
Phcog Mag.: General Article Cultivation of Some Medicinal Plant Species and Requirement of Seeds

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Abstract: Eighty-two species of medicinal plants have been described for their botanical and common names, plant families, medicinal uses and the most suitable and common cultivation methods. Thirty-nine species (Table 1) are categorized to be cultivated most economically and easily by seeds only whereas 22 species (Table 2) are categorized as cultivable equally well by seeds and other plant-parts, i.e. stem cuttings, root cuttings, slips, rooted slips, stolons, bulbs, rhizomes, tubers, bulbs, corms, suckers, runners, tillers, cleft grafting, air layering, ground layering, gooti and live ends of the tops of previous year's plants etc. (*Eclipta alba*, *Costus speciosus* and *Andrographis paniculata* etc.). Twenty-one species (Table 3) are categorized as cultivable by any other means other than seeds (*Gloriosa superba*, *Acorus calamus*, and *Tylophora asthamatica* etc.). For 30 species, which are cultivable by seeds only, the

amount of seeds required per hectare, has also been calculated and presented. Similarly, for certain species, amount of propagules (rhizomes, tubers and bulbs etc.) are also given. Such information will be extremely useful for all those persons who wish to cultivate various medicinal plant species at commercial level.

Introduction

Lack of complete and reliable information on the cultivation practices of medicinal plants is the biggest hurdle in their propagation. However, it is one of the most effective ways of their conservation. Cultivation of any plant becomes costlier if the proper way of cultivation is not used. Therefore, the economics of the trade does not attract the farmers to grow the drug plants. As many as 627 plant drugs are being traded in our country and, only 70 plant species are purely under cultivation. Plants have been traditionally cultivated by a number of methods. Some of them are grown by rhizomes (Ginger, Turmeric etc.), while others are cultivated by stem cuttings (Sugarcane, Roses etc.). A number of species are also propagated by bulbs (Onion, Garlic etc.), corms (*Colocasia*), bulbils (*Cycas*), root cuttings (*Rauwolfia serpentina*), rooted stem cuttings (*Pelargonium*, *Geranium* etc), tubers (Potato, Sweet Potato etc.), live ends of the tops of previous year's plants (*Acorus calamus*), suckers (*Piper longum*), slips (*Cymbopogon* species), rooted slips (*Catharanthus roseus*), runners (*Glycirriza glabra*), stolons (*Mentha* species) and tillers (*Asparagus*) etc. There are more than one method for a species also. In the recent past, new methods like air layering, gooti and ground layering have also been successfully applied for a number of plant species. Micropropagation by tissue culture, organ culture, pollen culture, ovary culture and even single cell culture have also been standardized for a few species. But, the most common and the oldest method, which is still popular and economic, is the cultivation by seeds. However, the collection of seeds should be at the proper time when they are fully mature. They must also be properly stored as their germination behaviour changes considerably due to improper storage. In the present paper, several plant species have been listed in three different categories:

- 1) Those plant species which are cultivated only by seeds as it is the easiest and most economical method (Table 1),
- 2) Those plant species which are cultivated by seeds but by other methods and plant-parts also as they are equally economical, easily available and successful in cultivation (Table 2), and
- 3) Those plant species, which can be cultivated by other plant-parts than seeds (Table 3) as the seeds are either short lived, recalcitrant (lose their viability in a very short period of few days to few weeks), pseudo-seeds (hollow seeds having no embryo or very little developed embryo inside) and do not give a satisfactory outcome. They may have very low percentage of germination due to various kinds of dormancy.

In all, 39 species of medicinal plants have been described as most suitable for cultivation by seeds only (Table 1). The required amount of seeds per hectare have also been given for 30 species as the amounts of

such seeds could not be determined for 9 species (*Aegle marmelos*, *Azadirachta indica* and *Alangium lamarckii* etc.). Important medicinal uses of all the plant species are also given in brief (Rao et al., 1999). In some species, seeds are so small and minute that only 3 g (*Chrysanthemum cinerariaefolium*), 125 g (*Ocimum basilicum*), 250 g (*Artemisia annua*), 350 g (*Cephaelis ipecacuanha*) and 375 g (*Solanum varium*) or very little amount of seeds is required for one-hectare plantation. However, there are some species whose seeds are large and heavy and required as much as 50 Kg per hectare (*Mucuna pruriens*), 11 Kg/ ha (*Anethum graveolens*), 10 Kg/ ha (*Foeniculum vulgare* and *Coriandrum sativum*) etc.

Cultivation by Seeds: To find out the requirement of seeds for a particular species for cultivation at a site is very important as it depends upon the germination potential of seedlot available for sowing. If the cultivation site is a small area, there is no much significance of the required seed amount as it will be very little. But, when the plantation site is large enough, the amount of seed required is important as it plays important role in determining cost: benefit ratio of the cultivation (Prasad and Kandya, 1992). The seedlot be tested for germination capacity and then Kilogram Effective Factor (KEF) will be determined for each species separately. KEF is actually the weight of seeds of a species, which is expected to produce the same number of plantable plants, which are required in a hectare land area, and the number of plantable plants per kilogram of seeds is determined by the following formula:

Number of plantable plants per Kg of seed = Number of pure seeds in a Kg x Plant percent

Plant percent (percentage of surviving seedlings from a sample of 400 seeds) is determined for all seedlots (collected from different localities) by recording the number of those seedlings, which remain sound at the end of the germination test. Prasad (1990) has estimated the approximate requirements of various medicinal plants in Government Ayurvedic Pharmacy of Gwalior and Raipur and indicated the cost: benefit ratios for various medicinal plant species and concluded that net return from the cultivation of Sarpagandha (*Rauwolfia serpentina*) was Rs. 54270/ha, from Bach (*Acorus calamus*) Rs. 27040 /ha, from Tikhur (*Curcuma angustifolia*) Rs. 48040/ha, from Safed Moosali (*Chlorophytum borivillianum*) Rs. 13020.

The turnover of the Indian Herbal Drug Industry was around Rs. 2300 crores in 1997 and is estimated to be Rs. 4000 crores at present. The export alone had touched Rs. 255 crores in 1997. This aspect needs to be taken at a very level as 50 to 80% of the developing countries depend on traditional medical practices for their health care, which are basically derived from medicinal plants. It has also been speculated that over 30,000 efficient and safe medicines are being prepared by the plants in the world (Rao et al. 1999). The number of licensed pharmacies in Indian System of

Medicines is about 46,000 and the global demand for medicinal and aromatic plants is growing at the rate of 7% per annum.

Handling of seeds for cultivation is a multi-facet and important aspect, starting from their collection, to processing, storage, testing, and sowing in the field. Two most important aspects are being given here in brief. But, authenticity for the identification of the material is foremost. The seeds must be genuine, however, there are only a very few reliable sources for the supply of authentic plant material. Foundation for Revitalisation of Local Health Traditions (FRLHT) at Jarakanbande Kaval, Post Attur via Yelahanka, Bangalore 560064 can guide in this regard.

Purity of seeds: It should be determined in the beginning by removing all other materials from the seedlot, i.e. seeds of other species, cut and shriveled seeds of the same species, pieces of branches, stems, flowers and fruits etc. stones, and all inert matter other than sound seeds of the same species.

Storage of seeds: Seeds are required to be stored from a few days (short term) to a few months or even a few years (long term) depending upon their use in the field. Most of the seeds require air tight conditions for storage so that there should be no loss of moisture content from the seeds and they must not die. Such seeds are to be stored in polythene bags or glass bottles. The container must be filled as much as possible so that fast deterioration of seeds is reduced due to anaerobic atmosphere in the container. Only a small amount of oxygen is left in the container which is consumed slowly by the seeds for their respiration and carbon-di-oxide is filled in its place. Such an atmosphere is favorable for longevity of seeds.

Like moisture content, storage temperature is also important for longer viability span of seeds. Lower temperature keeps the rate of respiration low, thus the life span of seeds during storage becomes longer. Between 50°C and 0°C, every 5°C lowering of storage temperature doubles the life of the seed.

Table 1 : Medicinal plants which are economically and easily cultivated by seeds only

Species (Botanical Name) Common Name Family	Medicinal Uses	Seeds required per hectare
<i>Ammi majus</i> Honey plant Apiaceae	For Sun-tan lotion and in the preparation of medicines against leucoderma	2.5 Kg / ha
<i>Ammi visnaga</i> Bishop's weed Apiaceae	Coronary insufficiency, Angina pectoris, Bronchial asthma,	2.5 Kg. / ha
<i>Atropa belladonna</i> Belladonna Solanaceae	Manufactures of tinctures, Plasters, Sedative, Stimulant, Anti-diuretic, Anti-asthmatic	2 Kg. / ha
<i>Abelmoschus moschatus</i> Musk-dana Malvaceae	Gonorrhoea, Hysteria, Antiseptic, Perfumery, Agarbattis, Chewing Tobacco, Tea products, Carminative	1 Kg / ha
<i>Apium graveolens</i> Celery Umbelliferae	Sedative, Anti-spasmodic, Nerve stimulant, Seeds rich in Vitamin B	1.5 Kg / ha
<i>Artemisia annua</i> Annual worm weed Asteraceae	Anti-malarial, Anti-mycotic, Skin moulds, Perfumes, Cosmetics and in Dermatology	250 g / ha
<i>Artemisia paitens</i> Devanam Asteraceae	Perfumery, soaps, Flavouring of foods like pastries, Beverages etc.	1.5 Kg / ha
<i>Aegle marmelos</i> Bel, Bilva Rutaceae	Astringent, Stomachic, Diarrhoea, Cooling, Laxative, Diuretic	N. D.
<i>Azadirachta indica</i> Neem Meliaceae	Skin diseases, Ulcers, Rheumatism, Anthelmintic, Malaria fever, Boils, Eczema, Purgative, Cleaning teeth	N. D.
<i>Alangium lamarckii</i> Uduga Alangiaceae	Astringent, Anthelmintic, Emetic, Diaphoretic, Tuberculosis	N. D.
<i>Anethum graveolens</i> European Dill Umbelliferae	Flatulence, Colic pain, Vomitting, hiccups,	11 Kg / ha
<i>Anethum sowa</i> Indian Dill Umbelliferae	Flatulence, Colic pain, Vomitting, hiccups,	11 Kg / ha

<i>Cephaelis ipecacuanha</i> Ipecac Rubiaceae	Emetic, Diaphoretic, Amoebic, Dysentery, Guinea worms, and oriental sore	350 g / ha
<i>Chrysanthemum cinerariaefolium</i> Pyrethrum Asteraceae	Insecticide	3 g / ha
<i>Cymbopogon martinii</i> Palma rosa, Kamakshi Poaceae	Perfumery, Cosmetics and flavouring of tobacco	2.5 Kg / ha
<i>Cassia angustifolia</i> Sunamukhi Fabaceae	Laxative, Purgative for habitual constipations	5 Kg / ha
<i>Coriandrum sativum</i> Dhania Umbelliferae	Carminative, Flavouring agent, Herbal tea with milk cures bleeding of piles, Antispasmodic, Diuretic	10 Kg / ha
<i>Commifera mukul</i> Guggal Burseraceae	Astringent, Antiseptic, Stomachic, carminative, Digestant	N. D.
<i>Digitalis lunata</i> Fox glove Scrophulariaceae	In case of burns, Myocardial stimulant	2 Kg / ha
<i>Eucalyptus citriodora</i> Lemon scented gum Myrtaceae	Soap, Perfumery and cosmetic industry, Arthritis, cold	N. D.
<i>Eucalyptus macromyncha</i> Rutin Bearing Eucalyptus Myrtaceae	Rheumatic fever, Purification of blood, Coronary thrombosis	N. D.
<i>Foeniculum vulgare</i> Umbelliferae Saunf	Infantile colic, Flatulence, Germicide against hook worms,	10 Kg / ha
<i>Hyoscyamus niger</i> Henbane Solanaceae	Sedative, Anodyne, Tranquilizer, Antiseptic, Anti-spasmodic, Asthma	5 Kg / ha
<i>Hibiscus sabdariffa</i> Rosella Malvaceae	Diuretic, Demulcent, Emollient, Laxative, Anti-septic, Asthma, Dyspepsia, Debility	2.5 Kg / ha
<i>Matricaria chemomillia</i> Chamomile Asteraceae	Anti-spasmodic, Expectorant, Carminative	1 Kg / ha
<i>Mucuna pruriens</i> Dulagondi, Karench Fabaceae	Spermatorrhoea, Menstrual disorders, Nervine tonic, Anti-Parkinson's disease, Scorpion sting, Astringent	50 Kg / ha
<i>Ocimum basilianum</i> French Basil Lamiaceae	Contains Vitamin A and C, Mouth washes, Dental creams, and confectioneries	125 g / ha
<i>Ocimum sanctum</i> Tulsi Lamiaceae	Anti-septic, Expectorant, Stimulant, Anti-pyretic, Memory Enhancer, Diaphoretic, Anti-periodic	3.3 Kg / ha
<i>Ocimum grattissimum</i> Lamiaceae Clocimum	Medicines, Cosmetics, Perfumes	2 Kg / ha
<i>Oroxylum indicum</i> Bignoniaceae Dundilamu	Rheumatism, Purgative, Stomachic, Anti-septic, Anti-cancer, Spleen enlargement	N. D.
<i>Oenothera lamarckiana</i> Onagraceae Evening Primerose	Cardio-vascular disorders, Diabetes, Breast problems, Menstrual syndrome, Eczema, Arthritis, Alcoholism	1 kg / ha
<i>Psoralea coralyfolia</i> Fabaceae Bapchi	Leucoderma, Leprosy, Psoriasis	7 Kg / ha

<i>Plantago ovata</i> Plantaginaceae Isabgol	Cooling, Mildly astringent, Emollient, Laxative, Diuretic, Diarrhoea, Affections of kidney, bladder and piles	8 kg / ha
<i>Papaver somniferum</i> Papaveraceae Opium Poppy, Aphim	Sedative, Cough etc.	6 Kg / ha
<i>Strychnos nux-vomica</i> Loganiaceae Mushini	Nervous disorders, Paralysis, Headache, Antidote for sedative poisoning, Snake bite,	N. D.
<i>Silybum marianum</i> Asteraceae Holy Thistle	Jaundice, Dropsy, Uterine trouble, Intermittent fevers, Demulcent, Haemorrhages	3 Kg / ha
<i>Santalum album</i> Santalaceae Sandal, Chandan	Cooling, Stimulant, Astringent, Aphrodisiac, Expectorant, Anti-pyretic, and exhilarating	N. D.
<i>Solanum viarum</i> Solanaceae Steroid bearing Solanum	In the synthesis of cartisones and sex-hormones used in birth control, Anti-inflammatory and anabolic	375 g / ha
<i>Withania somnifera</i> Solanaceae Ashwagandha	Adaptogenic, Tonic, Diuretic, Rheumatic, Febrifuge, Sedative, Anthelmintic	5 Kg / ha

N. D. = Not Determined

Table 2 Medicinal plants which are cultivated by other means as well as seeds

Species Local Name Family	Medicinal uses	Cultivation Methods
<i>Asparagus racemosus</i> Satawar, Sat-muli Liliaceae	Demulcent, Aphrodisiac, Diuretic, Anti-dysenteric, Dyspepsia, can improve intellect, Galactagogue	Seeds, Tubers, Roots Tillers
<i>Andrographis paniculata</i> Kalmegh, Kirayat Acanthaceae	Bitter tonic, Febrifuge, Anodyne, Astringent, Alexipharmic, Loss of appetite, Anaemia, Anti-periodic	Seeds, Stem cuttings
<i>Bursera delpechiana</i> Indian Lavender Tree Burseraceae	Native of Mexico, Introduced to India, Perfumery, Soaps and Cosmetics, Essential oil obtained from epicarp	Seeds, Air layering, Cleft grafting, Rooted cuttings
<i>Bixa oreliana</i> Jafra, Annatto Bixaceae	Colouring food products, Cosmetics, Hair oil, shoe polish, floor polish	Seeds, stem cuttings
<i>Catharanthus roseus</i> Sada Bahar Apocynaceae	Anti-spasmodic, Hypotensive, Leukemia, Abortifacient, Anti-dysenteric, Skin diseases	Seeds, Stem cuttings,
<i>Cinchona officinalis</i> Cinchona Rubiaceae	Anti-malarial drugs, Anaesthetic, Stomachic, Appetizer, Important source of quinine,	Seeds, Cuttings, Patch budding, Stooling,
<i>Costus speciosus</i> Chengalava Zingiberaceae	Used as a febrifuge Source of corticosteroids, Sex hormones used in birth control, Tonic, Anthelmintic	Layering, Cleft graft Seeds, Rhizomes, Stem cuttings
<i>Duboisia myoporoides</i> Cork wood tree Solanaceae	Anti-spasmodic, Anti-cholenergic, Mydriatic properties, alkaloids useful in paralysis	Seeds and root cuttings
<i>Eclipta alba</i> Bhingraj Asteraceae	Astringent, Asthma, Bronchitis, Rheumatism, Hair-restorer,	Seeds, Cuttings
<i>Emblica officinalis</i> Aonla, Amla, Euphorbiaceae	Diuretic, Cooling, Laxative, Jaundice, Hair growth, Asthma, Bronchitis, Scurvy	Seeds and Grafting
<i>Garcinia cambogia</i> Kerala Tamarind Guttiferae	Digestive, Preparation of anti-obesity drugs, vegetable butter,	Seeds and Grafting
<i>Lavandula officinalis</i> Lavender	Perfumes, Talcum powders, Soaps, Scenting.	Seeds, stem cuttings

Lamiaceae

<i>Lawsonia inermis</i> Mehndi, Henna Lythraceae	Anti-bacterial, Against boils, Burns, skin disease, For colouring hair, nails and soles. Silk, wools and leather	Seeds, stem cuttings
<i>Ocimum kilimandscharicum</i> Kapur Tulsi, Camphor Basil Lamiaceae	Pharmaceuticals, Disinfectants, Source of Camphor (60 to 80%), Insecticide, Mosquito repellent	Seeds @ 200 g / ha Stem cuttings
<i>Piper longum</i> Long pepper Piperaceae	Aphrodisiac, Asthma, Hiccups, Leucoderma, Jaundice, Alterative,	Seeds, suckers, Cuttings, Layering
<i>Pogotemon cablin</i> Patchouli Lamiaceae	Infusion of fresh leaves used for menstrual disorders, Masking agent in depilatory creams	Rooted stem cuttings,
<i>Podophyllum species</i> Papra, Papri Berberidaceae	Purgative, Alterative, Emetic, Vermifuge, Tonic, Cholagogue, Effective in some forms of Cancer	Seeds, Rhizome cuttings
<i>Rauvolfia serpentina</i> Sarpagandha Apocynaceae	Sedative, Anti-hypertensive Epilepsy, Psoriasis, Anti-Spasmodic, Insanity, Snake-bite	Seeds, Root cuttings, Stem cuttings
<i>Rosa damascena</i> Fasli Gulab, Bulgarian rose Rosaceae	Tonic, Laxative, Anti-pyretic, Aphrodisiac, Flower buds used in cardiac troubles, Enlarged tonsils	Seeds, Stem cuttings (IBA 200 ppm)
<i>Rosmarinus officinalis</i> Rosemary Lamiaceae	Soaps and cosmetics, Perfumery	Seeds and stem cuttings
<i>Thymus vulgaris</i> Thyme Lamiaceae	Laxative, Anti-septic, Anthelmintic, Expectorant, Carminative, Diuretic, Sedative, Asthma, Perfumery	Seeds, Stem cuttings
<i>Valeriana jatamansi</i> Valerian Valerinaceae	Hysteria, Hypochondriasis, Nervous disorders, Epilepsy, Tonic, Stimulant, stocks, Depression	Seeds, Old root Rhizomes

Table 3 Medicinal plants which are cultivated by other methods than seeds

Botanical Name Local Name Family	Medicinal Uses	Cultivation method
<i>Acorus calamus</i> Araceae	Stomachic, Appetiser, Kidney diseases, Sedative and analgesic, Mental ailments, Chronic diarrhoea and abdominal tumours	Live ends Bach, Sweet flag, of tops of the previous crops.
<i>Aloe vera</i> Kalabandha Liliaceae	Liver disorders, Rheumatism, Skin disorders, Intestinal worms, Emollient, Cold, Prolapsed uterus	Rhizomes Root suckers
<i>Coleus forskohlii</i> Pashan-bhedi Lamiaceae	Chronic cough, Asthma, Painful urination, Abdominal colic, Nervous disorders, Anaemia, Improves vitality, Epilepsy	Stem cuttings
<i>Cymbopogon flexuosus</i> Lemon Grass Poaceae	Important source of Citral, soaps, Production of Vitamin A, Cosmetics, Leprosy, Epilepsy, Mosquito repellent	Slips
<i>Cymbopogon winterianus</i> Citronella Poaceae	Manufacture of mosquito repellent creams and de-odorants, Perfumery, soaps and cosmetics	Slips
<i>Dioscorea floribunda</i> Yam Taccaceae	Source of steroids, Corticosteroids, and Sex hormones, used in birth control, Anti-arthritis, Anti-inflammatory	Tubers (2.5 tons/ha)
<i>Gloriosa superba</i> Vajramu, Kalihari Liliaceae	Against gout, Rheumatism, Abortifacient, Piles, Chronic ulcers	V shaped rhizomes
<i>Glycerrhiza glabra</i> Sweet root, Liquorice, Mulethi Fabaceae	Tonic, Expectorant, Demulcent, Mild-Astringent, Laxative, Against irritation of urinary organs and mucous membranes	Rooted cuttings Runner, under ground stem
<i>Gymnema sylvestris</i> Sugar killer, Podapatri	Cardiac stimulant, Diuretic, for treating diabetes	Stem cuttings, Tubers

Asclepiadaceae

Jasminum species Bela, Chameli, Jui	Flowers in a preparation of piles, Leaves for toothache, Leaves chewed in ulceration of mouth, In a preparation for eczema	Cuttings and ground layering, Seradix
Oleaceae <i>Kaempferia galanga</i> Kapur Kachri	Stimulant, Expectorant, Diuretic, Carminative, Cough, Dyspepsia, Malaria, Headache	Rhizomes (1.2 tons / ha)
Zingiberaceae <i>Marjorana hortensis</i> Sweet marjoram	Perfumery, Confectionary, Garlands, Hair abnormalities	Cuttings
Lamiaceae <i>Mentha cardiaca</i> Scotch spearmint	Toothpaste and pharmaceutical preparations, Source of spearmint oil, Flavouring chewing gums,	Runners and growing tips
Lamiaceae <i>Mentha piperata</i> Vilayti pudina	Stimulant, Stomachic, Carminative, Used for allaying nausea and flatulence, Tooth-paste, Cough syrups, Mouth washes	Runners, Growing tips, Stolons
Lamiaceae <i>Mentha arvensis</i> Pudina, Japanese mint	Stimulant, Carminative, Infusion of leaves digestive, Rheumatism, Ointments, Painbalms, Flavouring food and tobacco	Suckers, Runners, Growing tips
Lamiaceae <i>Pandanus fascicularis</i> Ketaki, Kewda, Mogili	Rheumatic, Arthritis in animals, Scabies and diseases of heart and brain, Leprosy, Perfumes, Agarbattis	Cuttings
Pandanaceae Pelargonium species Geranium	Extraction of Geraniol and Rhodinol, Excellent for artificial rose otto, Pharmaceutical preparations, Perfumery	Rooted stem cuttings, IBA 2000 ppm
Geraniaceae <i>Polyanthus tuberosa</i> Rajni-gandha	Diuretic, Emetic, Gonorrhoea, Perfumery Cosmetics, Tuberose oil,	Bulbs @ 1.25 lakhs / ha 800 - 900 Kg
Amaryllidaceae <i>Tinospora cordifolia</i> Amrit-valli, Tippiatiga	Fever, Dyspepsia, Antipyretic, Anti-spasmodic, Anti-diabetic, Emetic, Leprosy, Jaundice	Stem cuttings
Menispermaceae <i>Tylophora asthamatica</i> Verripala	For curing Asthma, Bronchitis, Dysentery, Diarrhoea, Whooping cough,	Stem cuttings
Asclepiadaceae <i>Vetiveria zizanioides</i> Khus, Vetiver	Fixative, Perfumery, Cosmetics, Roots woven into mats used in coolers	Rooted slips
Poaceae		

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