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Organic Cultivation Methods for Maximizing Berberine Content and Quality of Giloy (*Tinospora cordifolia*)

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Abstract

Tinospora cordifolia (Giloy) is an important medicinal climber commonly used in the Indian Ayurvedic system for its extensive beneficial potential, with antipyretic, antidiabetic, anti-inflammatory, hepatoprotective, antioxidant, and immunomodulatory properties. The plant is widely prevalent across tropical and subtropical regions of India and Southeast Asia. It is traditionally harvested from forests, although systematic cultivation practices has been slowly increasing after the COVID-19 pandemic. Giloy grows well in well-drained sandy loam soils and is generally propagated through stem cuttings, with 80–90% sprouting success when pre-soaked and treated with IBA/IAA. Organic nutrient sources such as farm yard manure, vermicompost and neem cake improve soil health, vegetative, and phytochemicals particularly berberine content. Intercropping with neem, mango has been reported to enhance medicinal quality. Appropriate spacing, suitable irrigation, mulching, and weed and nutrient management are the important agronomic practices that favour yield and quality of the crop. Harvesting starts when stems reach >2.5 cm diameter, yielding about 1500 kg fresh biomass per hectare. Overall, improved organic and agronomic practices can effectively enhance sustainable production and medicinal quality of *T. cordifolia*.

1. Introduction

Giloy, scientifically known as *Tinospora cordifolia*, is a climbing shrub belonging to the family Menispermaceae and is native to the tropical regions of the Indian subcontinent. Generally known to as *Guduchi* or *Amrita*, Giloy has been valued in traditional Ayurvedic medicine for centuries due to its numerous therapeutic properties (Devi, 2021). Giloy is known for its active compounds, including alkaloids, glycosides, and polysaccharides, which pay to its pharmacological properties, such as immunomodulatory, anti-inflammatory, and antioxidant belongings (Poonia et al., 2023). Giloy played potential role in managing COVID pandemic. Studies found that active phytocompounds present in Giloy are skilled of impeding viral proteins associated with SARS-CoV-2 (Balkrishna et al., 2021).

India is the main hub for Giloy cultivation. The plant has been

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found in a variety of regions from the Himalayas to the Western Ghats. The states of Uttarakhand, Himachal Pradesh, Madhya Pradesh, West Bengal and Maharashtra are largely well-known for Giloy due to favorable climate (Qi et al., 2022). In these regions, Giloy is often cultivated in mixed cropping systems with neem and mango plants.

2. Field Preparation under Research Condition

Giloy grows well in well-drained, loamy soils rich in organic matter. Proper soil preparation includes tilling the soil to a depth of 15-20 cm, clearance of any preceding crop residues, and confirming the pH ranges between 6.0 and 7.5 for optimum growth (Panda and Giri 2020).

2.1. Planting time and plant geometry

Planting is done in rainy season June-October. Plant geometry depends on the plantation crops grown in the field. So spacing is variable for the new field. Giloy can be grown along with nearby neem or mango saplings planted as per the recommended spacing. However, a spacing of 1.5×1.5 m^2 is sufficient for fresh sole planting of cuttings.

2.2. Propagation

The common method of propagation is 20 cm stem cutting of 1.6 cm in diameter, chosen form disease-free mother plant cuttings. IBA/IAA hormone 3% helps to increase bud sprouting in stem cutting (Gupta et al., 2021).

2.3. Irrigation

Generally, irrigation is not required. However, in case of new planting one irrigation after planting is needed to establish the cutting. There is no need of irrigation as rainy weather's sufficient for sprouting and growing.

2.4. Growth habit

• Stems: Giloy has long, slender, stems that can grow as long as 20 meters. These stems have the ability to encircle together objects to provide support. (kushwah et al., 2023).

• Aerial Roots: As it climbs, Giloy can cling to everything through its aerial roots. These roots give the plant the ability to firmly grip walls, or trees.

• Heart-shaped Leaves: The leaves of the Giloy plant different along the stems and are classically heart-shaped or cordate. They normally measure 5 to 12 cm in length, are smooth, and have evident veins (Jabiullah et al., 2018).

• Flowering Time: Flowering arises in May–June. while fruiting is witnessed in September-October. Interesting all plants do not bear flowers.

• Fruits: Giloy plants have small, drupe-like berry fruits that become red when ripen. Birds frequently eat these fruits, which aids in seed dissemination (Jabiullah et al., 2018).

• Seed: This species is under Moonseed family which bear curved shaped seeds, embryos are equally curved in shape. Additionally, the endocarp is decorated in diverse ways, which gives crucial taxonomic characteristics (Gupta et al., 2021).

e. Intercropping: Giloy as a climber found growing with neem, mango and other trees. However, has no it has no effect on neem, mango and other plants (Jayswal et al., 2022). If stem cuttings with aerial roots are thrown on trees, they begin to grow and also strike roots in the ground.

f. Nutrient Management: It is mostly grown in forest area, so negligible research work has been reported on its agronomic management. However, our field investigation revealed that farm yard manure @ 10 t ha^{-1}, vermicompost @ 5 t ha^{-1} is sufficient for higher yield. In general, 75:50:50 NPK kg ha^{-1} is good enough to meet the crop demand. Panchgavya @ 3% Spray at 60 days after planting and seaweed @ 3% Spray at 60 DAP are helpful for the good growths.

g. Weed management: Two hand weedings during initial period of about 50 days are sufficient to check weeds.

h. Harvesting: When the stem develops to a diameter of >2.5 cm, it can be harvested. The stem needs to be separated into little pieces and dried in the shade. It can be kept in cool, place and kept in gunny bags.

i. Yield: The plant produces roughly 1500 kg of fresh woody stem, which in about two years. (Gupta et al., 2021).

3. Chemical Content

One of the most important and well-studied alkaloids in Giloy is berberine. Tinosporine is also active constituent of Giloy, contributing to its large-scale use in traditional medicine systems (Sharma and Pandey, 2010). Tinosporic acid also present in giloy.

4. Conclusion

Tinospora cordifolia (Giloy) is a extremely valued medicinal climber commonly used in traditional healing schemes for its diverse beneficial properties. The plant

grows dynamically under tropical Indian situations and can be successfully propagated through stem cuttings with nominal input requirements. Technical cultivation practices with proper spacing, trellising, organic nutrient management, irrigation arrangement, weed management suggestively increased plant growth, biomass yield, and phytochemical content, mainly berberine.

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