



## Magical power of medicinal plant: The sarpagandha

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*Rauwolfia serpentina* (L.) is a woody perennial shrub, commonly known as 'Sarpagandha' is an endangered medicinal plant found in Bangladesh, China, Indonesia, India, Malaysia, Nepal, Pakistan, Sri Lanka and Viet Nam. It is a good source of many (>50) important alkaloids of medicinal value. Its natural source is now almost exhausted due to indiscriminate recurrent harvest and other anthropogenic pressure and activities.

The quality of any raw medicinal plant and the consumer products derived from them depends on the genetic and environmental factors in addition to cultivation techniques, harvesting stages and practices, post-harvest procedures including storage and transportation etc. Inadvertent microbial or chemical contamination during any of the production stages may lead to deterioration in the quality and efficacy of the raw materials and the resultant consumer products. Therefore, it has been felt necessary that detail information on the species including its good agricultural and collection practices, post-harvest procedures and quality standards should be documented for wider dissemination and to facilitate all stakeholders in the identification, collection/production and subsequent management procedures.

It is indigenous to India. It is distributed in the foothills of Himalayan range, deciduous forests of South East Asia including Burma, Bangladesh, Sri Lanka, Malaysia, the Andaman Islands and Indonesia. In India, it is found in the central region, *i.e.* between Sirmor and the Gorakhpur district of Uttar Pradesh, in shady, moist or sometimes swampy localities.

**Climate and soil :** *R. serpentina* can grow under a wide range of climatic conditions. It flourishes in a hot humid condition and can be grown both in the open and in partial shade; it cannot stand the full open sun. In its natural habitat the plant thrives under the shade of forest trees or at the very edge of the forests where three of the four sides are

protected against too intense an illumination. It prefers a tropical or sub tropical belt having the benefit of monsoon rains (250 cm-500 cm rainfall annually), preferably the south-west. The plant grows in a wide variety of soils from sandy alluvial loam to red lateritic loam or stiff dark loam. The soil should be acidic with pH about 4.0-7.0.

**Propagation:** *R. serpentina* can be propagated by seeds, root cuttings, root stumps and stem cuttings.

**Seed propagation:** Seed propagation is the best method for raising commercial plantation. Seed propagation is done by direct sowing of seeds in the field has not been found



successful and hence, seedlings are raised in the nursery and transplanted in the field. The germination percentage of seeds is very poor and variable (25-50%) and is often as low as 10 per cent. This is attributed partly to the adverse influence of the stony endocarp. Seed germination in *Rauwolfia* is highly variable. It is

reported to vary from 5 to 30 per cent even when only heavy seeds are chosen for sowing purpose. Light and heavy seeds can easily be separated by simple water flotation. Germination of heavy seeds during May-June after soaking them in water for 24 hours was 20-40 per cent and 62.77 per cent germination was recorded in freshly collected heavy seed lot. In all, 6 kg of seeds are sufficient to raise one-hectare plantation.

**Propagation by root cuttings:** For propagation by root cuttings, large tap roots with a few filliform lateral secondary rootlets are used. Cuttings of 2.5-5.0 cm long are planted horizontally about 5 cm. near 50 per cent of the root cutting sprouts in about a month. Root cutting are planted during spring season closely in nursery beds containing well matured FYM, sand and saw-dust. The beds are kept moist through watering. The cuttings begin to sprout within 3 weeks. These can be planted in field during rainy season after 8 to 10 cm rains are received; the seedlings are transplanted at 45 cm row to row and 30 cm plant to plant distance. In this manner, an estimated

100 kg of root cuttings are found sufficient for planting one hectare area.

**Propagation by root stumps:** This method met with about 90-95 per cent success or sometime even 100 per cent. About 5 cm of roots, intact with a portion of stem above the collar, are directly transplanted in the field having irrigation facilities.

**Stem cuttings:** Cuttings taken from woody twigs have also been tried for propagation. Hard wood cuttings have been found better than softwood cuttings; cuttings, 15.0-23.0 cm long having three internodes are most suitable. Hard wooded stem cutting measuring 15 to 22 cm are closely planted during June in the nursery beds where continuous moisture is maintained. After sprouting and giving out roots, these plants are transplanted in the main field at given spacing.

#### **Raising of seedlings and planting:**

In Maharashtra and Madhya Pradesh, April end, in West Bengal first week of May or little later and in Jammu and Dehradun during third week of May are found to be most suitable time for sowing seed in the nursery. The nursery is prepared by raised beds of 10 x 10 m. dimension under partial shade made up of one-third of well matured FYM and leaf mould and two-thirds amount medium of silt-loam soil. About 500 sq m. seed bed area is sufficient for raising seedlings enough for planting one hectare land. The seeds sown, 2-3 cm apart in rows in shallow furrows during April end. The furrows are then covered with a fine mixture of soil and FYM. Keep the beds just moist by light watering. Germination starts after 15-20 days and continues upto 30 to 40 days. Seedlings are ready by mid-July for transplanting. The seedlings are transplanted at 30 cm distance within the rows spaced at 45 cm. If rains are not received during or immediately after transplantation irrigation is necessary for better stand. Rauvolfia is long duration (18 months) and slow growing crop particularly in the initial stage; thus different intercrops have been tried.

**Manure and fertilizers:** Farmyard manure or compost at the rate of 30-37 cartloads per hectare is applied. 30 kg N in 3 divided dose and 60 kg P<sub>2</sub>O<sub>5</sub> and 30 kg K<sub>2</sub>O per hectare applied during transplantation.

**Irrigation:** Rauvolfia, if grown in areas which receive rainfall of 150 cm or above well distributed throughout the growing season such as in Assam and Kerala, can be raised and rainfed crop under subtropical conditions. During rainy season no need to irrigate the plantation, in summer and winter monthly once irrigation is required. It needs regular irrigation where temperature rise high combined

with low rain fall during rainy season. It is suggested that 15 to 16 irrigations, amounts to irrigation at 20 days interval in summer and at 30 days interval in winter.

**Weeding:** The Rauvolfia field should be kept relatively weed-free in the initial period of growth. This means giving two to three weedings and two hoeings in the first year where sole Rauvolfia crop is taken or 5-6 weeding where intercrops in Rauvolfia are practised. Weeding and hoeing is done once before monsoon starts, second in the month of December and twice in rainy season.

#### **Insect –pests and their management:**

– *Root Knot Nematode (Meloidogyne incognita and M. Hapla)*: Root knots appear as galls caused by nematode. It stunted growth. Etiolation and decrease in the leaf size are the symptoms in the aerial portion. It can be controlled by application of 25 kg of 3 G Carbofuran or 20 kg of 10 G Phorate granules /ha will control them.

– *Pyralid caterpillar (Glyphodes vertumnalis)*: It causes appreciable damage to the leaves. It rolls the leaf and feed on the green matter of tender leaves causing defoliation. They can be controlled by spraying 0.2 per cent Rogor.

– *Cockchafer grubs (Anomala polita)*: It attacks the seedlings about 2 cm below the hypocotyls, resulting in their drying up. To control the attack of grubs, mix phorate granules with the soil at the time of nursery preparation.

#### **Diseases and their management:**

– *Leaf spot*: It appears as Dark-brown colored spots on the upper surface of the leaf and yellowish – brown on the lower surface. The affected leaves turn yellow, become dry and subsequently fall off. To control this disease, Dithane M-45 @ 0.2% is to be sprayed before the monsoon and repeated at monthly intervals until November.

– *Alternaria tenuis*: It attacks the leaves, resulting in minute, brownish or dark coloured circular spots with a yellowish margin on the ventral side of the leaves. It can be controlled by spraying with 30 g Blitox in 10 litre water.

– *Harvesting and yield*: Roots of exploitable size are generally collected 2-3 years after planting. When plants have shed their leaves, are for richer in the total alkaloid content. Roots dug up, freed from the adhering soil and during the process care should be taken not to damage the bark of the root. Such collected roots are thoroughly air dried and packed usually in gunny bags. Though the *R. serpentina* can be propagated by various methods, optimum yield of roots (including thick, thin and fibrous) is obtained when propagation done by seeds. The yield of fresh root per plant varies from 0.1kg to 4.0kg (air dry

basis). Plants raised from seeds work out about 1175 kg per hectare as compared with 175 kg in case plants raised from stem cutting and 345kg obtained from root cuttings. Two year old plantation yield 2,200 kg of air dried roots per hectare and 3,300 kg from a 3- year old plantation.

– *Cost of cultivation*: Approximate cost of cultivation comes around Rs.62,000/- per hectare.

#### **Post-harvest handling:**

– *Cleaning*: Uprooted roots are cleaned from mud and sand. They are beaten with a club to remove the adhering soil. The main taproot may be cut into transverse pieces. Roots are cut into 12-15 cm pieces for drying.

– *Drying*: Cleaned roots are then lay down for drying.

– *Packing*: Airtight bags are ideal for it. Sarpagandha must be packed in poly or nylon bags to prevent the entry of moisture.

– *Storage*: The dried roots are stored in polythene lined gunny bags in cool dry place to protect them from mould. Roots should be stored in dry places. Go downs are ideal for the storage. Cold storage is not good for it.

– *Transportation*: In general farmers use bullock carts or tractors for sending the produce to nearby market. From market yards, the produce is transported to distance in ordinary trucks and Lorries. Perfect packing, care in loading and unloading and quick transport results in less spoilage of crops.

#### **Economics of cultivation per hectare land:**

- Duration: 18 months
- Sale of roots 3,000 kg @ Rs.140/kg = 4, 20,000
- Sale of seeds 30 kg @ Rs.400/kg = 12,000
- Gross returns = Rs. 4, 32,000
- Expenses = 1, 80,000
- Net returns = Rs. 2, 52,000

**Major chemical constituents:** The major alkaloids present in roots and root bark are reserpine, serpoterpene, ajmaline, ajmalicine, serpentine, serpentinine, serpaajmaline, yohimbine, rescinnamine, deserpidine, coryanthine, reserpiline, alstonine, arginine, lycine, serine, aspartic acid, glutamic acid, thereonin, alanine, praline, valine, tyrosine, phenylalanine, iso-leucine, cystine, histadine, asparagines, glutamines, glycine, tryptophane and phytosterol, oleic acid, chandrine, papavarine, corynanthine, raunatine, rauvolfinine, sarpagine.

**Mode of action:** The latex-rich plant leaves have a large number of alkaloids, of which the most important is reserpine, which is to be found upto 3 per cent and rescinnamine. Reserpine affects the activity of several chemical messengers in the central nervous system (neurotransmitters). In particular, it weakens the effect

of noradrenaline and reduces in this way the activating effect of the sympathetic nervous system, which is part of the unconscious nervous system. As a result, blood vessels relax and the heart beats slower. Reserpine has a hypotensive and sedative effects also. Sarpagandha is also used in homeopathy to reduce the hardening of the arteries to treat hypertension.

**Medicinal properties and uses:** Rauwolfia roots are of immense medicinal value and have steady demand in both domestic and international markets. In action, the root is bitter, acrid, laxative, diuretic, antidote to snake venom, expectorant and febrifuge. In folk and tribal medicine, the root of this plant is used during delivery to stimulate uterine contractions and promote the expulsion of the foetus. Crying babies are put to sleep by working mothers by making them to suck the breasts, which are smeared with the root-paste. It is also a valuable remedy in treatment of painful affections of the bowels. Roots are used for treating various Central Nervous System disorders. The root of this plant contains several alkaloids; the major and most potent alkaloid is 'reserpine', which is very much useful in insomnia and reducing blood pressure.

The root extracts are used for treating intestinal disorders, particularly diarrhoea and dysentery and also used as anthelmintic. It is used for the treatment of cholera, colic and fever. The juice is used as a remedy for opacity of the cornea. The total root extracts exhibits a variety of effects viz., sedation, hypertension, brodyardia, myosis, ptosis and tremors which are typical of reserpine.

– In Ayurveda, the plant root is astringent, anti-poisonous, and used in fever, worm infestation, wound and mental disorders. Root is also anthelmintic and used to cure ulcers and snake bites and scorpion sting madness.

– Root bark is chiefly sedative and hypnotic and used in reducing blood pressure. Root is considered as hypnotic, sedative, antihypertensive, specific for insanity, and its root decoction is employed in ulcers and madness and used as anthelmintic and antidote to snakebite. Roots constitute the drug Rauwolfia which has been employed for centuries for relief from nervous disorder including anxiety states, excitement, maniacal behavior associated with psychosis, schizophrenia, insanity, insomnia and epilepsy. Extracts of the roots are valued for intestinal troubles; aqueous decoction of root is given to cattle in diarrhoea.

– Leaf juice is used for removal of opacities of the cornea of the eyes, and consumptions of fresh small pieces lower the blood pressures and facilitate baby birth and mental disorders, ulcers, snake bites and scorpion sting.

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