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## Effect of plant age and ripening stages on physical characteristics of Sweet orange *cv.* Malta

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### Abstract

A study was conducted to determine the impact of different plant age and maturity stages on physical characteristics of Sweet orange *cv.* Malta. The fruits were harvested from three different age groups i.e. 5 years, 8 years and 13 years respectively at premature stage (22th August) and at mature stage (22th October). The study was carried out at Agriculture Lab, D.A.V College, Abohar during the year 2017-18. Various physical parameters such as fruit size (length and breadth), fruit weight, fruit volume and specific gravity were evaluated. Total of 12 samples were taken from all age groups and at different maturity stages (4 samples from each age group at two stages). It was concluded that Sweet orange *cv.* Malta fruit samples showed significant increase in its physical characters in all age groups during maturity except specific gravity which were decrease during maturity. The fruit samples from 13 year old plants with maturity showed best quality characteristics and November month is suited as best for harvesting of Sweet orange *cv.* Malta.

**Keywords:** Plant age and ripening stages, Sweet orange *cv.* Malta.

### Introduction

Orange is the fruit of citrus species *Citrus x sinensis* in family Rutaceae. It is also called Sweet orange, to distinguish it from the related *Citrus x aurantium*, referred as bitter orange. The Sweet orange reproduce asexually (apomixes through nucellar embryony) varieties of Sweet orange aeries through mutations. The orange is a hybrid between Pummelo (*Citrus maxima*) and mandarin (*Citrus reticulata*). Sweet orange were mentioned in Chinese literature in 314 BC. As of 1987, orange tree are found to be most cultivated fruit tree in the world. Orange trees are widely grown in tropical and subtropical climate for their sweet fruit or processed for it juice or fragrant peel.

It is a common experience to find the contractors harvesting fruits while still immature and green and dumping those in the markets. This is done to realize more money by catching early market. But this practice does incalculable damage to the prestige and image of the fruit industry, besides depressing future demand for fresh fruit. In the interest of overall well-being of the fruit industry and to save our nation from the ill effect of immature fruits on their health, the practice of selling immature fruits need to be curbed. Citrus fruit should be harvested when they are fully ripe and had developed their characteristic flavour and aroma. These do not at all improve in quality after they have been harvested from the tree. The sale of under ripe citrus fruits is prohibited by law in some of the horticulturally advanced countries like the U.S.A, Australia and South Africa. In India, however, there is no restriction on the sale of such fruits and the contractor to whom the fruit crop is usually auctioned, and traders have a free play in the matter. The fruit is picked regardless of its proper stage of maturity and quite often sent to the market in a raw condition. Such fruits, brings a bad name to the producer, and also endanger the health of the consumer. This practice, therefore, requires to be discouraged. Though harvesting of fruits, in general, at their proper stage of maturity and ripeness is of great importance in all fruits, yet it is of greater significance in citrus fruits. Being non climacteric, these fruits fail to ripen after picking (Abhishek *et al.* <sup>[1]</sup>).

Tree age play an important role in fruit quality, but studies to determine its effect are rare in fruit crops and especially in citrus. Tree age affected the TSS and acidity content of ‘Satsuma’

mandarin and juice content (Matsumoto *et al.* [2]). The 20 year old trees of Marsh seedless grape fruit produced bigger fruit with thinner rinds compared with 34 year old tree (Ozeker [3]). Therefore, the present investigation was carried out to study the effect of tree age and ripening stage on the physical characteristics of Sweet orange cv. Malta.

## Material and Method

The study was done on the fruits of Sweet orange cv. Malta of three different age groups i.e 5 years, 8 years, 13 years. Four samples of each age group were harvested from a private Malta orchard present in village Diwan Khera, Tehsil Abohar, Fazilka (Punjab) in the month of August and October 2018. These samples were brought to Agriculture Lab, D.A.V, College, Abohar. Total of 12 samples were collected from all age groups and at two maturity stages (four samples from each age group at two stages). The physical parameters i.e. fruit size, fruit weight, fruit volume and specific gravity were taken into consideration. Average length and breadth of samples were measured using vernier's calliper and was expressed in millimetres, fruit weight was evaluated with the help of digital weighing balance and expressed in grams, fruit volume was determined by using water displacement method with graduated cylinder and expressed in milli litres and specific gravity was calculated by dividing weight with volume of fruit and was represented in  $\text{gml}^{-1}$ .

## Result and Discussion

### 1. Fruit size

#### 1.1 Fruit Length

Fruit length Sweet orange cv. Malta of showed a significant increase in all age groups during ripening of the fruit. Data regarding the change in length of the fruit has been presented in Table 4.1. It has been observed that fruits from 13 year old plants have maximum fruit length (67.42 mm). Among the stages, the maximum fruit length has been recorded in mature fruits (67.36 mm). Similar, Morakinyo and Bamgboye [4] recorded the maximum length (42.32mm) in 50 year old plant followed by (33.84mm) in 30 year old plant and minimum (30.66mm) in 20 year old plant while studied the physical properties of Tenera cultivars of oil palm fruitlet. Similar finding of George *et al.* [5] observed the length growth pattern of the Sarawak pineapples was characterized by a slow growth phase at Stage I, which lasted for 4 weeks after anthesis, followed by an exponential increase of length growth from Stage II to stage IV.

#### 1.2 Fruit Breadth

Fruit breadth also shows a significant rise in Sweet orange cv. Malta fruits in all age groups during maturity. The data recorded has been shown in Table 4.2. It has been observed that maximum fruit breadth was of fruits of 13 year old plants (68.27mm) and among the ripening stages, mature fruits had maximum breadth (68.56mm). Similar, Kochhar *et al.* [6] observed maximum fruit breadth (79.87mm) in mature stage and (66.44mm) in premature stage of ripening. Among the age groups, maximum fruit breadth (75.42mm) found in 8 year old plant followed by (72.44mm) in 12 year old plant and minimum (71.61mm) in 4 year old plant while studying the impact of different plant age and maturity stages on physical characteristics of kinnow (*Citrus reticulata* Blanco). Similar, Nakorn and Chalumpak [7] observed the maximum fruit diameter (17.05cm) in 8 year old tree followed by (15.64cm)

in 6 year old plant and minimum (15.18cm) in 4 year old tree while studying effect of tree age on the fruit development and fruit quality of Pummelo var. Tabtimsiam.

### 2. Fruit weight

The Table 4.3 shows the observations recorded in study in Sweet orange cv. Malta shows the changes in fruit weight in different age groups and changes in fruit weight at different maturity stages. It is clearly observed that 13 year old plants had maximum weight (176.24g) among different age group fruits. whereas among the stages, mature fruits show maximum weight of (185.43g). The maximum fruit weight (33.60g) of 8 years old trees followed by (33.41g) in 15 year old plant and minimum (28.20g) in 25 years old trees was observed by Bahlouli [8] while, conducted an experiment on the effect of the tree age in the behavior of the Apricot tree. Similar, Iqbal *et al.* [9] studied the seven stages i.e T1 to T7 of fruit development at different interval in month of January and February 2009 and observed maximum fruit weight (164.3g) in T5 stage and minimum (126.9g) in T2 stage.

### 3. Fruit Volume

The change in fruit volume of Sweet orange cv. Malta has been presented in Table 4.4 in which different observations regarding fruit volume of different age groups and at different maturity stages are shown. From the data it has been observed that fruit volume of 13 year old plants had been recorded the maximum (195.87 ml) among the age groups. The mature fruits showed maximum fruit volume (211.83 ml) followed by premature fruits (152.91 ml). Similarly, the minimum volume of 24 ml were recorded in green fruits followed by 37.0 ml in partial ripe and maximum volume 50 ml in ripe fruit by Ishak *et al.* [10] while studied the some physical and chemical properties of Ambarella (*Spondias cytherea* Sonn.). Al-Maiman and Ahmad [11] observed the minimum value of volume (126.74  $\text{cm}^3$ ) in unripe fruits followed by (156.74  $\text{cm}^3$ ) in full-ripe and maximum value of volume (161.02  $\text{cm}^3$ ) was observed in half-ripe fruits.

### 4. Fruit Specific Gravity

The change in specific gravity in Sweet orange cv. Malta was observed among different age groups and at different ripening stages. The data observed to change in specific gravity has been presented in Table 4.5. Different observation of specific gravity were recorded during the study in which it was recorded that 5 year old plant fruit had maximum specific gravity (0.91g/ml) followed by 13 and 8 year old plants shows similar specific gravity (0.90g/ml). Among the ripening stages maximum specific gravity (0.94g/ml) recorded in premature stage and minimum (0.87g/ml) in mature stage. The opposite result were recorded by Verma and Kushwaha [12] while studied effect of stage of maturity on physico-chemical characteristics of Gola pear (*Pyrus pyrifolia*) and observed that the specific gravity of pear fruit was increased by 2.88 % significantly from 1.04 to 1.07 at mature to ripe stage, respectively. Kumar and Ram [13] observed the maximum value of specific gravity (1.0g/ml) in 30 years old plant, then (0.98g/ml) in 18 years old plant and minimum (0.97g/ml) in 6 years old plant while studying the tree age affects postharvest attributes and mineral content in Amrapali mango (*Mangifera indica*) fruits.

## Observation and Tables

**Table 4.1:** Effect of Age and ripening stage on Fruit length (mm)

Stages	Age			
	5 year	8 year	13 year	Average
Immature	64.41	63.11	65.15	64.22
Mature	67.28	65.12	69.70	67.36
Average	65.84	64.11	67.42	65.79

**Table 4.2:** Effect of Age and ripening stage on Fruit Breadth (mm)

Stages	Age			
	5 year	8 year	13 year	Average
Immature	64.20	64.48	65.29	64.65
Mature	67.57	66.87	71.25	68.56
Average	65.88	65.67	68.27	66.60

**Table 4.3:** Effect of Age and ripening stage on Fruit Weight (gm)

Stages	Age			
	5 year	8 year	13 year	Average
Immature	142.72	141.00	150.52	144.74
Mature	181.42	172.92	201.97	185.43
Average	162.06	156.96	176.24	165.08

**Table 4.4:** Effect of Age and ripening stage on Fruit volume (ml)

Stages	Age			
	5 year	8 year	13 year	Average
Immature	152.50	150.00	156.25	152.91
Mature	202.50	197.50	235.50	211.83
Average	177.50	173.75	195.87	182.37

**Table 4.5:** Effect of Age and ripening stage on Fruit Specific Gravity (g/ml)

Stages	Age			
	5 year	8 year	13 year	Average
Immature	0.93	0.94	0.96	0.94
Mature	0.89	0.87	0.85	0.87
Average	0.91	0.90	0.90	0.90

## Conclusion

The results concluded from the present investigation are that the Sweet orange fruit samples collected from the different age groups and at different stages showed a variable growth pattern in physical and chemical characters. The physical characteristics such as fruit length, fruit breadth, fruit weight, fruit volume were gradually increase during ripening of the fruit while the fruit specific gravity were to be decrease from immature stage to mature stage of ripening.

Among the tree age the physical characteristics such as fruit length, fruit breadth, fruit weight and fruit volume and Specific gravity were be observed maximum in 13 year old plant followed by 5 year plant and minimum in 8 year old plant. Thus it has been concluded from the research that the 13 year old orchard is best for quality sweet orange production and best time for harvesting is at maturity stage in the month of October-November.

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