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Review on production techniques of GI Crop, Udupi Mallige (*Jasminum sambac* (L.) Aiton)

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Abstract
Jasmine, *Jasminum sambac* (L.) Aiton cv. Udupi Mallige belonging to family Oleaceae, is a fragrant commercial flower crop of coastal Karnataka. Udupi Mallige is being cultivated in homestead gardens and is concentrated in the surrounding villages of Shanakarpura, in Udupi district. The crop has been tagged under Geographical Indication (GI) due to its unique fragrance and quality flowers from Udupi region. Udupi Mallige is extensively used in religious functions and perfumery industry as it is having mild fragrance, which gives a feeling of optimism, euphoria and confidence. Its fragrance is also known to cure depression, nervous exhaustion and stress. Udupi Mallige which has been recognised internationally for its fragrance has got potential demand for export market, especially to Gulf countries. The crop flowers thought the year and the peak flowering is observed during March-April (on season). There is a demand for Udupi Mallige flowers during October to February (off season), as most of the religious functions and marriage ceremonies tend to occur during off season. At present there are about 20,000 farmers cultivating this crop in small and marginal land holdings (0.02 to 0.2 acres). The retrospect of trend in area and production statistics of Udupi district from 2008-09 to 2016-17 reveals marginal decline in crop area. But this crop has been extended to neighbouring districts of the state. Studies on Udupi Mallige with respect to production of quality planting material, techniques for enhancing flower production during off season and increasing the keeping quality of the flowers is very limited. The review on the production techniques on Udupi Mallige gives good scope for exploring in the area of research and development in the future.

Keywords: Udupi Mallige, Geogrphical Indication (GI)

Introduction
Jasmine (in Kannada mallige) is an important traditional flower crop of our country. Although more than 2,000 species are known, 40 species have been identified in India and 20 species are cultivated in South India (Bhattacharjee, 1980) [6]. Also, in Karnataka a number of species have been covered all over the state, out of which Udupi Mallige is most commonly cultivated in Udupi district. The other important cultivars are Mysore Mallige (*Jasminum grandiflorum*) and Hadagali Mallige (*Jasminum auriculatum*). Recently, Mysore Mallige, Udupi Mallige and Hadagali Mallige have been registered under the Intellectual Property Rights (Anon., 2008) [1]. Geographical Indication status has provided executive rights to the local community to cultivate these three species and continue to grow for many more years. At present, Department of Horticulture, Government of Karnataka is encouraging farmers to promote cultivation of these cultivars through conducting workshops, financial assistance, formation of Farmer's Producers Orgnisation (FPO's) and market support.
Udupi Mallige cultivation is very particular to southern parts of Udupi such as Shankarapura, Shirva, Belman, Kaup, Katapadi and surrounding areas. Udupi mallige is usually grown by small farmers. The average size of the land holdings is about 0.02 to 0.2 acres. Many of the farmers of this region depend directly on cultivation of Udupi Mallige for their livelihood (Krishnamurthy *et al.*, 1995) [9]. At present there are about 20,000 farmers in the Udupi district who are involved in the cultivation of Udupi mallige (Anon., 2013) [3]. The total area under this crop during 2008-09 in the Udupi district was about 325 ha with the production of 2389 metric tonnes (Anon., 2009) [2]. Whereas during 2016-17, total cultivated area of 214 ha was recorded with an annual production of 1391 metric tonnes of flowers (Anon., 2017) [4]. Growth trend of this crop is declining in area and production in Udupi district due to many reasons.

But, crop has extended to neighbouring districts of the state such as Dakshina Kannada, Uttar Kannada and Shivamogga due to the popularity of crop which has been gained from national and international market (Shivakumar *et al.,* 2016) [10].

Udupi Mallige is grown for its fragrant flowers. The flower buds are harvested every day morning before 6.30 am. The female members of the family from this region are engaged in tying of flowers to make garlands, which in local language called as 'Chendu'. One single Chendu consists of 800 flowers. Four Chendu heaped one above the other to form an 'Atte' (Dhanaraj, 1997 and Anon., 2013) [7, 3].

Udupi Mallige garland is commonly used by ladies for decorating their hair, worshipping God and other auspicious occasions as it has the aesthetic value. The shelf life of Udupi Mallige extends up to 10 hours (under normal conditions) from plucking (Shivakumar *et al.,* 2016) [10]. As the flowers are harvested in bud stage, it remains unopened and fresh for long period (10 to 12 hours) hence, the flowers can be transported to distant market.

GI tag: Udupi Mallige also known as Shankarapura Mallige is very unique in its fragrance, speciality in quality and popular in the region, for these reasons Udupi Mallige has been tagged under Geographical Indication (GI) on 23rd December 2013 and the GI allotted number is 267103 (Anon., 2013) [3]. This GI tag of the crop keeps with brand name for export market and hence fetches remunerative price for the farmers.

Morphology: Udupi Mallige plant is a bushy shrub with light green leaves and yellowish shade, 5-7x2.5-3.5 cm, nerves slightly raised beneath, acute at both ends, entire, ovate-lanceolate. Flowers in cymose inflorescence and borne in the axils and also terminal. Flower buds are about 2-2.93 cm long and diameter of opened flower is about 2.86 cm. Calyx 6, petals 6-8, bracteate (Dhanaraj, 1997 and Arumugam *et al*., 2002) [7, 5].

Climate: The crop has greater adaptability to the coastal climate. It can be grown in plain as well as undulated land. Sun light from North-East direction is appropriate for its growth. Sun light throughout the day results in good growth and yield. Udupi Mallige grows healthy and luxuriously in soils having rich organic matter content. The plant has optimum growth in sandy soil, red soil, laterite soil and red loamy soil. Soil with poor drainage is not suitable for cultivation of this crop. Prolonged water logging around the basin results in rotting of roots leading to wilting of the plant.

Propagation: Seed setting is a very rare phenomenon and could be observed under unusual weather conditions (Inderesh *et al*., 1994) [8]. Hence, propagation through seeds is not a regular practice. Semi hard wood or hard wood cuttings are used as propagating material. Stem cutting of 12 cm to 15 cm long, semi hard wood cuttings are ideal for propagation. Cuttings should be planted at 45^0 to give best rooting. The cuttings are treated with IBA 2000-2500 ppm for 30 seconds which enhances better rooting (Shivakumar *et al*., 2016) [10]. The rooted cuttings will be ready for field planting after 6 months from raising nursery. Local method of propagation practiced by farmers is by division of root slips from old clumps and directly planting them in the field (Krishnamurthy *et al.,* 1995) [9].

Micropropagation: Micropropagation studies has been carried out in other *Jasminum* sps. whereas very few reviews are available on *in vitro* propagation studies in Udupi Mallige. For the first time Dhanaraj, A.L., (1997) [7] conducted *in vitro* propagation studies on Udupi Mallige to standardize the type of explants, culture media, and the combination of growth regulators for callus initiation, multiplication and regeneration. Axillary buds from the nodal explants were first activated on Miller's medium with BA and kinetin. Callus induction was observed from all parts of the plants like shoot tips, nodes, internodes, midribs and leaf sections. Miller's medium with increased BA concentrations revealed the regeneration from callus.

Field planting: Spacing of 2.0 m × 2.0 m or 2.4 m × 2.4 m between the plants accommodates 644 to 1000 plants $acre^{-1}$. Pit size of 2 cubic feet is required. Pits are filled with mixture of compost (20 kg/pit), top soil and 250 grams neem cake to control soil borne pests. Planting during the month of August is recommended for coastal region of Karnataka (Krishnamurthy *et al*., 1995) [9].

Manure and Fertilizer: Well decomposed compost or FYM of about 20 kg/plant per year during the month of September - October should be applied. Fertilizer application should be given in two splits, during the month of May – June and September – October. During first year 90:570:130 g/plant N: P: K should be applied and the dosage should be increased in the second year to 175:1150:260 g/plant N: P: K.Third year onwards 270:1710:400 g/plant N: P: K should be applied (Shivkumar *et al.,* 2016).

Special cultural practices

Watering and weed management: Udupi Mallige plant flowers throughout the year (Indiresh *et al.,* 1994) [8]. Based on the soil condition and weather parameters the plants are irrigated daily or once in every 2 to 3 days. Form the month of December to May, each plant require 20 to 30 litres of water through drip irrigation. Hand weeding should be done twice a year. Light digging of soil around the basin helps in removal of weeds. Mulching with polythene cover or leaf litter controls weed growth and retains soil moisture (Shivkumar *et al.,* 2016).

Soil and moisture conservation: Cultivation of Udupi Mallige in undulated areas leads to leaching of soil and nutrients. To avoid leaching losses, crescent shaped bunds should be made. In summer spreading of dried leaves around the plant basin helps in conserving the moistures. The dried leaves thus spread around the basin converts into organic manure which helps in plant growth. Coastal soils are acidic in nature with p^H range from 4.5 to 5.0. To neutralize soil p^H, 250 to 500 g of agriculture lime should be applied 15 to 20 days before application of fertilizers around the basin of the plant (Shivkumar *et al.,* 2016). Maintaining the soil p^H of 6.0 to 7.0 will be help in the absorption of nutrients by the plants from the soil.

Removal of flower bud: Udupi Mallige starts bearing flowers immediately after field planting along with new shoot development. Thinning of flower buds up to 6 months from planting will enhance vegetative growth.

Pruning: Timely pruning operation will reduce the pest population in Udupi Mallige plants, through providing

optimum aeration and Sun light. Removal of dead, over crowded and watery shoots results in higher flower yield and bears throughout the year. The plant canopy should be maintained at a height of 4 feet from the ground level for easy plucking of flowers. The ideal time for pruning is during September to October. The cut ends should be treated with Bordeaux paste immediately after pruning. Staggered pruning has been recommended for uniform flower production throughout the year, as the pruning of all the plants at once will result in low yield (Shivakumar *et al.,* 2016) [10].

Harvesting

Economic yield of Udupi Mallige starts from third year onwards and continue upto 20 years. Under good management practices, economic yield may be expected in the first year of planting. During first year, 0.5 kg flowers/plant can be harvested by following recommended cultivation practices. In the second year 1.5 kg flowers/plant and 2.5 kg flowers/plant during third year of planting can be expected.

Marketing

Shankarapura village in Udupi district is the main hub for the market of Udupi Mallige. Market price will be decided based on yield, quality and demand in the local market. There is a high demand for Udupi Mallige flowers in Poona and Mumbai and also in Middle East countries and Pakistan, especially during wedding season. The price of Udupi Mallige price rises to Rs. 800 to Rs. 1,000 per 'atte' from a meagre Rs. 100 during on season (Anon., 2013) [3].

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