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Review Article

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Overview of Kumquat Tree - Management Practice and Varieties

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Summery

Kumquat tree considered the smallest citrus tree, the fruit is the only one in family Rutaceae eating whole with sweaty peel, kumquat tree tolerant cold conditions more than other citrus varieties, it could grow in wide range of soils and climate. There are four main varieties of kumquat (Nagami, Meiwa, Marumi, and Hong kong), Nagami kumquat is widely grown in different regions, as it is a more vigorous, hardy and prolific producer. Kumquat fruits are oval or round shape, it is reached by different nutrients and phytochemicals, and antioxidant like ascorbic acid, carotenoids, flavonoids, vitamins, Iron, and essential oils, also, Kumquats fruit are reaching in fiber, kumquat used as a fruit tree in the garden or an ornamental plant.

Background

Kumquats are evergreen small trees or shrubs, it is a small tree in the family Rutaceae, it is slow growing citrus tree, kumquat tree called also "The little gems of the Citrus family" or "Golden Orange", kumquat fruit considered the smallest citrus fruit, kumquat trees are cold tolerant than most citrus varieties, it is growing under cold conditions and survive down to (-7° c). Kumquats trees are native to China and South Asia region, the first describe for kumquat was in Chinese literature in 1178 A.D., however, kumquat included in a list of plants cultivated in Japan in 1712. Kumquat introduces to Europe in 1846 by Robert Fortune, and thereafter into North America, but now kumquat widely cultivated in various citrus-growing regions of the world. Kumquat fruits eating whole fruit with the peel when used as a fresh fruit, the peel is sweet and edible with a typical aroma due to the presence of flavonoids and terpenoids [1]. also, it can be candied, prepared as marmalade, added to fruit salad and preserved in sugar syrup in the food industry, Kumquat also an important source of nutrients and phytochemicals, like ascorbic acid, carotenoids, flavonoids and essential oils [2].

Moreover, there are four kinds of kumquats, Meiwa Kumquat, Nagami Kumquat, Marumi Kumquat, and Hong Kong Kumquat, but the round kumquat variety, which looks like a small orange are

the most spread varieties, however, Nagami kumquat (*Fortunella margarita*) considered the most common variety in the world [3].

Botanical Discription

Kumquat is a small tree or shrubs one of the *Rutaceae* family, now classified as *Citrus Fortunella* or *Citrus japonica*, the kumquat tree in the field at full maturity and under proper conditions reach heights of 2 to 3 m (Figure 1), but generally average around 1.5 or 2 m, when used as pot plant it is grown much less that tall [4]. Kumquat dormancy is profound, and they break dormancy later than another citrus variety. Trees have a rounded or a vase-like canopy, with light-green branches has a few spines or thornless, the leaves are simple, dark-green, glossy above, lighter beneath, lanceolate, (3.25- 8.6 cm) long. Flowers are fragrant, white with 5-petals, borne in the leaf axils as a single flower or 1 to 4 together, In general, Kumquats are later blooming than other citrus varieties, the flowers are self-pollination as other citrus trees, the fruit is oval-oblong or round, (1.6- 4 cm) wide; peel is golden-yellow to reddish-orange, with large, conspicuous oil glands, the fruit peel is the sweetest part of this citrus fruit instead of the pulp, the pulp is scant, in 3 to 6 segments, not very juicy, acid to light acid; contains small, pointed seeds or sometimes none, the fruit matures in November or later, it is the only citrus fruit that can be eaten skin and all.



Fig. 1. Field Image: Kumquat orchard in Egypt [4].

Climate

Kumquat required a hot summer, ranging from 26° - 37° C, also, need full sun, it could tolerant 10 to 15 degrees of frost without injury, due to the tree enter winter dormancy for several weeks to avoid cold injury, and remain without any new flushing or flowering for a period of warm weather. It grows in the regions where the climate is too cold for other citrus fruits, even the Satsuma mandarin, also, kumquat tree grows and tolerates seaside conditions which other citrus varieties could not, generally, Kumquat trees grow and fruiting better in warmer regions.

Soil

Kumquat trees tolerate a wide range of pH and most soil types from light soil to heavy clay, however a soil pH range between 5.5 and 6.5 is optimal for growth and productivity, preferable good drain soil.

Propagation

As other citrus varieties kumquat trees are seldom grown from seed as they grown poorly on their own roots, therefore Kumquats grafted on other rootstocks like Rough lemon or trifoliolate orange (*Poncirus trifoliata*), Rangpur lemon, also, Sour orange are suitable rootstocks for warm regions.

Fertilizing

Kumquat trees like other citrus varieties are heavy feeders and will benefit from a moderately nitrogen-rich soil but also require macro (N, P, K, and Ca) and micronutrients and trace minerals (Mg, Mn, Fe, Cu, Zn and B), after orchard established fertilizing program should be applied in moderate doses during growth season, also, preferable use foliar application for micro elements fertilizers, in late fall all fertilizing must be stooped to avoid produce new flushes affected by cold conditions. In the first year, the newly planted trees need about ¼ kg of 8-8-8 or 13-13-13 fertilizers per tree applied in March, in the second year, fertilizers added as soil application in January or early February around 500-650g/tree of 8-8-8 or 13-13-13 per year. The mature tree (12 years old or more) received about 8kg/ tree/ yearly divided to about 6 doses during growth season.

Pruning

Kumquat tree needs little pruning, it is only to remove dead branches and suckers to maintain shape or reduce tree height, as other citrus trees pruning after harvesting to determined proper shape and control tree size, Also, in the young tree, all shoots under grafting union need to remove regularly.

Kumquat Varieties

There are four varieties of Kumquats as following:

1. Nagami Fruits (*Fortunella margarita*)
2. Meiwa Fruits (*Fortunella margarita*)
3. Marumi Kumquat (*Fortunella japonica* Swing.,)
4. Hong Kong (*Fortunella hindsii*)



Figure 2: Nagami fruits.

The fruit has oval-shape and more oblong than the 'Meiwa'(Figure2), Nagami fruits are more acid in taste, has a smooth, shiny rind that ranges from yellow-orange to deep orange color, Nagami is most commonly grown as it is a more vigorous, hardy and prolific producer, it is excellent in containers.

Meiwa Fruits (*Fortunella margarita*)



Figure 3: Meiwa fruits [5].

Meiwa tree is thornless and fruit is more rounded and sometimes necked (Figure 3), there is variegation of fruits in color

of green and yellow stripes, the fruit is large and fleshy, and has a sweet flavor, juicer, less seedy than other varieties, also, the fruit has thinner peel than other kumquats, it is considered the best kumquat for eating fresh.

Marumi Kumquat (*Fortunella japonica* Swing.,)



Figure 4: Marumi fruits [5].

The fruits are round and sometimes, spherical, larger, fruits plump and golden, (Figure 4) has a spicy flavor, Meiwa kumquats fruits sweeter and juicier than Nagami kumquats

Hong Kong (*Fortunella hindsii*)



Figure 5: Hong Kong fruits [6].

Hong Kong kumquat is the smallest fruited tree of the kumquats, the wild tree form of the species is naturally tetraploid, however, a cultivated trees are diploid form, and usually nominated Golden Bean kumquat, the leaves are small and narrow, it produces

a lot of very small round red-orange fruits around a half inch in diameter (Figure 5) and the fruits are hold on the tree well, the fruit is very sour and the rind is thin, also, there are large seeds 2 or 3 in each fruit, therefore, the fruit is virtually inedible. Hong Kong kumquat tree is a slow grower, it is proper for ornamental purpose or as a pot plant, also, it is great as a bonsai plant [7].

Harvesting

Fruit ripens later than other citrus fruits, it starts ripening from mid to late winter and always crops very heavily, for the fresh fruit market, it has been customary to clip the fruits individually with 2 or 3 leaves attached to the stem [4].

Kumquat as Pot Plant

Kumquat tree considered a beautiful landscape or pot plant, for growth in containers, Kumquats need to graft on dwarfing rootstock like (*Poncirus trifoliata* or *Cleopatra mandarin*), and they can be trimmed to a smaller stature. As a potted plant, they can be grown anywhere and moved indoors or outdoors as the weather dictates, in the case of indoor plants, trees need some direct sunlight during the winter. Also, kumquat trees used as a pot plant in patios and courtyards.

Fruit Composition

Kumquats fruits including various nutrients and phytochemicals, such as ascorbic acid, carotenoids, flavonoids, vitamins, Iron, Calcium, Potassium, and essential oils, also, Kumquats fruit are reaching in fiber [8]. Each one kumquat provides about 14% of a person's daily value of vitamin C, therefore, Kumquats considered a well-balanced source of vitamins and antioxidants like Cryptoxanthin, zeaxanthin, and lutein [9].

Fruit Uses

1. Kumquat fruits used as a fresh fruit, the peel totally the sweetest part of the fruit with a sweet flavor, however, the pulp is sour when eaten together it produces an unusual refreshing flavor.
2. Fruit often used to make candies, but in this case, fruits should be left until they lose some of their moisture and acquire richer flavor, the fruits are easily preserved whole in sugar syrup.
3. Preserved and candied fruit, also, fruits used for marmalade and jam production.

Pests and Diseases

Kumquat tree as orchard trees or pot and dooryard may be attacked by most of the common citrus pests and diseases, but, kumquat trees are highly resistant to citrus canker. Root rot is the main disease for kumquat tree, due to excessive irrigation, also, Citrus Gummosis disease affected growth and productivity of kumquat trees, therefore, avoided direct water contact with the trunk of the tree through preparing a small clear ring around the trunk reduce tree infection. Potted kumquats are subject to other pests like mealy bug infestations, also, pots or Containers should have more drainage than normal, air circulation and ventilation are advisable. Aphids, Scales, and mites infected kumquat trees, also, leaf miner attack new flushes.

Conclusion

Kumquat is very delightful tree of family Rutaceae, the fruits are reaching by several nutrients phytochemicals, antioxidant, and fibers, also, kumquat use for horticulture production and as container plant, Meiwa fruit is considered the best kumquat for eating fresh, however, Hong kong kumquat tree is proper for ornamental purpose and it is great as a bonsai plant.

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