

Picrorhiza Kurroa (Karu/Kutki)

Propagation Model

Introduction

Picrorhiza Kurroa is one of the oldest and well-known herb in Ayurvedic system of medicine. It is a perennial herb with creeping stolon that is a side branch with nodes that have roots on lower side in contact with the soil. Its flowers are light purple or pale white in colour and its fruits are a two-celled spherical capsules. The species is found in alpine Himalayas between 2700m and 5000m altitudes.

Medicinal Properties & Uses

Karu roots yield a glycosidal bitter principle, kutkin, found to be a mixture of two iridoid glycosides, picroside I and kutkoside. Stolons, the creeping branches on sides of the plants are known to be liver protective, tumor inhibitory and anti-inflammatory secondary metabolites. Karu or Kutki is useful for asthma, cold, and cough, and also administered in liver complaints, anaemia, and jaundice.



Fig.1 Picrorhiza kurroa

Favourable Growing Conditions

Climate & Soil

The plant grows well in cool and moist climate where a sandy loam soil is best suited for its cultivation. It mainly grows in rich organic carbon and porous humus texture with covering of litter to maintain the desired moisture level. A canopy shade helps to maintain the moisture requirements and also encourages maximum growth and thickness of stolon, and overall productivity in the natural habitats and ex-situ cultivation.

Water Requirement

High moisture during rainy season is required for better survival of seedlings and cuttings in field plantations. Watering is not required if planting is done during the rainy season in high moisture conditions. Decrease in moisture immediately after planting of rooted cuttings reduces the survival and results in high plant mortality. Therefore, in this situation irrigation will be required for a few days till the cuttings are established.

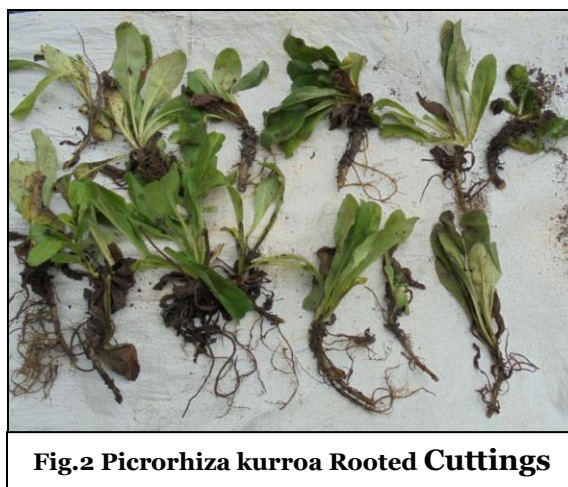
Growing Techniques & Processes

Propagation Material

Kutki or Karu is propagated through rooted cuttings (clonal Propagation) and also through seeds. To maintain quality, clonal propagation is preferred over seed multiplication. Propagation from seeds is complicated and is practiced only by researchers aiming for limited planting only. Seeds are quite delicate without the seed coat and it is very difficult to collect and visualize seeds in the capsule. The capsules are crushed gently in the bags to remove outer covering, and the outer broken capsule shells are taken out. Post that spongy, minute and irregular sized seeds are left behind in the bags. However, seeds are found to have limited viability.

Stolon Rooting

Successful propagation and cultivation with rooting of stolon cutting is most successful and suitable for good production in a short time period. Vegetative multiplication with commonly available rooting hormone (Rootex-1) or without hormone through normal dip in water for 24-48 hours during rainy season is quite successful. Remove cuttings with growing leaves and plant in nursery beds or polybags for further development during the rainy season, and at the time of harvesting of stolon for rooting,



plant the same in soil beds in a nursery and polyhouse. For community plantation in SHGs, rooted cuttings needs to be arranged in the rainy season.

Land Preparation & Sowing

Land preparation is started 3-4 weeks prior to the plantation. The planting fields, which are at high altitude above 2700m, are selected 3 to 4 weeks prior to plantation and also in accordance with the availability of seedling or rooted cuttings for the plantation. A layer of about 500 Kg/bigha (12.5 bigha = 1 hectare) vermicompost prepared from Farm Yard Manure (FYM) is spread in the field to increase the organic carbon and porosity level of the soil. Raised beds of 150 cm width are made with deep passages on both sides for drainage of excess water, ease of weeding, and compost addition at later stages. If possible, field with sloping surface should be selected to avoid water logging and ensure better growth of plants.

Around 70,000 rooted cuttings are required for plantation in 1 bigha at a distance of 4"x4". Land needs to be prepared in the month of June, and plantation should start post rains in July. It is not possible to provide bulk planting material to large number of farmers owing to the high cost of root cuttings (Rs.5-10 per cutting). Therefore, about

10,000 cuttings can be provided to each farmer, and after 2 years each cutting will further give on average 5 cuttings each, that can be used for expansion of the plantation. The gestation period of Karu species is long and farmers can harvest after 3 years. Additionally, Karu is a perennial herb that requires only the maintenance of the mother plant, which gives cutting (stolons) to be either sold and/or utilized as planting material.

Planting Density

Rooted cuttings are planted 4” apart (Fig. 3) for better plant development and harvestable stolon. As mentioned earlier, Karu is a perennial herb and produces stolon on all its sides for harvesting. A planting distance of 30 cm facilitates spread of stolons on all sides of the plant, and weeding and hoeing at different stages of growth. Optimal success is achieved on a leveled and sloping field at more than 2700 m and higher altitudes. Plant will grow and survive at lower elevation and flat fields also but either harvestable stolon will not be formed or it will fail to acquire desired thickness and medicinal contents.



Fig.3 Plantation of Picrorhiza kurroa

Nutrient Requirement

Fertility requirement depend on the type of soil of the selected site. Normally, soil with high organic matter with addition of vermicompost is ideal for growing. As the plant is perennial and development of stolon requires high nitrogen, therefore regular addition of vermicompost or decomposed broadleaved tree litter with humus is needed at different intervals. Approximately 400-500 Kg vermicompost per bigha is required to be added for a good harvest. Vermicompost is to be added before the plantation or during the winter months. In winters, either manure is added directly to the soil by thoroughly mixing it or in 4-6 inch deep trenches around the plant. Broadcasting of compost on the plantation should be avoided as it will damage the leaves and the plants alike. Farm yard manure or semi digested animal excreta applications will develop insect pest problem and should be avoided. In case of non-availability of vermicompost litter of broad leaves like oaks can be used as substitute for increasing the fertility.

Weed Control

Weeding is done monthly in early stages when plants are small and can be done as per requirement in later stages. This may vary from site to site and can be planned as per the site conditions.

Crop Maturity & Harvesting

Karu mature at different stages at different altitudes. Completion of reproductive phase of plant marks the maturation of the plant. This completes with fruit setting and seed formation in September at lower altitude and in October at alpine zone. Harvesting of stolon which is achieved normally in the third year after the plantation, is done with a knife or pruning scissors. Mother plant is kept intact for the regular growing cycle and the harvested stolon with roots is removed from the mother plant. Apical part of the harvested stolon with 2-3 roots is removed from the remaining stolon and planted or buried in the soil to provide new plant for planting in the coming rainy season (Fig. 4). Harvesting of every stolon will provide twin benefit of the raw drug and a new plant for the next year planting.



Fig. 4 Sustainable Harvesting *P. kurroa*

Post-Harvest Management

- ✓ Harvesting of *P. kurroa* normally from nature is done by uprooting of plants with stolons, leaves and roots. There is a myth that roots of *P. kurroa* are saleable drug and uprooting damages the population of this plant in nature. Roots of the plant are in fact fibrous and only side branches technically called stolons (a type of stem) are the drug parts.
- ✓ Collection of uprooted plants with leaves and stolons in humid climate is done in plastic bags which spoil the material fast and heat in the bags starts degradation of material immediately after harvesting. Therefore, harvesting of only side branches with removal of apical portion with leaves for enrichment of plantation is practiced (Fig. 5).
- ✓ Stolon without root and leaves should be stored in gunny bags or bamboo basket with proper aeration. Collected stolons which are free of leaves and roots should be washed to remove adhering soil and then spread on the pucca floor or on tarpaulin or cloth sheet for drying in defused sun light.



Fig.5 *Picrorhiza kurroa* Harvested

- ✓ Slow drying maintains the quality of the drug and colour of the stolon, which is necessary for good market returns. Dried stolon are stored in cloth bags in a room free from moisture till these are sold.

Expected Yield

No.	Details	Quantity / Value
Income		
1	Yield per bigha* (12.5 bigha = 1 hectare)	100-120 kg
2	Rate per Quintal	Rs. 1.00 -1.50 lakh
3	Estimated Income/bigha in 4th Year	Rs. 1.00- 1.20 lakh
Expenditure		
1	Cost of 10,000 mother cuttings to start cultivation on 1.00 bigha (will provide around 50,000-60,000 plants in 3 rd Year for establishing 1 bigha plantation)	Rs. 40,000
2	Other expenditures (lump sum estimate per bigha)	Rs. 10,000
3	Total Estimated expenditure/bigha	Rs. 50,000
Estimated Margin/Income per bigha		Rs.50,000-Rs.60,000

Market Trend

The average market price of dried Karu is around Rs.1-1.5 lakh per quintal. Interested farmers and Self Help Group (SHG) members should be encouraged to establish prior connections with buyers for the sale of their produce. Entering into contracts with these buyers prior to the actual harvest ensures a more stable and profitable market engagement.

Sustainability

Long term and continued functioning of Karu propagation model is dependent on its proven success in harvest and economic returns. Following are the key sequential steps, which when adopted can help in achieving the envisioned long term success of the propagation model.

Step 1: Identification of Area for Cultivation by Selected SHGs - The first crucial step involves identification of suitable areas with the potential for cultivation of Karu. This necessitates a detailed examination of the terrain and soil conditions in collaboration with the selected SHGs.

Step 2: Training & Capacity Building - The success of propagation relies heavily on the knowledge and skills of the stakeholders involved. As such, comprehensive training and capacity-building programs are essential for both the SHGs and the project staff. This step ensures a clear understanding of the agro-technology and cultivation practices.

Step 3: Timely Arrangement of Planting Material - To kick start the cultivation process, it is imperative to ensure timely availability of high-quality planting material. This includes seeds, seedlings, rooted cuttings, and any other essential resources required for a successful initiation of the cultivation cycle.

Step 4: Demonstration Plantation - Practical, on-field demonstrations are pivotal in showcasing the correct application of agro-technology. These demonstrations serve as a valuable learning experience for farmers, and aid in disseminating knowledge on best practices for Karu cultivation.

Step 5: Follow-up Steps for Good Harvest - A systematic approach is essential to ensure a successful harvest. Follow-up steps, including monitoring plant health, addressing challenges, and providing necessary interventions, are critical to achieve optimal growth conditions.

Step 6: Proper Harvesting - Harvesting is a critical phase in the cultivation process. Knowledge of the ideal harvesting time, methods, and the preservation of the plant's medicinal properties are key aspects that should be addressed during this stage.

Step 7: Semi-Processing & Marketing - Once harvested, semi-processing and effective marketing strategies come into play. This involves preparing the medicinal herbs for market consumption while adhering to the quality standards and regulations.

Step 8: Registration of Growers - Himachal Pradesh Forest Department Transit Rules 2013, provide provisions for the private land Medicinal Plants Growers for their registration with the concerned Division Forest Officer (DFO). This needs to be expedited to facilitate the transit of harvested produce for marketing.