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INTERCROPPING OF MEDICINAL PLANTS

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ABSTRACT:

Medicinal and Aromatic plants are upstream elements of food, flavor and cosmetic industries. These plants can be cultivated in order to obtain essential oils and fragrant chemical for commercial use. The demand for Medicinal and Aromatic plants is increasing day by day at national as well as international markets and in *Ayurvedic* preparations medicinal plants are mainly used and are in short supply from traditional source. Therefore intercropping of medicinal plants shall be advocated and adopted for obtaining additional remuneration for the farmers. Medicinal plants like *Lavendulaofficinalis, Atropa belladonna* and *Echinacea purpurea* are important source of alkaloids and essential oils, which have huge demand in pharmaceutical industries. The wide spacing available in the tree type of plantation facilitates the cultivation of Medicinal plants as an intercrop because utilization of Medicinal plants as an intercrop with other plant to generate an additional income to farmers.

Key Words: Medicinal plants, Intercropping, Plantation.

INTRODUCTION: Intercropping is the practice of growing two or more crops in proximity. The most common goal of intercropping is to produce a greater yield on a given piece of land by making use of resources that would otherwise not be utilized by a single crop.[1] Careful planning is required, taking into account the soil, climate, crops, and varieties. It is particularly important not to have crops competing with each other for physical space, nutrients, water, or sunlight. Examples of intercropping strategies are planting a deep-rooted crop with a shallow-rooted crop, or planting a tall crop with a shorter crop that requires partial shade. Inga alley cropping has been proposed as an alternative to the ecological destruction of slash-and-burn farming.[2]The cultivation of medicinal plants can be performed either by means of

(1) Monoculture

(2) Intercropping techniques

Intercropping techniques are mainly adopted when the land area is limited. Intercropping techniques that are used with plants of shorter period to harvest will generate income for farmers during the waiting period before they can get income from the medicinal plants. In the diversification era of agriculture, growing of medicinal crops in the existing cropping systems would be more appropriate to boost up farmers income and fulfill the nation's domestic and export demand. The global demand of such products is rising substantially, therefore, appropriate agro-techniques need to be developed and standardized. When crops are carefully selected, other agronomic benefits are also achieved. Lodging-prone plants, those that are prone to tip over in wind or heavy rain, may be given structural support by their companion crop. Creepers can also benefit from structural support. Some plants are used to suppress weeds or provide nutrients. Delicate or light-sensitive plants may be given shade or protection, or otherwise wasted space can be utilized. An example is the tropical multi-tier system

where coconut occupies the upper tier, banana the middle tier, and pineapple, ginger, or leguminous fodder, medicinal or aromatic plants occupy the lowest tier.

TYPES OF INTERCROPPING: The degree of spatial and temporal overlap in the two crops can vary somewhat, but both requirements must be met for a cropping system to be an intercrop. Numerous types of intercropping, all of which vary the temporal and spatial mixture to some degree, have been identified. These are some of the more significant types:[3],[4]

1.Mixed intercropping, as the name implies, is the most basic form in which the component crops are totally mixed in the available space.

2.Row cropping involves the component crops arranged in alternate rows. Variations include alley cropping, where crops are grown in between rows of trees, for example Non-commodity or value-added crops may be incorporated for extra income, including sunflowers or medicinal herbs, planted in between rows of nut or fruit trees alternated with nursery stock trees or hazelnut and strip cropping, where multiple rows, or a strip, of one crop are alternated with multiple rows of another crop.

3.Intercropping also uses the practice of sowing a fast growing crop with a slow growing crop, so that the fast growing crop is harvested before the slow growing crop starts to mature. This obviously involves some temporal separation of the twocrops.

Further temporal separation is found in relay cropping, where the second crop is shown during the growth, often near the onset of reproductive development or fruiting, of the first crop, so that the first crop is harvested to make room for the full development of the second.

Intercropping is the growing of two or more cropsin close proximity to promote beneficial interactions between them. The principle of trap cropping relieson combining plants in such a way that they occupy different ecological niches. Plants that occupy different niches are more likely to complement eachother as they use different resources and carry out different functions.When designing an intercropping scheme, there arefour components to consider: spatial arrangement, plant density, maturity date and plant architecture.[5] Seeding rates are often reduced to avoid overcrowding. Rates should also reflect the desired yield for each crop. Staggering planting / harvesting dates takes advantage of peak resource demands, reducing competition between crops. Including plants with a variety of heights and growth patterns also ensures reduced competition. For example, a tall cornplant can capture sunlight and create a beneficial understory environment for a low-growing, shade tolerant species.

BENEFITS OF INTERCROPPING: The use of intercropping can provide benefits to a management system, including decreased insect pest pressure, reduced need for external inputs, increases in biodiversity, enhanced production and lower economic risk. Separating susceptible plants with non-host species provides a physical barrier to insect pest movement, limiting spread and decreasing likelihood of damage to susceptible varieties. For example, separating plantings of solanaceous crops, such as tomatoes and potatoes, that are susceptible to Colorado potato beetle, with a non-host crop, such ascorn, can reduce the movement of Colorado potato beetles from one solanaceous crop to another. The addition of multiple species enhances

biodiversity and encourages beneficial insect populations, offering natural biocontrol. Resulting beneficial interactions between plants can confuse insects, lowering insect pest levels, lessening the extent of damage and reducing the need for external inputs. Inclusion of multiple crops utilizing different environmental niches increases the productivity per unit of land, allowing for financial diversification, as well as reduced financial risk in the event of crop failure.[6]

Other advantages of intercropping system include: (1) reduced risk of loss when the price of medicinal plants declines, (2) increased land productivity, and improved physical properties and preserved land due to low possibility of weed growing in the area. Plants that can be intercropped with medicinal plants include corn, beans, shallot, chilies, green beans, and sweet potato. Nutrient management particularly in cropping system is an ideal and most important crop production technology but proven research findings are very few for medicinal plants which can be adopted. Mishra (1995) advocated the advantages of nutrient management in cropping system as compared to individual crop basis.

HERBS AND THEIR CHEMICAL CONSTITUENT IN *VRIKSHAYURVEDA:*

TABLE NO.-1[7]

S.No.	Herb	Reference No.	Properties
1	*Panchmoola*	187	Antifungal, Antibacterial and Antiviral
2	*Yasthimadhu*	191	Antimicrobial,Antimutagenic,Antifungal, Antibacterial
3	*Madhuka*	191	Pesticidal oil, Antibacterial
4	*Triphala*	192	Antibacterial
5	*Vacha*	194, 195	Antibacterial
6	*Kustha*	194	Antibacterial
7	*Ativisha*	194	High Phenolic Content, Antirodent
8	*Hinghu*	195	Antifungal and Antibacterial
9	*Vidanga*	52,54,195,196,198, 212,219	Antibacterial and Antimicrobial
10	*Ushna*	195	Antibacterial, Antifungal and Antihelmenthic
11	*Bhallataka*	195	Antibacterial, Antifungal and Antimicrobial
12	*Vidari*	206	Antifungal
13	*Nyagrodh*	210	Wound-Healing

SHRUBS USED AS AN INTERCROPPING: Table No.-2[8]

Shrub as intercrop	Part used	Propagation	Harvesting	Total expenditure	Yield per acre	Price per kg.	Net profit
Adhatodabeddomei	Whole plant	By tender stem cutting	within 2-3 yrs	Rs.25,000-30,000/acre	6,000kg (from intercrop), 8,000kg (from pure crop)	Rs.15	Rs.65,000 /acre(from intercrop) Rs.95,000/acre (from pure crop)
Nilgirianthus Ciliates	root and a part of stem	by tender stem cutting	within 2-3 yrs	Rs.22,000-25,000/acre	8,000-10,000kg (root and stem)	Rs.6.50 (fresh), Rs.21 (semi processed)	Rs.30,000-40,000/acre
Baliospermumsolanifolium	Roots	stem cuttings with3-4 nodes	within 2-3 yrs	Rs.30,000/acre	6,000kg	Rs.18/kg (semi processed)	Rs.78,000 /acre
Plumbagoindica	Roots	stem cuttings with 3	within 11/2-2yrs;	Rs.40,000-50,000/acre	2-21/2tons	Rs.55	Rs.70,000-87,500/acre
Clitoriaternatea	Whole plant androots	through seeds	within 6 months	Rs.10,000-15,000/acre	2,000-2,500kg	Rs.20/kg	Rs.30,000-35,000/acre
Coleus zeylanicus	Root and stem	by tender stem cutting	within 6-9 months	Rs.15,000/acre	1,000kg	Rs.65-70/kg	Rs.50,000 /acre
Bacopamonnrieri	Whole plant	Stem cutting		Rs.50,000/acre	1,000-12,00kg	Rs.10/kg	Rs.50,000-70,000/acre

SELECTION OF CROPS:SELECTION OF MEDICINAL AND AROMATIC PLANT SPECIES DEPENDS UPON THE SOIL TYPE AND CLIMATIC CONDITIONS AND MANAGEMENT PRACTICE TABLE NO.-3[9]

Crops	***Aloe barbadense***	***Withaniasomnifera***	***Convolvulus macrophyllus***	***Chlorophytumborivilianum***
Soil type	Sandy-loamy	Sandy loam, medium black	Sandy-loamy	Sandy loam, medium black
Planting time	June to august	Second fortnight of September	June to July	15-30 June
Spacing	60x60cm.	Broadcasting or 30 cm.	30cm. line sowing	30x10cm.
Suckers	28,0000 suckers/ha	7-10kg/ha	6-8 kg/ha	800-1000kg/ha Sprouted fleshy root
Manure/ha	Basal FYM 10 to 15 tons	Basal FYM 10tons. NPK 15-15-0	Basal FYM 10 to 15 tons	Basal FYM 10 and 2 tons castor cake or 5 ton poultry manure.
Irrigation	As per requirement	5 to 6	As per requirement	As per requirement
Harvesting	After 2-2.5yrs, Every 3 months	135 DAS	Oct., Feb. June	100-120 DAS
Yield/year	10 to 30 ton/ha as per soil type	500 to 600kg/ha	5000 to 6000kg/ha	4000 to 5000 fresh or 1000 dry kg/ha

The ideal plant drug, grown in ideal land should be harvest with purity, facing towards eastern or northern quarter. The logic about facing is based on the same though as stated earlier. The lord of northern quarter Moon and that of eastern quarter Sun empower the plants (as in the sunlight plants perform their photosynthesis to store energy) .One more important point guided by *acharyas* that is most of the plant drugs should be harvested in*Pushya,Asvini or Mrigsiranaksatra*(star). The mystery of behind this that moon being the lord of plant drugs. *Pushya* and *Mrigsira*remain strong in this period so energies in the plants and their parts to upper most level.

*Acharyacharak, Susruta and Raj Nighantu*decribed the specific time regarding harvesting of plants and their parts as following:Table No.-4[10]

S. No.	Part Used	Cha.Ka.1.	S. Su.36	Ra. Ni.2
1.	*Mula* (Roots)	*Grishma*(summer)*Sisira*(late winter)	*Pravrit*(between summer and rainy season)	*Sisira*(late winter)
2.	*Palasa*(Tender leaves)	*Varsha*(autumn)*Vasanta*(spring)	_	*Grishma*(summer)
3.	*Sakha* (Branches)	*Varsha*(autumn)*Vasanta*(spring)	_	_
4.	*Phuspa* (Flower)	as per season	_	*Vasanta*(spring)
5.	*Twak* (Bark)	*Sarat* (late autumn)	*Sarat*(late autumn)	-
6.	*Kshira* (Latex)	*Sarat* (late autumn)	Hemanta(early winter)	-
7.	*Sara* (Wood)	Hemanta (early winter)	*Vasanta*(spring)	-
8.	*Phala* (Fruits)	as per season	*Grishma*(summer)	*Vasanta*(spring)
9.	*Kanda* (Tuber)	*Sarat* (late autumn)	-	Hemanta(early winter)
10.	*Patra*(leaves)	-	*Varsha*(autumn)	*Sisira*(late winter)
11.	*Panchanga*	-	-	*Sarat*(late autumn)

CHALLENGES:

- Lack of developed markets for products
- Unfamiliarity with technologies
- Lack of awareness
- Competition between trees, crops, and animals
- Lack of financial assistance
- Lack of apparent profit potential
- Lack of demonstration sites
- Expense of additional management
- Lack of training or expertise
- Lack of knowledge about where to market products
- Lack of technical assistance
- Cannot afford adoption or startup costs, including costs of time
- Unfamiliarity with alternative marketing approaches (e.g. web)
- Unavailability of information about intercropping
- Apparent inconvenience
- Lack of infrastructure (e.g. buildings, equipment)
- Lack of equipment
- Insufficient land
- Lack of seed/seedling sources

ADVANTAGES:[11]

- Medicinal Plants could help poverty alleviation.

- Selected multipurpose medicinal plants to halt land degradation,
- "The global value of herbal medicines is estimated at $65 billion,{1$=44.31 Rs today}.
- Greater share of the increased global value of medicinal plants
- Provide culturally acceptable healthcare, food, and a sustainable source of income by developing niche market.

We can get required fresh herbs round the year through that we can achive the ultimate goal of ayurveda*"Swasthsya Swasthya Rakshanm Aatursya Vikar Prashmanm Ch"*[12]One can get herbs with their optimum qualities as our text described"*Bahukalpam Bahugunam Samppnam Yogyam Osdham*" and herbs will be full of their *Ras, Guna, Virya and Vipaka* .[13]

SUGGESTIONS DURING INTERCROPPING OF MEDICINAL PLANTS:

- Don't use pesticide at any level.
- Use organic mannure as per requirement.
- Irrigant with fresh and soft water, polluted water should not be used .
- Sowing seeds in time.
- Management should be there of drainage of extra water timely.

Harvesting and intercropping should be on proper time and proper land as our acharyas prescribed as following- Before intercropping the medicinal plants first examine the farm (bhumi)which are five types.these are –[14]

1- Parthiva
2- Apya
3- Agneya
4- Vayaya
5- Akasiya

It is must because our *dravyas* and our body both are *panchabauthik (sarvamdrvyampanchbauthikamasminarthe)*Besides *panchbauthik* composition accomplishment of *rasas* is also obtained with the contact of land. Plants obtain their nutrition through ground water having been absorbed through their roots and spreads all over the plant via tissue system. So the examine of *bhumi* is must.

CONCLUSION: Intercropping of compatible plants also encourages biodiversity, by providing a habitat for a variety of insects and soil organisms that would not be present in a single-crop environment. This in turn can help limit outbreaks of crop pests by increasing predator biodiversity. Additionally, reducing the homogeneity of the crop increases the barriers against biological dispersal of pest organisms through the crop.

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