

Cultivation Protocol For

Arnebia euchroma



Family: Boraginaceae

Local/common names:
Ratanjot, Laljari, Masreen

Status: Critically Endangered (IUCN)

Distribution and habitat: Ratanjot occurs principally in the alpine and sub alpine zones of Kashmir, Kumaon, Garhwal and Nepal on open slopes and shrubberies in the altitudinal range of 3000-4300 m. Some of the common localities are Har-ki-Doon, Himtoli, Kedarnath, Mana, Valley of Flowers, Gorson, Dronagiri, Malari (Uttarakhand), GHNP, Pin Valley, Chamba, Lahaul and Spiti, Rohtang, Kinnaur Valley (Himachal Pradesh) and Kurrum Valley, Deosai, Makra, Kagan Valley, Bedori, Aliabad, Pir Panjal (Kashmir). In the sub alpine zone, Ratanjot occurs mostly in shaded areas amidst Betula, Rhododendron, oak and pine trees. In the alpine zone the species occurs in open sunny locations.

Environment for growth: The species prefers sandy, rocky and moist grassy slopes in the wild but cultivation can be practiced on gentle slopes found in high altitude areas. At lower altitudes, propagules can be raised on gentle slopes or even flat land with proper drainage so that the developing rootstock does not decay due to stagnant water. The plant prefers light (sandy) soils, requires well-drained soil and can grow in nutritionally poor soil. It prefers acidic, neutral and basic (alkaline) soils. It cannot grow in complete shade.

Parts used: Shoots and roots.

Market rate: The current market rate varies from Rs. 110-150/- per kg although this is dependant on the seasonal demand and quality of the raw material.

Agro technology:

- **Means of propagation:** Propagation is carried out either through seeds or terminal buds.
- **Collection of seeds:** The best time for seed collection is the first week of October at the onset of the dry season when the flowers are in bloom. Immediately after collection, the seeds are sun dried (at least for 3 days) and stored at room temperature in brown paper bags. The dry seeds should not contain more than 5-7% of moisture. The seeds can be stored for a longer duration under refrigerated conditions (4°C).
- **Seed treatment and germination:** Seed treatment with GA₃ is effective for dormancy breaking and to stimulate and synchronize uniform germination. The first week of March-May is the best time for sowing although the time may vary according to the altitude and other environmental conditions like temperature, humidity, soil condition and availability of daylight. Pre-winter sowing is also reported to be very successful as the seeds are naturally exposed to cold stratification or chilling condition during four months of continuous cold. Germination usually takes place within 2 - 8 weeks at 20°C. Prechilled (14 days) seeds sown in the nursery bed with (1:1) sand/soil ratio perform better. Sowing should be done superficially and placing seeds deep inside the soil should be avoided. Watering-twice a week after sowing till germination and at the initial stages of growth must be maintained because lack of optimum moisture may damage the crop growth. As much as 87% of the germination has been reported in the field.

- **Land preparation and soil work:** In the first step stones and pebbles are removed from the land followed by uprooting of weeds and bushy plants. Thereafter, ploughing is done 3-4 times depending on the condition of the soil. For increasing soil fertility, FYM, cow dung, forest litter or humus is to be added and mixed completely with soil. Compost or vermicompost can be added for fertility alleviation. In one-half of land, 20-25 quintals of organic manure should be mixed to increase productivity.
- **Nursery preparation:** Usually nursery soil is prepared with compost, FYM or forest litter to prepare a healthy soil mixture, which is light in weight, well decomposed, well drained and free from insects as well as weeds. Decomposing organic material generally increases the nutrient content in the potting mixture and enhances the air spaces as well as water holding capacity of the soil. Generally beds are prepared after proper ploughing of the soil so that the topsoil becomes powdery and free of stones. The beds are watered frequently and seeds are sown at not more than half-inch depth. Mulching is preferred to reduce the moisture loss that helps germination enhancement.
- **Transplantation:** After attaining three-leaf stage, the seedlings are transplanted to the field. A spacing of 30 x 30 cm between the rows and between the plants is maintained. Maximum survival rate after field transplantation has so far been reported as 67%. During transplantation, care must be taken that the beds or the field is in moist condition and the seedlings should be pulled out of the beds only after loosening the soil to avoid root damage. The transplanted seedlings are kept under proper shade until they recover completely from transplantation shock.
- **Vegetative propagation:** Mature individuals at the (reproductive) stage are best suited for multiplication because they have the maximum number of terminal buds (3-5) as compared to vegetative phase (1-3 buds). Individuals are harvested after seed set formation. The terminal growing point (5 cm long) is used for vegetative propagation. For best rooting performance, chilling pretreatment can be provided for 40 days.
- **Water management:** Irrigation is generally conducted twice in a month during the dry season and infrequently in the rainy season.
- **Maturity and harvesting:** The species flowers in the fourth year. As age advances, the root diameter increases and scars on the roots deepen to form grooves. After flowering, the roots start decomposing from the core and disintegrate into 3-5 ramets, which again follow the same cycle. Individual flowers can be harvested sustainably after the seeds are set. Harvesting at this stage ensures availability of maximum above ground and below ground biomass, the presence of maximum buds in terminal growing points (which can be utilized for further propagation) and optimum content of active constituents at this stage.
- **Post harvest technique:** Immediately after collection, the seeds must be sun dried for 3 days and stored at room temperature in brown paper bags. The seeds can be stored for a longer duration under refrigerated condition (4°C). The roots are dried properly under the sun and stored in a cool and dry place. The healthy roots are always given preference in case of grading. The upper and middle

portions of the roots are graded as better while the bottom end is not considered good.