Manual on Home Garden for East & South Coastal Plains Agro-Climatic Zone

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PREFACE

Understanding Home-garden

'Utilizing the small home stead space to produce chemical free, safe and healthy fresh food round the year', on the other hand, valorizes common sense principles of community autonomy, cultural integrity and environmental stewardship'.

'Manual on Home Garden for East & South Coastal Plains Agro-Climatic Zone' can be an effective way to communicate about and involve people in sustainable small scale farming. This manual is designed for both learners and practitioners who are actively involved in strengthening household, especially in tropical regions.

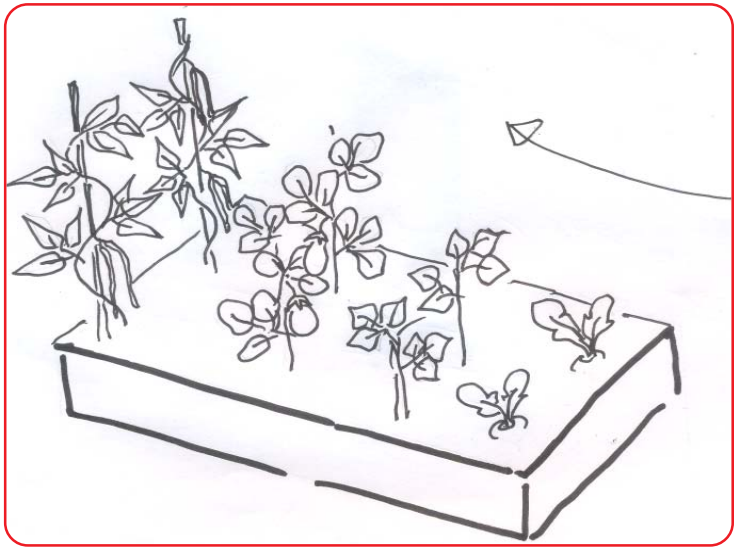
The illustrations and descriptions of the manual are formulated with respect to the community's present practice; the manual reflects technological changes in practice whether large or small - includes community's outreach activities and the process of evaluation.

Why Home gardens'

Global warming is real and Climate change is happening round the world. In recent years, scientists have become alarmed at the rate of environment degradation and loss to mankind. Unpredictable seasonal cycles portend loss to livelihoods security through reduced agricultural activities. At stake are the marginal & small communities, especially the women and children.

'Practicing Home-garden' is very functional approach to environment conservation practice that provides solution to micro-climatic challenges that directly impact on food, nutrition, agriculture productivity, poverty, hunger and malnutrition; we have chosen 'home garden' as small scale biodiversity and its conservation through women participation as the organizing theme for this manual. However, principles and techniques in this manual can also be applied in developing an interpretive program that focuses on other types of issues, such as health & sanitation, environment pollution or agricultural productivity, to name a few.

Home Garden Essentials-1



Season:
All seasons/Especially Dry

Idea:
Raised beds are preferred to avoid soil compaction, as the area often gets waterlogged during wet season. Plants are arranged, shortest towards east and tallest towards western end, to optimally use sunlight.

Design:
Plants are arranged according to height on a 9-10 square meter [100-120 square feet] raised bed [width not more than 135 cm or max. 5 feet]; the raised beds are to be 15-18 cm or [1-1.5 feet] high. Daily required greens like spinach, bush bean, brinjal, pole bean, chilli etc., whose seeds can easily be saved are usually planted. The beds generally combine crops/vegetables with different root depths and light requirements. About 1cm of rice husk/ hull, and 1cm of vermi-compost is spread on top of the bed and incorporated in the top soil. Nutritionally rich and multi season, multi-use plants are given priority.

Purpose:
To use small space more intensively and improve soil drainage. To always have some fresh food in the house, that is nutritious and safe. Some of the plants may also provide the structural support for the others.



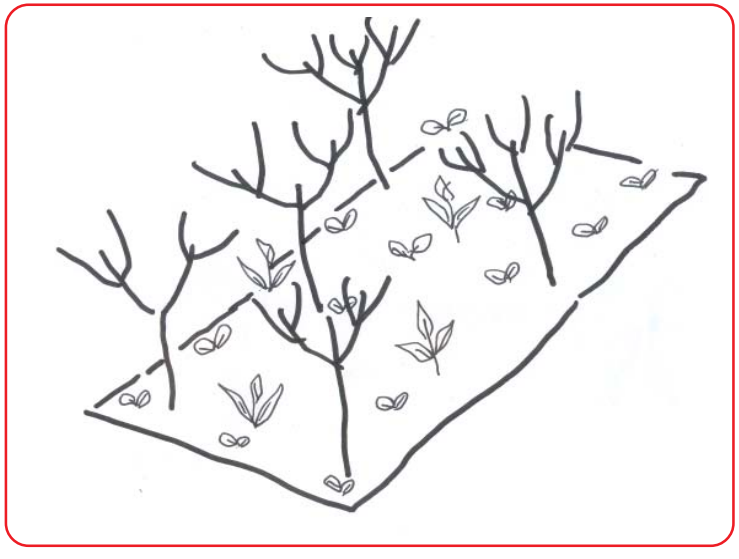








Home Garden Essentials-2



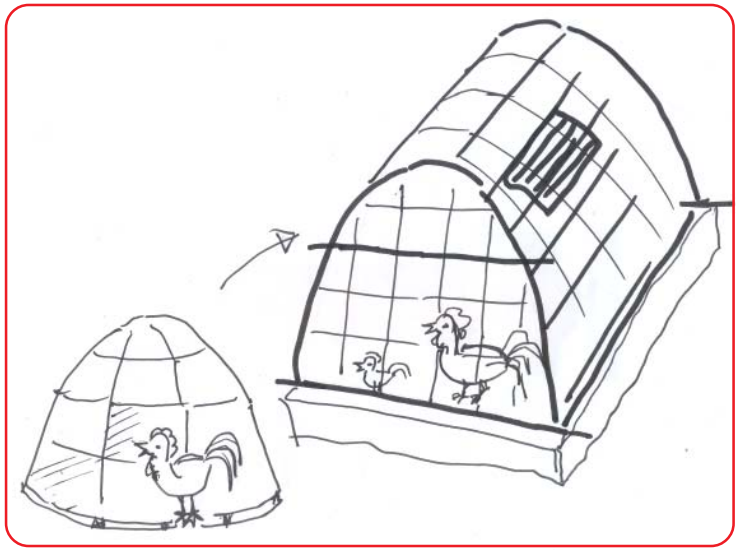
Season:
Mainly Dry Season

Idea:
2/3 varieties, which are considered good companions, should be planted mixed with to take maximum advantage of space and water, nutrients, and protecting each other from pests/diseases/weeds etc.

Design:
Planting of the main species is done in alternate spaces, about 50-60 cm (1.5 feet to 2 feet) apart, depending on height and size of the plant variety. In-between spaces are filled up by the less high secondary species [often the bushy type of cowpea or beans, as they fix nitrogen], finally the seeds of a shade tolerant herbor other cover crop is spread in the remaining space e.g. Tomato, French-beans, carrot, turnip, coriander etc. can be placed together, in the post monsoon period [cool season].

Advantage:
Good companions often help each other by better control of pests and weeds and optimize use of water. Since the maturity speed is different, food is available for a longer period of time. Weeds do not get light and are therefore less.

Using Birds/Animals to till soil in the Home Garden, and perform other functions



Season:
Post Monsoon

Idea:
People already raise chicken under baskets. The only change is design of the same.Chicken are kept in bottomless, square shaped cages over small raised beds, and they loosen the soil by scratching, do weeding, kill grubs & insects in the soil, fertilise it. If the beds are made of equal size, the cage can be shifted after 4-6 weeks and seeds of the next vegetable planted.

Design:
The beds and cages are 135 to 150 cm (4 to 5 feet) wide, 180 to 200 cm (6-7 feet) long and 100-120 cm high (3-4 feet). There are few cross pieces above 100 cm or so and there is a flap to throw in food scraps without removing cage. The cage helps to keep chicken near the vegetables without harming them and their natural behaviour is usefully employed. Roughly 2-3 local birds should be kept per square meter.

Advantage:
Cage is shifted from place to place within the nutrition garden. The natural behaviour of the birds is employed to do the necessary work in the garden, thus reducing maintenance labour for weeding, fertilization and loosening top soil. At the same time, vegetables close to household are protected from the chicken. Similar idea can be employed in larger scale fruit orchards as well.



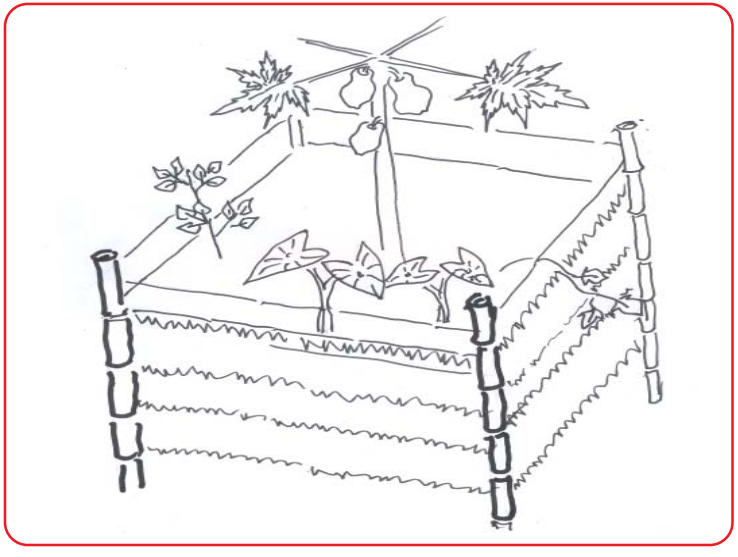








Very high Beds



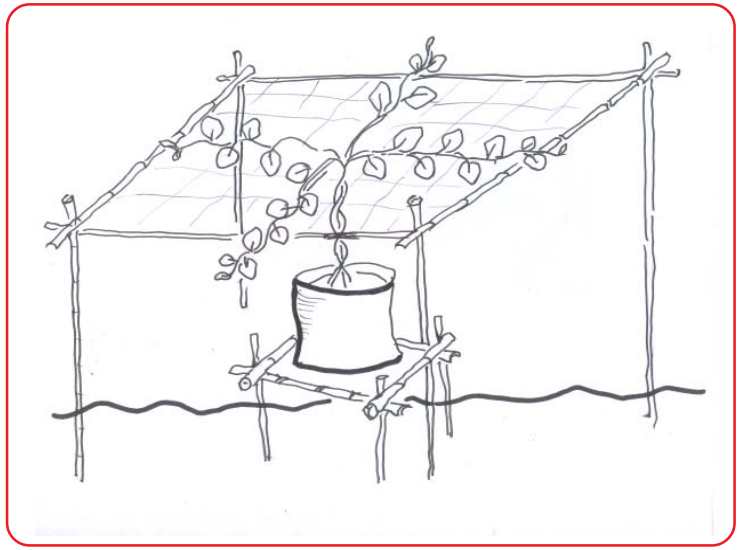
Season:
Any season, but especially wet

Idea:
Using chopped up water hyacinth with alternate layers of soil to create a 150-180 cm raised platform to raise plants that do not like wet or heavy soil such as papaya, gourds etc and long season plants such as chillies, malabar spinach (Poi sag; Botanical: Basella alba) etc.

Design:
A 2 m X 2 m or 3 m X 3 m, bamboo frame is erected; the sides can be made of old fishing nets, or palmyrah leaves. The water hyacinth weed which is commonly available is chopped up and laid in alternative layers. Each layer is usually 27-30 cm high, after which a 2.5 to 3.0 cm high later of soil is added. The bed is made about 150-165 cm high (4.5 to 5 feet), top most layer of soil is 15-18 cm deep, and some compost is also added to this layer. Plants (seed and seedlings) like papaya, taro, various climbers and creepers can be grown over the raised bed.

Advantage:
Slow decomposing water hyacinth weeds are productively utilized. Plants that grow year round, but do not tolerate 'wet-feet', can be grown on such beds constructed near houses, even when soil gets covered with a 50-60 cm deep layer of water.

Planting in Raised bags



Ecosystem:
Home Garden & Small Farms

Season:
Mainly Rainy Season

Idea:
Creeping and climbing plants are raised from earthen pots or large sacks held over water by a bamboo frame and the plants spread on nets or thin bamboo stems, tied across the frame.

Designs:
Many fields remain unutilised due to flooding. Water accumulates to a depth of 1 m - 1.2 m usually. A 6 m X 6 m climbing frame is constructed and at the centre a raised stool like structure is created. From a bag or large mudpot placed on it, creepers such as gourds can be spread high over water. The bag is filled with soil, rice husk and compost or vermicompost mixed at the ratio of 1.5:0.5:1.0

Advantage:
Creeping Vegetables, such as bitter gourd, ridged gourd, ivy gourd etc and Basella can be grown year round above flooded fields to improve food supply and generate income. Mudfish and shell-fishes can be grown in the water below the frame.



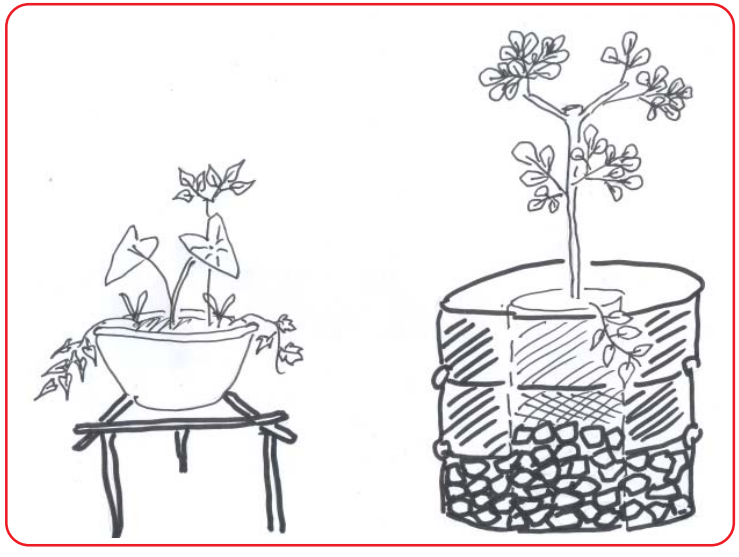








Other raised beds



Season:
All season

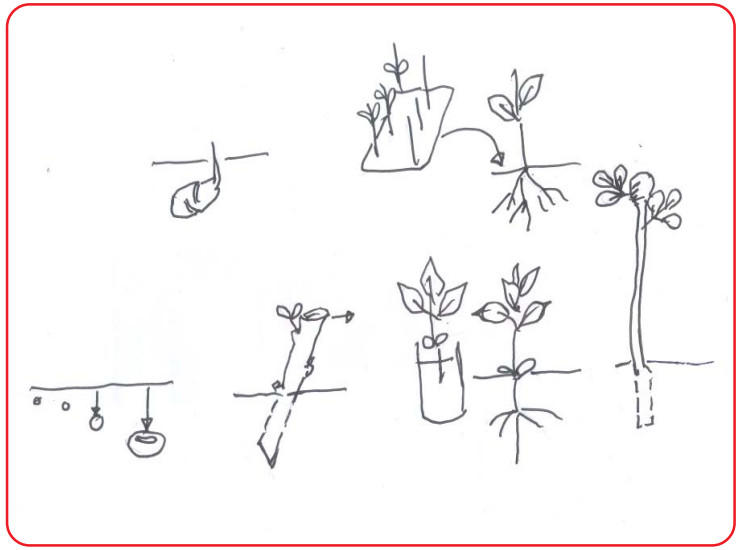
Idea:
Plants grown over saline water or poor soils using old tyres (part of motor vehicles) or in an earthen pot on a bamboo platform.

Design:
Three or even four large truck or car tyres are put on top of each other and tied to prevent displacement. Lower levels and sides of tyres are filled up with brokenbricks and stones. Top layer, 25-30 cm deep, is filled with soil and compost mixture [1:1 ratio], plants which yield regularly and are used often are planted, e.g. Papaya at centre, Chillies or Taro below and water convolvulus growing over sides.

We can use a large earthen pot [often used in villages to feed cattle], lifted by a platform, constructed by bamboo or other wood that does not rot easily, and fill it up with soil mixture. Bottom should be filled with brick /stones and 4 holes made to facilitate drainage. Pots should be at least 45 cm deep.

Advantage:
Growing long season/annual plants and perennials sensitive to water-logging, such as papaya, lime-lemon etc. can be grown near houses. Plants also get protected from chicken, goats etc.

Various ways to propagate plants



Seasons:
All places and all seasons

Idea:
Plant propagation from seeds, cuttings, stems, potted or bare-root seedlings, corms/bulbs etc.

Detailed Description:
Plants are propagated directly from seeds, broadcasted on surface [in case of small seed such as amaranth greens], or planted deep [as in beans, gourds etc] usually seeds are planted at a depth of 3 times their thickness; some plants are raised in beds or pots and are then transplanted [generally after 5-6 weeks].

Plants also can grow from corms/bulbs/bulbils etc e.g. ginger/ turmeric/ yams etc. We can multiply some vegetables by planting stem cuttings or plant stumps, Poi or Indian spinach, sweet potatoes are example, edible trees and shrubs such as drumstick, Sauropus (English: Star gooseberry Botanical: sauropus androgynus) etc can be multiplied from planting large branch cuttings.

Relevance:
We can raise many plants in protected nurseries and transplant them when they are larger, avoiding many pests and problems.



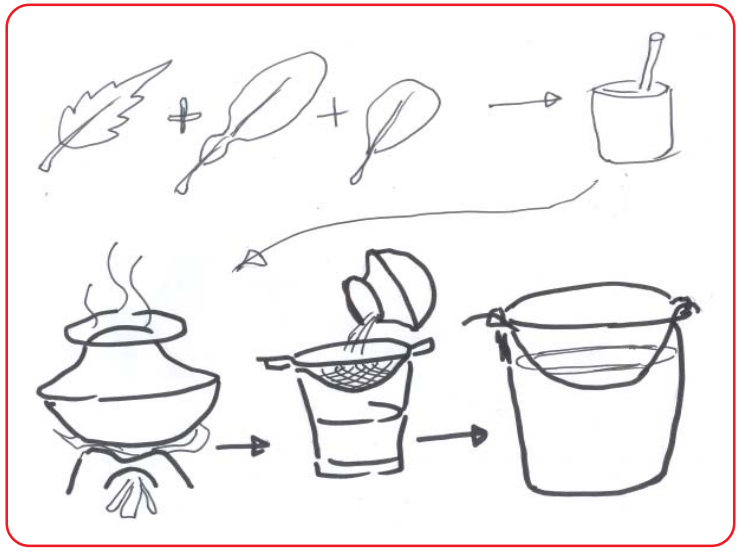








Bio-pesticides



Seasons:
All places and all seasons

Idea:
Insect repellants made from various plants, often called botanicals.

Detailed Description:
Plants that are aromatic - such as herbs and spices, plants that have bitter taste - such as neem, nirgundi (vitex negundo); and plants that have a milky sap often possess anti-feed-ant, anti-fungal or anti-bacterial properties.

We often crush these plants, soak them overnight in equal volume of water; strain them through cloth and then dilute them with 5 - 6 times mild soap water. Such solution is sprinkled on the crops/ vegetables, usually in the afternoon; once in 10 day or whenever the pest density justifies.

Relevance:
Locally available plant extracts are used, that can be made easily at home and sprinkled with care towards sunset when pests become active and bees/ other pollinators, even human or livestock are not harmed. Sprinkling wood-ash also helps to prevent plants from chewing insects. Non-edible oil cakes of Neem, Mahua etc are often mixed with compost and incorporated in top-soil to combat soil-borne diseases and nematodes etc.

Extraction and Storage of vegetable seeds

Season:
All places and all seasons

Idea:
Various methods of drying/ storing vegetable seeds at home, for use in the next season.

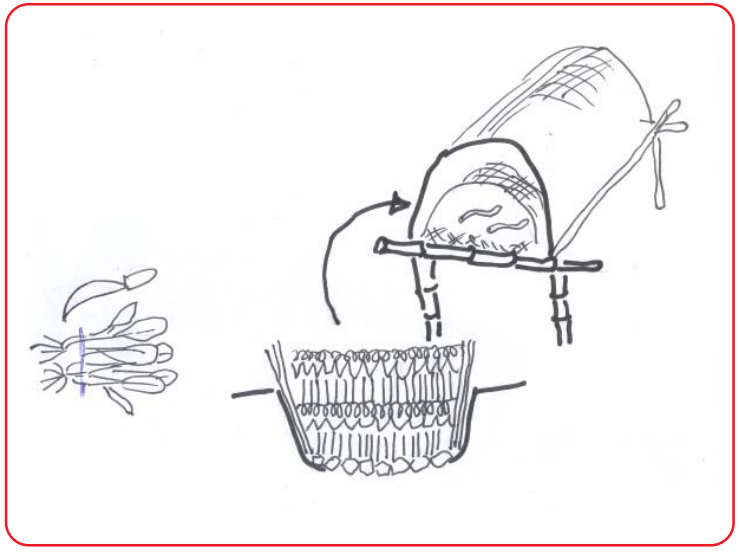
Description:
In nutrition gardens, we prefer to grow only those vegetables, herbed for which we can save seeds easily. Many spinach produce seeds when they reach maturity, all we need to do are harvest the whole plot and dry it in a semi shaded and airy location. Tomato, Cucumber, Brinjal etc have pulp around the seeds, we need to soak them in water for 24-48 hours, stirring the solution 2-3 times a day, and the seeds which sink are then preserved after drying in early morning or late afternoon sun. Some seeds such as ladies-finger, maize, roselle, ridge gourd etc are often preserved as whole. All storage should be in dry and shady place. Preserving beans, we often need to mix 5-6 ml of neem oil to a 500 ml bottle of bean seed to prevent it from pests.

Relevance:
Gardeners need to know character of the locally adapted varieties, and select seeds from healthy plants and mature, well proportioned fruits. This can prevent many diseases and deter pests, if only strong and vigorous seedlings are transplanted.






Vermi-composting



Season:
All spaces; especially dry season

Idea:
Most of the Agro-waste can be recycled as animal droppings/ urine sometime by facilitating absorption in suitable media such as coir dust.

Description:
As water-logging is a problem in this area, vermicompost is preferred and can be made on a raised platform after pre-digestion in a hole for 5-6 weeks.

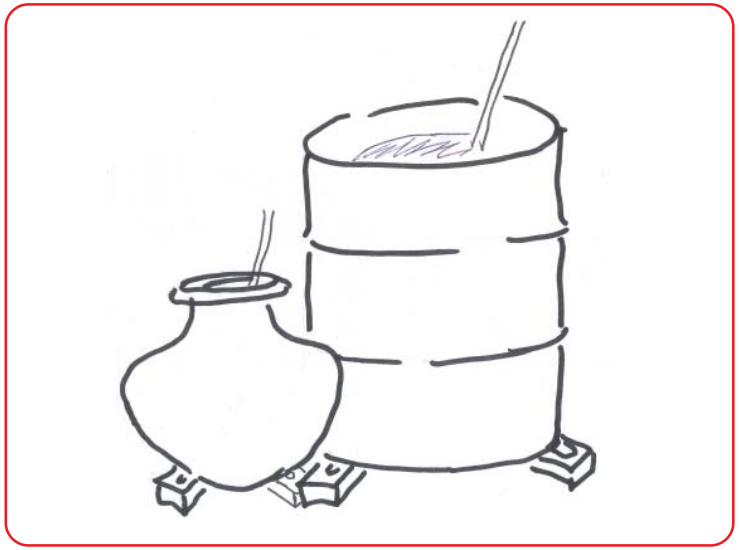
Chopped up water hyacinth can be the main ingredient, and chicken / duck/ goat manure could be mixed along with kitchen waste to attain a carbon - nitrogen ratio of 25-30:1.

Once semi-decomposed manure is heaped up to 50-60 cm on raised bamboo platform which is shaded, any quick multiplying type of earthworm could be released.

The heap needs to be kept wet for rapid decomposition. Depending on the number of earthworm added, the vermicompost should be ready for use in 8-12 weeks.

Advantage:
Composts supply some nutrients, but are even more important as soil-amendments, which is very important to reduce bulk-density of heavy soils and also as buffer to salinity, which is a problem in the coastal region.

Preparation of liquid manure



Seasons:

All seasons and spaces

Idea:

Making of liquid manures for maintaining soil fertility, either used to treat seeds/ seedlings; or sprinkled on leaves [foliar application], or added to top-soil at regular intervals.

Details:

Several types of manure or compost teas are made either from raw manure or from ready compost. For treating seeds, concentrates are often made by mixing cattle dung with equal volume of urine, and fermented with 5 parts water for 8-10 days. The mixture is stirred twice everyday for 5 - 10 minutes and when applying, strained and diluted with water 1:1, for soaking seeds @ 2 - 2.5 ltr./kg of seed.

For application to crops, mother solution is often made by mixing cattle manure with equal volume of urine and crushed leaf or kitchen waste. This is diluted by mixing with 10 - 12 times water and allowed to ferment for 10 - 14 days with 2 - 3 times a day stirring. Before application on leaves, it is diluted by mixing with 2 litres water and for soil application, equal volume of water. [Rate about 2.0 - 2.5 litre for a 9 square meter area, once a week]

There are several other types of solution, but stirring regularly is essential, and ready solution can be kept for about 10 - 14 days, in case of chicken/ duck/ goat manure, fermentation period is reduced up to 4 - 5 days.

If ready compost [made at high temperature] is used, only about 1.0 - 1.5 litre of compost needs to be immersed in 50 litres of water and a hand full or two of liquid jaggery is added. The solution is artificially aerated, for up to about 24 hours, and then the solution are applied, roughly @ 1 lit/4 - 5 square meter area.

Relevance:

All these are micro-biological solutions, made at home after some basic training. These can easily reduce the need for synthetic fertilizers and even large quantities of farm yard manure (FYM).

We can also apply Bacterial or fungal cultures available in market, mixing 4 - 5 packets [800-1000 grams], in 5 kg of vermicompost for application to 1 acre plot.

Such methods work better when the field is ploughed to a shallow depth, and mulched on the surface. They can fertilize and also control soil-borne diseases.



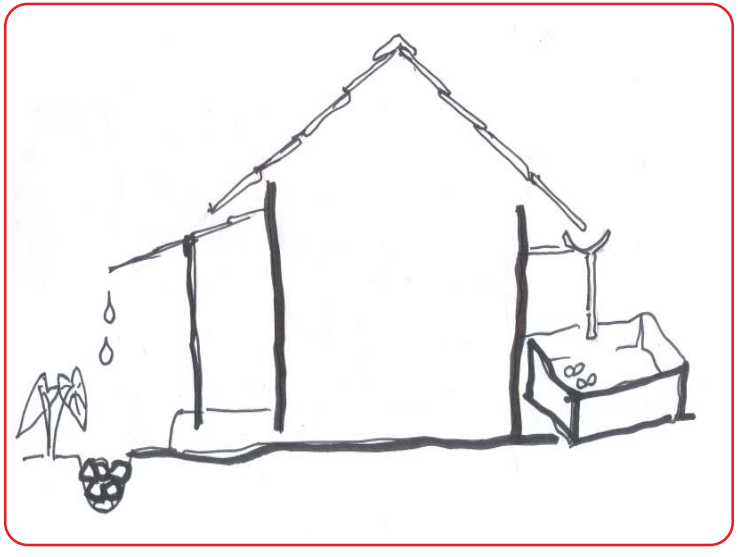








Harvesting rainwater from rooftop



Season:
During Monsoon

Idea:
Roof water can fall into soak-pits dug along the drip-line and Colocasia/Alocasia can be planted nearby, or rainwater collected from roof can be stored in a cement tank and used for raising mud-fishes, azolla, aquatic vegetables etc.

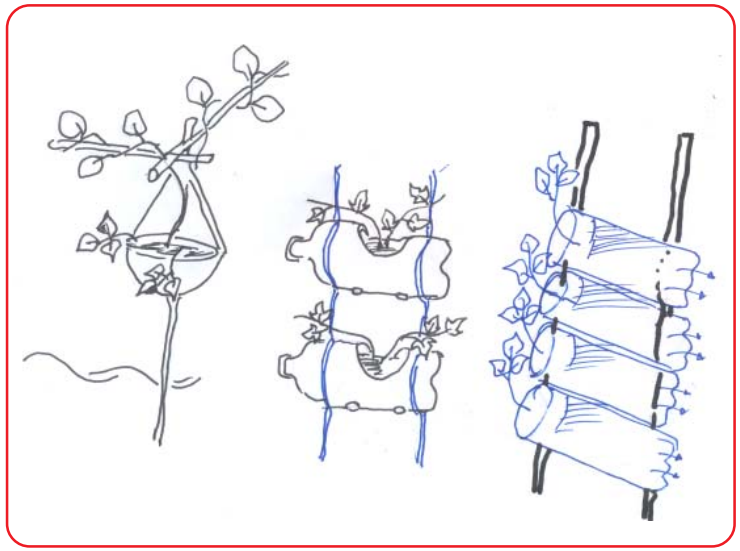
Design:
A 2 meters wide, 3 meters long, and 120-135 cm deep tank, can be built behind the house to store rain water and part of this can be used for irrigating plants in the nutrition garden.

Azolla, duck-weed, water spinach can be grown in the tank, and mud fishes, shell fishes etc can also be raised to augment food / fodder supply.

For leaf panel and straw roofs, some sort of filter mechanism will have to be installed to keep dirty water out as far as feasible.

Advantages:
Water supply can be enhanced and growing season will be lengthened. As outlined above, fodder and food supply would be enhanced! Local household's capacity to deal with climate change would have been strengthened.

Hanging plants in small spaces!



Season:
All times

Idea:
Growing creeping or climbing vegetables and herbs from hanging pots or bottles (1.5 to 2 litre plastic bottles); the bottles can also be stacked up a bamboo frame. As the areas available are small and seasonally flooded, this can be good idea to grow some plants near the house.

Design:
Large pet bottles are cut open as shown in the diagram, and some small holes are made to help drainage. The bottles should ideally be wrapped to make them opaque, and not expose roots to sunlight. The soil mixture used to fill bottles, pots, bamboo pieces, or even shells of green coconut, should have 1 part soil + 1.5 parts well prepared compost + 0.5 parts coir dust, rice hull or sand.

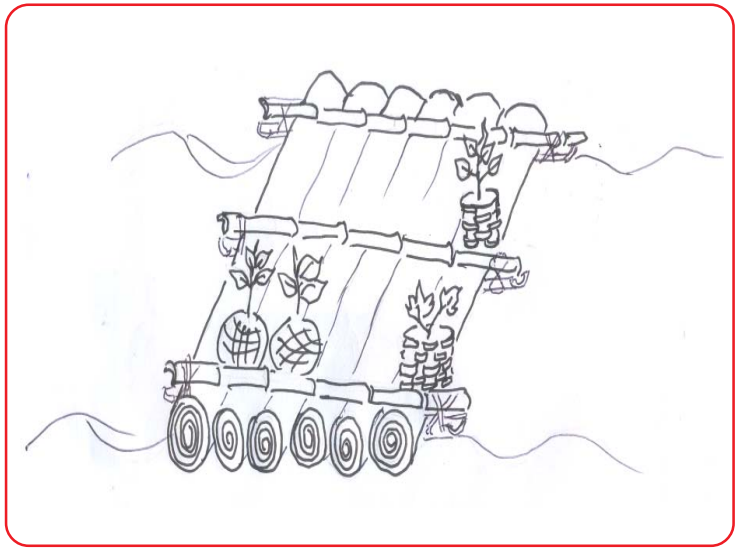
The shallow containers can be hung from any tree, rafter of house or frame corner and leafy vegetables that can grow on shallow soils can be planted e.g. water convolvulous, ivy guard etc., edible weeds such as Indian pennywort, can also be grown, succulent herbs that can be eaten or used as medicine such as sweet basil, aloe, Indian borage (Plectranthus amboinicus) etc can also be planted.

Advantage:
As explained, this technique will make production possible in small spaces and with less water. The design approach would be suitable for land less community.






Floating Nursery



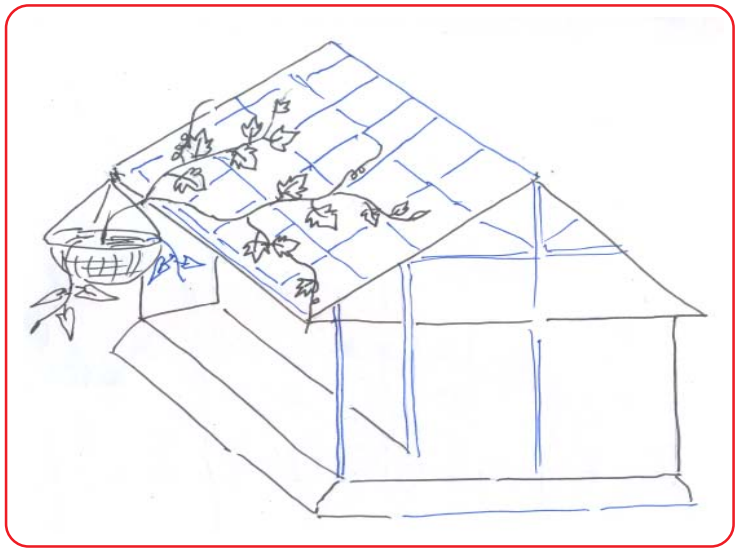
Season:
Dry season

Idea:
Starting seedlings around mid November on floating nurseries. Transplanting 7-8 weeks old saplings raised in Pandanus leaf baskets or water hyacinth + mud + cow dung balls as soon as water recedes.

Design:
The floating platforms are made of banana stems/ water bottles etc and balls are usually made of chopped water hyacinth + soil or silt + cow-dung. Pandanus leaves could also be weaved into small baskets to hold the seedlings. These balls or baskets filled with 0.5 soil + 1.5 vermicompost + 0.5 -0.8 coir dust, are arranged on the floating platform and seedlings of vegetables to be grown in the post monsoon season are raised.

Advantage:
During rainy season the platform floats and seedlings are not affected by floods. No time is wasted, once water level goes down, the seedlings are transplanted with the pot/ seed ball around their roots; plants start yielding 5 - 6 weeks from transplanting date, and they tolerate moisture stress better.

Baskets with creeping plants hung from roof corner



Seasons:
All seasons

Idea:
Climbers and creepers, which grow rapidly, and where the leaves also are edible, can be grown from hanging baskets and allowed to spread on rooftop.

Design:
2-3 seedling of basella, traditional variety of bottle gourd, small pumpkin etc are planted in a 30 - 40 cm deep basket, lined with large leaves or several layers of newspaper filled with soil, vermicompost and coir dust or rice husk mixed in 1:1:1 ratio; hung from a corner with strong coconut rope that is locally made. The height of the basket should make watering convenient.

Advantage:
To prevent from floods and grazing by stray animals, climbing plants are grown in baskets hung from rafters and roof spaces are utilised. As observed in the villages, the open space is limited. Also plants such as sweet potatoes, water spinach, talinum etc, and edible wild plants such as dwarf water-clover (marsilea minuta), gotu kola herb or Indian pennywort (centella asiatica), Brahmi (bacopa monnieri) etc can be grown in such hanging baskets and leaves harvested as food at regular intervals.









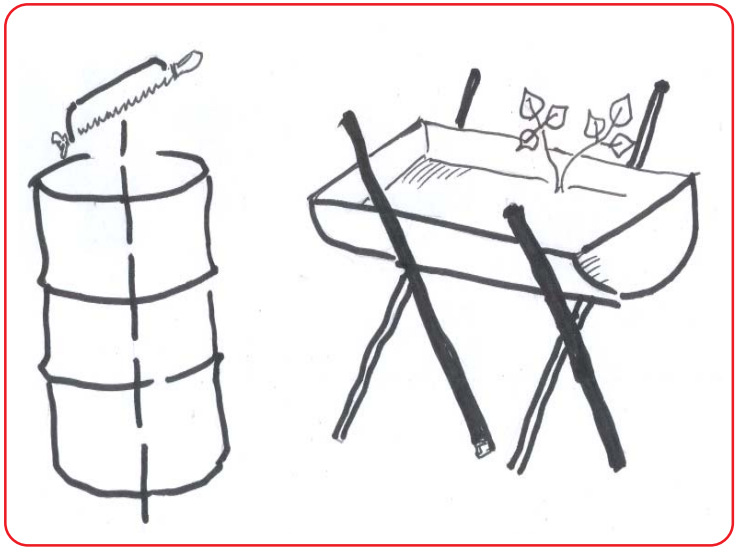


Drum plantings

Seasons:
Mainly wet, but all season

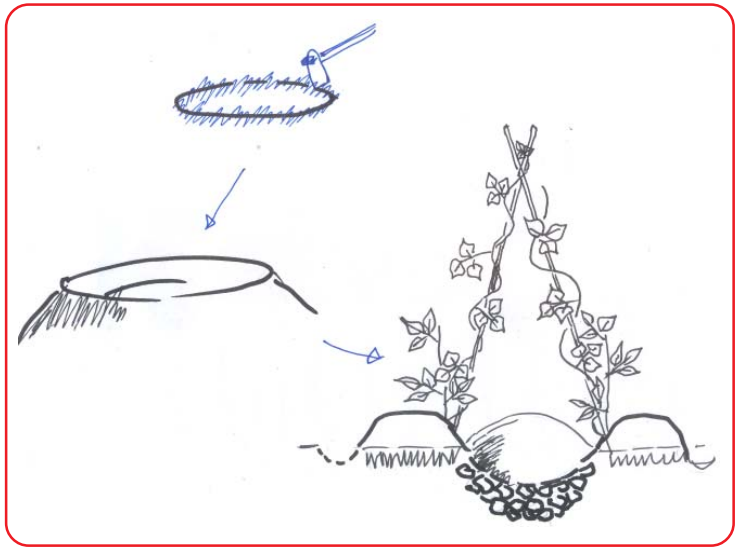
Idea:
Drums are vertically cut into half and raised above water by bamboo or wooden frames.

Design:
Old oil drums are washed and cut into two halves vertically. Such half-drums can be used to grow many vegetables and herbs, once they are filled with soil and compost mixture and lifted above water level by bamboo or wooden frame. Few holes are made at the bottom to drain excess water.



Advantage:
Regularly needed herbs and spices such as chillies, coriander, mint, bunching onion, basil etc can be grown round the year near the houses. Such drums or other large containers can be easily shifted to a sunny spot or a shaded area.

Circle gardens



Season:
Mainly late and post monsoon

Idea:
Circle gardens are made easily to combine plants together in a small space. They also do away with the need to make separate compost and need less watering.

Design:
A circular space is marked, first we loosen soil along the perimeter, then in the center a bowl shaped hole is excavated, and soil is piled up along the edges, compost or FYM is mixed along with the soil in equal volume. On the inner slope the seeds are planted, about 10 - 12 cm above the original soil surface, top of the circle is mulched with dry leaves or straw pieces. Household vegetable wastes, and water used in washing utensils etc is regularly added to centers. The inner diameter is 100 cm; bunds are 30 to 40 cm wide at base, 15 - 20 cm high. Brick pieces or charcoal are placed below the center to allow drainage of excess water.

Sticks planted like a pyramid allow climbers like bitter gourd, beans etc to grow, and in-between, about 3 - 5 ladies finger, cluster bean or some erect plant seeds are sown.

Advantage:
Circle gardens require less space, and are easy to make and maintain. They are particularly suitable in areas like this where soil is compact and water is of low to medium salinity, salt if any are accumulated on top, away from growing roots of the plants.



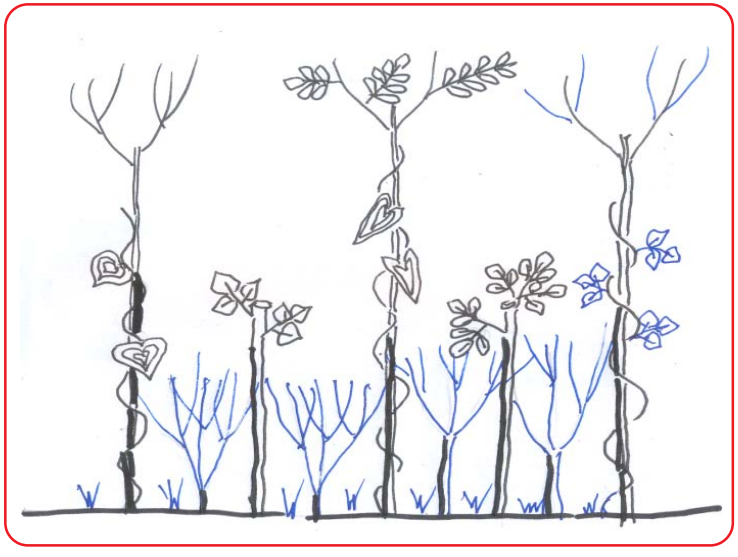








Multi level and utility living Fence



Season:
All seasons

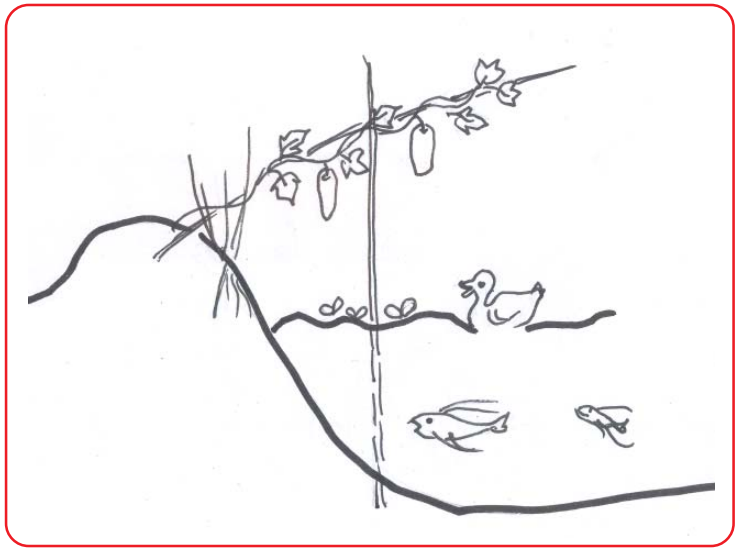
Idea:
A multi level fence can protect the house from wind, dust etc and keep producing some food/ fuel/ material for mulching and liquid manure making, botanical spray to deter pests etc.

Intervention:
Multi storey or tier and multi utility living fenceis made of small crown trees like Agati (Sesbania grandiflora); pollardable trees such as Milo (Thespesia populnea), Indian coral tree (Erythrina variegata) and drumstick; coppicable trees such as Cassia (Cassia siamea), Gliricidia (Gliricidia sepium), Ipil ipil (Leucaena leucocephala); shrubs such as Basanga (Adhatoda vasica), Nirgundi (Vitex negundo) etc and vertical climbers such as yams and winged beans, sword bean; low creepers such as small bitter gourds are also used. Often flowering shrubs such as hibiscus, Oleander (Nerium sp.), Night flowering Jasmine (Nyctanthes sp.); and fruiting shrubs such as Karaunda (Carissa carandas), custard apple, jujube (Ziziphus jujuba) are incorporated.

Tall trees are usually planted at 3 - 3.6 m interval, 2 pollarded trees are placed in-between and remaining places are filled with coppiced trees, shrubs etc.

Advantage:
Fences can be multi-functional; they not only protect the vegetables inside, but can be productive too, and allow expansion by adding vertical space. They can attract pollinator and provide perching space for the predator birds.

Multi-utility Ponds



Ecosystem:
Wet lands/ ponds

Seasons:
All, especially wet season

Ideas:
Growing vine vegetable on trellises extending over water; growing azolla or duck-weed over water surfaces, mudfish-shellfish etc and ducks in the water, and semi-aquatic herbs and grasses on the edges/banks.

Design:
Small household ponds and shallow ditches are quite common in the area. Usually, these are not much used, except for raising some mudfish. The banks can be made gently sloping [30-35 degrees], aquatic plants such as Bramhi, Indian pennywort (Centella asiatica), Water Spinach (Ipomoea aquatica) etc can be planted on the slopes; 2 - 2.5 m high trellises can be made on north-western sides, with bamboo and nets to allow creepers to grow above the water. Ducks @ 2 - 3 per square meter can fertilize the pond and azolla or duckweed can be grown on the surface for feeding ducks/ fishes etc to enhance income.

Advantage:
More food as well as enhanced livelihood opportunities for small-holders.



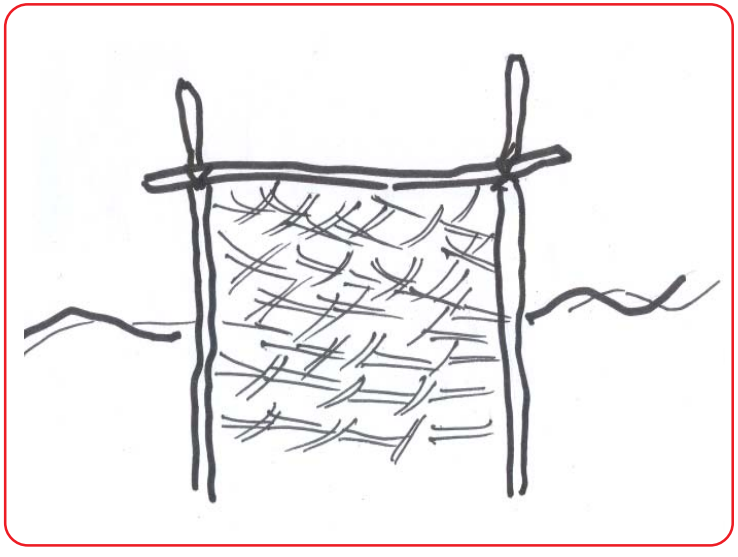








Raised Beds with Weeds



Season:
Wet season

Idea:
Using lowlands for growing semi-aquatic leafy vegetables, spreading from intermittent floating platforms constructed out of water hyacinth and other debris'.

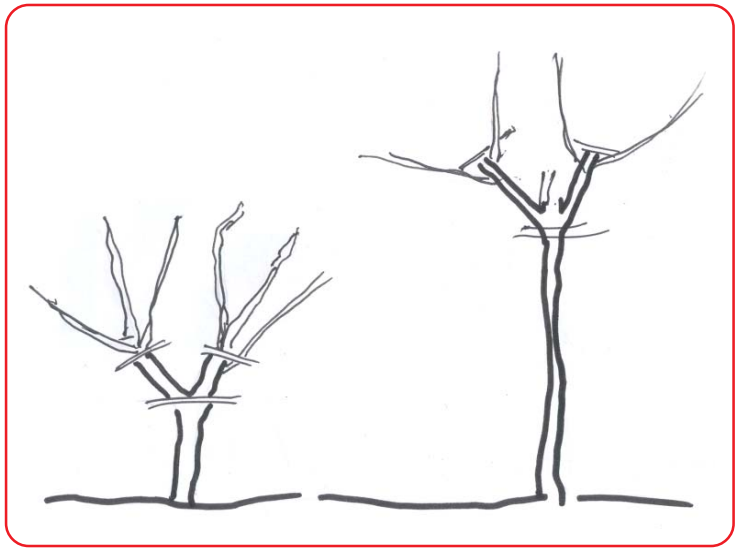
Design:
120 to 150 cm high platforms are made towards beginning of monsoon and these are stuffed with crushed/ flattened water hyacinth and other debris. The beds should be about 150 cm - 160 cm wide, at 5 to 6 m intervals.

The top surface need not have soil as the plants are grown in large mud-balls as described in the floating nursery technique.

Plants like water spinach can be grown on the sides to spread in the water surfaces in-between beds. Leafy vegetables such as Basella or jute leaf (Corchorus sp.) can be grown on the beds.

Advantage:
Removing water hyacinth from river surfaces nearby will also improve river flow, and open up other possibilities; reduce flooding in the surrounding area. For large scale crushing a sugarcane juice extraction mechanism can be used. MGNREGS could also be utilized.

Coppicing and pollarding



Season:
All

Idea:
These are techniques employed to control the growth of fast growing multi-purpose trees and shrubs, used in home gardens and farms as Agro-forestry systems.

Details of practice:
Fast growing MPTs and shrubs are commonly planted around gardens, farms, ponds and on waste lands, in community managed plantations and forests etc, to produce firewood and fodder, generate mulch/ composting materials, as well as reduce soil erosion in the adjacent lands by wind and water.

When main stump of the trees or shrubs are cut 45 - 50 cm from soil surface, we call it 'coppicing'. This generates more leaves, and is done 2 - 3 times a year; such trees may never produce flowers and seeds.

It is called 'pollarding', when the main trunk is cut 210-240 cm above soil, and emerging branches are cut again after they are 50 - 60 cm from the main trunk, this forces the tree to remain small and form a compact crown, which allows regular plucking of leaves.

Relevance:
These are among the most important interventions to quickly increase the biomass supply, which makes other income-generating activities feasible! Trees managed in this way can be planted very closely [45 - 60 cm intervals]



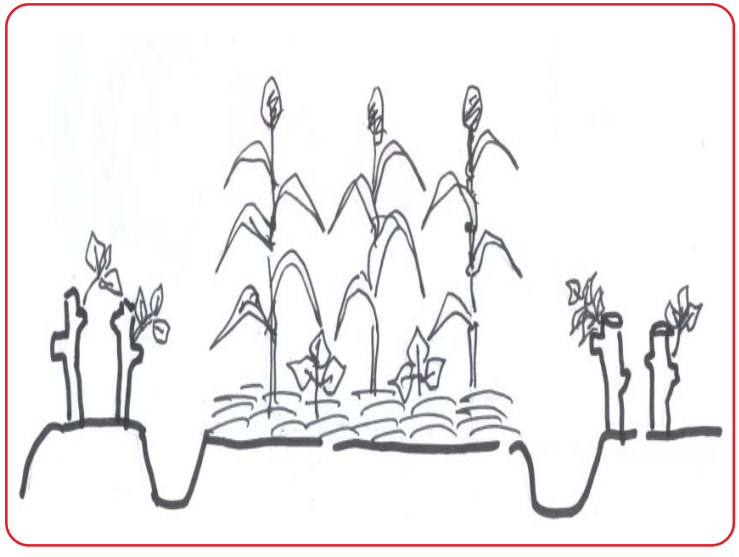








Alley cropping



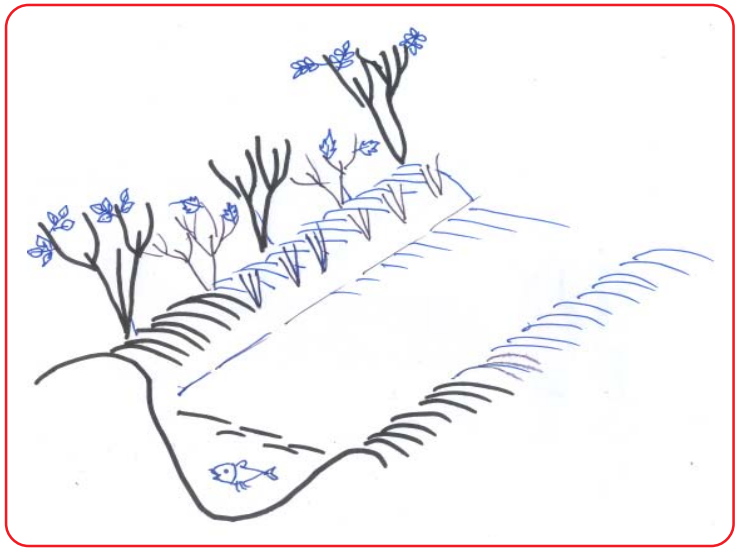
Seasons:
Wet/ Dry season

Idea:
In post-monsoon trees are chopped down/ coppiced at 45 - 51 cm level, and seasonal crops or vegetables are grown in-between, during the flooded season trees are allowed back to grow producing fodder etc, thus utilizing the farmlands round the year.

Intervention:
Tree beds of about 120 - 150 cm wide and 45 - 50 cm wide are made with 30 - 35 cm deep drains on either side; crop beds 300 cm to 360 cm wide allowing plows to go round. Trees grown here will be tolerant to some water-logging, e.g. Sesbania sesbans, Gliricidia sepium, Lannea coromandelica and similar trees will be planted. Pithecellobium dulce and Acacia nilotica may form the outer hedge as they are thorny and form a dense hedge.

Relevance:
At present, fields are left fallow for 6 - 7 months; this system will prolong that and create more fodder for livestock. Some leaf and small twigs can be incorporated in soils or used as mulch. Large cuttings can enhance the firewood supply. The trees also will ensure more evapo-transpiration, and assist in Carbon sequestration.

Canal rehabilitation/deepening



Ecosystem:
Common land

Season:
All

Idea:
Some drainage and irrigation channels exist in the area, but have been dysfunctional or diminished, due to soil erosion. One such canal has been partially re-excavated, resulting in faster drainage of surrounding fields and more fish rising in some parts.

Intervention:
Canals with tree planting: 2 - 2.5 m wide and 190 - 200 cm deep channels with trees, bushes, and grasses on both sides; fish will be raising in water. [Note: sides should be less than 42 degrees and planted with Napier grass or some other semi-perennial fodder-grass].

On both side of the canal 1.5 to 2 m wide strips need to be left, and planted with mulberry, Ziziphus sp, Kumquat (Citrus japonica) etc.; Neem and Karanj can also be grown in sections / locations where it does not interfere with field crops.

Advantage:
As stated, more and better quality fodder will become available; enhancing livelihood options. Fish, crab, shrimp raising etc can be allowed in canals, provided it does not impede water flow!!



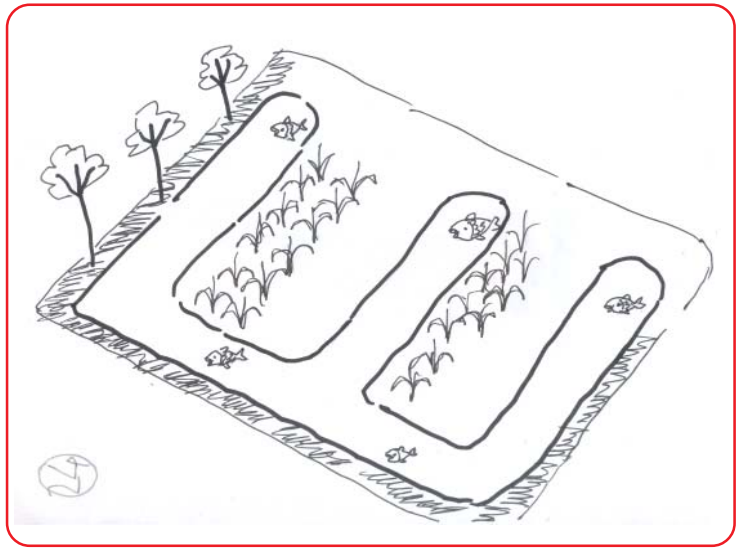








Alternate land use/ Beds & Trench system



Ecosystem:
Small farm where depth is high

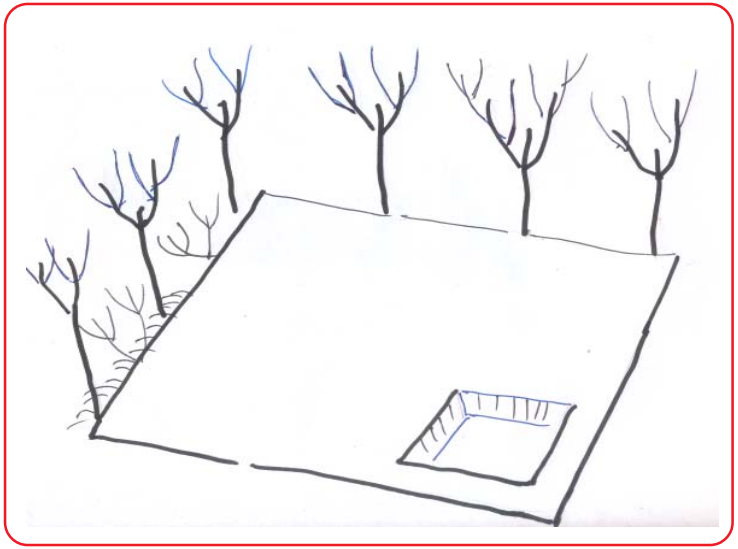
Season:
All

Idea:
Part of the field is dug deeper and soil excavated is used to raise height of the other areas of the farm, where pulses, vegetables, food grains are grown, deep trenches are used to grow fishes/ frogs/ crabs etc.

Design:
English letter 'E' shaped pond is excavated to 180 - 200 cm depth, about 150 - 180 cm wide. Beds are made equally wide and 90 - 105 cm high. On the edge, Acacia nilotica, Sesbania sesbans etc are planted.

Advantage:
Such interventions can permanently alter the shape and productivity of farms where water depth is more than 60 cm, but less than 90 cm. This will make farming possible round the year!!

Small Field Ponds



Season:
Post Monsoon

Idea:
In farm where usually inundation level is shallow, a pond about 15% - 20% of the land in size can be made, and used for post monsoon supplementary irrigation. Pollarded nitrogen fixing trees planted on the field bunds as a live fence.

Design:
In fields where water level stays below 50 - 60 cms a farm pond can be dug in a corner and trees & shrubs that can tolerate periodic inundation can be grown along the border of fields.

The farm ponds are usually in a corner, 20% of the field size, and about 2.5 m deep. With the soil from the pond, a bund about 45 cm wide, 30 cm high is constructed around the field, for planting pollardable NFTs along the bunds. Sesbania sesbans, Acacia nilotica etc are examples of species suitable for the bunds.

Advantage:
The pond helps to drain rainwater faster and the stored water can be used for growing vegetables. The trees help by evaporating water faster and by producing green matter for mulching, compost making, animal fodder etc. Winter cultivation is common even now in village but many plants do not survive the long dry period from Dec-June.











Crop Rotation:

This is often practiced in gardens to allow soils to recover. Leafy vegetables like spinach and fruit vegetables such as pumpkin, cucumber, tomatoes etc, as well as grains e.g. corn are considered heavy feeder.

Most roots and tubers, such as beets, carrots, yams and taros, and herbs and spices such as ginger, turmeric, chillies, garlic, bunching onion etc are considered medium feeders as they remove less nitrogen.

Most beans and peas are considered low feeder and can be grown on poor soils, they even add Nitrogen.

High Feeder should be followed by Medium Feeder, and preceded by Low Feeder.

Another factor needs to be considered, crops from same family should not be grown together or in the same plot to avoid diseases and pests. Some of the main families are:

Cucurbitaceous [cucumber, pumpkin and all the gourds belong to this group, most of these plant need water, but do not like poorly drained soils];

Solanaceae [Brinjal, tomato, chilli, potatoes etc belong to this group];

Fabaceae [almost all the beans and peas belong to this family, which usually have deep roots and therefore tolerate drought better];

Convolvulaceae [water spinach and sweet potatoes belong to this family]; Malvaceae [ladies finger and sour sorrel or roselle belong to this family]; Chenopodiaceae [beet root and spinaches belong here].

To avoid pests, we try also to grow aromatic herbs [with strong smell], in-between or around the main crops: some of these plants are Basil, Coriander, mint, small marigold, button chrysanthemum, Indian borage etc.

Vegetables in different pH ranges of soil

pH range:

pH is used to measure acidity or alkalinity of soil, 7 is neutral [distilled water], it is a logarithmic scale, i.e. as we go down one step to 6 acidity increases by 10 times, as we go up to 8 , 9 etc alkalinity increases by 10 or 100 times.

pH range	Vegetables
6.0 to 7.0	Spinach, pole bean etc.
6.0 to 7.5	Bush beans, Beet-roots, Radishes, Green peas etc.
5.5 to 7.0	Brinjal, Chilli etc.
5.5 to 7.5	Tomato, Gourds, Pumpkin, Cucumber etc.
6.0 to 8.0	Ladies finger, Roselle, Sweet potato etc.

Compost or vermi-compost act as a buffer, i.e. allow crops to grow in more acid or alkaline soil.

The regional geography across the Gram Panchayats Sukal and Madhuban indicates mostly heavy clay soil; deficient in organic matters and top soil is prone to cracking.

A few of the useful trees that can tolerate this type of cracking and their major uses are listed below:

Babool (Acacia nilotica) is high density timber used in plough and in making charcoal, leaves superbly liked by goats and sheep as fodder, exudes a commercially valuable gum. [P]

Neem (Azadirachta indica) is known as medicinal and insect repellent tree, the new leaves are eaten, the seeds are rich in insect repellent oil, and the timber is useful for small constructions. [P]

Subabool (Leucaena leucocephala) has leaves/pods high quality fodder and good material for vermicompost, timber fairly good quality firewood. [C]

Karanj (Pongamia pinnata) attracts bees; foliage not edible, seeds contain oil with insecticidal property and used often as hair oil, and for bio-diesel; oilcake kills soil-borne diseases as fertilizer.

Shisam (Dalbergia sissoo) leaves are high quality fodder; timber of medium high quality. [P]

Agastya (Sesbania grandiflora) leaves and flowers are edible and produce little shade and good as support tree for climbing plants, low density timber is medium good fuel. [P]

Note:

C = Coppicable; P = Pollardable

About the Author

Mr Ardhendu S Chatterjee graduated from St Xavier's College in Kolkata University and studied later in Asian Rural Institute in Japan. He founded a NGO called DRCSC, an important resource center working on several issues of vital importance including agriculture.

He has worked as instructor and consultant in India and South Asia teaching how to grow vegetables and herbs. He worked with various NGOs in Cambodia in developing its agriculture and agro-forest practices through his job and voluntary work with IPM programmes of FAO, and IDRC International. He has extensively travelled and met many individual and groups of organic/nature/ecological farmers in various countries.

He has facilitated several trainings on Permaculture, and Ecological Agriculture and visited Canada, and USA in relation to his work on Environmental Education, and Participatory Research with Rural Communities.

About the implementing organizations

RCDC (Regional Centre for Development Cooperation): RCDC, with head office at Bhubaneswar, is a professionally managed non-government organization. It envisions a scenario where 'Rights are Secured - Resources are Managed & Sustained- Poverty is Past'. It has two decades rich experiences of working with community in 1035 villages to achieve sustainable natural resource management based livelihoods augmentation and environment protection. RCDC thrives on quality research, documentation and root-based advocacy on community-led natural resources. RCDC provides knowledge and resource support for this project.

SWAD (Society for Women Action Development): SWAD envisages an equitable, egalitarian, just and harmonious society with holistic development of Women & Marginalized community. The nearly two decade old organization has strong grassroots presence in Puri district. SWAD has rich experiences of working with communities on issues of gender and disaster mitigation. SWAD implements the model interventions of this project.









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