



## NUTRITIONAL STATUS OF MALTA ORCHARDS IN BIKANER DISTRICT

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**ABSTRACT** : The nutritional survey studies conducted in Blood Red Malta orchards during 2009-10 revealed that all leaf samples were found deficient in nitrogen content, high in phosphorous content and low in potassium. The micro-nutrient analysis of Malta leaves showed sufficiency of iron and copper content, low in manganese and zinc content. The physico-chemical analysis of Malta fruits revealed that excellent Malta production can be achieved in arid soils of Bikaner district with proper management of nutrients at both macro and micro level and harvesting of fruits in the December-January can provide remunerative returns to fruit growers in the canal command areas of Bikaner district.

**Keywords** : Blood red, malta, nutrient, content, fruit weight.

Blood red variety of Malta remained popular till late seventies in SriGanganagar district of Punjab. Malta was a very delicious fruit with the 'red blood' variety being popular among fruit consumers. It got its name as the fleshy portion of the fruit had a reddish tinge and even the juice had a slight tinge of red. The red blood was not only juicy but tastier than the other Malta varieties. But the blood red Malta disappeared when the Kinnow made its appearance in Sri Ganganagar district of Rajasthan and Punjab in the 1980's. The ascent of Kinnow cultivation led to replacement of Blood red malta as its yield were better and therefore it gave better returns to the grower. Another reason for decline in Blood red Malta cultivation was that growers always wanted quick returns and they did not have the patience to wait till mid January which is the most appropriate time to harvest this variety as during this time the fleshy portion begins to acquire red colour due to extreme cold conditions in Western Rajasthan. The plantation acreage under Blood Red Malta cultivation is very meager in Rajasthan especially in Bikaner district. With an intent to explore the possibility and quality of Blood Red Malta, present studies were undertaken in Bikaner district during 2009-2010 to estimate nutritional status and quality attributes of Blood Red Malta orchards in Bikaner district.

### MATERIALS AND METHODS

The survey of blood red Malta orchards was carried out during 2009-2010 at two locations in Bikaner district. In each location, twenty trees in the age group of 10-15 years with uniform size and vigour

were selected. The methodology for leaf sampling was adopted as suggested by Singh and Kunwar (17) for sweet orange. Composite leaf samples consisting of physiologically matured leaves were taken in the month of June from shoots of 4-5 months old leaves for nutritional diagnosis. The sample size consisting of 30 leaves in each sample were taken from all the four directions of the tree at breast height. These samples were washed with distilled water containing dilute (0.2%) detergent solution followed by successive washings with 0.1 N HCl and double distilled water. Samples were then dried in an oven at 70°C for 24 hours and ground. N and P contents were determined colorimetrically as suggested by Jackson (6). Fe, Mn, Cu and Zinc in the triacid digest of the leaves were determined with an atomic absorption spectrophotometer.

The characters studied under physico-chemical analysis of the Malta fruits are described as under:

**Fruit weight** : Average of fruits was taken on an electronic weighing balance of Sartorius make.

**Fruit length and breadth** : Fruit length and breadth was measured with the help of Vernier Calliper and the average was calculated.

**Fruit circumference** : Fruit circumference was measured with the help of thread tied to centre of fruit with the completion of periphery to the starting point. The length of the thread was measured on a meter scale and the average was calculated.

**Juice vesicles weight per fruit** : Juice vesicles weight per fruit was calculated as follows:

Juice vesicles weight/fruit =

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$$\frac{\text{Weight of juice vesicles}}{\text{Total fruit weight}} \times 100$$

**Juice (ml) :** Juice after extraction was measured in the measuring cylinder and the average was calculated in milliliters.

**Proportion of juice to fruit (%) :** The juice recovery percentage was calculated as follows:

Juice recovery percentage =

$$\frac{\text{Weight of juice}}{\text{weight of fruit}} \times 100$$

**Total Soluble Solids :** TSS content was directly measured on Zeiss hand refractometer (0-32) on degree brix at 25°C room temperature.

**Ascorbic acid :** Fruit juice samples were centrifuged at 1650 rpm for 5 min. at 4°C. The supernatant was used for determination of ascorbic acid content by titration with 2,6-dichlorophenol indophenols sodium salt hydrate according to AOAC(1).

**Total sugar content :** Total sugar content was determined by using Anthrone reagent method as given by Dubois *et al.* (5) and reducing sugar content was measured by Nelsons Modification of 'Somogyis method' using Arsenomolybdate reagent.

## RESULTS AND DISCUSSION

### Leaf nutrient content analysis:

Data on the determination of macro and micro nutrient status of blood red Malta orchards are presented in Table 1. A peep into the data reveals that the nitrogen content of Malta leaves varied between 1.24 to 1.25 per cent with a mean value of 1.24 per cent. Analysis of Malta leaf samples revealed that all the plant samples were found deficient in nitrogen content. The results of present investigations are in conformity with the earlier findings of Prasad *et al.* (13) and Coutinho and Veloso (3). The low concentration of nitrogen in Malta plants may be attributed to low nitrogen status of soils, poor organic matter, high pH and inadequate application of nitrogen. Added fertilizers given in insufficient quantities may not be adequate enough to meet the demands of the plants.

The phosphorous content of Malta leaves ranged from 0.26 to 0.58 per cent with a mean value of 0.42 per cent. The evaluation of Malta leaf samples showed that all leaf samples were found high in phosphorous content. The fair P content in malta leaves might be due to medium to high phosphorous status of orchard soils and proper uptake, mobilization and utilization by

plant tissues. The results of present findings are duly supported by Singh and Kunwar (17) and Reddy *et al.* (15).

The potassium content of Blood red Malta leaves varied between 0.71 to 1.17 per cent with a mean value of 0.94%. Analysis of Malta leaf samples revealed that all plant samples were found low in potassium content. The poor fertility status of K in malta leaves might be due to medium potassium fertility status of soil as well as hidden hunger of plants for this nutrient and inadequate application of potassic fertilizers. The results of present investigations are in agreement with those reported by Kanwar *et al.* (8); Nijjar and Singh (12) and Tilleria *et al.* (18).

The iron content of Malta leaves ranged from 172.22 to 172.56 mg kg<sup>-1</sup> with a mean value of 172.39 mg kg<sup>-1</sup>. The evaluation of Malta leaf samples showed that all leaf samples were found sufficient in iron content. The fair iron status of malta leaves might be due to medium iron status of orchard soils. The manganese content of malta leaves varied between 15.01 to 29.72 mg kg<sup>-1</sup> with a mean value of 22.36mg kg<sup>-1</sup>. The poor manganese status of malta leaves might be due to poor manganese status of orchard soils and it may be due to alkaline nature of soils. Similar findings were supported by Reuther (16) and Bell *et al.* (2).

The evaluation of Malta leaf samples indicated a range between 12.15 mgkg<sup>-1</sup> to 13.82 mgkg<sup>-1</sup> with a mean value of 12.98 mgkg<sup>-1</sup>. The medium status of copper content in Malta leaf samples might be attributed to medium status of orchard soils. Similar findings were reported by Rao (14). The content of zinc in the leaf samples of Malta varied between 12.24 to 16.21 mgkg<sup>-1</sup> with a mean value of 14.22 mgkg<sup>-1</sup>. The low zinc status of Malta leaf samples might be due to phosphorous zinc interaction in the soil, whereas high phosphorous availability renders zinc less available to the plants. The results of present findings are in accordance with those reported by Kamboj *et al.* (7).

### Physico-chemical analysis of fruit samples :

The data presented in Table 2 revealed the morphometric and biochemical variation in the Blood red Malta fruit samples of the two locations surveyed. Fruit weight variation ranged from 283.83g in location Khajuwala 2 to 284.46g in location Khajuwala 2 of Bikaner district. Lal and Sharma (9) reported that average fruit weight of Malta was 283.0 g whereas Mohammad *et al.* (11) reported that fruit weight was

found highest in Sweet orange cv. Blood Red and it was recorded as 211.66g.

The maximum length of the fruit (7.47 cm) was measured in the fruits of Khajuwala 2 as compared to (7.44 cm) measured in fruits of Khajuwala 1. The maximum breadth of the fruit (8.02 cm) was also measured in fruits of Khajuwala1 as compared to (7.98 cm) measured in the fruits of Khajuwala 2. Similar findings were reported by Daulta and Arora (4) who reported that average length and breadth of fruit in sweet orange cv. Blood Red was 6.58 cm and 7.11 cm, respectively.

The maximum circumference of the Malta fruit (27.71cm) was measured in the fruits of Khajuwala 1 as compared to (27.66 cm) as measured in the fruits of Khajuwala 1.

The highest juice vesicles weight per fruit (203.81g) was recorded in the fruits of Khajuwala 1 as compared to (202.91g) recorded in the fruits of Khajuwala 2. The maximum juice (132.50 ml) was recorded from the fruits of Khajuwala 1 as compared to (131.50 ml) recorded from the fruits of Khajuwala 2. The maximum peel thickness (0.51 cm) was measured in the fruits of Khajuwala2 and Khajuwala 1, orchards respectively whereas Daulta and Arora (4) recorded average rind thickness of 0.51 cm in sweet orange cv. Blood Red, which is in close conformity with the results of present findings. There was great variation observed in the total number of seeds. Maximum number of seeds (23.75) were recorded in the fruits of Khajuwala2 as compared to (22.25) recorded in the fruits of Khajuwala 1.

The maximum length of segments (6.14 cm) was measured in the fruits of Khajuwala 2 as compared to (5.98 cm) measured in the fruits of Khajuwala 1. The maximum width of the segment (3.18 cm) was also measured in the fruits of Khajuwala 2 as compared to (3.05 cm) measured in the fruits of Khajuwala 1.

The maximum seed percentage (1.12%) was recorded in the fruits of Khajuwala 1 as compared to (1.07%) recorded in the fruits of Khajuwala 2. Peel percentage ranged from maximum (26.71%) in the fruits of Khajuwala 2 to minimum (23.90%) in the fruits of Khajuwala 1.

Rag percentage ranged from maximum (3.02%) in the fruits of Khajuwala 1 to minimum (2.13%) in the fruits of Khajuwala 2. The segment percentage ranged from maximum (71.65%) in the fruits of Khajuwala 1 to minimum (71.50%) in the fruits of Khajuwala 2. The maximum juice recovery (46.44%) was obtained in the fruits of Khajuwala 1 as compared to (46.25%) recorded in the fruits of Khajuwala 2. The maximum content of total soluble solids (7.570brix) was recorded in the fruits of Khajuwala 2 as compared to (7.12°brix) was recorded in the fruits of Khajuwala1. Average TSS content of malta fruit was reported between 9.7 per cent by Lal and Sharma (9) at Pithoragarh; 12.0 per cent by Mathur and Godara (10) at SriGanganagar and 10.10 per cent by Daulta and Arora (4) at Hisar in cv. Blood Red of Malta. The low TSS content in Malta fruits might be due to higher degree of granulation observed in Malta fruits under present investigations.

Maximum organic acids (0.52%) were found in the Malta juice samples of Khajuwala 2 as compared to (0.47%) recorded in the Malta juice samples of Khajuwala 1 orchard. The maximum TSS/Acidity ratio (15.14) was found in the fruit of Khajuwala 1 as compared to (14.55) in the fruits of Khajuwala 2. Daulta and Arora (4) recorded 15.78 : 1 TSS/Acidity ratio in sweet orange cv. Blood Red. Maximum ascorbic acid content (23.75mg/100 ml juice) was recorded in the fruits of Khajuwala1 as compared to (20.25 mg/100 ml juice) recorded in the fruits of Khajuwala 2.

The total sugars percentage varied considerably from each other. Maximum total sugars (6.80%) was estimated in the fruits of Khajuwala 2 as compared to (6.12%) estimated in the fruits of Khajuwala 1.

**Table 1: Contents of macro and micronutrients in leaf samples of Blood Red Malta collected from orchards in Bikaner district.**

| Locations    | Macronutrients<br>(% of oven dry basis) |           |           | Micronutrients<br>(mg kg <sup>-1</sup> of oven dry basis) |             |             |             |
|--------------|---|-----------|-----------|---|-------------|-------------|-------------|
|              | N                                       | P         | K         | Fe  | Mn          | Cu          | Zn          |
| Khajuwala 1  | 1.24                                    | 0.26      | 0.71      | 172.22  | 29.72       | 12.15       | 12.24       |
| Khajuwala 2  | 1.25                                    | 0.58      | 1.17      | 172.56  | 15.01       | 13.82       | 16.21       |
| Overall Mean | 1.24                                    | 0.42      | 0.94      | 172.39  | 22.36       | 12.98       | 14.22       |
| Range        | 1.24-1.25                               | 0.26-0.58 | 0.71-1.17 | 172.22-172.56   | 15.01-29.72 | 12.15-13.82 | 12.24-16.21 |
| CV(%)        | 0.57                                    | 53.87     | 34.60     | 0.14  | 46.51       | 9.09        | 19.73       |

Maximum reducing sugars (4.65%) were estimated in the fruits of Khajuwala 1 as compared to (4.56%) reducing sugars estimated in the fruits of Khajuwala 2.

**Table 2: Physico-chemical characteristics of Blood Red Malta fruits.**

| Locations Characters            | Khajuwala 2 | Khajuwala 1 | Pooled C.V. (%) |
|---------------------------------|-------------|-------------|-----------------|
| Fruit weight (g)                | 283.83      | 284.46      | 10.50           |
| Length (cm)                     | 7.47        | 7.44        | 10.65           |
| Breadth (cm)                    | 7.98        | 8.02        | 2.58            |
| Circumference (cm)              | 27.66       | 27.71       | 2.15            |
| Juice vesicles wt./fruit        | 202.90      | 203.81      | 10.32           |
| Juice (ml)                      | 131.50      | 132.50      | 12.68           |
| Peel thickness (cm)             | 0.51        | 0.50        | 4.15            |
| Total Seeds (no.)               | 23.75       | 22.51       | 6.15            |
| Segment (no.)                   | 12.25       | 11.50       | 5.40            |
| Segment size (cm)               |             |             |                 |
| Length                          | 6.14        | 5.98        | 6.54            |
| Width                           | 3.18        | 3.05        | 13.99           |
| Seed (%)                        | 1.07        | 1.12        | 17.65           |
| Peel (%)                        | 26.71       | 23.90       | 6.81            |
| Rag (%)                         | 2.13        | 3.02        | 26.44           |
| Segment %                       | 71.50       | 71.65       | 0.59            |
| Juice recovery (%)              | 46.25       | 46.44       | 2.64            |
| TSS <sup>0</sup> brix)          | 7.57        | 7.12        | 9.54            |
| Total acidity (%)               | 0.52        | 0.47        | 14.58           |
| TSS/Acidity ratio               | 14.55       | 15.14       | 20.08           |
| Ascorbic Acid (mg/100 ml juice) | 20.25       | 23.75       | 15.56           |
| Total sugars (%)                | 6.80        | 6.12        | 5.51            |
| Reducing sugars (%)             | 4.65        | 4.56        | 4.68            |

\*Fruits were harvested in the first week of November, 2009

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