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A BRIEF REVIEW ON INTER-CROPPING METHOD FOR CULTIVATION OF MEDICINAL DRUGS

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ABSTRACT

India as an agriculture country depends upon farming for its percentile economy. Most of the farmers follow intercropping method for cultivation of food items. Bengal gram- red gram, cotton- red gram, wheat- Bengal gram etc are some examples of intercropping/ mix cropping. Such kind of cultivation technique helps farmers to produce greater yield on given piece of land and also in protecting crops from parasite, maintain soil fertility, also fertilizers and pesticides requirement is less in such kind of farming. This method can also be use in cultivation of medicinal drugs with food crops. Such a motivation will help to conserve medicinal drugs, maintain biodiversity, improvement in efficacy of soil. It will also favor the growth of economy. Herbs are main component of Ayurveda, unani, Chinese etc line of treatment. But in today's scenario herbs are substituted or adulterated as the recourses are scanty, for profit distributors/ suppliers are the main culprits in market. This situation can be overcome through cultivation of various medicinal plants. But no one (farmer/cultivator) can devote only in cultivation/conservation of medicinal plants, so for this intercropping is one of the method can be make into practice. Medicinal plants like *Shatavari, Ashwagandha, Sarpagandha, Vacha* which are shallow rooted annual or biannual yield can be grow with crops like black gram, brianjal, red gram etc which are perennial. Some govt. bodies, private institutions are working in this field to conserve and flourish market demand of medicinal plants in collaboration with food crops.

KEYWORDS: intercropping, medicinal plants, conservation, cultivation.

INTRODUCTION

The history of medicinal plants is as old as history of civilization, world over. The relevance of local herbal health traditions have not diminished despite the giant strides made in the field of modern medicine. In fact modern or western medicine too is the beneficiaries of herbal traditions in as much as 25% of the drugs of this class are plant-based. The contribution of traditional drug plants to modern or western medicine can be traced severally as raw material source and more importantly as the knowledge source of biological activity. But what is most surprising is the fact that, even today, 75% of world population- belonging to developing countries are still dependent on traditional medicine for their health care.

Current level of international trade in medicinal plants (including categories referred to as "Pharmaceutical plants" and "botanical drugs") is reported to be more than USD 800 million was the average annual value over the period 1992-1995 according to the UNCTAD database, International Trade Centre, Geneva. In this, India's share was only Rs. 200 corer (less than 6 percent) as against Rs. 12,000 crores (nearly 36 percent) of China. This should be surprising when we realize that indigenous medicinal plants of India have a hoary tradition of varied usage: in human and animal health care- encompassing preventive, promotive and curative aspects and also as ingredients in cosmetics and as fertilizers and safe bio-control agents in agriculture. India has a rich heritage of using medicinal plants in its codified medical systems like Ayurveda, Unani and Siddha as well as the highly diverse folk traditions. About 8000 plant species, out of folk medicinal use India, by the All India Coordinated Research Project on Ethno-Biology (AICRPE) of Government of India. In codified health traditions of India about 2000 species are estimated to be used in "Ayurveda", 1500 in "Siddha" and approximately 900 species in "Unani". India is thus endowed with one of the world's richest bio-diversity and cultural traditions in respect of medicinal plants. The combination of rich cultural heritage diversity in soil and climatic conditions and rich flora are the potential strengths of India. A scientific and sustainable use of these natural endowments and a healthy commercial sense and development orientation is all that is required to make India self-reliant in primary health care and launch the country on a course to become a world leader in the natural products industry.

The traditional medicine industry in India mostly belongs to the small- scale category. The exact number of manufacturing units in the industry is not known. However, secondary

sources suggest that there are over 7000 small and cottage scale licensed units in the country and also at least an equal number of unlicensed ones. In recent year premier industrial houses have also entered the field of manufacture of Ayurvedic and herbal products. This bespeaks not only of the economic potential but also the sustained relevance of traditional medical science in modern times. The exports of indigenous formulations including Ayurvedic, Unani and other Herbals. Although still very small, show an upward trend having risen form a modest beginning of Rs. 16 crores in 1990-91 to Rs. 308 crores in 1998-99.

The industrial demand for the medicinal plant resources has been on the rise due to the worldwide buoyancy in the herbal sector engaged in production of herbal health care formulations; herbal based cosmetic products and herbal nutritional supplements. In India, nearly 9,500 registered herbal industries and a multitude of unregistered cottage-level herbal units depend upon the continuous supply of medicinal plants for manufacture of herbal medical formulations based on Indian Systems of Medicine. In addition to the industrial consumption, significant quantities of medicinal plant resources are consumed in the country under its traditional health care practices at the household level, by traditional healers and by practitioners of Indian Systems of Medicine. Whereas, more than 6,000 higher plant species are estimated to be used in the codified and folk healthcare traditions in the country, the quantum of their consumption has remained a matter of guestimate. The fallout of the lack of reliable species-wise demand estimates - so very important for sustainable management of medicinal plant resources - has been an inadequate focus on the management of medicinal plants in the country. In fact, wild populations of many a medicinal plant species, forming the major resource base for the herbal industry, are reported to be facing a serious threat of extinction due to indiscriminate harvesting.

Some of the indigenous tropical medicinal plants consumed in large quantities by pharmaceutical industries are *Andrographis paniculata, Azadirachta indica, Cassa senana, Commiphora wightii, Curculigo orchioides, Eclipta prostrate, Embelia Rives, Emblica officinalis, Garciniagummi-gutta, Hemidesmus indicus, Plumbago Zeylanica, Saraca asoca, Terminalia chebula, Terminalia bellirica, Tinospora cordifolia, Vetiveria zizanoides* and *Withania somnitera*.

Further, several native medicinal plants are attracting attention in the context of search for safe curative or preventive drugs. Handa (1992) and others have listed several plants where significant research leads have been obtained confirming their efficacy. These are : *Acorus*

calamus (tranquilizer), *Albizia lebbeck* (immunomodulator), *Andrographis paniculata* (antihepatotoxic) *Boswellia serrata* (antiarthritic), *Centella asiatica* (brain tonic), *Coleus forskohlii* (cardiotenic), *Commiphora wightii* (antihypercholestremic), *Curcuma longa* (anti inflammatory), *Phyllanthus amarus* (antihepatotoxic), *Picrorrhiza kurroa* (antihepatotoxic), *Tinospora cordifolia* (immune modulator), *Sidar hombifolia* (anabolic), *Valeriana wallichi* (tranquilizer) and *withania somnifera* (adaptogen).

Altogether there are estimated 800 to 900 botanicals in all India trade. The supply of around 600 to 700 items of raw drugs is mostly obtained from wild stands. The rate of depletion of wild resource, of many such medicinal plant species, have outpaced regeneration capacity with the sad result that a number of these are now facing threats of extinction and are enlisted under the Red category. This is echoed in the current red list of medicinal plants of Southern India finalized through a rigorous process of CAMP (Conservation Assessment and Management Plan) workshops involving the participation of experts from several institutions. A few examples of Southern India's Critically Endangered (CR) and Endangered (EN) medicinal species, which are currently being traded, are *Decalepis hamiltonii*, *Niligiri anthusciliatus* and *Pterocarpus santhalinus*. All the three species are endemic to southern India, which means these species do not exist in the wild state anywhere else in the world other than Peninsular India. In addition to 55 endemic medicinal species which have been assigned Red List status another 45 non-endemic medicinal species have been assessed as "threatened" in the states of Karnataka, Kerala and Tamil Nadu. These threatened species fall under the Red List categories of Critically Endangered (CR), Endangered (EN) and Vulnerable (VU). Some of these regionally threatened non-endemic species which are currently being traded are: *Coscinium fenestratum*, *Cycas circinalis*, *Drosera peltata*, *Holostemmaada-Kodien*, *Michelia champaca*, *Nervilia aragoana*, *Nothapody tesnimmoniana*, *Operculina turpethum*, *Oroxylum indicu*, *Piper longum*, *Rauvolfia serpentine*, *Salacia reticulate*, *Santaulm album* and *Saraca asoca*.

Supply of these drugs are through- wild, harvests (from forests as well as other land use categories like roadsides, wastelands, farm bunds, etc.), cultivation, imports and etc.

A solution to overcome these situations is cultivation of medicinal plants by farmers and other agencies on a large scale. But due to traditional values, cost efficacy and lac of knowledge results in negligence of harvesting of such drugs in farm lands. If we look on

overall India's farming technique, most of crops are cultivated simultaneously that is termed as intercropping.

What is intercropping?

"Growing two or more crops simultaneously on the same field. Crop intensification is in both time and space dimensions. There is intercom competition during all or part of crop growth. Farmers manage more than one crop at a time in the same field."

Types

1. **Mixed intercropping**

"Growing two or more crops simultaneously with no distinct row arrangement." This is frequently the form taken in indigenous slash-and-burn or fallow agriculture.

2. **Row intercropping**

"Growing two or more crops simultaneously where one or more crops are planted in rows." This is the pattern usually encountered in intensive agriculture, where the plow has replaced the machete and fire as the main tool of land preparation.

3. **Strip intercropping**

"Growing two or more crops simultaneously in different strips wide enough to permit independent cultivation but narrow enough for the crops to interact agronomically." This form of intercropping is more common in highly modernized systems, especially where the intensive use of machinery is desired.

4. **Relay intercropping**

"Growing two or more crops simultaneously during part of the life cycle of Bach." This form of intercropping may actually include the other three as subsets, since its primary categorization variable is time.

Social & economic advantages of multiple cropping systems

1. Dependence on only crop is avoided.
2. Less need to import energy.
3. Wildlife is favoured
4. Reduction in the outlay for fertilizers.
5. There is much greater flexibility of the distribution of labour.
6. Possible to recover investments in much less time.
7. Availability of harvest over a much longer period of time .
8. Can occupy much more labour.

9. The farmer of little economic resources can produce a large variety of useful products.
10. Permit a gradual change in more destructive farming practices to more appropriate technologies.
11. Promote a return to the land.
12. Components can constitute a type of "savings" for the future.
13. Promote interdisciplinary activities.

Some species that can be intercropped with its whole details are given below-

Species	***Baliospermum solanifolium* (Danti – Nagadanti)**	***Clitoria ternatea* (Aparajita)**	***Bacopa monnieri* (Brahmi)**	***Pseudarthria viscida* (Prisniparni)**	***Desmodium gangeticum* (Saliparni)**	***Adhatoda beddomei* (Vasa)**
Part used	Roots	Whole plant and roots	Whole plant	Roots	Roots	Whole plant
Propagation	Stem cuttings with 3 – 4 nodes	Seeds	stem cutting			
Plantation	4 cuttings on each mound having one foot diameter and 20 cm height, More economical than planting rooted seedlings in pits	Seedlings planted on raised beds at a distance of 20 cm, Bright sunlight is required.	cultivated in paddy fields and marshy places	Simple broadcasting of seeds in ploughed field	Simple broadcasting of seeds in ploughed field	5 tender stem cuttings on each mound at an espacement of 2 ft, On hill slopes directly in the soil
Harvesting	within 2 –3 years	within 6 months		Within 6 months	Within 6 months	within 2 – 2½ years
Yield/acre	6000 Kg	2,000 – 2,500 Kg	10,000 – 12,000 Kg			6000 Kg – whole plant from 1 acre(intercroppig), 8000 Kg (pure crop)
Total Expenses	Rs. 30,000 / acre	Rs. 10,000 – 15,000 / acre	Rs. 50,000 / acre	Rs. 50,000 / acre	Rs. 50,000 / acre	Rs. 25,000 – 30,000 / acre
Price	Rs. 18/Kg - Semi-processed (cut into 2" long pieces) fresh roots	Rs. 20 / Kg (Whole plant)	Rs. 10 / Kg			Rs. 15
Net profit	Rs. 78,000 / acre	Rs. 30,000 – 35,000 / acre	50,000 – 70,000 / acre	Rs. 30,000 / acre	Rs. 30,000 / acre	Rs. 65,000 / acre (in intercropping), Rs. 95,000 / acre (from pure crop)
Note	The leaves and tender aerial portion can be used as green manure to coconut trees		3 harvests possible in a year	As a cover crop in Rubber plantations for first 4 years	As a cover crop in Rubber plantations for first 4 years	In Coconut plantations and for the first four years in Rubber estates

Above chart shows a brief about some species that can be taken with inter cropping.

Below are some medicinal species and their trade sources- (verities among these species can be taken into consideration for intercropping by studying their habitat matching with near to agriculture crop).

1. Medicinal Plant Species in High Trade sourced mainly from Wastelands, etc.

Abrus precatorius (Gunja), Achyranthes aspera (Upmarga), Aerva lanata (Cheroola), Andrographis paniculata (Kalmegh), Bacopa monnieri (Brahmi), Boerhavia diffusa (Punarnava), Cardiospermum halicacabum (Mudakkatham), Cassia absus (Chaksoo), Cassia tora (Chakoda beeja), Centella asiatica (Brahmi booti), Centratherum anthelminticum (Kali zeeri), Citrullus colocynthis (Indrayan), Convolvulus microphyllus (Shankhapushpi), Curculigo orchioides (Kali musli), Cynodon dactylon (Durva), *Cyperus esculentus (Musta), Cyperus rotundus (Nagar motha), Datura metel (Dhatura), Eclipta prostrata (Bhringraj), Fumaria indica (Shatara), Hedyotis corymbosa (Pitpapra), Hemidesmus indicus (Anatmool), Hygrophylla schulli (Tal makhana), Ipomoea nil (Kaladana), Merremia tridentata* (Prasarani), *Ocimum americanum (Ban tulsi), Peganum harmala (Harmal), Phyllanthus amarus* (Bhumiamla), *Pluchea lanceolata (Rasna), Plambago zeylanica (Chitrak), Pseudarthia viscida* (Moovila), *Psoralea corylifolia (Bawachi), Sida rhombifolia (Bala), Sisymbrium irio (Khubkalan), Solanum anguivi (Katheli badi), Solanum nigrum (Makoi), Solanum virginianum (Kateli), Sphaeranthus indicus (Gorakh mundi), Tephrosia purpurea (Sarpankha), Tinospora cordifolia (Giloy), Tragia involucrata (Kodithoova), Tribulus terrestris (Gokshura), Trichosanthes cucumerina (Patol* panchang), *Vetiveria zizanioides (Lavancha), Withania coagulens (Panir dodi), Woodfordia fruticosa* (Dhatki).

2. Medicinal Plant Species in High Trade sourced from Tropical Forests

Acacia catechu (Katha), Acacia nilotica (Babool), Acacia sinuata (Shikakai), Aegle marmelos (Bael), Albizzia amara (Cheroola), Alstonia scholaris (Saptaparni), Anogeissus latifolia (Dhawada), Asparagus racemosus (Shatavari), Baliospermum montanum (Dantimool), Bombax ceiba (Simal), Boswellia serrata (Salai guggul), Buchnania lanzan (Chironji), Butea monosperma (Tesu phool), Careya arborea (Vaai kumbha), Cassia fistula (Amaltas), Celastrus paniculatus (Malkangani), Chlorophytum tuberosum (Safed musali), Cinnamomum sulphuratum (Dalchini), Clerodendrum phlomides (Arnimool), Coscinium fenestratum (Maramanjal), Cyclea peltata (Paadu kizhangu), Decalepis hamiltonii (Magali), Desmodium gangeticum (Salparni), Embelia tsjerium-cottam (Vaividang), Emblica officinalis

(Amla), Garcinia indica (Kokam), Gardenia resinifera (Dikamali), Gmelina arborea (Gambar Chhal), Gymnema sylvestre (Gudmar), Helicteres isora (Marod phali), Holarrhena pubescens (Kutja), Holoptelea integrifolia (Aavithali), Holostemma ada-kodien (Jeevanti), Ipomoea mauritiana (Palmudhukkan kizhangu), Ixora coccinea (Thechippoovu), Lannea coromandelica (Jhinganjingini), Litsea glutinosa (Maida chhal), Lobelia nicotianaefolia (Lobelia leaves), *Madhuca indica (Madhuka), Messua ferrea (Nagakesar), Mimusops elengi (Bakul), Morinda pubescens (Manjanathi), Mucuna puriens (Kaunch beej), Nilgirianthus ciliatus (Kurinji), Operculina turpethum (Nishoth), Oroxylum indicum (Tetu chhal), Premna serratifolia (Arnimool), Pterocarpus marsupium (Vijaysaar), Pterocarpus santalinus (Rakta chandan), Rauvolfia serpentina* (Sarpagandha), *Rubia cordifolia (Manjishtha), Santalum album (Chandan), Sapindus mukorossi* (Reetha), *Saraca asoca (Ashoka Chhal), Schrebera swietenioides (Ghanti phool), Semecarpus anacardium (Balave), Shorea robusta (Raal), Smilax glabra (Chopchini), Soymida febrifuga (Rohan), Sterculia urens (Karaya), Stereospermum chelonoides (Patala), Strychnos nux-vomica (Kuchla), Strychnos potatorum (Nirmali), Symplocos racemosus (Lodh pathani), Terminalia arjuna (Arjan), Terminalia bellirica (Behra), Terminalia chebula (Harda), Vateria indica (Manda dhoopa), Wrightia tinctoria (Inderjau), Ziziphus xylocarpus (Ghonta phala) *Commiphora wightii (guggul) and Aquilaria agallocha (agar), largely sourced.*

3. Medicinal Plant Species in High Trade sourced from Temperate Forests

Abies spectabilis (Brahmi talish), Aconitum ferox (Vachnag), Aconitum heterophyllum (Atis), Berberis aristata (Daruhaldi), Bergenia ciliata (Pashanbheda), Cedrus deodara (Devdar), Cinnamomum tamala (Tejpatra), Ephedra gerardiana (Somlata), Juniperus communis (Hauber), Jurinea macrocephala (Dhoop), Nardostachys grandiflora (Jatamansi), Onosma hispidum (Ratanjot), Parmelia perlata (Chadila), Picrorhiza kurroa (Kutaki), Pistacia integerrima (Kakarsingi), Rheum australe (Revandchini), *Rhododendron anthopogon (Talish patra), Swertia chirayita (Chirata), Taxus wallichiana (Talish), Valeriana jatamansi (Mushakbala), Viola pilosa (Banafasha).*

4. Medicinal Plant Species in High Trade sourced largely from Cultivation

Abelmoschus moschatus (Muskdana), Acorus calamus (Bach), Adhatoda zeylanica (Adusa), Aloe barbedensis (Kumari), Alpinia calcarata (Chittartha), Azadirachta indica (Neem), Caesalpinia sappan (Pathimugam), *Cassia angustifolia (Sonamukhi), Catharanthus roseus (Sadabahar), Cichorium intybus (Kasani), Croton tiglium (Jamalghota), Curcuma*

angustifolia (Tikhur), Curcuma zerumbet (Kachur), *Ficus benghalensis (Vada Chhal), Ficus religiosa (Arali chakkiLakh Pippal), Gloriosa superba (Kalihari), Indigofera tinctoria (NiliAkika), Inula racemosa (Pushkarmool), Jatropha curcas* (Nepalam seed), *Kaempferia galanga (Kacholumra), Lawsonia inermis (Henna), Lepidium sativum* (HalimKurassani), *Ocimum basilicum (Sweet basil), Ocimum tenuiflorum (Tulasi), Piper longum* (Pippali), *Plantago ovata (Isabgol), Plectranthus barbatus (Gandhira), Pongamia pinnata (Karanj), Prunus armeniaca (Chuli), Saussurea costus (Kuth), Silybum marianum (Milk thistle), Simmondsia chinensis (Jojoba), Trachyspermum ammi (Ajwain), Vitex negundo (Neergundi), Withania somnifera* (Ashvagandha), *Ziziphus jujuba (Ber).*

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