

Galgal: A boon for pickle industry

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A large number of citrus species are believed to have originated in India. In yesteryears, large numbers of citrus species are conserved in various institutes of the country for breeding programmer. Superior and elite materials are good sources for enhancing production and upgrading farmer's income.



Therefore, research efforts are required to collect superior strain with distinct desirable traits, which can be utilized for improvement and development of new cultivars. In India, kinnow mandarin and sweet orange are

commercially grown, whereas lemon species locally known as galgal (*Citrus pseudolimon*), English name: Hill lemon, Kumaon lemons is confined to a limited extent in India due to high acidity and less content of sugars in its fruits. Galgal is one of the important fruits crops in rainfed areas where other crops are grown in very limited scale due to water deficiency and poor soil health. It is found in semi-wild state in the North West Indian hill states of Jammu and Kashmir, Punjab, Himachal Pradesh and Uttarakhand. Lemon species *Pseudolimon*, is very hardy fruit crop and has been traditionally cultivated in various climatic zones. In these areas, large number of genetic diversity exists in various climatic zones. It is commercially used for making pickle as its fruit contain high acidity and more thickness of fruit peel. Therefore, its pickle can survive long time without any deterioration. Furthermore, galgal is one of the most important and god send fruit crop because its plants can be grown in far flung and barren land in *kandi* areas. Keeping the importance to improve the lemon specie, selected strain of galgal can survive without irrigation and its plants can tolerate more

than 40°C temperature during summer season and 4°C low temperatures without any frost injuries during winter season as per data observed in investigation. Availability of a wide gene pool in the form of genetic diversity is a prerequisite for crop improvement therefore it is very important to conserve good strains of fruit crops for further crop improvement. Genetic diversity is the extent of genetic variability among the individual in a single species and between the species. In recent years, collection and conservation were primarily made for the quality of fruits and to uplift fruit grower's income in particular areas.

Soil: The galgal fruits thrive in deep fertile, loose and well drained soils devoid any hard pan layers of calcium carbonate in the rooting zone. The soil having electrical conductivity upto 0.5 mmhos/cm, calcium carbonate upto 5 per cent, lime concentration upto 10 per cent and pH upto 8.5 are suitable for successful cultivation of galgal. The optimum pH range for galgal cultivation is between 5.5 to 7.5. Galgal plants are susceptible to salt injury and cannot thrive well in saline/alkaline soil. In the presence of excessive free lime induces chlorosis. Galgal tree are successfully grown in rainfed/ dryland areas of Jammu. In this areas are less irrigation facilities and deep water table *i.e.* 400-500 meter below the ground.

Manures and fertilizers : The full amount of farmyard manure and phosphatic fertilizer should be applied in January. Whole potash and half nitrogenous fertilizer should be applied 15 days before flowering, whereas remaining half of nitrogenous fertilizer should be given after fruit set.

Foliar spray of nutrient mixture (400 g CuSO₄ + 200 g FeSO₄ + 200 g ZnSO₄ + 200 g Borax + 1.04 kg lime + 100 l water) on new emerging growth flushes is beneficial for arresting citrus decline and improving yield and quality of fruits.

Description of selected strain: A medium sized tree, 3.1 m tall, plant spread North-South: 3.5 m and East-West:

Crop	Age (Year)	FYM (kg)	Nutrient basis (g) per plant		
			N	P ₂ O ₅	K ₂ O
Galgal	1	5	80	16	15
	2	10	160	32	30
	3	15	238	48	45
	4	20	320	64	60
	5	25	398	78	75
	6	30	477	94	90
	7	35	558	110	105
	8	40	637	126	120
	9	45	720	142	135
	10 and above	50	798	158	150

3.2 m, with an irregular and loose crown and a trunk 5.9 cm in diameter. Green and smooth bark, numerous, stout, thorns upto 2.0 cm long; petioles; petioles 1.9 cm long and 0.3cm wide, marginally winged, distinctly articulated; leaflets broadly elliptic-ovate to oblong, 12.5 cm, crenate, base cunceate-rounded; flowers in clusters of 8, seldom solitary, terminal or axillary, mildly fragrant. Fruits ovate-oblong, ground colour green, mature stage yellow, average fruit weight 530 g, total number of fruits: 110, Fruit length: 11.2 cm, width 7.2cm, Average number of seeds: 18, Seed length: 1.1 cm, Juice content: 160 ml, Fruit ground colour: green, Pulp weight: 240 g, Peel weight: 180 g, Fruit maturity: last week of October, Peel thickness: 1.3cm, Apex: slightly nipple, rind: 0.6 cm thick, strongly adhering, segments:8, pulp: light yellow, coarse, vesicles cylindrical, loosely packed, light yellow, conical ovate with prominent ridges and smooth surface.



Fig. 1 : Galgal at RRSS, Raya, SKUAST-Jammu

Special feature of selected strain: The selected strain is probably the cold hardy, without any frost injuries. Plant can tolerate temperature above 40°C and easily survive without irrigation during summer months. Its plants can easily be grown in degraded and barren land. Moreover, this strain had shown heavy fruiting, equal size fruit, bunch type's fruiting and resistance from insect and pests attack. Moderate resistance from citrus gummosis disease was

also observed in this strain during investigation.

Irrigation or supply of water: The galgal tree should be irrigated at 10 days and 30 days interval during summer and winter, respectively. Water supply should not come in direct contact with trunk. The young plants upto 3- 4 years should be irrigated at weekly intervals. However, galgal plants can be survive during summer season in less water requirements then another *Citrus* spp. i.e. kinnow sweet orange, kagazi lime, lemon etc. by adopting mulching around the basin of the tree.

Intercropping: Intercropping in galgal orchards upto age of 3 to 4 years is attractive, for which shallow rooted, short duration, less exhaustive having good canopy cover and supportive in adding nutrients through nitrogen fixing crops are pea, cowpea, gram, bean etc. are considered safe and profitable. In additions to that some other crops like tomato, gourds, okra etc. can also be grown as the intercrops in non-bearing galgal orchards.

Uses: The main use of Galgal fruits is to make pickle and it is souring agent in many food preparations. Its pickle can be stored for long time without any obliterate its quality. Galgal pickle is very popular in North India and there exists a generous trade in it. Villagers concentrate galgal juice by heating and it is called "Chukh" in local dialect.

Harvesting and yield : Galgal fruits are harvested generally between December and January in the month. The average yield in terms of number of fruits in galgal are 125 to 150 fruits/tree / year.

Management of major Insect –pest and diseases :

Insect- pest:

Citrus leaf miner (*Phyllocnistis citrella*): Young larvae mine into the epidermal layer of young tender leaves by making silvery



Galgal leaf infested with leaf minor

white zig-zag galleries and suck sap. Infested leaves curl and their photosynthetic activity is reduced. Infested trees bear poor fruit setting and fruits are smaller in size.

Citrus Psylla (*Diaphorina citri*): Small wedge shaped grey insects seen sitting in a typical symmetry on the



Galgal leaf infested with Psylla

underside of the leaves and suck the sap, as a result, the leaves curl and distorted, the quality of

fruits is lowered.

Management : The peak period of these pests is the same *i.e.* March to September when maximum damage is rendered, therefore a spray schedule comprising or 4 to 5 sprays will control these pests. First spray during February-March before flowering use chloropyriphas 35 EC 1000 ml or dichlorvos 100EC 700 ml or spinosad 45 SC @ 0.34 ml or neem oil 5 ml or imidacloprid 17.8 SL @0.5 ml or phosolone 35 EC @ 1.5 ml or methyl demeton 25 EC 650 ml in 500 L of water. Second spraying should be done end of March or four weeks after first spray (after fruit set) imidacloprid 17.8 SL @0.5 ml per L. in 500 L of water.

Disease and their management :

Citrus canker (Xanthomonas axenopodis p.v. citri): The dark brown, rough, raised, pimple-like corky spots appear on leaves, twigs, branches, petioles, fruit stalks, fruits and thorn. On leaves, spots first appear on lower surface and then on upper surface, spots are surrounded by a yellow halo. Lesions on twigs are elongated. On fruits



Symptoms of canker on galgal leaves

the lesion are confined to rind only.

Management : Prune off the affected twigs before monsoon and destroy by burning. Spray the tree and nursery plants with Bordeaux mixture (1:1:100 or 1.0%) or copper oxychloride (300 g/100L water) or streptomycin sulphate (50g/100 L water) at 15 days interval. Give 5-7 sprays.

Gummosis or Foot Rot: (*Phytophthora parasitica* and

palmivora.): Bark on the tree trunk at the soil level turns brown, develops longitudinal cracks and starts gumming. The affected trees become weak, exhibit sickly appearance, usually blossom heavily and die before the fruit matures due to girdling effect.

Management:

- Scrap the disease portion along with some healthy part with sharp knife. Disinfect the wound with sodium hypo chloride-NaOCl (1 g/L water) and apply Bordeaux paste 2:3:30). Apart from these soil drenching with metalaxyl (2.0g/ L) is effective for management of disease
- Maintain good water drainage in the orchard. Avoid excessive irrigation, stagnation of water and injury to root or base of the tree trunk.

Wither tip /Anthracnose: (Collectotrichum gloeosporioides): Wither tip is characterized by shedding of leaves and die back of twigs. Infection of immature fruits results in fruit drop. In severe infection, branches show die back symptoms and the tree dies in a few years. On leaves, necrotic spots are found in concentric rings.

- Maintain tree vigour by proper irrigation, manuring and cultural practices.
- Prune off dead twigs during February and destroy by burning. Protect the cut ends with Bordeaux paste.
- Spraying of copper oxychloride (300 g/L water) or Bordeaux mixture (800 g copper sulphate + 800 g lime + 100 L water) during March, July and September.

Citrus Decline: (A syndrome involving infection by fungi, nematodes, viruses, phytoplasma and nutritional disorders).

The trees show decline in health and fruit yield, growth is stunted and the trees may ultimately die.

Management:

- Adopt cultural practices like hoeing, fertilization, intercropping and irrigation.
- Control aphids and citrus psylla by spraying insecticides like dimethoate, phosphomidon, monocrotophos or aldicarh to check the disease.
- Spray Bordeaux mixture (0.8%) or copper oxychloride (300 g/ 100 L water) or mancozeb (200 g/ 100 L water) for controlling fungal diseases.
- Spray zinc sulphate + lime (600 g + 300g/100 L water) at tender foliage stage.
- Use disease free bud-wood planting material for new plantation.
- Adopt integrated control measures with budwood certification, use of resistant rootstocks and fungicides / insecticides where the problem is acute.

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