

Role of Agroforestry in Management and Conservation of Medicinal Trees in Bihar, India

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Abstract Medicinal plants have always played a vital role in the treatment of various human ailments. Day by day, they are becoming more useful and popular because of being non-narcotic, having no side effects, easy availability at affordable costs and eco-friendly nature. Due to over exploitation, improper collection, habitat destruction, deforestation, invasion of exotic weeds, many medicinal plants have become threatened / endangered and the remaining ones are gradually coming under different threat categories. However, they can be managed and conserved merely by integrating them into agroforestry. To assess the feasibility of this measure in Bihar, a survey has been conducted in different crop fields of the state. The outcome of the study reveals that the integration of medicinal trees in agroforestry is rather an ideal approach for proper management and conservation of plant resources with medicinal values. The important medicinal trees like *Acacia nilotica* (Babool), *Aegle marmelos* (Bel), *Albizia lebbeck* (Siris), *Annona squamosa* (Sharifa), *Azadirachta indica* (Neem), *Bauhinia variegata* (Kachnar), *Bombax ceiba* (Semul) *Butea monosperma* (Palas), *Cassia fis-*

tula (Amaltas), *Cocos nucifera* (Nariyal), *Cardia dichotoma* (Lasora), *Dalbergia sissoo* (Shisham), *Emblica officinalis* (Amla), *Gmelina arborea* (Gambhar), *Madhuca longifolia* (Mahua), *Moringa oleifera* (Sahjan), *Syzygium cumini* (Jamun), *Tamarindus indica* (Imli), *Terminalia alata* (Asan), *Terminalia arjuna* (Arjun), *Terminalia bellirica* (Bahera), *Terminalia chebula* (Harara), *Vitex negundo* (Sinwar), *Ziziphus mauritiana* (Ber), act as the integral component of agroforestry in the province. These valuable trees perform very well in agroforestry as they avail management practices of crops and necessary conditions of conservation. Therefore, agroforestry should be encouraged and familiarized to manage and conserve medicinal trees in Bihar.

Keywords Agroforestry, Conservation, Management, Medicinal trees.

Introduction

Medicinal plants have been a major source of cure of human diseases since time immemorial. According to the World Health Organization (WHO), 80% of the worlds population rely on indigenous medicinal plants for their primary health care. Medicinal plants are gradually becoming more useful and hence popular mainly because of being non-narcotic, having no side effects, easy availability at affordable costs and eco-friendly nature. While the demand of medicinal plants is growing, many of them are going down at alarming rates, increasingly being threatened /endangered and eventually getting extinct in their natural habitats due

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to over exploitation, improper collection, habitat destruction, reckless deforestation, invasion of exotic weeds. However, they can be managed and conserved merely by integrating them into agroforestry [1, 2]. Furthermore agroforestry plays an important role in the production and conservation of medicinal trees [3, 4]. A perusal of literature reveals that no information pertaining to the cultivation of trees and shrubs in agroforestry systems of the state Bihar (India) is available. Therefore, the present investigation has been carried out to assess the feasibility of this measure of management and conservation of medicinal trees in the context of Bihar.

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Materials and Methods

The survey has been conducted for collection of samples, observation of growth performance and exploration of therapeutic uses of those trees which are being grown in the diverse crop fields designated as paddy fields, *rabi* fields, sugarcane fields, banana fields and other fields including gardens. During the period of investigation (March 2013-February 2016), these fields have been visited seasonally and selected randomly to cover maximum area encompassing different agro-climatic conditions of the province Bihar (24°20'10'' - 27°31'15'' NL and 82°19'50'' - 88°17'40'' EL). The local people and herbal drug practitioners, called *Vaidyas/Hakims*, have been interviewed following a well prepared questionnaire. Cross verification have essentially been made by questioning elderly knowledgeable rural people. The information pertaining to common name (s) of the trees, ailments being treated, plant parts or plant products used and their mode of administration have been recorded on spot. The plant parts put to medicinal uses

have been collected from *Vaidyas/Hakims* and also from the growing crop fields of the respective plants to ascertain their exact morphological nature as root, stem, leaf, bark, flower, fruit, seed. The flowering twigs of the tree having medicinal values have been collected and identified properly with the help of different floras. The identified ethnomedicinal tree species have been arranged in alphabetical order with respect to their botanical name followed by common name, family, tree size, grown in crop fields and medicinal uses.

Results and Discussion

The present study reveals that 35 tree species of angiosperms with medicinal values are commonly grown by the farmers in various agroforestry systems under different agro-climatic conditions of the state Bihar (Table 1). These trees are generally planted along the bunds, water courses, roads of the agricultural lands but not as sole crops at the cost of other agricultural crops on culturable lands. These trees are rarely cultivated in degraded or marginal lands in combination with agricultural crops. Immaterial of the places of their planting in agroforestry systems, these valuable tree species are used in the traditional practices to cure diverse ailments by rural people in the different parts of the province. Remarkably the integration of medicinal trees in agroforestry systems appears to be rather an ideal approach for proper management and conservation of plant resources with medicinal values. The important medicinal trees like *Acacia nilotica* (Babool), *Aegle marmelos* (Bel), *Albizia lebbbeck* (Siris), *Annona squamosa* (Sharifa), *Azadirachta indica* (Neem), *Bauhinia variegata* (Kachnar), *Bombax ceiba* (Semul), *Butea monosperma* (Palas), *Cassia fistula* (Amaltas), *Cocos nucifera* (Nariyal), *Cordia dichotoma* (Lasora), *Dalbergia sissoo* (Shisham), *Embllica officinalis* (Amla), *Gmelina arborea* (Gambhar), *Madhuca longifolia* (Mahua), *Moringa oleifera* (Sahjan), *Syzygium cumini* (Jamun), *Tamarindus indica* (Imli), *Terminalia alata* (Asan), *Terminalia arjuna* (Arjun), *Terminalia bellirica* (Bahera), *Terminalia chebula* (Harara), *Vitex negundo* (Sinwar), *Ziziphus mauritiana* (Ber), are acting as the integral component of agroforestry in the province. These valuable trees are performing very well in agroforestry as they are availing management prac-

Table 1. Common medicinal trees in crop fields of Bihar (India). *Tree Size : S=Small, M = Medium/Moderate, L= Large/T= Tall., **Grown In : A,B, C,D and E denotation for paddy, rabi, sugarcane, banana and other (inclusive of gardens) fields in respective serial order.

| Scientific (common) name/Family | TS*/GI* | Medicinal uses |
|--|----------|---|
| <i>Acacia catechu</i> (Khair)/Mimosaceae | M/A,,C.E | Bark decoction is taken to cure anaemia and indigestion. |
| <i>Acacia nilotica</i> (Babool) /Mimosaceae | S-M/A-E | Bark decoction is used in cough, dysentery and poor urinary Discharge. |
| <i>Aegle marmelos</i> (Bel/Siriphal) Rutaceae | S-M/A-E | Fruit pulp is eaten as a remedy in chronic diarrhoea and dysentery. |
| <i>Albizia lebbek</i> (Siris)/Mimosaceae | M/A-E | Fresh tender leaves are chewed for relief from night blindness. |
| <i>Albizia procera</i> (Safed siris)/Mimosaceae | M/E | Warmed leaves are applied as poultice on body parts affected by ulcers. |
| <i>Annona squamosa</i> (Sharifa)/Annonaceae | S/C-E | Root is taken as a drastic purgative in acute dysentery. Seeds are used as abortifacient. |
| <i>Azadirachta indica</i> (Neem)/Meliaceae | M-L/A-E | Decoction of bark or leaf is applied on infected portions to control skin diseases like boils, eczema and scabies. It is taken orally to control diabetes and skin diseases. Fresh tender leaves are chewed in the morning for speedy control of these diseases. Seed oil is applied externally against rheumatism. |
| <i>Bauhinia variegata</i> (Kachnar)/Caesalpiniaceae | M/B,D,E | Young flowers are eaten to control dysentery. |
| <i>Bombax ceiba</i> (Semul)/Bombacaceae | L/A-E | Bark paste mixed with rhizome paste of turmeric (<i>Curcuma domestica</i>) is regularly applied on painful joint parts. |
| <i>Butea monosperma</i> (Palas)/Fabaceae | M/A,B,E | Leaf decoction is consumed regularly to control diabetes. |
| <i>Cassia fistula</i> (Amaltas)/Caesalpiniaceae | M-L/B-E | Fruit pulp decoction is taken to control diabetes. Crushed seeds are boiled in mustard oil to prepare a lotion which is applied on wounds. |
| <i>Ceiba pentandra</i> (Safed semul)/Bombacaceae | M/A-E | Root juice is consumed continuously as an effective control measure of diabetes. |
| <i>Cocos nucifera</i> (Nariyal)/Arecaceae | T/A,D,E | Coconut milk is used in fever, liver complaints and piles. |
| <i>Cordia dichotoma</i> (Lasora)/Boraginaceae | M/A.E | Bark is used in diarrhoea, burning sensation and skin diseases. Fruit is used as a purgative in dysentery. |
| <i>Dalbergia sissoo</i> (Shisham)/Fabaceae | L/A,E | Bark is used to cure skin diseases and dysentery. |
| <i>Emblica officinalia</i> (Amla)/Euphorbiaceae | S-M/D,E | Fruit juice or powder is consumed to cure diarrhoea. |
| <i>Eucalyptus citridora</i> (Ghurni)/Myrtaceae | T/A-E | Leaf decoction is used in toothache. |
| <i>Ficus bengalensis</i> (Bargad)/Moraceae | L/A-E | Milky latex is soaked in <i>batasha</i> (a kind of sweets prepared from sugar and rice flour) and taken to cure diarrhoea. |
| <i>Ficus glomerata</i> (Gular)/Moraceae | L/A-E | Milky latex is taken daily in piles. |
| <i>Ficus religiosa</i> (Pipal)/Moraceae | L/A-E | Bark powder is mixed in mustard oil and the product is applied on soabies infected parts of skin. |
| <i>Gmelina arborea</i> (Gambhar)/Verbenaceae | L/A-E | Bark decoction is consumed in fever. |
| <i>Madhuca longifolia</i> (Mahua)/Sapotaceae | L/A-E | Seed oil is applied externally to cure skin diseases. |
| <i>Mangifera indica</i> (Aam)/Anacardiaceae | L/A-E | Seed powder of wild varieties is taken in diabetes. |
| <i>Melia azedarach</i> (Bakain)/Meliaceae | M-L/A-E | Leaf decoction is consumed to cure indigestion. |
| <i>Moringa oleifera</i> (Sahjan)/Moringaceae | S-M/D,E | Decoction of fresh tender leaves is taken by diabetic persons in empty stomach to lower down blood sugar level. |
| <i>Nyctanthes arbor-tritis</i> (Harsinghar)/Oleaceae | S/D,E | Leaf powder is mixed with honey and consumed in malarial fever. Leaf juice is used to cure sciatica. |
| <i>Pongamia pinnata</i> (karanj)/Fabaceae | M-L/E | Seed oil is spread on burns and skin diseases. Flower decoction is consumed by dibetic persons to reduce sugar level in blood. |
| <i>Syzygium cumini</i> (Jamun)/Myrtaceae | M-L/A-E | Extract or powder of fresh seeds is taken as an effective medicine against diabetes. |
| <i>Tamarindus indica</i> (Imli)/Caesalpiniaceae | M-L/A-E | Leaf paste mixed with rhizome paste of turmeric (<i>C. domestica</i>) is applied on painful parts for relief. |
| <i>Terminalia alata</i> (Asan)/Combretaceae | L/A-E | Bark powder along with bark powder of guava (<i>Psidium guajava</i>) is consumed in dysentery. |
| <i>Terminalia arjuna</i> (Arjun)/Combretaceae | L/A-E | Just like asan (<i>T. alata</i>). |
| <i>Terminalia bellirica</i> (Babera)/Combretaceae | L/E | Fruit powder is used in piles, diarrhoea and headache. |
| <i>Terminalia chebula</i> (Harara) /Combretaceae | M/E | Ripe fruit is used in diarrhoea and dysentery but unripe fruit as purgative and tonic. |
| <i>Vitex negundo</i> (Sinwar) /Verbenaceae | S/A-E | Leaf decoction is used in piles. |
| <i>Ziziphus mauritiana</i> (Ber)/Rhamnaceae | S-M/A-E | Bark is used to heal wounds. Leaves are used in scabies. |

tices of crops and necessary conditions of conservation. The agroforestry systems involving these trees are acting as an effective tool for economic boosts, ecosystem services and environmental benefits almost in the line of earlier findings [5–7]. Therefore, agroforestry should be encouraged and familiarized to manage and conserve medicinal trees in Bihar.

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