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ALTERNATE LAND USE THROUGH CULTIVATION OF MEDICINAL AND AROMATIC PLANTS - A REVIEW

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ABSTRACT

Indian farmers have been looking for some better alternative to diversify from traditional agriculture due to gradual reduction in profitability owing to decline in productivity, increased incidence of disease and pest attack in traditional crops, contingent upon their hardy nature and higher returns, medicinal plant cultivation is a better option. India needs to take up a systematic approach towards cultivation of medicinal plants to provide a consistent supply of medicinal plant produce of international quality. Senna, Periwinckle, Coleus, Keelanelli, Sadavari, medicinal Solanum, Aloe, Gloriosa and Poonaikali are some of the medicinal plant ideally suitable for wastelands. There are specific herbs that are suitable for all problematic soils, sodic, rainfed lands, dry land conditions and almost all kinds of unutilized and under utilized lands for better remuneration to the farming community.

Key words: Land use, Medicinal plants, Aromatic plant.

Today's healthcare systems mainly rely on drugs derived from plant materials. Most of the world's populations depend on traditional medicine to meet daily health requirements, especially in developing countries, where plants are the main source of medicine. China uses about 5000 species, while India uses 7000 species of medicinal plants. The WHO has estimated that over 80 per cent of the world population meets its primary health care needs through traditional medicine (Lambert, 1997). About 47.2 percent of the surface of the earth can be classified as dry land wherein 600 m.ha of land is devoted to dry land agriculture worldwide and more than 700 million people live in these regions.

They produce most of the world food grain including sorghum, barley, wheat, pearl millet, chick pea, pigeon pea, cowpea and groundnut. They get only minimal yield due to poor resource availability in dry lands and wastelands. Now traditional crops are no more economical to the farmers, thus medicinal plants gain its importance. Medicinal plants have higher demand in the market and are quite suitable to our soils and weather conditions. Thus as an alternate cropping system medicinal plants could be included in the cropping system and as well cultivated as sole crop.

Medicinal plants are the corner stones of both human and veterinary medical systems worldwide. In developing countries, where traditional medical systems prevail, the majority of people depend on medicinal plants to meet daily health needs. Industrialized nations also use medicinal plants, as ingredients to many pharmaceuticals. Across

Medicinal plants wealth in India

World	: 3,60,000 species
India	: 40 % plants- grown in16 agro- climatic zones
Ayurveda, siddha, unani	: 7195 plants
Folk medicines	: 4720 plants
Ayurveda	: 1773 plants
Siddha	: 1122 plants
Unani	: 751 plants

the globe, many cosmetics and household products contain plants of therapeutic or medicinal value.

Trade in medicinal Plants

About 42 percent of the sales of the top 25 selling drugs world-wide are either biological, natural products, or entities derived from natural products. Despite the historical and current prevalence of plants in the pharmacopoeia, only between 5 and 15 percent of the approximately 250,000 - 500,000 species of higher plants have been investigated for the presence of bioactive compounds. Germany's Federal Institute for Drugs and Medical Devices reported that out of 2,269 medicinal herbal products which have marketing authorization or have completed the registration procedure, 1,832 (80.1%) are single-herb preparations and 437 (19.3%) are fixed combinations of more then one herb or extract.

It is estimated that 4 billion people, approximately 80 percent of the world's population, use herbal medicine in primary health care. In the US and Europe, the medicinal plants trade has been growing at an average of 10 per cent per annum among this vegetable medicaments have 30% market share. Global sales for herbs/botanicals accounted for $ 18.5 billion in 2000, the major market being Europe, accounting to 38 percent of the global market. The leading European market is Germany, accounting for over 42 percent of the European market, followed by France (25%), Italy (9%) and the UK (8%). The medicinal plant trade is largely conducted through Germany. Most importers are located in Germany and it is the leading market for exporters in developing countries. The large European markets (Germany and France) are consolidating, while smaller markets show stronger growth. New markets at a global level include Brazil, Argentina, Mexico, India, China and Indonesia

Market potential in India

Export - 66 Million US dollars
Indian trade - Rs. 550 crores (2001)
Rs.10, 000 crores (2010) (anticipated)

Total turnover of ayurvedic medicinal plants is about 2300 crores in our country and India is the leading producer of the following herbs of Psyllium (husk & seeds) (77 crores), Senna (412 crores) and Pseudo – ginseng (8.39 crores).

Medicinal plants suitable for drylands

Dry land agriculture is characterized by uncertain monsoon resulting in low crop yield. Inspite of irrigation facilities available in the near future, 60-70% of the land shall remain dryland and it needs to be exploited.

In India, out of the net sown area of 143 m.ha, the dryland accounts for 93.13 m.ha (68.4%). This dryland agriculture 40 per cent population, 60 per cent of cattle heads and contributing 44 per cent to the total food grain production in India. Coarse cereals, pulses, oil seeds and cotton are the principal dryland

crops. Around 70 per cent of the population live in dry farming regions and their livelihood depend on success or failure of crops cultivated.

Advantages of growing medicinal plants in dry lands

The medicinal plants are in great demand since many pharmaceuticals industries needs medicinal plant products as raw materials. Plants can be grown successfully in all agro-climatic conditions and are suitable for wide range of soils. Medicinal herbs have wider adaptability to the adverse climatic conditions. Some crops are best suited to the mixed and relay cropping. Medicinal crops don't warrant high land management of pest and diseases. It can be cultivated as mixed crop or as sole crop.

Why the medicinal crops in dry lands?

Traditional crops are no more economical to the dry land farmers, Medicinal plants have higher demand in the market and found to be higher remunerative than traditional dry land crops. Plants are quite suitable to our soils and atmosphere and the crops have got shelf life.

Suitable medicinal plants for dry lands

Ashwagandha – *Withania somnifera*, Kalmegh - *Andrographis paniculata*, Senna - *Cassia angustifolia*, Makoi - *Solanum nigrum*, Tulasi - *Ocimum sanctum*, Sarpagandha - *Rauvolfia serpentina*, Guduchi - *Tinospora cordifolia*,Gudmar - *Gymnema sylvestre*, Shatavarai - *Asparagus racemosus*, Langali - *Gloriosa superba* are suitable to cultivate under dry land conditions (Narashima Reddy, 2006).

Improved varieties released for certain dryland medicinal plants

Crop	Variety	Institute where developed
Isagbol	Gujarat Isagbol - 1	Medicinal and Aromatic Plant Centre, Gujarat
	Gujarat Isagbol - 2	Medicinal and Aromatic Plant Centre, Gujarat
Senna	Tirunelveli senna, ALFT - 2	TNAU, Coimbatore
Opium poppy	Jawahar Apheem-16	JNKV, Bahaduri Research farm NPBGR, New Delhi
	Trishna (IC – 2)	Medicinal and Aromatic Plant Centre, Dept of Agronomy, RAU, Udaipur
	NOP – 4 (Kirtiman)	Medicinal and Aromatic Plant Centre, Dept of Horticulture, Faizabad.
	NBRI - 3	Plant breeding Lab. Nat. Bot. Res. Inst, Lucknow
	Sweta (GS2)	CIMAP, Lucknow
Khasi katri*Solanum viarum*	Glaxo variety, Arka sanjeevani	IIHR, Bangalore
Steroidal yam	Arka upkar	IIHR, Bangalore
Rauvolfia	RS 1	JNKVV, Indore (Madhya Pradesh

(Hegde *et al.*, 2002)

Cultivation practices of some medicinal plants

Name	Period	Seeds/ha(kg)	Spacing (cm)	Duration	Productivity (ha)
Sadaphuli	June - July	2.5	45X30	160 days	10 - 15q roots20-25 q herbage yield
Sarpagandha	June - July	5.5	45X30	18 months	6-10 kg seeds 15-20q roots
Ashwagandha	- do -	1.0	75X60	18 months	12-15q roots
Isagbol	Nov -Dec	4.0	Broad cast	120 days	10-12q seeds 10-12q roots
Senna	June - July	10	60X45	150 days	2-3q seeds

(Hegde *et al.*, 2002)

Cultivation details of some tree medicinal plants

Name	Spacing(m)	Flowering	Productivity /tree (kg)	Life of tree
Amla	7X7	June/July	50-150	-
Hirda	7X7	Dec/March	40-50	25-30yrs
Bel	6X6,8X8	June- Dec	20-40	25-30
Shikakai	2X1, 2X2	-	2-4	25-30
Ritha	7X7, 10X10	oct	30-40	25-30
Shevga	3X3, 4X4	-	1000-3000 fruits	

(Hegde *et al.*, 2002)

Review on the effect of NPK for different characters in rainfed medicinal crops

Crop	Reference	NPK (kg/ha)	Remarks
Solanum khasianum	Anon (1973)	60:20:20	Increased the berry yield
Solanum khasianum	Kaul and Xutshi(1976)	50:50:50	Better
Solanum khasianum	Nair(1984)	60:20:20	Increased berry yield and fruit weight
Datura stramonium	El - Hamidi *et* al. (1966)	Increased N and decreased K	Increased the alkaloid content
Datura stramonium	Moskov (1969)	90:60:45	Increased herbage and alkaloid yield
Datura stramonium	Shetty *et al.* (1990)	90:30:50	Increased plant height, stem diameter, number of branches and herbage yield
Senna	Gupta and Pareek (1981)	100:50:0	Increased herbage and pod yield
Isabgol	Ramesh *et al.* (1989)	75:25:30	Increased oil yield
Periwinkle	Hegde (1988)	100:50:45	Increased herbage and root yield.

Review on the effect of spacing for different characters in rainfed medicinal crops

Crop	Reference	Spacing (cm)	Remarks
Solanum viarum	Bhama (1991)	30x120	Decreased per plant berry yield but increased per ha berry yield and solasodine content.
Solanum viarum	Bhama (1991)	30x30/45x45	Increased the berry yield
Solanum viarum	Reddy and Krishnan (1996)	15x90	Increased the herbage and alkaloid yield.
Ashwagandha	Abbas *et al.* (1994)	8 lakh plants/ha (WS 20) and 6 lakh plants/ha (WS 22)	Increased Dry root and seed yield.
Senna	Nandi and Chatterjee (1981)	60X90	Increased the germination and growth, solasodine content per plant.
		30X30	Increased dry foliage
		60X30	Increased total percentage of Solasodine content per plant
Senna	Illangovan *et al.* (1996)	Wider spacing	Increased the leaf, pod and solasodine content.

MEDICINAL PLANTS SUITABLE FOR WASTELANDS

Wastelands in Tamil Nadu

Among the Total geographical area of 130 lakh ha, wastelands are accounted for 24 lakh ha (Paramaguru and Velmurugan, 2004)

Medicinal plants for Tamil Nadu

Senna (*Cassia angustifolia);*Periwinkle (*Vinca rosea);*Medicinal coleus (*Coleus forskholii),*Keelanelli (*Phyllanthus niruri),*Sadavari (*Asparagus racemosus),*Medicinal solanum (*Solanum khasianum),*Aswagantha (*Withania somnifera),*Aloe (*Aloe vera),* Gloriosa(*Gloriosa superba) and* Poonaikali(*Mucuna pruriens)* are found to be suitable for wastelands in Tamil Nadu.

Suitable medicinal plants for rainfed farming
List of medicinal plants suitable for rainfed farming

Local name	Scientific name	Plant type
Datura	*Datura stramonium*	shrub
Bhringraj	*Eclipta prostrata*	plant
Musali (white)	*Lawsonia inermis*	Tall shrub/small tree
Shikai	*Acacia rugata*	shrub
Sadaphuli	*Vinca rosea*	herb
Jatropha	*Jatropha curcas*	shrub
Tulasi	*Ocimum basilicum*	Herb erect plant
Jakhamjudi	*Tridax procumbens*	Herb erect plant
Khorpad	*Aloe vera*	Succulent
Mexican poppy	*Argemone mexicana*	herb
Ashwagandh	*Withania somnifera*	herb
Shatavarai	*Asparagus resemosus*	Shrub
Camphor	*Camphora officinarum*	tree
Sarpahgandha	*Rauvolfia serpentina*	herb
Isabgol	*Plantaga ovata*	herb
Amla	*Phyllanthus emblica*	Tree
Jamun	*Syzygium cumini*	Tree
Bel	*Aegle marmelos*	Tree

(Hegde *et al.,* 2002)

Hedge crops

	Common name	Scientific name
	Gajga	*Caeselpinia bonduc*
	Shikai	*Acacia sinuata*
	Vasaca	*Adhatoda vasica*
	Henna	*Lawsonia inermis*
	Kumari	*Aloe vera*
	(Narashima reddy, 2006)	

Suitable medicinal plants for waste lands of Tamil Nadu

S. No.	Region	District	Suitable Medicinal Plants
1.	North East	Kancheepuram, Vellore, T.V. Malai, Vilupuram, Cuddalore	Thoothuvelai, Adathodai, Nerunchil
2.	North West	Dharmapuri, Salem, Tiruchi	Gloriosa, Medicinal coleus, Periwinkle, Poonaikali, Aloe
3.	West	Coimbatore, Erode, Dindigul	Thulasi, Nochi, Gloriosa
4.	Cauvery Delta	Trichy, Thanjavur, Nagapatnam	Vallarai, Gymnema, Thulasi, Nochi, Brahmi, Ashwagandha
5.	Southern	Dindigul, Madurai,Pudukottai, Ramanathapuram, Virudhunagar, Tirunelveli, Thoothukudi	Senna, Periwinkle, Mucuna, Aloe
6.	Hill	Kanyakumari	Medicinal solanum, Aswagandha, Brahmi, Vallarai, Nannari, Karisalanganni
7.	Hills	Dindigul, Salem, Udhagamandalam	Aromatic plants, Geranium, Rosemary, Thymol, Pudina, Tulsi

(Pramaguru and Velmurugan, 2004)

INTEGRATION OF MEDICINAL PLANTS UNDER AGROFORESTRY SYSTEM

Silvomedicinal system

This is the new paradigm of integration of trees and medicinal plants which can provide an array of products ranging from food, fodder, fruit, fibre, pulp and medicinal plants etc. for consumption and trade on one hand and conserving the biodiversity and reducing the pressure on the natural resources on the other hand. This can provide an opportunity to diversify the existing wheat - paddy rotation which is not profitable and also due to the dwindling of water resources. With dwindling supply from natural resources and increasing global demand, the medicinal plants need to be cultivated to ensure their regular supply. Since majority of the medicinal plants are found in forest and also shade tolerant; therefore agroforestry system offers a convenient strategy for promoting their cultivation and conservation.

Why silvomedicinal system

Silvo medicinal system is needed to reduce the pressure on the dwindling resources of the country, to obtain sustainable and regular supply of wood, fiber, fruit and medicinal products, to obtain good quality and genuine raw material for catering the industrial demand, to improve the microclimate by lowering the surface soil temperature, to improve the soil physico chemical properties, to reduce the soil erosion and finally to increase the farm income.

Approaches feasible for silvomedicinal system

In, silvo medicinal system shade tolerant medicinal plants would be integrated as lower strata species in multistrata system. It would be cultivated in a short cycle in the existing stands of the plantation crops and the medicinal trees as shade providers and boundary markers.

These medicinal plants could be grown in the various trees like Arecanut, Rubber in the home gardens. These trees allow 30-50 per cent of incident light to underneath, which is ideal for some medicinal plants.

Growing medicinal trees as the shade providers and boundary markers

Tall and perennial medicinal trees are planted at wide spacing in this system. The interspaces in between the trees are utilized growing agriculture or medicinal crops. Trees such *as Prunus africana, Santalum album, Saraca indica, Aegle marmelos, Anona squamosa, Emblica officinalis, Moringa, Sapindus mukorossi, Azadarichta indica, Terminalia chebula, Terminalia arjuna, Jatropha curcas* etc. can be intercropped with annual crops in early years until the tree canopy covers the ground. However, the time up to which intercropping can be done depends upon the spacing and nature of the trees grown.

MEDICINAL PLANTS FOR THE UTILIZATION OF SODIC LANDS

Sodicity is one of the major problems affecting the irrigated land in the world. On a global

Selected medicinal plants which could be included in the agroforestry system for Northern India.

Medicinal plants	Common name	Plant part used	Yield (q/ha)	Market price(Rs/kg)
Aloe vera	Ghee kaur	leaves	390-410	2(leaves)
Anethum graveolens	sova	leaves	9.8-12	1500(oil)
Cassia angustifolia	Senna	leaves	15-20	15-20(leaves)
Catharanthus roseus	Sadabahar	Roots, Leaves	20-22	18-20(leaves)
Ocimum sanctum	Ban tulsi	Whole plant	25-30	180(dried leaves)

(Kaushal *et al.*, 2004)

Estimated cost and benefits from medicinal and aromatic plants in sodic soils

Crop	Yield (grain oil-1 yield)	Cost of cultivation(Rs)	Gross returns (Rs ha-1)	Net returns (Rs ha-1)
		Agricultural crops		
Paddy	3.0a (3.5)b	7000	20,000	13,000
Wheat	2.2a(2.8)b	8000	16000	8000
		Medicinal and aromatic plants		
Palmorosa	150c	15,000	50,500	34,500
Vetiver	30c	30,000	75,000	45,000
Isabgol	1.0a(4.0)b	10,000	60,000	50,000

A, grain yield (t ha-1); b, straw yield (t ha-1); c, oil yield (litre ha-1)

(Arun Prasad and Patra, 2004)

basis comprise 1.5 billion hectares, in which approximately 340 M ha (23%) are saline and another 560 M ha (37%) are sodic. The 10% of the total land surface is salt affected due to cumulative affects over decades or centuries adding water with some dissolved salts to the soils of arid and semi arid region. Studies have shown that some medicinal and aromatic can be successfully grown on sodic soils and give more economic returns than the traditional agricultural crops.

Medicinal plants have gained world-wide economic importance as its active constituents are being used in the pharmaceuticals, food, and cosmetic industry. To meet the demand it is imperative to utilize the hitherto lying ecological and economical unproductive barren sodic lands for growing medicinal plants. The return from the crop production in the first year in sodic soils may be low when compared with normal soils. As the soil gets improved due to continuous cropping, the higher yield could be attained in the forthcoming years.

Medicinal plants suggested for the sodic lands

Isabgol (*Plantago ovato*)

It is an important medicinal plant. Its seed and husk are mild laxative, emollient and demulcent. The efficacy of Isabgol is mainly due entirely to the large quantity of mucilage present in the husk. The dehusked seed is around 69% by weight of total seed of the crop and is rich in starch and fatty acids. It is cultivated in the parts of Gujarat, Rajasthan, Haryana and Punjab.

Egyptian Henbane

It is a perennial herb distributed in the sandy parts of the Egypt extending towards West Pakistan. It is potential source of tropane alkaloids hyoscamine and hyoscine used in various Unanai preparations and for its subsequent conversion to atropine for ophthalmic use.

Artemisia annua:

The herb *Artemisia annua* is a traditional herb in China for the treatment of fever and Malaria. It belongs to the family Asteraceae found wild in the temperate areas of the South –East Asia, Europe and North America. The leaves and inflorescence of this plant are commercial important essential oil produce anti malarial sesqueterpene, lactone and artemisinin. It is cultivated on commercial scale in China and Vietnam for the production of artemisinin. The plant is cultivated for its essential oil in several countries which is used in perfumes and cosmetics. *A. annua* could with stand Exchangeable Sodium Percentage (ESP) as high as 55 (pH 9.6).

CONCLUSION

Thus harnessing the demand of medicinal herbs, these herbs could be efficiently involved in the cropping system and too as sole crops to increase the productivity and profitability. The waste lands and

problematic soils could be also made cultivable lands with selection of suitable remunerative herbal plants.

Future line of work

Specific crop should be evaluated for each and every category of the wasteland, Medicinal plant cultivation may seem highly attractive but it has certain limitations that should not be overlooked while venturing into its cultivation. Organic based medicinal cropping system should be developed, Lack of exact market information, dominance of traders and non-existence of the local markets for medicinal plants are deterring the farmers. These constraints should be over looked in near future. Location specific systematic research on the introduction and developing the package of practices for medicinal plant would benefit farming community.

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