Introduction

Medicinal and aromatic plants are nature's gift to mankind to cure various diseases and ailments. These are underutilized, sparingly cultivated plant species in arable lands and mostly collected from natural sources. Among them herbs only are commercially cultivated for industrial use with good soil and better management practices.

India has 6.4 Mha (2.04 % gross area of India) of barren rocky land, which is unsuitable for cultivation of commercial crops due to poor soil conditions such as salinity, shallowness, rocky lands, and poor water holding capacity. Among them shallow soils and rocky lands can be effectively used for growing many trees, shrubs, and climbing plants which are having medicinal importance are possible with few techniques of land management. This will also help in conservation of rare, endangered and threatened species for future use. It also stabilizes the ecosystem by cultivating the trees and thereby helps in carbon sequestration.

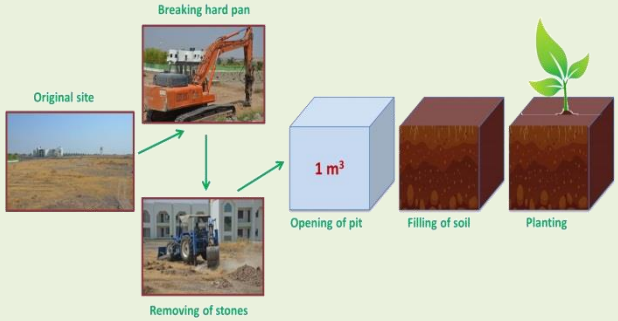
Soil characters of herbal garden at ICAR-NIASM

Herbal garden established in shallow basaltic soil having soil depth of 20 cm and hard murrum type soil underneath.

Soil showing hard stones on opening of pits

Spacing requirement for plant species

Plant type	Spacing (m)
Trees	6 x 6
Shrubs/small trees	4 x 4
Climbers	4 x 4



Land development for planting medicinal plants in shallow basaltic soils

Soil and moisture conservation

Moisture conservation and irrigating the plants in summer season is the biggest challenge in shallow soils where roots are in the surface and prone to drought stress very quickly. The following techniques can be adopted.

1. Half and full moon shaped bunds across the slope to collect runoff water.
2. Adoption of drip irrigation.
3. Crop residue mulching during dry season for soil moisture conservation.

Full and half mmoon shape bund with mulch and drip irrigation to conserve moisture and soil

Training and pruning of plant species

- Plants are required to be trained and pruning periodically for proper management of canopy and also to keep them in good shape.
- Pruning of tress once in year during March-April to remove lower branches and also dead and diseased

Properly trained of climber plants on to concrete pole

Table 1. Plant species suitable for shallow soil in dry land condition.

No.	Common name	Scientific name
1	Arjuna	*Terminalia arjuna*
2	Beal	*Aegle marmelos*
3	Beheda	*Terminalia bellarica*
4	Hirda	*Terminalia chebula*
5	Coral tree	*Adinanthera pawonia*
6	Cutch Tree	*Acacia catechu*
7	Flame of forest	*Butea monosperma*
8	Putranjeeva	*Putranjeeva roxburgaii*
9	Shamee	*Prosopis cineraria*
10	Soap Nut	*Sapindus Sp*
Shrubs/small trees		
11	Agnimantha	*Premna integrifolia*
12	Black currant	*Carissa caronda*
13	Eucalyptus	*Eucalyptus globra*
14	Fever nut	*Cesalpinia bonduc*
15	Nirgundi	*Vitex Nigundo*
16	Guggal	*Commiphora wightii*
17	Henna	*Lawsonia inermis*
18	Malabar Nut	*Adathoda zylanica*
19	Neem	*Azadiractha indica*
20	Red Sanders	*Ptreocarpus santalinus*

No.	Common name	Scientific name
21	Sandal wood	*Satalum album*
22	Soap Pod	*Cassia sinuat*
Herbs/grass/climbers		
23	Indian Aloe	*Aloe vera*
24	Lemon grass	*Cymbopogon flexuosus*
25	Citronella	*C. winterianus*
26	Vettiver	*Chrysopogon zizanoides*
27	Asparagus	*Asparagus racemosus*
28	Rosary Pea	*Abrus precatorius*
29	Bone setter	*Cissus quandrangularis*
30	Giloe	*Tinoposra cardifolia*

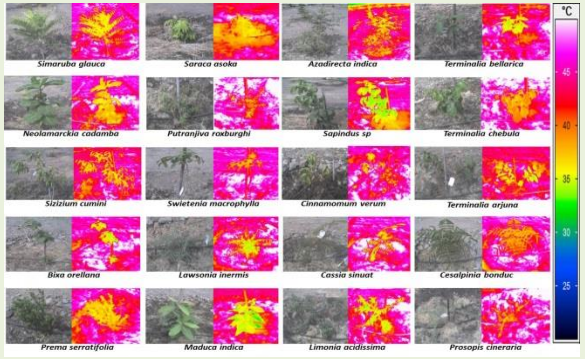
2018: Initial land and devloped garden view

2019 garden view 2020 garden view

View of herbal garden at ICAR-NIASM

Adaptation mechanisms of medicinal and aromatic plants to drought and shallow soil

Hardier plants such as *Sapindus, Terminalia sp.* guggal, wood apple, neem and khair have their canopy cooler as compared high water requiring plant species such as kadamb, parijatha and champa, thereby survive for long period without moisture in high temperature conditions. They can also survive in poor soils with shallow and rocky conditions.



IR image showing canopy temperature pattern of various plant species grown in shallow soils

Conversion of barren shallow soils in this manner will help in establishment of tree gardens with multiple species makes the environment stable by carbon sequestration, improving soil condition by reducing soil erosion, improving species diversity, conservation of native plant species,

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भाकृअनुप
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Model Medicinal and Aromatic Garden for Shallow Basaltic Lands

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