**Model Rural Homestead Farming – a real example of Crop Diversificaton**

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**Need for a home**

From the very beginning of civilization man felt his need for food and shelter and thus made home for living in and around the easily available place for food and other primary requirements of life. As a colonized and socially behaved human being they gradually put off their nomadic habit and established permanent place for living, the home.

**Basic criteria for a home:**They considered the following criteria for their habitat:

1. Food
2. Water
3. Safety
4. Building materials
5. Easy movement
6. Protection from adverse conditions

Habitats can be identified according to the nature of the terrain and surroundings influenced by the weather and climatic conditions of that geographical region. However, whether it is on the equator or in the arctic tundra, forest or desert the habitats can simply be classified as:

1. Houses in the hills and forests
2. Houses in the foothills
3. Houses on the plains
4. Houses on the floodplains
5. Houses in the tidal zones
6. Houses in the tundra.

**Home, crops and biodiversity**

With the advancement of the civilization cropping culture developed to fulfill the increased demand of their need, as the naturally available stock gradually depleted. Needs for the secondary and tertiary materials; like clothing, fuels, medicine, beverages, and paper-pulp etc., were also arising. It drove people to exploit resources, with their biased cropping to meet the immediate demand. Higher yield, productivity and market dictated the choice of crops. Therefore, thousands of species faced extinction to facilitate human desired crops under high tech application. However, it is the proper time to look behind to find out the useful species, study on indigenous techniques and their appliance through broad spectrum cropping. Use of wide-range species exploiting their characteristics can ensure the protection of natural diversity. For this, home is the ideal place for crop diversification. Conventional homestead farming emphasizes the family and local resource links and values indigenous knowledge and traditions, which are otherwise disappearing. It is the base of present days’ organic farming the produces of which are free from harmful chemicals, are more health giving and of better qualities than chemically farmed produces.

**A model home**

A model home should have the facilities to fulfill the requirement of shelter, safety, water, vegetation, pets and domestics, hygiene and sanitation, easy communication for schooling, medical treatment and transportation of goods etc. To meet the needs of families of various sizes and circumstances, the designs of homes should be recommended to provide reasonably satisfactory safeguards related to each size of family and also to make provisions for possible desirable features, which may come in future. For the homes of the country are one of its most important assets-assets which must be built to a standard at which people are likely to give reasonable satisfaction, and therefore hold their value, over the years.

**Building materials and design**

For shelter and safety, houses are made with available building materials e.g. Timber, earth, bricks, stones, bamboos, thatches, tins and irons and cement-concrete etc. with or without fence or hedges. Many different types of houses with different models and designs are constructed as per common or specific requirement of the locality. Most common factors are considered as: protection against storms and rains, winds, hails, sand storm, sun, heat and cold, floods, tides, ferocious animals, snowfall and ice-loads etc.

**Water source**

Perennial water sources e.g. rivers, streams, springs, lakes, ponds; surface wells, rainwater, melting ice and subsoil water etc. are used. As water is an indispensable thing for life, huge quantity of water is required for day-to-day life. Continuous supply of fresh water is a pre-condition for housing.

**Vegetation**

Vegetation for shelterbelt (shade and windbreaks), structural materials, fruits and vegetables, fodder, beautification, medicine, wood fuel, spices and mints, agric and household equipments and refreshment of air etc. is important. A model home is designed in a place where every area is utilized in a very planned way. Proper aeration and penetration of light need to be ensured. Open or shady, wet or logged, water bodies, plants, corpse, debris and wastages are utilized, processed or decomposed and recycled nicely under long run practices, which become true proverb now. Detail environmental aspects will be discussed later on.

**Pet birds and domestic animals**

Pet birds and domestic animals are essential members of household items. They are the sources of meat, eggs, milk, fur and biofertilizers. They also act as scavengers or consumers of leftover things and thus help in nutrient re-cycling. Some birds like robin, parrot and some animals e.g. dog and cat also work as watcher against theft or burglary. Cattle are used in ploughing, leveling, sugarcane crushing and in oil seed mills. Bee keeping is also an additional source of income.

**Hygiene**

Traditional housing always ensures proper aeration and light penetration. Facing is designed towards the direction of maximum availability of sunlight and ventilation of fresh air. Cow shed, latrines and decomposition pits for garbage are made far away from the living and bedrooms to ensure proper sanitation and hygiene.

**Communication and transportation**

Easy communication for education, marketing, health complex and transportation of goods are also important for model habitation. Under the modern housing facility, every house should have access for communication to make the life familiar with the outside world.

**Modern facilities**

Modern facilities e.g. electricity, gas, and cable and satellite communication and entertainment etc. are also deserves by the rural people. So provision must be kept under consideration for those.

**Thinking for a standard home**

To achieve a standard of living, it is essential to study the present conditions, minimum requirements of living, and endemic cultures and practices for home designing in different habitats. However, in present study on vegetation in rural homes is described with a view to correlate cropping culture with bio-diversification.

**Vegetation in a plain-land home of Bhrahmaputra Basin**

Vegetation includes grasses, herbs, shrubs or trees; aquatic or terrestrial flora used to grow for different purposes in the homes or homestead areas. It is so important that, one can say ‘home is made in vegetation’ or ‘vegetation is raised for the home’. However, a plain-land homestead vegetation of tropical riverine monsoon region of Brahmaputra Basin is studied to explore their uses and potentiality in species conservation.

The Old Bhahmaputra basin is an alluvial plain with fertile land and is densely populated. The people of that region are social, agriculture dependent and comfort loving. At present, single family home is rare but most of the homes are of multiple families with same descendants. Typically, raised floor homes are made on flood free highlands. Size of the homes varies from 100 sq. meters to more than a hectare area. Gross area can be distributed:

1. Covered area for structures e.g. houses, kitchen, cow-shed, stores for crops, fodders and fuel wood etc. : 25%
2. Open area for air drying, crop processing : 15%
3. Water source common pond or surface well : 20%
4. Passage and walkways : 5%
5. Vegetation : 33%
6. Garbage, latrines and bathing place etc. : 2%**Total:** **100%**

From the above, vegetation covers the highest land area of a village home of that area. The vegetation is used for essential purposes e.g. structural building materials, windbreaks, hedges and fences, fruits and vegetables, drinks and spices, dyeing and cosmetics, mulches, green manures, mastication, beverages, stimulants and medicinal, and for ornamentation and beautification etc.

Vegetation is usually grown considering the availability of sunlight, facing of the home, windbreaks against nor’wester and local storm and habitat of the plant species. Village homes are made facing south and east to get the sunlight for a maximum period and to facilitate good aeration for a healthy environment and also on the direction of the nearest road. For north south-directed road, it is east, and for east west it is usually south facing. Proverb says, “south facing is the king of houses, next for the east, west facing very bad, and north facing the worst and valueless”-Anonymous.

**Houses and structures**

Now-a-days, single family home is really very rare. Most of them are multiple family homes. Traditionally, members of the families are the descendents from the same origin. They usually use common water source, open spaces, cottage for the guests and visitors and graveyard etc. However, separate houses are used for different purposes e.g. Living-house

1. Kitchen
2. Cowshed
3. Fodder and fuel shed
4. The Hall or Boitak-khana (cottage for guests, social gathering and visitors).

**Position of the structures, water source and vegetation**

The houses are built so that easy approach, safety, aeration and firebreaks are ensured. A model vegetation of a typical village home is described considering the above aspects. From the long run practices man chose plant species considering essentiality, multipurpose use, easy culture, and growing habit etc. Before describing details of the vegetation some positions of the houses, ponds, open spaces and vegetations, are mentioned below.

1. Pond: At the front of the home i.e. in the south or east, to get the sunshine for the maximum time period.
2. The Hall or Baitak-khana: Constructed near the pond in the Bahirbati.
3. Outer open space (Bahibati Othan): Between Baitak-khana and living house, the area is used for crop processing and the southern area is used for vegetables and small fruit plants.
4. Main living house: Lies between Bahirbati and Ontharmahal Otan (Inner open space)
5. Inner open space (Ontharmahal Otan): Lies behind the main living house, around which extra living house for adult children, kitchen, fodder and fuel shed are made.
6. Extra living house: Lies in the north or west side of the inner open space
7. Kitchen: lies in the south or west side of the inner open space.
8. Cowshed: Lies northern side of the outer open space.
9. Fodder and fuel shed: Lies behind the cowshed in the Bahirbati.
10. Bath and toilets: Behind the kitchen for the female and one near the cowshed for the male.
11. Garbage: A small pit away from the cowshed.
12. Vegetation: Bamboo grooves, shelterbelt, hedges, vegetables, fruits and ornamental plants etc. are described under the common heading **“Vegetation**”.

**Vegetation**

Homesteadvegetation is primarily raised to fulfill the demand of plant products for household needs, which are previously mentioned. However, some important plants those are generally planted are described here mentioning their uses, habitat and sites with cultural practicesand how they can be utilized efficiently with maximum productivity.

**Bamboos:**

1. **Species grown:** – Jaibans (*Bambusa vulgaris*)*,*Barakbans (*B. belcoa*)*,*Mitenga (*B. tulda*)*and*Bethuabans (*B. plymorpha*) etc.

2. **Uses:** – Building construction, agricultural, fishing, household tools, fences, handicrafts, erosion control and windbreaks etc

3. **Habitat and sites:** – Prefers slightly acidic soil ranging from pH 4.5 to 6.0 and it grows well in flood free sandy loam soil. Continuous water logging hampers growth and propagation. Bamboo clumps are usually raised in the North and West sides (back side) of the homes. Five to six clumps are ideal to fulfill the whole demand of a family.

4. **Cultural practices:** Vegetative propagation is done by planting rhizomes in late March and early April. Branch cuttings can also be used for propagation. Optimum spacing is 6X6 meters. Mulching with bamboo leaves, straws, rice husks and old thatch debris etc. is very useful. Burnt ashes of leaves and debris are also found very helpful for the growth of bamboo. Burning fallen bamboo leaves and debris in February and early March is an age-old practice for returning nutrients and for controlling root diseases. But this must not be done after the second week of March, as the shooting activities can get affected then. New soil should be given around or at the base of the clump in March and April. Bamboo matures at the age of three when it is ready for felling. Peripheral young bamboos of less than two years old must not be extracted. Horseshoe or advance cutting methods can be followed for extraction. It should be remembered that bamboo grows very fast and attains at its full height (20 to 25 meter) and growth within 120 days. As there is no secondary growth it is not recommended to keep the bamboos without extraction after attainment of their maturity i.e. after the age of three years. A clump of 10 to 15 calms can give rise to 10 to 15 new shoots each year.

5. **Yield and productivity:** – Bamboos are the fastest plant species group and each year at least 10 Nos. bamboos can be extracted from each clump. Branches are also used to support other creeper and climber crops. Green leaves are used as a fodder for domestic animals. Many people also eat growing bamboo shoots.

**Multipurpose tree crops (MPTC): Tree species**

1. **Species:**Treese.g. Mango (*Mangifera indica*), Jackfruit (*Artocarpus heterophyllus*), Deuwa (*A. lacucha*), Black berry (*Syzigium cuminii*), Sunaloo (*Cassia fistula*), Coconut (*Cocos nucifera*), Palm (*Borassus flabellifer*), and Betel nut (*Areca catechu*) etc.
2. **Uses:** For fruits, timber, windbreaks, shade and some for erosion control and some for support or standard for betel leaves (*Piper betel*), black pepper (*Piper nigrum*) and Ipomoea etc. Mango, Jackfruit and Black berry leaves are used as fodder. Leaf and leaf-sheath of palms and nuts are used for brooms, fans, fibres, and for fancy weaving purposes. Fruit-fibres are used for coir industries; nut-shells for cups, spoons, hokkas and also for raising saplings in the nurseries as nursery pots. All of them have medicinal usage too.
3. **Habitat and sites:** These are mostly large tree crops; their plantations depend on the height, sizes of the canopies, leaf fall behavior and light obstruction behavior. Some trees prefer to grow in partially shady places but some are not. Some grow better in humus rich soil in partial shady places. Some trees can tolerate temporary water logging and wet conditions e.g. Palmyra palm and coconut, but jackfruit cannot thrive there. It is recommended to plant large tree species at the western and northern sides and palms and coconuts near the pond or water source.
4. **Cultural practices:**Most of the MPTCs can easily be grown from the seeds. However, mangoes are raised preferably by grafting to maintain the characteristics and quality of the fruit and also to get early crop within a year or two. Mangoes, Jackfruit and Jam should be planted in the north and west at a spacing of minimum 6 meters. Coconuts and betel nuts are suggested to plant on the banks of the pond at spacing 6 and 3 meters respectively. Betel nuts can also be grown as groove in the northern side of the home, however, on the bank of the pond it should be in north-south directed rows, to avoid sun scorch. Two nos. Palmyra palms can be planted on the both sides of the pondghat (Pukurghat) at the Bahirbati. A few Sazina plants can be planted among the nut trees on the bank. Coconut and betel nuts are suggested to plant at a closer spacing on a humus rich loam soil in partially shaded place and should be transplanted after two to three years to their permanent site. Watering and proper nursing can ensure good growth and early fruit bearing. Inter planting with Mander can enrich the soil. Black pepper and betel leaf vines can be grown on the coconut, betel nut and Mander, as standard or support. Almost similar cultural practices are followed for both pepper and betel leaf vines. Lemons can also be planted on the banks of the pond. Mulching with water hyacinths, chopped banana sheaths, fallen leaves, used decayed straws and nut fibers etc. can be given in autumn to protect the plants from desiccations. Coconut trees should be kept clean from dried leaf sheaths and dead inflorescences. Picking of green coconuts out yields the matured ones, and more beneficial. 10 and 5 Kg cow dung compost can be applied to each coconut and betel nut tree respectively every year at the beginning of the monsoon. For the better growth and early maturity of jackfruit trees, side splitting should be done at the age of three and four for cambial activity. Small branches from the trunk of the mature trees should be pruned off in autumn (Bhadra mash).
5. **Yield and Productivity:**Timbers of palms, jackfruit, blackberry and Sunaloo are durable; Sunaloo and palms are termite resistant. Mango timber is grouped as non-durable but can be used after one to three months dipping in water, boron diffusion treatment and with surface coating. These timbers are widely used for building construction, furniture making and agric equipments etc. One tree can produce 20 to 30 cubic feet of timber. Stumps of palms are used as canoe, fish trap and water pipes for drainage. Annually, each mango tree can produce 100 to 200 kgs of mangoes, a jackfruit tree can give 20 to 40 nos and a blackberry tree gives 200 to 500 kgs of fruits depending on the size and age of the trees.

**Fruit Crops:**

1. **Species:**Commonly used species areLitchi (*Litchi chinensis*), Kul (*Zizyphus mauritiana*), Guava (*Psidium guajava),*Kamranga*(Averrhoa carambla),* Amloki*(Phyllanthus embelica*), Latkan (*Bixa orellana*), Dalim (*Punica granatum*), Sofeda (*Manilkara zapota*), Papaya (*Carica papaya*), Banana (*Musa paradisiaca*), Ata (*Anona muricata*), Sharifa (*Anona squamosa*), Golapjam (*Syzygium jambos*), Jamrul (*S. samarangense*), Wood apple (*Aegle marmelos*), Hog plums (*Spondias pinnata*), Pineapple (*Ananas sativus*), Lemons (*Citrus spp*), Pummelo (*Citrus grandis*), Lukluki (*Flacourtia jangomas*) Orborai (*Phyllanthus acidus*), Bilumbi (*Averrhoa bilimbi*), Kamranga (*A. carambola*) Tomato (*Lycopersicon lycopersicum*), Futi (*Cucumis melo var. momordica*), Bangi (*Cucumis melo*), Khira (*C. sativus*) Water melon (*Citrullus lanatus*),Karamcha (*Carissa congesta*), Passion fruit (*Passiflora spp*.), Orborai (*Phyllanthus acidus*), Chalta (*Dillenia indica*), and Jalpai (*Elaeocarpus robustus*) etc.
2. **Uses:**Sweet or sour simple, composite and aggregate fruits grow well in the Brahmaputra basin. Pericarp, mesocarp, and endocarps, pseudocarp e.g. thalamus, receptacle or persistent calyx form edible part of the fruits. Fruits are rich with nutrients, vitamins and have medicinal value too. Some green fruits are used in tasty curry preparation.
3. **Habitat and Sites:**Fruit plants can be grown successfully selecting the sites and habitats on the basis of heights, canopy sizes, shade, soil status and availability of the space. Fruit plants can be classified large trees, small trees, bushy shrubs, herbs, creepers and climbers etc. on the basis of the above criteria their sites should be selected as follows:big trees e.g. Jalpai, Kamranga, Chalta etc., preferably on the west and north, just behind the houses. Small trees e.g. Guava, Latkan, Golapjam, Jamrul, Hog plums, Kul, and banana etc. on the southwest; Lichi, Amloki, Ata, Sharifa etc.on the northeast; bushy shrubs and small plants e.g. Karamcha, Dalim, Papaya, and Sofeda on the south and south east areas. However, Futi, Bangi, pineapple can be grown on the banks of the pond. Watermelon, tomatoes can be planted as seasonal crops on the open space on the south, southeast and eastern areas as creepers.
4. **Cultural Practices:**Minimum spacing for big trees should be 5 meter, for small trees 3 meters, shrubs 2 meters, watermelon, Futi and Bungi 2 meters and for tomato one meter only. Most of the fruit plants can be propagated from the seed stock. Banana and pineapples are mainly propagated vegetatively from suckers (crown, ratoon, slip and ground suckers etc.) rhizomes and buds (stem sections of pineapple). Fruit plants e.g. Citrus, Guava, Pomegranate, Litchi, Carambola, Custard apple, Jujube and Hog plums etc. are mainly propagated by different kinds of grafting, layering, cutting and budding methods to maintain their clonal characteristics. Fruit plants can be classified in to **Seasonal:** e.g. Tomato, watermelon, Futi and Bungi etc.;**Annual:**e.g. Palms, Pineapple, Litchi, Latkan and Wood apple etc.; **Bi-annual:**e.g. Jujube, Lemon and, Perennial:

Guava, Carambola, Pomegranate and Passion fruit etc. Creeper and climbers usually cannot withstand in wet and water logging conditions especially in the wet monsoon. Therefore, they are planted on raised areas or on earth mounts preferably made with well-dried farmland soil. Mulching with water hyacinth, fallen leaves and straws at the beginning of the dry season and watering in the dry season help in good production of most of the fruits. Pruning of certain plants e.g. Jujube, Guava and Lemon are very important for higher yield and quality. It is also recommended that propagation practices should be maintained and continued for regeneration and growth.

1. **Yield and Productivity:**Fruits can be classified as **“economical major fruits” (EMF)** e.g. Citrus, Papaya, Banana and Guava etc. and “**minor fruits” (MF),**are grown in homestead level and are part of the foodstuff items for the families. (Sandini, 1995). Their yield and productivity is really difficult to ascertain, however, in terms of crop bio-diversity they provide the raw materials, combinations of genes that produce the plant varieties upon which agriculture depends and therefore, their value is endless. As regards productivity, in present days a planned program for fruit production can ensure household consumption and also generate significant earning for family’s economic support. Some crops have also multiple uses e.g. banana and commercially their yield is much higher than any other monocrop. Banana as fruit; green banana, inflorescence, inner core stock as vegetables; ashes of dry fruit-peels and leaf sheaths for washing cloths; banana plants as canoe (vela), chopped leaf sheaths for water purification and mulching black pepper and betel leaf plants. Leaf sheaths are also used in the nursery for wrapping earth balls and shading newly planted sapling. Green leaves for packing raw foods and as meal plate etc. Banana leaf is also used as fodder.

**Vegetables**

1. **Species:**A large numbers of species are grown in the homes of the Old Brahmaputra basin. These are creepers, climbers, small plants and big plants of seasonal, annual, biannual and perennial nature. The common species are: Korolla (*Momordica charantea*), Kakrol (*M. cochinchinensis*), Jhinga (*Luffa acutangula*), Pural (*L. cylindrica*), Lao (*Langeneria siceraria),* Mistikumra*(C. maxima),* Sheem*(Lablab purpureus),*Chichinga (*Trichosanthes anguina),* Chal kumra*(Benincasa hipsida),* Dudkachu*(Colocasia spp.),* Mukhikachu*(Colocasia esculenta),* ManKachu*(Alocasia indica),* Olkachu*(Amorphophalus bulbifer),* Kalmi*(Ipomoea aquatica),*Sweet potato*(I. batatas),* Kham alu (*Dioscorea alata*), Pui*(Basella alba),*Data/Lalshak *(Amaranthus tricolor),* Egg plants*(Solanum melongena),* Tomato (*Lycopersicon esculentum*), Lady’s finger*(Abelmoschus esculentes),*Kachkola*(Musa paradisiaca var. paradisiaca),* Dhekishak*(Lygodium flexuosum),*Thankuni*(Centella asiatica),*Sajina*(Moringa oleifera),*Borboti*(Vigna sinensis),* and Papaya (*Carica papaya*) etc.
2. **Uses:** Vegetables are very important items for food nutrients and vitamins and medicinal purposes. Huge quantity of vegetables is needed for everyday life. The used parts are fruits, leaves and twigs, roots, corms, stems and shoots, flowers and inflorescences and stolons etc. Per capita daily consumption is about 500 grams.
3. **Site and habitat:** As a green crop light is the universal requirement of vegetables. However, need of intensity of the light differs from species to species and group of plants. According to light requirement they can be grouped in to: **Sun-loving** e.g. Papaya, Sheem, Chal kumra, Mistikumra, Lao, Shasha and Lady’s finger etc.; **Partial shade-loving** e.g. Lalshak, Mukhi kachu, Mankachu, Thankuni, Ferns and Misti Alo etc. and **Shade-loving**e.g. Ol kachu, Krisna kacuu and Cassava etc. The growing plants should plant sun-loving small plants in the open place in the south, southeast and east to ensure maximum receiving of sunlight. Partial shade-loving plants are preferred in the northeast and southwest places. The shade-loving plants can be grown in shady areas even directly under other trees or plants in all suitable places.
4. **Cultural practices:** Vegetables can also be classified as seasonal, annual, bi-annual, and perennial ones like the fruit plants. Bhahmaputra basin is very rich in homestead vegetable cultivation. Most of the seasonal vegetables are of creeper and climber groups. Wet monsoon creepers e.g. Chalkumra and Mistikumra are planted on earth mounts and supported to roof of the houses or on machang; climbers e.g. Chichinga, Zinga, Pural and Kakrol etc. on other trees, or cut branches and bamboo stick and branched bamboo support. For the dry season crops creepers e.g. Bhuikumra, lao, etc. are usually grown on the ground. Household wastage, cow dung and duck and chicken droppings; fish remains, blood, washing after-used water etc. are composted and used for enrichment of the soil nutrients; dry leaves, straws and wood ashes are also used as nutrient and in disease control. Planting, husbandry, and crop harvesting time are very important for homestead culture. Proper attention, management and in time harvesting can ensure maximum productivity.
5. **Yield and productivity:**Most of the green vegetables are grown in the sunny areas of the home and are well maintained; therefore, their yield and productivity is very high.

**Chilies and Spices**

1. **Species:** Different varieties of Capsicum, curry spices e.g. Ginger (*Zingiber officinale*), Turmeric (*Curcuma longa*), Mints (*Mentha arvensis*), Black pepper (*Piper nigrum*), Coriander (*Coriandrum sativum*), Cinnamons (*Cinnamomum tamala, C. vernum*), Chukair (*Hibiscus sabdariffa*) and Pahari Pudina (*Mentha spicata*) etc. are grown to meet the household demand and also for commercial purposes
2. **Uses:**The chilies and spices are used to make the food hot and lovely flavored and tasty. Some of them are used for making pickles, some for medicinal and digestive purposes. The used parts are fruits e.g. Capsicum, Black pepper and Coriander etc.; leaves and twigs e.g. Mints, Coriander and Cinnamon etc, rhizomes e.g. Turmeric and Ginger etc. Bark of Cinnamon is also used for flavoring foods. Leaves of Turmeric are used for wrapping of fermented dry fish, as a good protective material**.**
3. **Site and habitat:** Capsicum can be planted in sunny and partially shaded places, as per variety concern. Seasonal, annual, biannual and perennial types of plants are grown. They do not like waterlogging condition, but watering is needed in dry season. Black pepper is a potential crop of that region. It also cannot withstand in water logging areas but in dry season good mulching is required to protect from desiccation. It is a good climber, needs support or ‘standard’ which may be living trees e.g. Mander (*Erythrina indica*), Coconut, Betel nut, Jackfruit and Jujube etc. or bamboo, timber or concrete posts. Raised soil and partial shade is good for their growth. Ginger and mints grow well in sunny places but Turmeric prefers partially shaded or in the shade.
4. **Cultural practices:**Seeds can propagate most of the Capsicum species easily, but as they are both self and cross-pollinated it is difficult to maintain the purity of the varieties. Therefore, vegetative propagation by branch cuttings is preferred. Like betel leaf vines, black pepper can easily be propagated by five nodal cuttings and also by suckers. Pepper and betel leaf can be grown on standards of Mander at 2X2 meter spacing intercropping with betel nut and also on betel nut trees as a support crop. Application of compost, ashes of leaves and straws etc., mulching with water hyacinth, banana sheath, fallen leaves, old used straws and nut fibers etc. in dry season is highly essential. Watering in dry season is also important for their growth and production. Both turmeric and ginger are propagated vegetatively from the rhizomes, and they need soil rising for good crop production.
5. **Yields and Productivity:**A well maintained betel leaf vine can give 250 to 350 numbers of leaves in a year worth about Taka 500 to 800 and a black pepper vine can produce 1 kg. to 5 kgs. dry pepper berries depending on the age and growth, can earn Taka 100 to 500 each. Intercropping, pure or mixed cropping out yields any other crop. Capsicum, Turmeric and Ginger fulfill the everyday needs of a family and the surplus quantity is sold in market for additional income.

**Dyes, Oils and Cosmetics**

1. **Species:**Dyes and cosmetics: Mehdi (*Lawsonia inermis*), Leap stick tree or Red dye (*Bixa orellana*) and Turmeric (*Curcuma longa*) etc.; Oils: Coconut (*Cocos nucifera*), Castor (*Ricinus communis*), Sesame (*Sesamum indicam*), and Pitraj (*Aphanamixis polystachaya*) etc.
2. **Uses:** Mehdi leaves, Red dye seeds and Turmeric rhizomes etc. are used in dyeing hair, nail, and body decoration on special occasions e.g. festivals and marriage ceremony. Red dye and Turmeric are also used for coloring foods. Coconut, sesame and castor oil is edible and is also used as medicinal and lubricants. Coconut oil is also used as hair oil. Pitraj seed oil is widely used as lubricant. Oil cakes of castor and pitraj seeds are also used as fertilizer.
3. **Site and habitats:** Mehdi, Red dye, Turmeric, Castor plants prefer to grow in partially shaded areas of northeast and southwest parts or on odd corners like around the compost pit. Castor and Mehdi prefer wet soil but cannot withstand in waterlogged soil.
4. **Cultural practices:**Mehdi is generally propagated vegetatively by branch cutting method, however, Red dye, Castor, Sesame and Pitraj are propagated from the seeds.
5. **Yield and Productivity:**The yield and productivity of Coconut and Turmeric are described earlier. A ten years old Pitraj tree can give 100 to 150 kg dry seeds. Moreover, Pitraj timber is durable and widely used for structural and agricultural equipments.

**Flowers and ornamental plants**

1. **Species:**Common species are: Rose (*Rosa cantifolia*), China Rose (*Hibiscus rosa-sinensis*), Togor (*Tabernaemontana divaricata*), Ixora (*Ixora coccinea*), Cordium (*Codiaeum veriegatum*), Jasmine (*Jasminum sambac*), Madhabilata (*Quisqualis indica*), Marigold (*Tagetes patula*), Hasnahena (*Cestrum nocturnum*), Gandharaj (*Gardenia jasminoides*), Kalaboti (*Canna indica*), Railway creeper (*Ipomoea cairica*), Karobi (*Nerium indicum*), Yellow Oleander (*Thevetia peruviana*), Kamini (*Murraya paniculata*), Moragphul (*Celosia argentea*), Nayantara (*Catharanthus roseus*), Seuli (*Nyctanthes arbortristis*), Sunaloo (*Cassia fistula*) and Bokul (*Mimusops elengi*) etc. grown well in the rural homes.
2. **Uses:** Flowers and ornamental plants are grown for beautification and ornamentation of the homes. Some of them have medicinal value and most of them spread sweet smell. Birds, flies and bees are attracted to collect or suck nectar from the flowers and thus facilitate pollination of other flowering crops. Bokul also gives good quality timber.
3. **Site and habitat:**Togor, Ixora, Kalabati and Railway creeper grow in wild condition in shade or partially shaded places with association of other wild plants. Madhabilata is usually termed as gate plant grown on the gate and on the roof of the houses. Hasnahena, Gandharaj, Cordium and Kamini etc. are grown in the Bahirbati and also at the corners of the houses for beautification. Orchid like Venda grows as epiphyte on Mango and Blackberry trees.
4. **Cultural practices:** Most of the flowering and ornamental plants can be propagated by vegetative methods e.g. branch or stem cuttings, suckers and rhizomes etc. However, Kamini and Bokul are preferably propagated from the seeds. Pruning is a very important factor for maintaining the bush as well as inducing flowers. Mulching and watering in the dry season is also very useful.
5. **Yields and Productivity:**It is very difficult to ascertain the productivity of the flowering and ornamental plants. It is the pleasure and recreation, which is invaluable. However, there is a potentiality for commercial plantation of certain plants e.g. Tuberose (*Polianthes tuberosa*), Rose, Marigold , Lily and Orchids etc.

**Medicinal plants**

1. Species: Common medicinal plants are grown: Tulshi (*Ocimum americanum*), Babui Tulshi (*O. basilicum*), Ram Tulshi (*O. gratissimum*), Krishna Tulshi (*O. sanctum*) Kalomegh (*Andrographis paniculata*), Tokma (*Hyptis suaveolens*), Patharkuchi (*Kalanchoe pinnata*), Neem *(Azadirachta indica)*, Bashak (*Adhatoda zeylanica*), Arjun (*Terminalia arjuna*), Amloki (*Phyllanthus embelica*), Akanda (*Calotropis procera*), Nisinda (*Vitex negundo*), Motkhila (*Glycosmis pentaphylla*), Ulatkambal (*Abroma augusta*), Apang (*Achyranthes aspera*) Thankuni*Centella asiatica*), Dhutra (*Dutura metel*), Kalaoni (*Boerhaavia diffusa*), Oal kachu (*Amorphophallus campanulatus*), Aparajita (*Clitoria ternatea*), Harhjorha (*Cissus quadrangularis*), and Telakuche (*Coccinea cordifolia*) etc.
2. Uses: For Fever and common cold: Tulsi, Neem, Pathorkuchi; Asthma and Bronchitis: Bashak, Akanda and Datura Heart disease: Arjun, Ulatkambal; Dysentery: Tokma, Bael, Thankuni; Piles: Orbarai, Bilumbi, Oal and Mankachu; Skin disease: Neem, Mehdi and Akanda; Urinogenital diseases: Ghritakumari (Aloe), Pathorkuchi, Amloki, Ulatkambal and Telakuche etc. are very effective. Use parts may be the leaf, stem, bark, fruit seed and root etc. Usually they contain tannins, alkaloids, essential oils and phenolic compounds etc., which help in curing diseases.
3. Site and habitat: The villagers usually grow them in the homestead area to get quick aid from the plants in the diseases and most of the medicinal plants have multiple uses. Some are grown very near the houses e.g. Tulsi, Tokma, Kalaoni and Pathorkuchi; some as hedge e.g. Bashak, Motkhila, Lantana and Bishjara; near the pond e.g. Akanda, Arenda and Nisinda and shade loving creepers and corms e.g. Thankuni, Kalaoni and Oal kachu etc.
4. Cultural practices: Both seed and vegetative propagation methods are followed; however, Pathorkuchi is being propagated from leaf buds.
5. Yield and Productivity: The importance of medicinal plants is increasing very fast with the awareness of susceptibility and detrimental side effects of antibiotics and other chemical drugs. Herbal extracts are being used to cure the complicated and dangerous diseases like cancer, asthma, hypertension and leprosy etc. commercial plantation will be feasible and their productivity will also be comparable with other valuable crops.

**Fence and Hedges**

1. **Species:**Mehdikata (*Duranta repens*), Lentana (*Lantana camara*), Justicia (*Justica diffusa*), Bashak (*Adhatoda zeylanica*), Keya (*Pandanus odoratissimus*) and Ixora (*Ixora coccinea*) are widely used as hedge-plants to maintain privacy. Hogla (*Typha elephantina*), and some other spiny cactus are also used for fences. Jeol Bhadi (*Lannea coromandelica*) is used as fence post.
2. Uses: To maintain privacy and for security hedges are raised. Hedge plants have medicinal and ornamental uses also. Normally they are not palatable.
3. **Site and habitat:**Mehdikata, Bashak and Ixora are raised in the sunny boundaries, whereas Lantena, Justicia, Canes and Keya are grown in the shaded and partially shaded sites. They create good environment for living wild animals e.g. wild cats, jackals, rabbits, lizards, snakes and birds etc.
4. Cultural practices: Most of the hedge plants are developed by vegetative method. Branch cuttings are used to propagate Mehdikata, Bashak, Ixora, Lantena and Justicia, whereas, Canes from seeds and suckers and Keya mainly from the suckers. Most of the hedge plants are to be maintained carefully; seasonal pruning, mulching and compost application improve the vigorosity and ornamentation.
5. **Yield and productivity:**Their yield and productivity are really difficult to ascertain. They are very useful plants having medicinal, ornamentation value, of course their pruning litters and dropped leaves are the source of green materials for compost. They are very easy to establish quickly and thus ensure the privacy and security of a home. It is also the pleasure and satisfaction, which is invaluable.

**Other important plants**

Some other plants e.g. Murta (*Cyperus rotundus*) and Canes (*Calamus spp*) grow luxuriantly in wet and shady places, very important weaving materials for making expensive mat, baskets, furniture, and many other handicrafts etc. These are also used for erosion control. Both seed and vegetative methods are followed for their propagation. Some valuable timber trees e.g. Rangi (*Toona ciliata*), Silkorai (*Albizzia procera*), and Mehogani (*Swietenia mahagoni*) etc. are also grown in homestead forests.

**Pets and Domestics**

Cows, buffalos, goat, dog, cat, hens, ducks, pigeon and dove etc. are the important domestic animals and the sources of income. Cows and buffalos for farming, milk and meat; goats for meat and milk; hens and ducks for egg and meat; dog and cat for security and rodent pest control. Their excreta, droppings, litters and waste remaining etc. are the good sources for bio-fertilizer and are very useful in nutrient recycling and to improve the fertility status of the soil.

Skins of cows, buffalos, and goats are very important for leather industries; horns, hoofs and bones are also used as fertilizer industries.

Once, horses were the main carrier for transportations of goods and traveling to distant places, but, motorized vehicles are now replacing those and their uses are also decreasing. However, horse race is still a very favorite game for recreation. Ox fight is also an important game of that area during the dry season.

Fishes and Aquatics: Pond is not only a source of water for domestic uses but also a great source of proteins, minerals and vitamins etc. Different kinds of fishes e.g. Rui (*Labeo rohita*), Katla (*Catla catla*), Mrigel (*Cirrhinus mrigala*), Boush (*Labeo calbasu*), Gania (*L. gonius*), Shol (*Channa striatus*), Gojal (*C. marulius*), Boal (*Wallago attu*), Bangla (*Cirrhinus reba*), Taki (*Channa punctatus*), Cheng (*C. orientalis*) Koi (*Anabus testudineus*), Shing (*Heteropneustes fossilis*), Magur (*Clarius batrachus*), Tangra (*Mystus cavasius*), Gulsha (*M. cavasius*), Pabda (*Ompok pabda*), Chitol (*Notopterus chitala*), Kanla (*N. notopterus*), Puti (*Puntius ticto*), Sharputi (*P. sarana*), Mola (*Amblypharyngodon mola*), Kakia (*Xenentodon cancila*), Kanpona (*Aplocheilus panchax*), Chapila (*Gudusia chapra*), Ier (*Mystus aor*), Pangash (*Pangasius pangasius*), Khailsha (*Colisa lalia*), Chanda (*Chanda ranga*), Vedra (*Nandus nandus*), Gutum (*Lepidocephalus guntea*), Baim (*Macrognathus aculeatus*), Potka (*Tetradon cutcutia*) and Nilotica (*Nilotica nilotica*) etc.

Other aquatics are Prawn, Crabs, Turtles, Oyster (Zinuk), Snail, Frogs, Snakes, and Lizards etc. are found in the pond.

Water hyacinth *(Eichhornia sp)*, Kessra *(Jussiaea repens),* Water chestnut*(Trapa natans)*, Water luttuce *(Pistia sp)* Water wart (*Azolla sp)*, Water lily (*Nymphaea lotus*), Lotus *(Nelumbo sp), Spirogyra*, and Planktons grow in the pond. Aquatic animals use them for their food and shelter.

Most of the aquatic plants are rich in essential nutrient like potash. Water wart can fix atmospheric nitrogen and is very useful for plant crops.

**Garbage and Waste Disposal and Compost**

It is the very old practice that the villagers used to dump all the household wastages in 2 pits, one in the ondarmahal and another in the bahirbati at suitable places away from the houses, for decomposition at least for six months. Different species of fungi e.g. Ascobolus, Peziza, Agaricus, Mucor, Saproligna and Actinomycetes; and other microbes bacteria, Annelids e.g. Earthworms, Insects e.g. weevils etc. make them humus, an excellent nutrients easily available for the crops. Since household wastages are of multiple sources e.g. plants and animal residues, cow dung, droppings of chicken, pigeon and duck etc. their nutrient value is very high.

Cooking furnace and smoking ashes are also heaped in a place and used as nutrient source for agricultural farming.

**Economics of Vegetation**

It is very interesting to note that, the economics of homestead vegetation is very poorly evaluated. Very little work is available on this subject, although it is the most contributory wealth of rural life and is very significant in biodiversity, species utilization and thus for natural conservation of large number of species through human activity and cultural practices. A home is a microclimate with biotic, edaphic and climatic factors; exchanges between living and non-living substances and recycling of ingredients in a simple ecosystem. Proper and maximum utilization of land is ensured by maximum attention of the family members for the longest time period. Cultural practices are developed studying the naturally growing habit and habitats over the hundreds of years. Most of the practices are become proverbs and still they are in use without any doubt, in this highly developed technological era.

However, demand and supply control the price of the commodity, therefore, to face immediate demand, increased yield and productivity dictates the cropping cultures over throwing the long rotation and indirectly benefited ones, although their presence is equal or more beneficial to ecological balance and cycling of ingredients between living and nonliving environments. Advance technology, in one sense, a weapon for quick exploitation of the resources at a predatory nature. But, it is now realizing that, every creation is beneficial for the human beings, therefore, their presence and continuation should be evaluated. To make it clear, an example can be cited: comparison between exotic fruits e.g. apple, grape and pears with indigenous jackfruit, pineapple, guava and Kamranga etc. certainly former group has more demand with higher price. Likewise vegetables e.g. Spinach, Carrot, Beet and Corn shoot have the more value than native Kolmi, Helencha, Amaranths, Mistikumra and Chalkumra etc. Therefore, proper evaluation of their properties and uses should also come under economical consideration. Otherwise, producers will loss the actual value of their products and the market, middleman and high tech products will dominate and the theory of bio-diversification will be on biased formula. Therefore, indigenous resources should be evaluated and appropriate technology should be developed for processing, preservation, and transportation, marketing and also through market protection of exotic commodities, as the situation demands.

For appropriate technology, study of indigenous cultural practices is highly essential. What to plant, where to plant and how to establish the crops with maximum utilization of land, higher yield and maximum productivity should be studied. It should be realized that, although cropping culture is a human biased activity, but natural habitat through long period adaptability, association between flora and fauna and multidisciplinary uses must be considered. Right plant species should be planted in the right place. So-called advocacy for afforestation with the plants of different habitat, without studying their ecological behavior, should not be planted for homestead vegetation. Bangladesh is a small country with the highest population density; therefore, a very little scope remains for passing a longer period to get economic benefit from aimless cropping. Homestead vegetation should always be logical, economically supportive, and of multiple uses.

**Designing a Future Standard Home**

Urbanization and quick industrialization are squeezing the high lands in the flood free zones, thus depleting the agricultural land. With the increase of population the numbers of families and the demand for new home is increasing at 2 to 5% rate, every year. If the situation continues, within next 20 years there will be no space in the flood free zone even for agricultural farming. So, it is the high time for standardize and designing rural homes to bring under specific Code of Practices. These homes should have modern facilities e.g. electricity, gas, satellite communications, telephone, entertainment and easy transportation, education and recreation. Since the present study involves the homestead vegetation, therefore, a little scope remains for designing a standard home.

The purpose of this study is to set out the guiding considerations for the design of the homes to develop conventional plan forms or to explore new living arrangements to suit the changing needs. For a present day home we must consider the tomorrow’s requirement also. Following criteria should generally be considered for setting a standard home:

1. **External Appearance:**Good layout and landscaping, together with the use of good and well chosen external materials and colors will definitely create good appearance. It requires the thought of qualified professional people for landscape and architectural designing by ensuring that newly created property and its environment is properly looked after, its fresh appearance actually improves with the years as the gardens, trees and shrubs grow to maturity.
2. **Strength, Stability and Serviceability:**Building structures require to have strength, stability and serviceability. It is the responsibility of the designer to meet all three requirements. The structural members must be strong enough to resist all the forces imposed on the building during its lifetime. The designer has to consider the worst possible combination of forces or loads. The building must not topple over, blow away or collapse due to lack of stiffness. The building must have sufficient bracing so that the walls remain at right angles to the floor. The occupants must find the building comfortable and usable. The home must feel and look safe to the layman.
3. **Access to the home:** The most important, to be met by house and layout together, that there should be access for motorized vehicles from the main road or public path so that store goods, equipments and tools, entrance of maintenance men and transportation of goods can easily be done.
4. **Gardens and Vegetation:** Beautification cum vegetables, fruits and medicinal plants etc. have enormous important with income generation and day-to-day consumption improves the standard of living and for pleasure. It is to be cultivated and has to be kept tidy and to be updated by different cultural practices e.g. pruning, replanting or replacement and crop rotation etc. The sites should be selected considering the individual plants’ behavior, sunlight penetration, proper aeration and wind protection.
5. **Play space:** While the child’s attendance at school is becoming compulsory between the ages of five to fifteen, enjoyment facilities for following his out-of-school interests is, and must remain, within the child’s or parents’ choice. It should be of as much concern to the general public that the child has the necessary facilities for these leisure-time activities as that there is a school for him to attend. It is therefore felt that a minimum amount of space should be devoted to areas designed for children’s play. Common playground for several homes organized by a statutory or voluntary organization may be supervised by trained play leaders will more effective.
6. **Provisions for motorized vehicles:** Cars, ploughing tractors and other transports are increasing at a very high rate as the economic condition is improving and high tech farming industry are developing in the rural areas, therefore, homes should be planned from the start on the basis for parking and movements of cars, other motorized transports and agricultural equipments.
7. **Energy source: Straws and wood fuel, kerosene, electricity, gas and coal:** In the near future, there will be a definite change in the rural energy sector. Conventional use of dry straws and wood fuel and kerosene will be replaced by gas, coal and electricity. Therefore, domestic installations should be designed keeping the provisions for equipments e.g. lights, television, cookers, refrigerator, microwave and computer etc.
8. **Water source:** Permanent source for drinking water is very difficult to find out. However, pond, surface well and rainwater can be used safely after filtration and boiling, in every individual home. Common filtration plant can also be made for several homes. Well-maintained pacca surface well is the ideal source for safe water.
9. **Safety in the home:** To reduce the risks of accidents from fire, electric and gas installations etc and burglary necessary protection designs should be considered.

Considering the above and the requirements of different families, the homes can be standardized for general people as follows:

**1. Single family home:**Single or double storey building or bungalow type homes designed with modern facilities for rich and elite class people.Individual pond, terrace, gardens, play space and entry road etc. should be there.

**2. 2-Storey double family home:**Common pond, terrace for two families but separate entries with common modern facilities for mid income group.

**3. 2-Storey multi-family home:** Common pond, terrace and entries but separate gardens with common modern facilities for low income group.

**4. Single storey multi-family home:**Common pond, terrace but separate gardens, common facilities for entertainment for poor or land less people.

Sizes of the home and houses or rooms should be standardized on the basis of the number of family members and on income groups.

**CONCLUSION**

A home is a great source of livelihood materials, a nearest place for exchanging and recycling ingredients, option and origin for organic farming and activity spot for direct participation by all family members without limiting by time period. Home gardening in participation with women utilizing their knowledge of crops, soils, water management, medicinal plants, growing techniques, daily management of natural resources representing the most complex agrosilvipastoral systems which should be recognized for conservation and sustainable use of biological diversity, control of resource management and production. Therefore, the productivity and importance of homestead vegetation and crop is significantly higher than any other high tech cropping culture. Indigenous cultures, practices and wide range uses of hundreds of species in a limited space widened the implication of bio-diversity.

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