Cultivation Protocol For

Angelica glauca

Family: Apaiceae, Umbelliferae

Local/common names: Choru, Chora, Gandrayan

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Status: Threatened in western Himalayas (Handa, 1996) and critically endangered (Molur and Walker, 1998)

Distribution and habitat: *Angelica glauca* is naturally distributed in the entire Hindukush Himalayas including Afghanistan, Pakistan and northwest to central Himalayas at an altitude range of 1,800-3,700 m. The plant generally prefers moist grassy gentle slope with humus rich soil and is found in sub-alpine to alpine forests where the dominant species are *Rhododendrons* and species-representatives of *Picea, Quercus, Abies* and *Acer*.

Environment for growth: The species prefers humus rich deep soil with good drainage and moderate water holding capacity. It thrives well in slightly acidic to near neutral soil conditions. The plant grows luxuriously in open sunny slopes or in partial shade and moist well-drained soil with enough organic matter. The plant prefers coarse porous sandy-loam soil. It cannot toerate water logging. The farming prospect of *Angelica glauca* in the high altitudes of the temperate to sub-alpine Himalayas between 2,000-3,200 m is quite bright provided the land has gentle slope and well drained humus rich soil. A temperature range of 20-25° C during summer and -5 to -10°C during winter is conducive for the growth of the plant.

Parts used: Roots, stem, leaves and fruits

Market rate: The market rate of the dried roots is not stable; it varies from Rs.300/- to Rs.400/- per kg.

Agro-technology

- **Means of propagation:** The seeds are better for propagation than root cuttings although vegetative propagation of this plant through cuttings of roots and rhizomes is quite common.

- **Collection of seeds**: The seeds are harvested from late September to mid-October. The seeds of the primary umbel mature early. On harvesting, the seeds should be properly dried in the sun. Solar driers may be used for this purpose. The dried seeds are stored in airtight polythene bags or plastic jars and stored relatively cool places.

- **Seed treatment and germination**: The seeds should be sown immediately after collection because their viability may be affected during storage. Generally seeds are soaked for 24 hours in water before sowing. A treatment of sodium hypochlorite for 30 minutes significantly stimulates seed germination and reduces mean germination time under nursery conditions. Treatment with auxins improves the percentage of germination. Treatment with nitrogenous compounds is recommended for the improvement of germination percentage and reduction of germination time especially for the high altitude provenances (3,000 m and above).

- **Land preparation and soil work:** Land preparation should be done at least 15 days before seed sowing and well-decomposed FYM should be applied although it is not always recommended at higher elevations. The land is ploughed into a fine tilth after the crop stubble, boulders, deep-rooted sedges or weeds are removed. The clods or hardened masses of soil must be broken because they

impede germination. Soil compaction resulting from snowfall must be removed by digging up of the soil. The ploughed soil must be mixed with well rotten farmyard manure at the rate of 3,500 kg/ha or an equivalent of 280-300 kg/*bigha*. A sufficient gradient is provided to the land by ploughing and leveling of the soil for facilitating drainage. Sheep and goat manure has been found to be the best for cultivation. About 15 qt of manure is required for one acre of land initially (especially at lower altitudes). The application of fertilizers is generally done during land preparation and before cultivation starts. Manure is also applied after the completion of the vegetative growth phase during October before snowfall. At higher elevations, forest litter is a better option for application with 20 qt forest litter being sufficient in one bigha of land. The advantage of forest litter is that it enhances the growth of the plants as well as their survival and yield. In addition, it provides the plants with protection from diseases. Inorganic fertilizers should be avoided to reduce heavy metal contamination as well as restore the active principle.

- **Nursery preparation:** The seeds are ideally sown immediately after harvesting during November-December. Seed viability is very low and immature seeds have better potential than the mature seeds. The seeds germinate after 25-40 days if sown after 24 hours soaking in water. In one bigha of land 500-550 g of seeds are sown. The seeds are preferably sown in the raised beds. Usually the seeds are sown at 0.5-0.7 cm depth. It is always better to sow them in late October or November before snowfall. In lower altitudes (2,000-2,500 m) the seeds are sown during March-April just after the snow melts.

- **Transplantation:** It is advised to carry out transplantation at the beginning of the rainy season. If irrigation facilities are available and the surroundings are moist, the plants can be transplanted, especially at 2,000-2,500 m elevation. In case of high altitudes like 3000 m and above, the climate is usually dry and transplantation should be done in June-July just after the onset of rain. Approximately 30,000-32,000 plants can be planted in one acre, which indicates that the optimum plant density should be 6,000-6,500 plants per bigha. It has been reported that the species can be successfully intercropped with *Saussurea costus*.

- **Vegetative propagation**: Vegetative propagation through root cuttings is quite successful. The apical portion of the roots is transplanted during the rainy season 45 cm apart. One of the benefits of root propagation is that the plants can be harvested after two years while seed propagated plants can be harvested after the third year. Application of auxin in low concentrations improves the percentage of rooting and number of adventitious root formation.

- **Water management:** Irrigation should be done twice a week during the dry season. The species prefers to grow in soil with water containing capacity. For optimal germination, the soil should be always moist and after germination also the soil should remain moist for 1-2 months. Optimal soil moisture helps the growth of the roots and rhizome in the soil. In case of propagation through rhizome cuttings, irrigation is required every day for at least 2-4 weeks. Thereafter, irrigation may be provided once in a week except during the monsoon.

- **Weed and pest control**: In the high altitude moist regions, weeds pose a grave problem. Regular weeding is very essential but has to be done carefully. When the plants are very small, hand weeding is advised. Later, when the plants attain full size weeding can be done with a cutter. For protection from different diseases, vermi-compost can be applied as manure.

- **Maturity and harvesting:** Under cultivation, harvesting is generally done within 2-3 years. Harvesting time is generally September-October depending on the time of flowering, which in turn depends on the altitude and edapho-climatic situation. In case of seed propagated crops, maturity comes after three years, while in root propagated ones, crops attain maturity within two years.

- **Post harvest techniques:** At high altitudes a yield of 3-3.5 quintals of dry roots can be expected from one acre of plantation.