvesting and prevention of runoff water and soil erosion need to be taken up on priority basis.

B. Space allocation

The need of land and water for different components like crops, livestock, fish and other enterprises varies. The most interesting aspect of this homestead farming is that every portion of the land need to be used for cultivation. For example, in one homestead farm, about 50 percent of the land is kept for growing vegetables, 20 percent for plantation and fruit crops, 15 percent for rearing of cattle and poultry and the rest 15 percent for cultivation of fodder and other components. General farming practices and fruit cultivation being easy for integration, the low land is used for growing vegetables that give them a good income throughout the year. Based on the project study, the allocation of different types of spaces for crops is recommended as follows:

Table 2. Crop cafeteria for different types of space under homestead farming

	<i>Kharif</i> Season	<i>Rabi</i> Season
Sunny Space	Bitter gourd, long bean, snake gourd, cucumber, bhendi, amaranthus, colocacia	Knolkhol, clusterbean, palak, raddish, amaranthus, methi, chilli, brinjal, onion, long bean, knolkhol
House roof	All cucurbits	Pendal bean
Trellis	Perennial-Little gourd, pumpkin, bitter gourd, snake gourd, bottle gourd, ridge gourd	Perennial-little gourd
Land below trellis	Ginger, turmeric, colocacia,	Perennial leafy vegetables
Pond bank	Cucurbits	Long bean, water melon
Slightly Marshy land	Banana, mint	Banana
On trees	Perennial-black pepper Annual-cucurbitaceous vegetables	Perennial-black pepper

2. Consolidation of boundary through live fencing

All along the boundary, nitrogen fixing trees like *Glyricidia* can be planted for enriching the soil and also for supplying food, fodder and fuel through loppings at regular intervals. Self-growing local plants and weeds can also be used for making compost and also as nutritional supplements for humans and cattle. Mulching of these loppings can be done to stop soil erosion, conserve the moisture and growth of weeds. It also adds organic matter and protects the

micro-organisms from direct exposure to sunlight.

3. Integration between cattle shed - compost pit - vegetable garden

Cattle are raised essentially for milk. Cow urine and cow dung are used for making compost or vermi-compost in permanent pits or on a plastic sheet laid on the ground. Compost, especially vermi-compost serves as excellent manure for the vegetable garden. Cow urine and cow dung are also used in the pond as manure.

4. Integration between cattle shed-biogas pit-kitchen-vegetable field

With only a small investment, a bio-gas unit can be a very useful intervention. Instead of using cow dung and urine

directly in the compost pit, it may be transferred to the bio-gas unit. The gas generated may be transferred to the kitchen for use as fuel or for lighting gas lamps. The slurry which is collected in a separate pit may be used in the vegetable garden field as excellent manure.



Cultivation of Red Amaranthus and radish in the field of Virendra Parab-Porvorim, Goa



Long beans (Wal) in the Homestead of Deepavati (Sangolda-Goa)



Cultivation of vegetables in Homestead of Deepawati Wargaonkar (Sangolda-Goa)



Cultivation of vegetables in Homestead of Narayan Gawde (Velling-Goa)



Cultivation of Lady Finger in Homestead of Chandrakant Gaonkar (Chodan- Goa)



Onion grown in the homestead of Mrs. Deepavati, Sangolda-Goa



Cultivation of elephant foot yam for increased profitability

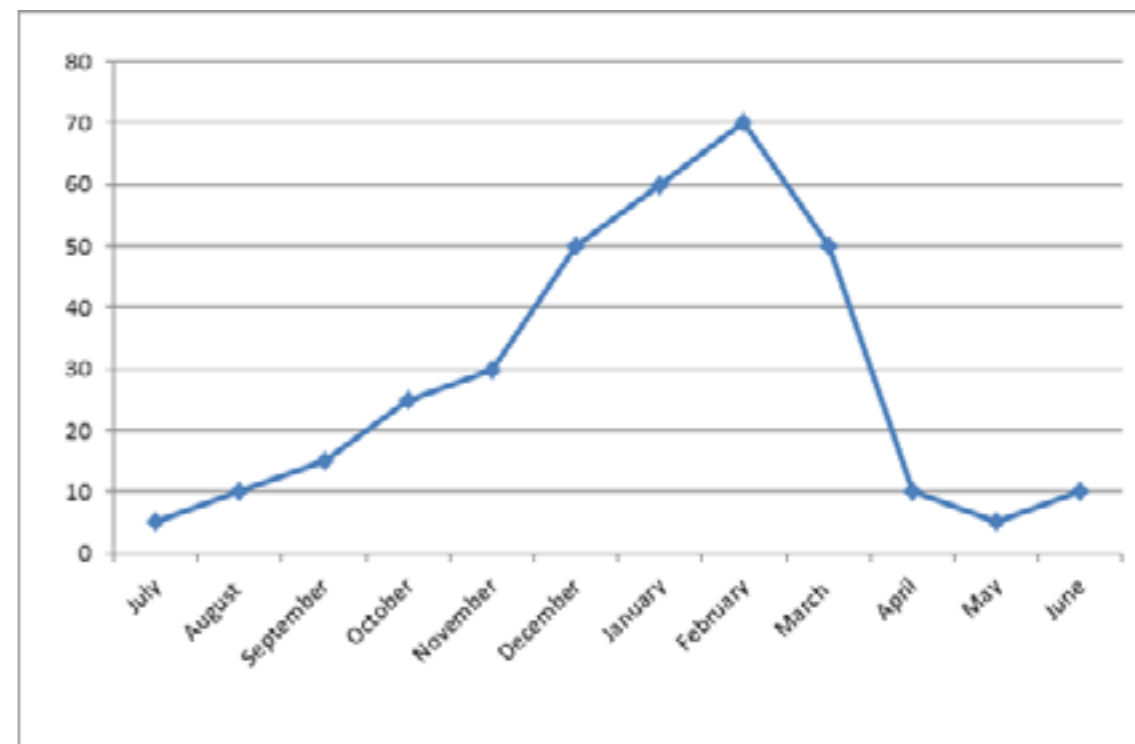


Fig 1. Seasonality in round the year vegetable production in homestead area

5. Awareness regarding agro-chemicals and organic inputs

Farmers need to be trained and made aware to reduce, rather stop use of chemical pesticides and emphasis need to be laid on use of organic manures, green manures, vermi-compost, extract of various plants and weeds or ash as organic herbicide, etc.

6. Seasonal cultivation of vegetables

Many of the vegetables are season bound and need to be selected for better productivity. The market also plays a crucial role in selection of the crops for each season as there will be a wide variation in price structure.

The vegetables that form a part of the homestead in Western region are red amaranthus, brinjal, chillies, cluster beans, okra, radish, drumstick and different varieties of gourds including cucumber and pumpkins. Sweet potatoes, vegetable cowpea, onion are also grown to some extent. Although a wide variation is observed in vegetables grown during *kharif* and *rabi* seasons by the homestead farmers of Western region, the results of the field trials on homestead farming indicated that the vegetables cultivation is more

concentrated during November to March period (*rabi* season) due to limited cropping of vegetables in rainy season owing to continuous and heavy rainfall received in the region.

It was observed that for a family of five, each homestead produced a good amount of vegetables in all the months except from March to May. Maximum vegetables were produced during November to March period.

7. Flower production for aesthetic value and profits

The cultivation of seasonal and perennial flowers offers a great scope especially in places like Goa where there is a great demand due to booming tourism. Even a small land allocation on a continuous basis especially in frontage of the household will not only beautify the outlook of the house but also makes the availability of fresh flowers for special occasions of the household.

8. Processing and value addition of homestead produce

It is very much important that the tiny produce developed at the homestead with lot of care finally is more useful for the end user with better returns.



Marigold flowers grown in the homestead garden of Mrs. Deepavati (Sangolda- Goa)



Drying of homestead grown chillies for value addition

For this, processing of the produce by following proper techniques, their value addition and proper marketing is very much crucial.

9. Distribution pattern of homestead grown vegetables

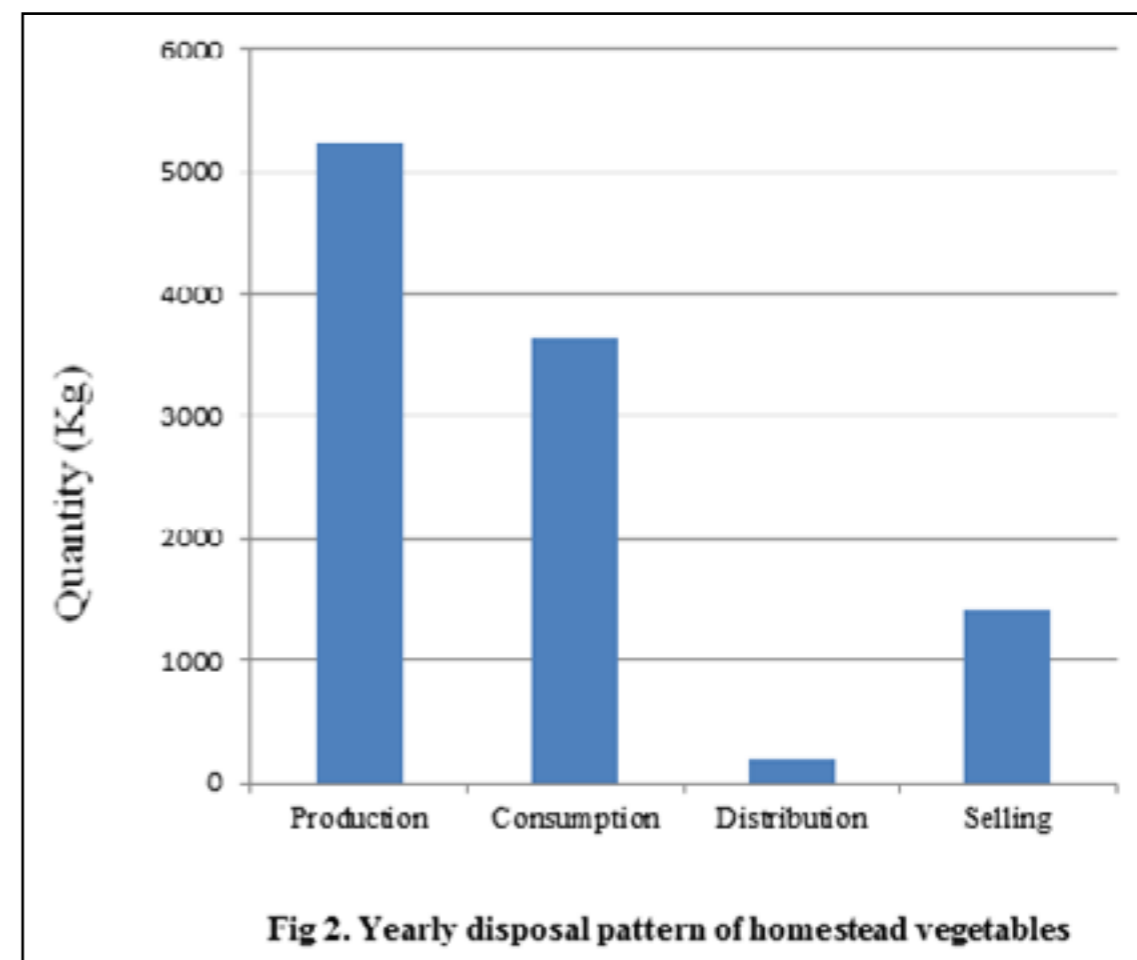
Another key attribute of home gardening is the equitable distribution of the produce within the community. While a large proportion of the production is consumed domestically, many products such as fruits, vegetables

and medicinal /ornamental plants are also are generously shared within the local communities. This egalitarian distribution of the agricultural produce is significant in a social milieu and renders the home garden system a unique social disposition.

Following the technological intervention, sufficient quantities of seasonal vegetables were produced in all the 20 homesteads selected in the project, the details of which have been provided in Table 3. In most of the vegetables the produce was consumed by

Table 3. Total marketable surplus of vegetables produced through Homestead Farming System

Crop	Mean quantity produced (kg)	Mean quantity consumed (kg)	Per cent consumption	Mean quantity sold (kg)	Per cent surplus
Amaranthus	409	344	84.1	65	15.9
Knol Kohl	251	221	88.0	30	12.0
Radish	418	325	77.8	93	22.2
Spinach	146	103	70.5	43	29.5
Onion	244	194	79.5	50	20.5
Bitter gourd	32	32	100.0	-	-
Brinjal	413	294	71.2	119	28.8
Ridge gourd	229	147	64.2	82	35.8
Chilli (dry)	724	210	29.0	514	71.0
Cluster bean	151	133	88.1	18	11.9
Long bean	320	252	78.8	68	21.3
Okra	281	273	97.2	8	2.8
Methi	35	35	100.0	-	-
Snake gourd	77	67	87.0	10	13.0
Cucumber	94	52	55.3	42	44.7



the household itself except in crops like chillies, where the percentage consumed by the household was relatively less as compared to the quantity sold in the market.

A perusal of the data on the distribution pattern of homestead grown vegetables indicated that nearly two-thirds of the homestead grown vegetables are consumed in the household with only

one-fifth of the vegetable produced being sold in the market while a part it is exchanged among the neighboring households. Further, it was also observed that most of the vegetable production in the homesteads is concentrated during November to March period coinciding with the post rainy period.

Similarly, the consumption pattern was estimated in banana produced



Tissue culture banana (Grand Naine) in homestead of Rajendra Gaonkar, (Bethoda, Goa)

Table 4. Total marketable surplus of banana produced through Homestead Farming System

Variety	Mean quantity produced (kg)	Mean quantity consumed (kg)	Mean quantity sold(kg)
Grand Naine	830	504	326

in different homestead farms. It was observed that in banana, nearly 29.2 per cent was available as surplus after household consumption.

10. Backyard poultry rearing

In most of the homestead farms, the birds are of local, poor in weight, egg laying type and they are reared by

free range system and are not properly cared. Up-gradation of local birds with introduction of Gramapriya breed of dual purpose nature, i.e. for eggs as well as for meat helped the farmers to generate additional income. The breed is also suitable for backyard rearing and can be easily maintained with kitchen and other farm waste. It was observed that 100 per cent of the eggs produced

Table 5. Total marketable surplus of eggs produced through Homestead Farming System

Crop	Mean quantity produced (kg)	Mean quantity consumed (kg)	Mean quantity sold (kg)
Eggs	150	150	--

were consumed by the households, thus enhancing the overall nutrition of the farm family. Poultry manure with the richest source of nutrients was also available for recycling of nutrients into the fields.

11. Utilization of homestead grown vegetables

The study on homestead farming revealed that among the annual production of vegetables, a major portion was consumed by the household. In terms of nutrition a huge amount of vitamin A and also surplus quantity of vitamin C were produced. Except niacin and riboflavin a good amount of thiamin, calcium and iron were also produced. Thus only from a small homestead garden, the widespread deficient vitamins (vitamin A and C) could be successfully mitigated. The total income was 2.5 times higher than the production cost, therefore, homestead vegetable production was

economically viable, and in addition farmers obtained healthy food and created good relationship through free distribution of vegetables among relatives and neighbours. Moreover, most of the sale proceeds from vegetable were owned by women, which they used for purchasing of small household items and for children education.

12. Family labour based production system

Availability of family labour is very crucial for the success of Homestead farming. The study on homestead farming revealed that family labour utilization was enhanced with homestead gardening. Further, a job oriented variation was also observed among the male and female members of the family. In land preparation, sowing and marketing, male had a major role while for intercultural operations, harvesting and cooking women had the major role.

7. Development of Homestead models for different holding size

Based on the data collected and the interactions with the clients, model homestead units for different holding sizes of the household are attempted keeping in view the family requirement, marketing potential and the resource situations including part or full time availability of the family members to work in their gardens. As the majority of the households have a holding of 500, 1000 and 2000 m² in the region

relevant models to suit to these holdings were attempted. These models although are apt for Goa situations could also be used in other parts of the country with suitable modifications.

The details of economics of different component crops for a model homestead of 500 m², 1000 m² and 2000 m² are given below. The economics varies depending on the number in each of the component crops/ enterprise.

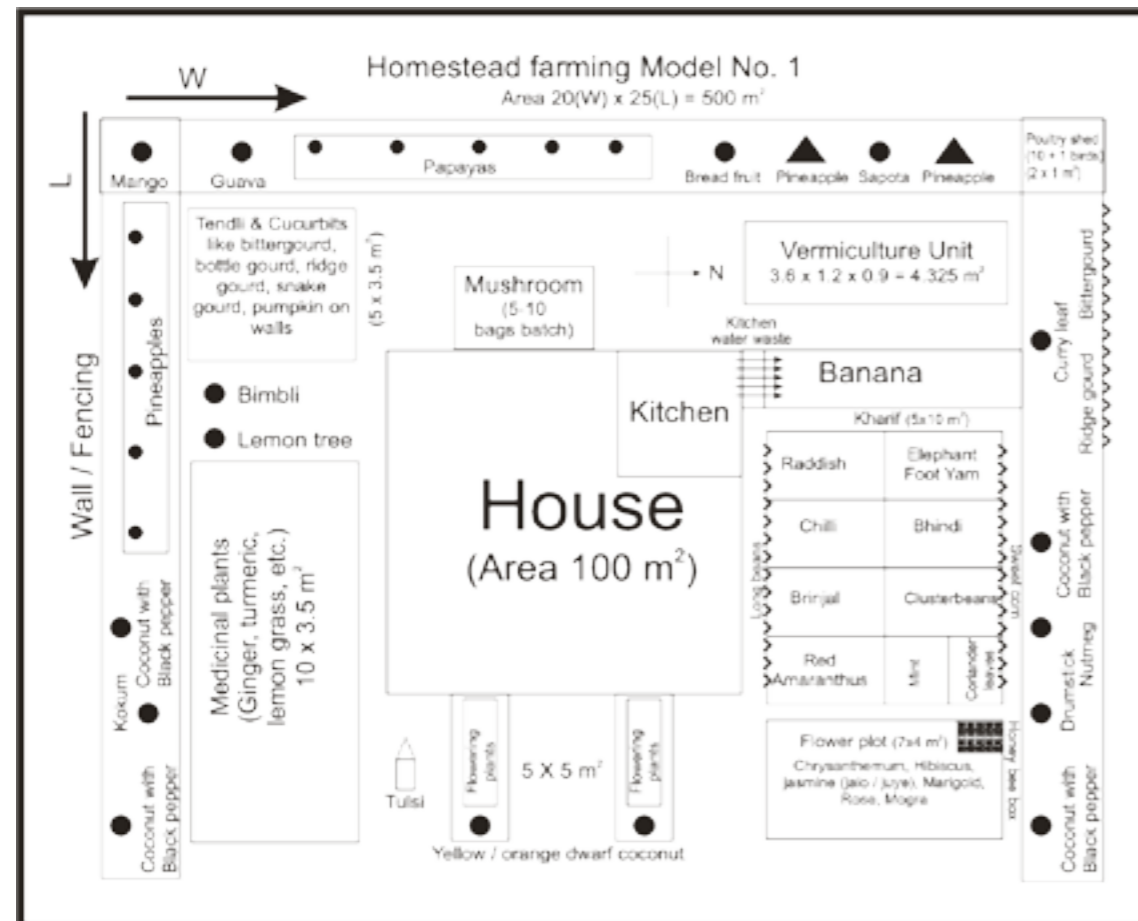


Table 6. Economics of Homestead farming model for a unit of 500 m² in one year(Rs.)

Years/Crops	Nos/area	1 st year		2 nd year		3 rd year		4 th year		5 th year		6 th year	
		Cost	Return	Cost	Return	Cost	Return	Cost	Return	Cost	Return	Cost	Return
Coconut	6	1800	-	300	-	350	-	400	-	450	900	100	1100
Mango	1	300	-	50	-	75	-	100	500	150	1000	150	2000
Sapota	1	300	-	50	-	75	50	100	100	150	200	150	400
Guava	1	150	-	25	-	50	50	50	100	50	150	50	200
Breadfruit	1	250	-	25	-	50	-	50	500	50	1000	50	1500
Papaya	5	250	2000	100	2000	100	2000	100	2000	100	2000	100	2000
Kokum	1	150	-	25	-	50	-	50	200	50	250	50	300
Drumstick	1	100	1000	25	1000	25	1000	25	1000	25	1000	25	1000
Banana	2	200	400	100	400	100	400	100	400	100	400	100	400
Bimbli	1	100	-	25	100	25	100	25	100	25	100	25	100
Lemon	1	100	-	250	-	25	100	25	200	25	200	25	200
Pineapple	8	150	-	50	150	50	150	50	150	50	150	50	150
Vegetables	80 sq.mt	2000	8000	2000	8000	2000	8000	2000	8000	2000	8000	2000	8000
Black Pepper	4	200	-	100	-	100	300	150	600	200	800	250	1200
Medicinal-Plants	35 sq.mt	900	3500	900	3500	900	3500	900	3500	900	3500	900	3500
Poultry	10 birds	500	1000	250	1000	250	1000	500	1000	250	1000	250	1000
Mushroom Unit	10 bags / batch	2500	3000	1500	3000	1500	3000	1500	3000	1500	3000	1500	3000
Vermiculture Unit	1 Unit	4500	8000	1500	8000	1500	8000	1500	8000	1500	8000	1500	8000
Apiculture	1	3500	3000	2000	6500	-	6500	-	6500	-	6500	3500	3000
Floriculture	50 sq.mt	500	2000	500	2000	500	2000	500	2000	500	2000	500	2000
Total		18450	31900	9725	35650	7725	36150	8125	37850	8075	40150	11275	39050

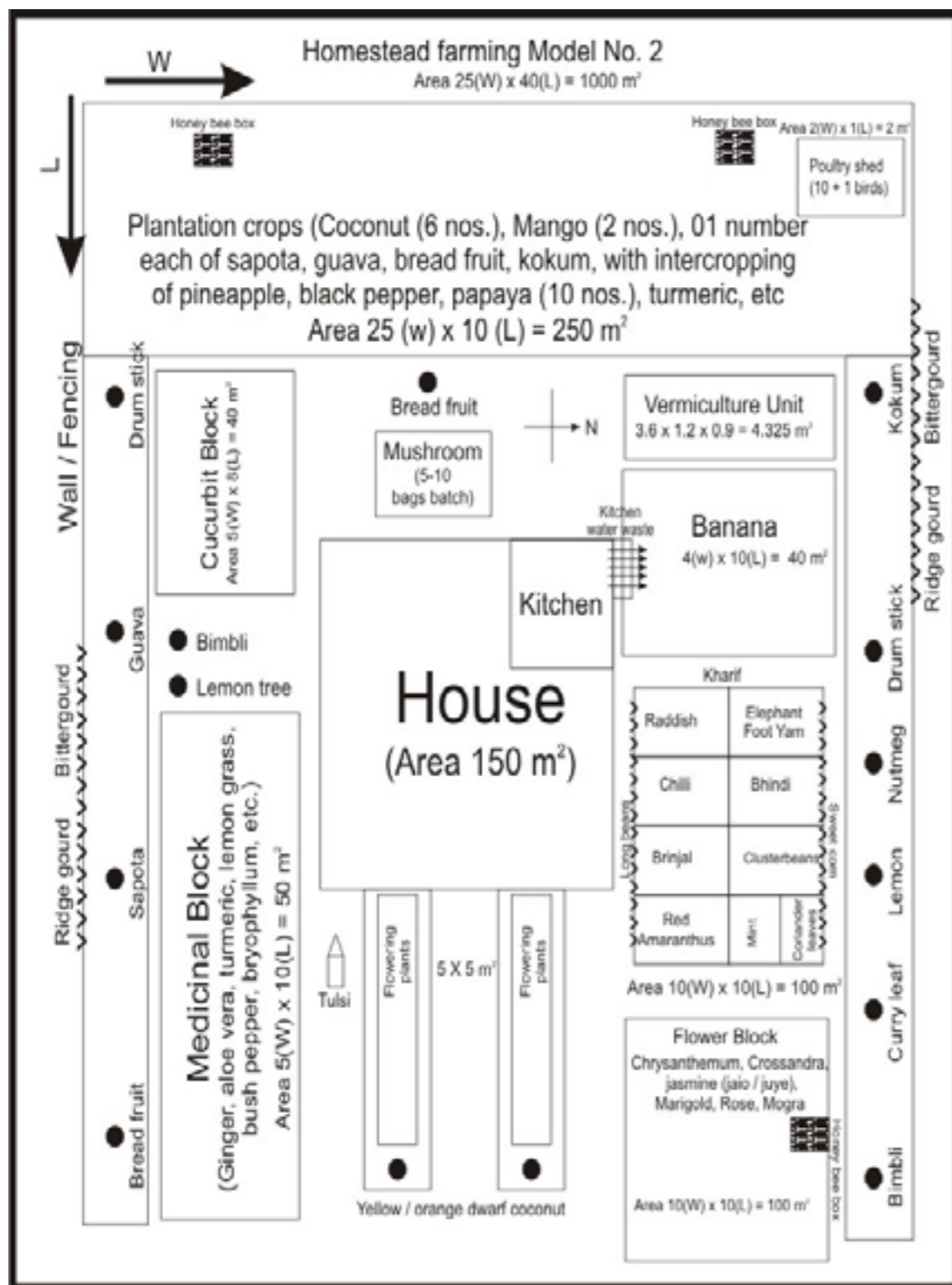


Table 7. Economics of Homestead farming model for a unit 1000 m² in one year (Rs)

Years/ Crops	Nos/ area	1 st year		2 nd year		3 rd year		4 th year		5 th year		6 th year	
		Cost	Return	Cost	Return	Cost	Return	Cost	Return	Cost	Return	Cost	Return
Coconut	8	2400	-	400	-	500	-	600	-	700	-	140	1400
Mango	2	600	-	100	-	150	-	200	1000	300	2000	300	4000
Sapota	2	600	-	100	-	150	100	200	200	300	400	300	800
Guava	2	300	-	50	-	100	100	100	200	100	300	100	400
Breadfruit	2	500	-	50	-	100	-	100	1000	100	2000	100	3000
Papaya	10	500	4000	200	4000	200	4000	200	4000	200	4000	200	4000
Kokum	2	300	-	50	-	100	-	100	200	50	250	50	300
Drumstick	2	200	2000	50	2000	50	2000	50	2000	1000	2000	1000	2000
Banana	10	1000	2000	1000	2000	1000	2000	1000	2000	1000	2000	1000	2000
Bimbli	2	200	-	50	200	50	200	50	200	50	200	50	200
Lemon	2	200	-	500	-	50	200	50	400	50	400	50	400
Pineapple	16	300	-	100	300	100	300	100	300	100	300	100	300
Vegetables	160 sq.mt	4000	16000	4000	16000	4000	16000	4000	16000	4000	16000	4000	16000
Black Pepper	8	400	-	200	-	200	600	300	1200	400	1600	500	2400
Medicinal plants	50 sq.mt	1200	4000	1200	4000	1200	4000	1200	4000	1200	4000	1200	4000
Poultry	10 birds	500	1000	250	1000	250	1000	500	1000	250	1000	250	1000
Mushroom	10 bags / batch	2500	3000	1500	3000	1500	3000	1500	3000	1500	3000	1500	3000
Vermiculture	1 Unit	4500	8000	1500	8000	1500	8000	1500	8000	1500	8000	1500	8000
Apiculture	2	7000	6000	4000	13000	-	13000	-	13000	-	13000	7000	6000
Floriculture	100 sq.mt	1000	4000	1000	4000	1000	4000	1000	4000	1000	4000	1000	4000
Total		31700	50000	16300	57500	12100	58500	12750	61700	13800	64450	20340	63200

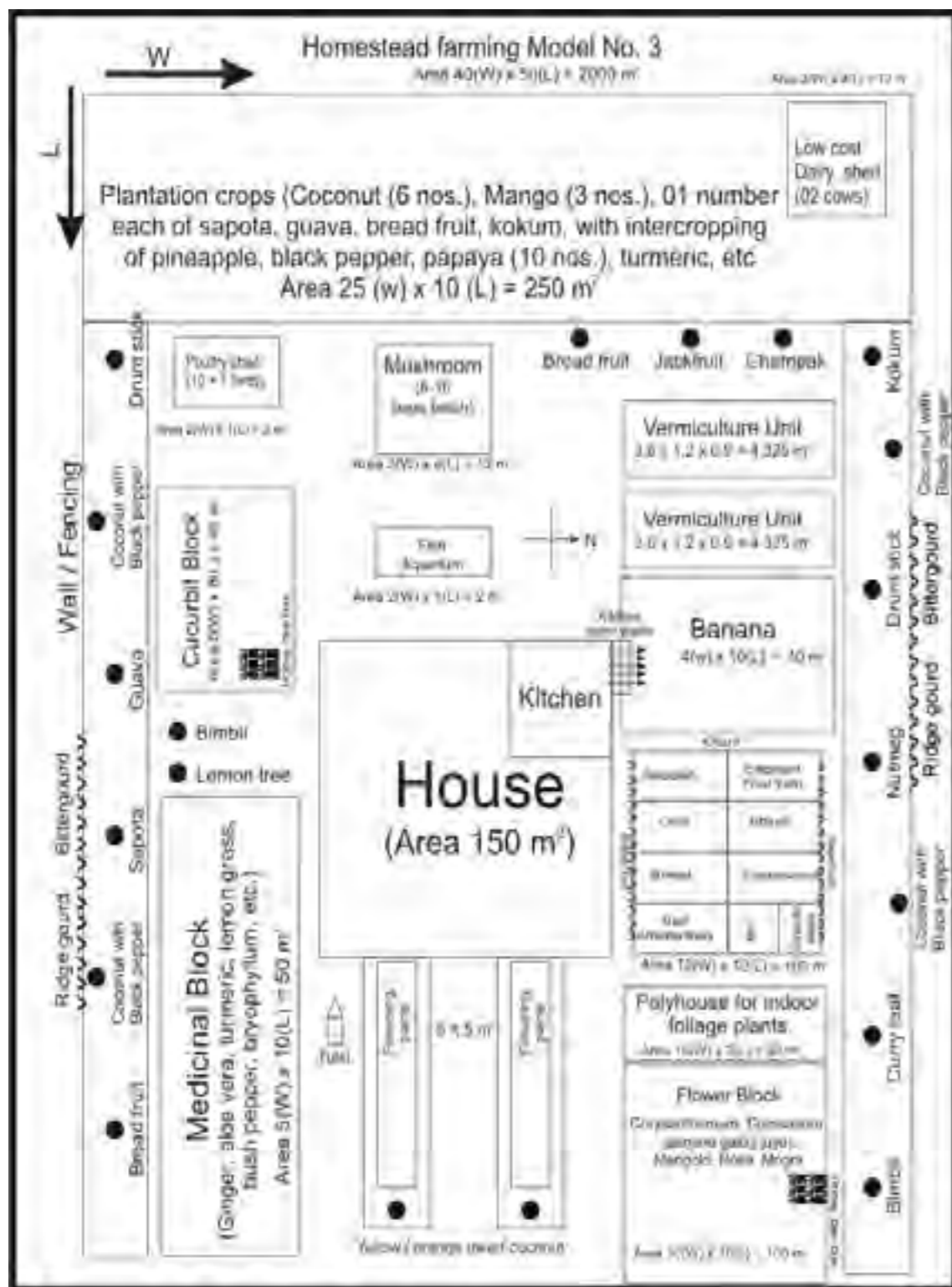


Table 8. Economics of Homestead farming model for a unit 2000 m² in one year (Rs)

Years/ Crops	Nos/ area	1 st year		2 nd year		3 rd year		4 th year		5 th year		6 th year	
		Cost	Return	Cost	Return	Cost	Return	Cost	Return	Cost	Return	Cost	Return
Coconut	12	3600	-	600	-	750	-	900	-	1050	1800	210	2100
Mango	3	900	-	150	-	225	-	300	1500	450	3000	450	6000
Sapota	2	600	-	100	-	150	100	200	200	300	400	300	800
Guava	2	300	-	50	-	100	100	100	200	100	300	100	400
Breadfruit	2	500	-	50	-	100	-	100	1000	100	2000	100	3000
Papaya	10	500	4000	200	4000	200	4000	200	4000	200	4000	200	4000
Kokum	2	300	-	50	-	100	-	100	200	50	250	50	300
Drumstick	2	200	2000	50	2000	50	2000	50	2000	50	2000	50	2000
Banana	10	1000	2000	1000	2000	1000	2000	1000	2000	1000	2000	1000	2000
Bimbli	2	200	-	50	200	50	200	50	200	50	200	50	200
Lemon	2	200	-	500	-	50	200	50	400	50	400	50	400
Pineapple	24	450	-	150	450	150	450	150	450	150	450	150	450
Vegetables	160 sq.m	4000	16000	4000	16000	4000	16000	4000	16000	4000	16000	4000	16000
Black Pepper	12	600	-	300	-	300	900	450	1500	600	2000	625	3000
Turmeric	30 sq.m	1200	4500	1200	4500	1200	4500	1200	4500	1200	4500	1200	4500
Medicinal plants	50 sq.m	1200	4000	1200	4000	1200	4000	1200	4000	1200	4000	1200	4000
Poultry	10 birds	500	1000	250	1000	250	1000	500	1000	250	1000	250	1000
Mushroom	10 bags / batch	2500	3000	1500	3000	1500	3000	1500	3000	1500	3000	1500	3000
Vermicul- ture	2 Units	9000	16000	3000	16000	3000	16000	3000	16000	3000	16000	3000	16000
Fish Aquarium	2sq.m	8000	7500	1000	7500	1000	7500	1000	7500	1000	7500	1000	7500
Apiculture	2	7000	6000	4000	13000	-	13000	-	13000	-	13000	7000	6000
Floriculture	100 sq.m	1000	4000	1000	4000	1000	4000	1000	4000	1000	4000	1000	4000
Planting Material	30 sq.m	35000	-	8500	15000	8500	15000	8500	15000	8500	15000	8500	15000
Total		78750	70000	28900	92650	24875	93950	25550	97650	25800	102800	31985	101650

The models have been developed along with allocation of the land for various components like vegetables, flowers, plantation crops, medicinal plants, fruit plants, vermi-composting, mushroom shed, as well additional components like apiculture, fish aquarium, poultry rearing, etc. The crop / enterprise combination can be selected based on household requirement, area of holding size, availability of water

for irrigation, work force, marketing potential, etc. Although typical models have been developed to the holding size of 500, 1000 and 2000 m², the crop / enterprise combination including the area can be suitably modified depending on actual situation at the farm level. Further, it was also observed that the choice of component will be wider and integration is complete with increase in holding size.

8. Balancing nutrition through homestead farming

In India nearly 29 per cent of the population lives below the food consumption-based poverty line, lacking sufficient resources to afford diet of 2,122 kilocalories (kcal) per person per day, along with other basic necessities. Apart from the prevailing deficit in total calories intake, the normal diet of the people is seriously imbalanced, with inadequate consumption of protein, fat, oil, fruits and vegetables, and with more than 80 per cent of calories derived from cereals. Women and children are especially vulnerable to their greater nutritional requirements. It is also reported that vitamin C, iron and other mineral nutritional deficiency are widespread resulting in different types of diseases, hampering physical growth and retarding brain development.

Food is the basic necessity of our life. Most people eat what they like or because it is warm or out of habit. Choice of food is not influenced by the awareness of nutritive value. Food is a prerequisite of nutrition. Nutrition includes everything that happens to food from the time it's eaten until it is used for various function in the body. We now realize quality of our health depends upon the nourishment that we provide to our body.

Animal foods which are the richest sources of many micronutrients, including Vitamin A, are beyond most people's means in the country. Hence, promoting the production and consumption of comparatively cheap vegetables and fruits is an important strategy for combating nutritional deficiency. Per day at least 200 g of vegetable is needed

for an adult man / woman, whereas the people are consuming only around 35 g / head / day. However, research findings also suggest that lack of nutritional knowledge contributes to the problem of malnutrition.

Fruits and vegetables play an important role in the balanced diet of human beings by providing not only the energy rich food but also provide vital protective nutrients. They are not only adorning the table, but also enrich health from the most nutritive menu and tone up the energy and vigour of a person. They have a vital role to play on the food front in as much as they are the cheapest sources of natural foods and can admirably supplement the main cereals.

The consumption of these items in sufficient quantities provides taste, increases appetite and provides fair amount of fibres, which are required for maintenance of good health and are beneficial in protecting against diseases. They provide valuable roughage which promotes digestion and helps in preventing constipation. The intake of these categories of food in our diets are far from satisfactory more so in low income groups. Nutritionally fruits and vegetables occupy an important place in human diet for the valuable minerals and fats content in them. Some of them are good sources of carbohydrates (sapota, banana, bread fruit, Jack fruit

...etc), minerals like calcium and iron (all leafy vegetables, dates, and raisin), vitamin A (mango, papaya, green leafy vegetables) vitamin B-complex (apple, apricot, grapes, and other vegetables) and vitamin C (aonla, guava, citrus and vegetables).

In order to have fresh fruits and vegetables in kitchen, it is better to have homestead garden in the house compound. Fruits and vegetables obtained from market lack much freshness and deteriorate in the food value besides their exorbitant price. Therefore the best quality of the fresh produce can be had from one's own nutrition garden as the time interval between the harvest and the consumption become the least. Further, working in the gardens is a pleasure and means of recreation and a possible family enterprise in which all members have due share to spend the leisure hours. Further, the gardening will also help in giving an exercise to the body and soothes the mind which in turn will also help to keep the family members healthy and happy.

Important horticultural sources of essential nutrients

1. Calories :- Tapioca, sweet potato, yam, potato, colocasia, onion, plantain, breadfruit, jack fruit, pumpkin, onion, banana, peas, etc.

2. Proteins: - Peas, cowpea, etc.

3. Vitamins A:- Carrots, spinach, amaranthus, colocasia, methi leaves,

drumstick leaves, pumpkin, mango, papaya, passion fruit, tomato, etc.. B-Complex: - Peas, broad beans, tomato, banana, grapes fruits, bhendi, capsicum and other vegetables.

5. Vitamin C: - Aonla, leafy vegetables, tomato, orange, lemon, guava, mango, etc

6. Calcium: - Curry leaves, drumstick, spinach and all the other leafy vegetables, custard apple, etc.

7. Iron;-All leafy vegetables, dates, raisins, guava, etc.

Thus, homestead garden help in nutritional security of the farm family and also supplement the needs of the vulnerable group (pregnant and lactating mothers and children below five years), to overcome the malnutrition and micro nutrient deficiency and other health consequences. Further, it improves the nutritional value chain by means of production, availability and stability of food production.

Because food supply is the primary aim of the home gardens, vegetables and

fruit yielding trees are most frequent there. In a study of the home gardens in Southern Kerala it was found that the gardeners grew 28 fruits, 21 vegetables and 12 spices and condiments. Some of these are seasonal crops, while others are perennials. Besides meeting the calorie requirements of the gardener and his family, they are also important sources of minerals and nutrients.

The results of the project study revealed that nutritionally, the homestead farming met a sizeable portion of the mineral and vitamin requirement of the household family members although the carbohydrate, protein and fat requirements were only met partially. The family nutrition was much improved through a mix of vegetables, including tuber crops, fruits, spices, plantation crops and medicinal plants. Further, a mixed vegetation around the household also brought a change in the local micro-climate with long term benefits on health of family members.

Table 9. Nutritional demand met by the homestead vegetable production

	Per capita recommendation of vegetable as per ICMR (for normal male adult)	Per capita mean availability of nutrients (g/ person/day) through homestead farming	Excess /deficit (g/ person/day)
Energy(cal)	170	45	125
Protein(g)	17	6.0	11
Fat (g)	3.5	0.7	2.8
Calcium(mg)	750	300	450
Iron(mg)	25	16	9

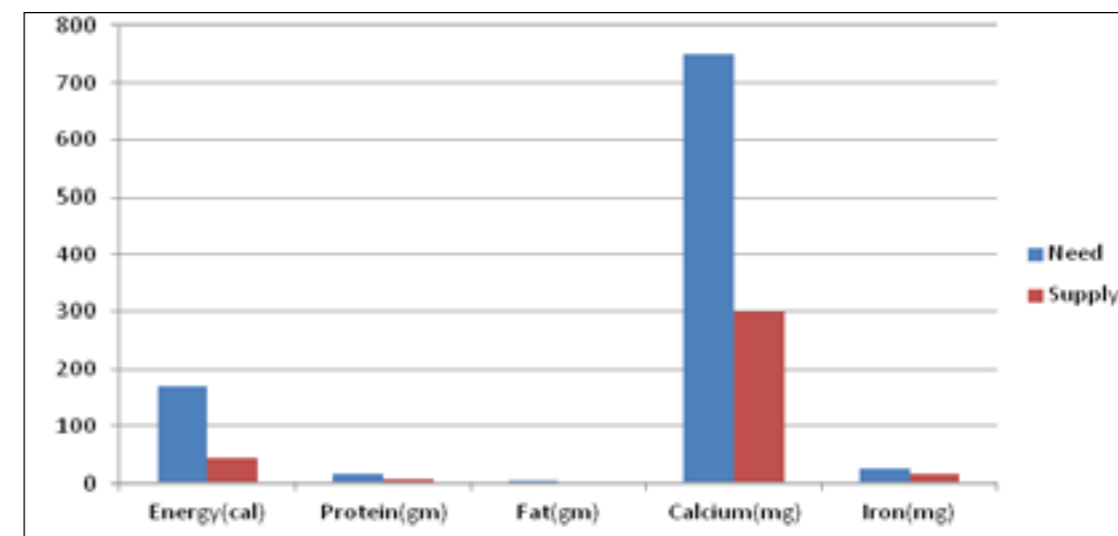


Fig 3. . Homestead gardening in meeting the different nutritional aspects

9. Plant Diversity of Home gardens

While species diversity abounds in the home gardens, wide variations in species assemblages have been reported from home gardens in different geographic/eco-climatic regions. The suite of species in a particular region also is variable. A large number of herbaceous crop plants including medicinal and aromatic plants are also reported to occur in these gardens.

In general the high floristic richness of home gardens implies it's potential to serve as repositories of genetic diversity and act as insurance against pests and disease outbreaks. The villagers also pursue several religious/ cultural beliefs, customs and taboos, which influence the diversity/composition of home gardens. Some crops/ trees/ animals are preferentially retained or excluded by them.

The system with a mix of vegetables,

flowers and medicinal plants as intercrops in fruits and plantations involving spices could able to sustain the biodiversity of vegetation around the household with a change in the local micro-climate having long term benefits on health of family members.

Some of the common bio-diversity observed under West coast situations is as follows:

1. Vegetables:-Radish, amaranthus, brinjal, chilli, longbean, okra, etc.
2. Plantation crops:-Coconut,arecanut, etc.
3. Spices:-Black pepper, cinnamon, nutmeg, etc.
4. Flowers:-Marigold, crossandra, jasmine, hibiscus, rose, etc.
5. Fruits:- Mango, banana, papaya, sapota, etc.
6. Medicinal plants: - Curry leaves, tulsi, etc.



An array of bio diversity variation observed in Western region

Conclusion and Recommendations

From the several years of research and development work on homestead farming across locations it is clear that in most of the months in a year farmers were able to fulfill their daily requirement of vegetable. Through the increased intake of homestead vegetables and fruits, demand of Vitamin A and C were met along with fulfillment of iron and calcium. Moreover women employment was created along with small amount of cash income. Thus, homestead vegetable gardening helps to improve food security and reduce

nutritional deficiency. However, nutritional education is crucial for mitigating deficiency and sustainability of vegetable gardening. The technology is recommended for widespread dissemination among the small farmers of the region by creating mass awareness through media, development partners like Directorate of Agriculture and NGOs. However, supply of quality seeds should be ensured through development of entrepreneurship / reliable seed dealers for successful implementation of the programme.

Back Cover



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