

# A trans-disciplinary approach for cultivation techniques and conservation of selected critically endangered medicinal plants Shavnam Chaudhary, Meena Shamrao Deogade, Damini Sharma, Tanuja Manoj Nesari All India Institute of Ayurveda, New Delhi, India

# Introduction:

The importance of Medicinal plants in India has been increasingly recognized by agriculturalists and Pharmaceuticals, during past two decades. Ninety percent of herbal industry's requirement of raw material is taken out from the forests, resulting in to the ruthless exploitation and destruction of its natural habitats. A number of species have been rendered vulnerable to extinction and many important plants have become critically endangered due to lack of cultivation and also due to unsustainable collection of these plants from their natural habitat and forest. Therefore, the cultivation of these plants is needed to ensure a dependable, continued supply. Since in-situ conservation of these resources alone cannot meet the ever-increasing demand of the pharmaceutical industry, the development of cultural practices and propagation methods for these plants in suitable agro-climatic regions are necessary. Due to poor seed germination and low seedling survival, regeneration under natural conditions is low for critically endangered medicinal plants. These plants are restricted to a narrow geographical range with stringent ecological requirements. Thus, plant cultivation and conservation strategies like modern agro-techniques and ancient agricultural practices are necessary before species extinction.

# **Objective:**

To review the latest agro-techniques and ancient agricultural techniques mentioned in '*Vrikshaayurveda'* in increasing the yield of critically endangered medicinal plants that will help the farmers to earn more profit by increasing the yield of medicinal plants



# **The Leading Exporters of Medicinal Plants** (2020)

	<b>Estimated Annual</b>	
Species Name	Trade (MT)	
Aconitum heterophyllum	100-200	
Aquilaria malaccensis	50-100	
Commiphora wighi	1000-2000	
Embelia ribes	100-200	
Nardostachys grandiflora	500-1000	
Picrorhiza kurrooa	1000-2000	
Saraca asoca	1000-2000	
Saussurea costus	100-200	
Swera chirayita	500-1000	
Taxus wallichiana	100-200	
Innula racemosa	1000	

Source: ITC, Trademap, 2021.

Market value of critically endangered plants

Agrotechniques:seeds.• Seeds have no dormancy period and are sown mmediately after collection. Plants raised from seeds have very slow growth and the cotyledonary phase pseudomonocotyle) persists for at least one growth eason (three to four months).July. The field bring the soils application of t/ha is recomm t/ha is recomm directly in theJuder polyhouse conditions and sandy textured soil, germination takes about two months to complete. However, diurnal temperature variations (25–25 °C) and nulching of soil promote germination within 15–25 daysTransplanting directly in the meeding, prot be done period• When tuber segments are used as planting material, hey are treated with GA3 (gibberellic acid) (200 PPM parts per million]) for maximum rooting percentage and murvival.Intercultural C weeding, prot be done period• Disease and F noted. However	Material- E. ribes is propagated throughPicrorrhiza kurroa: Agro-techniquetion and Fertilizer Application: Crop is raised ct sowing of seeds in the field during June- d is well ploughed followed by harrowing to ls to a fine tilth and free from weeds. The f organic manure (FYM) at the rate of 5-10Picrorrhiza kurroa: Agro-techniqueVirial during June- d is well ploughed followed by harrowing to f organic manure (FYM) at the rate of 5-10Picrorrhiza kurroa: Agro-technique	Costus can be propagated through seeds and roots The propagation is done normally through seeds during October-November before snowfall (Goraya and Ved, 2017). The long cultivation cycle (3 years) of costus is the major constraint on the way of plant cultivation. In costus cultivation, profitable roots are harvested in 2-3 years. But, the three years' old plant gives a better output. Manure is applied two times in a year with two different	Nardostachys jatamansi: Agro-techniques: Nursery technique Raising propagules The crop can be grown by raising a nursery in May, from seeds or vegetative rhizomes separated from the mother plants insandy soil inside the polyhouse. Both seeds and rhizomes are treated with GA3 (gibberellic acid; 100 PPM[parts per million]) and 200 PPM) for 48 hours for rapid germination/sprouting. To obtain good active chemical ingredients, plants must be collected after senescence in October and to achieve better survival rate.
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Aconitum heterophyllum Wall. ex Royle

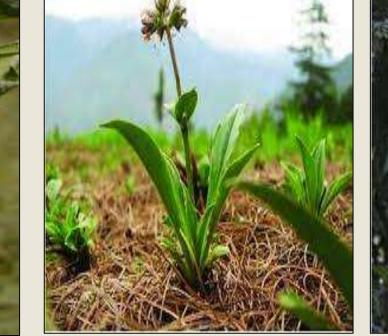
Aquilaria malaccensis Lam. Thymelaeaceae Primulaceae

Embelia ribes Burm. f. Picrorhiza kurroa Royle ex

Benth

Saussurea costus (Falc.) Lipsch









Taxus wallichiana Zucc. Taxaceae Sthouneyak

Inula racemosa Hook. f 🍼 steraceae

Nardostachys grandiflora

Wilde

Saraca asoca (Roxb.) De

# Ranunculaceae \*\*\*





371N Asteraceae Kushth

222422 Pushkarmool



Fabaceae Sita-ashok Chirayata

#### Taxus wallichiana: Agrotechniques:

Cutting is a very common and popular method of propagation (external and internal factors like season, light, presence of leaves and internal tissue organization determine the formation of roots in stem cuttings). Taxus cultivation through seed dispersal or seed sowing is

not easy because seed collection is often difficult and germination normally takes time due to longer dormancy period, nonviable seeds and eating of seeds by birds.

#### Commiphora wightii: Agrotechniques:

**Raising propagules** The planting stock for raising the crop can be prepared in a nursery through seeds, stem cuttings or air layering of 5–8- year-old mother plants. Only the black-coloured seeds are viable and sown during March to June, preferably in polybags

However, cuttings can be pretreated with guggulu solution (100 mg/litre) or IBA (indole-3-butyric acid @ 10 mg/litre) to hasten rooting and to achieve better survival rate.

#### Saraca asoca:

#### Agrotechniques:

Seeds are the most suitable propagation material. Mature seeds are collected from more than five- to sixyear-old plants in December–January.

Raising propagules : The seedlings are raised in a nursery in March. The seeds are sown in mother beds or Saraca asoca – flowering and fruiting polybags of 25 cm × 20 cm size. The potting mixture consists of equal quantities of soil, sand, and FYM (farmyard manure). The seeds germinate in about 15 days.

Propagule rate and pretreatment Approximately, 2 kg seeds are required for raising seedlings for planting in 1 hectare of land at a spacing of  $3 \text{ m} \times 3 \text{ m}$ . The seeds may be soaked in water for 12 hours before sowing, which improves the germination percentage. Vegetative propagation of asoca has also mentioned by Vrahamihir

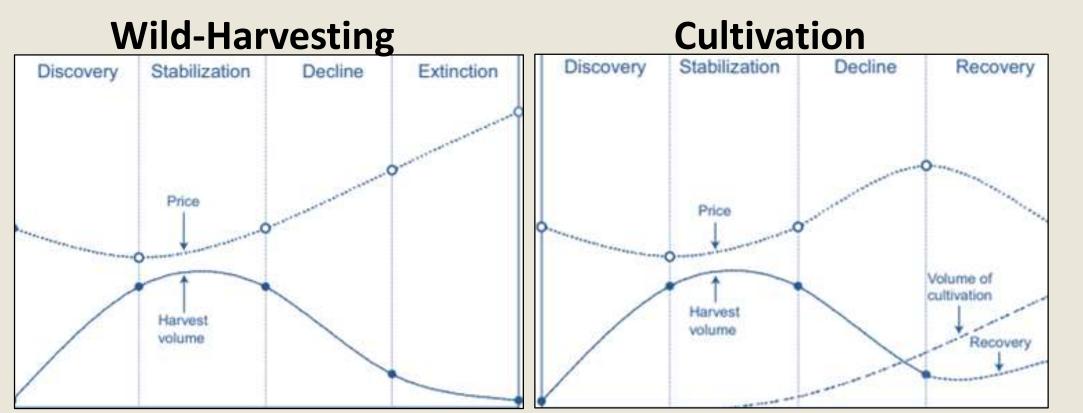
### Swertia chirata: Agrotechniques:

Raising propagules The crop is grown through nurseryraised seedlings. Sowing is done in October–November, Seeds of chirayata germinate well under nursery conditions in the media having FYM (farmyard manure), sand, and soil in 2:2:1 ratio. Seeds are sown in rows 10– 15 cm apart and covered with 0.5-cm thick layer of sand or fine soil. It takes about 25–28 days for complete germination to take place under nursery conditions. Chilling treatment of seeds at 3 oC or below for 15 days is required for good germination in the nursery

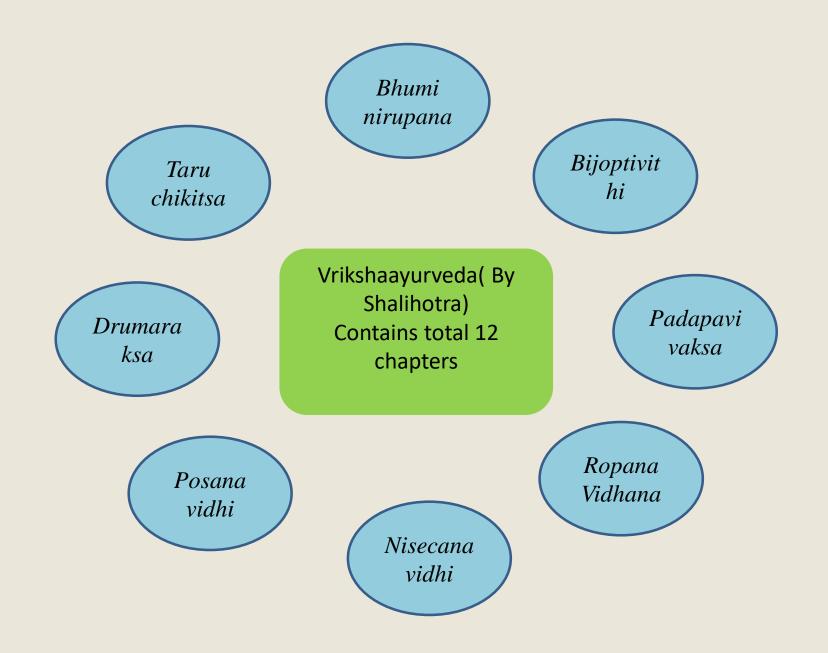
# Aquilaria malaccensis:

Agrotechniques:

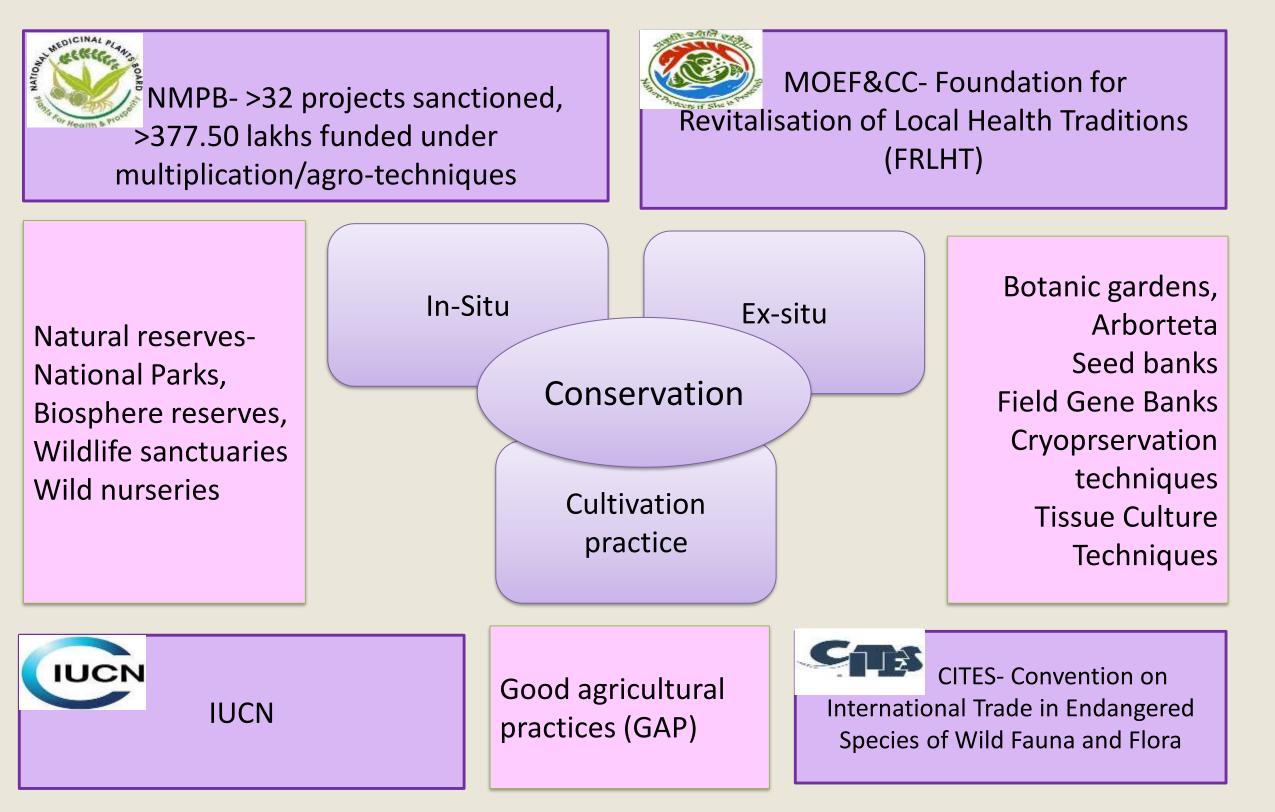
Aquilaria malaccensis produces seeds after 7–9 years while some other species produce seeds only once in their life cycle. Seed viability is approximately 1 week and germination takes place between 16–63 days (Ng 1992). Not all mature trees produce the gaharu resin. Germination rates may reach 90% for mature fruits that are sown immediately (Chang, pers. comm.). Trial planting on the grounds of the Forest Research Institute Malaysia have shown that survival of tissue-cultured plantlets 24 months after planting was 66.3% while that of seedlings was 40.3%. The initial and final plantlet heights were 43.1 and 136.6 cm, respectively, while those for the seedlings were 27.9 and 114.8 cm, respectively



## **Ancient Agricultural Techniques:**



# An illustration of the methodological approaches used to conserve medicinal plants



The transition from wild collecting to medicinal plant cultivation involves changes in price and harvest volume. The price of raw materials rises in step with the overharvesting-induced decline in wild resources. As a result, the commercial feasibility of cultivation for the resource recovery and price stabilisation of medicinal plants increases.

- It lessens the burden of harvesting on extremely rare and slow-growing species, which are most susceptible to attack. • It ensures steady supply of raw materials.
- The habitat-specific nature of medicinal plants grown nearby will be known to farmers.
- The market's availability creates greater opportunities for socioeconomic improvement.
- It costs more than wild harvest.
- Prior to and throughout production, significant expenditure is required.
- The farmers need constant technological assistance.
- If a programme or source of funding is no longer available, organizations may stop operating certain facilities, such as nurseries establishment.

**Conclusion:** From the above review, it is concluded that combination of agro-techniques would be the great idea for protecting these critically endangered species from extinction . Development of habitat specific nurseries for better harvest volume can be done by government and other agencies initiatives along with the support of local farmers.

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