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COMPARATIVE ANALYSIS OF ASCORBIC ACID CONCENTRATION IN *CITRUS RETICULATA* (KINNOW) COLLECTED FROM DIFFERENT TEHSILS OF SARGODHA

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ABSTRACT

The present study was conducted to evaluate ascorbic acid concentration in *Citrus reticulata* (Kinnow) collected from different tehsils of Sargodha. *Citrus reticulata* in Sargodha have good source of Vitamin C contents but the *Citrus reticulata* (Kinnow) of bhalwal have excellent source of Vitamin C. Fluctuation in ascorbic acid concentration in *Citrus reticulata* (Kinnow) which was collected from different tehsils of Sargodha is due to environmental changes. Results show that highest concentration of Ascorbic acid in the *Citrus reticulata* of bhalwal which is 32.31mg /ml. While lowest amount of Ascorbic acid concentration was found in *Citrus reticulata* (Kinnow) collected from kotmomin which is 23.12mg/ml Silanwali 20.33mg/ml and *Citrus reticulata* of sahiwal having ascorbic acid concentration is 19.31mg/ml.

INTRODUCTION

Citrus occupies a prominent position in fruit industry of the world including Pakistan. *Citrus* is most important fruit crop of Punjab province. One of its important varieties, Kinnow, *Citrus reticulata* is admirable due to its flavor, taste as well as nutritional value. *Citrus* is the most important fruit crop in Pakistan both in the area under cultivation (199.9 thousand hectares) and fruit production (2.132 MMT). Crop nutrition and disease management are of vital importance for plant health and orchard viability in terms of yield and quality (Muhammad *et al.*, 2011).

The *Citrus* fruits are nutritionally important, as nearly all of its species are rich in vitamin-C, minerals, phytochemicals and dietary fibre (Altaf *et al.*, 2008). Additional benefits of *Citrus* fruits include protection against infections, diseases and cancer insurgence. The *Citrus* fruits are mainly processed for pure orange juice that does not contain fibre. It is exceptionally nutritious as 12 oz. (354.84 ml) of orange juice contains approximately 110 percent of recommended dietary allowance (RDA) of vitamin-C. Additionally, it also provides vitamin A, B1, B6, calcium, folic acid, iron, magnesium and potassium. An average orange fruit yields 60 calories. Besides these functional ingredients, oranges are also rich in beta-carotene and bioflavonoid and these all components are essential elements in healthy diet (Ahmad *et al.*, 2012).

Citrus is grown on about 170,000 ha of land in Pakistan, constituting about 30 percent of the area under all fruit orchards (Saleem *et al.*, 2008; Ashraf *et al.*, 2010). *Citrus* is generally grown all over Pakistan but the Punjab province has the largest area under this fruit tree. The major *Citrus* variety grown in Punjab is Kinnow covering 80 percent of the total *Citrus* growing area (Altaf, 2006).

In Pakistan, Kinnow is grown on a large scale in Punjab (Naz *et al.*, 2007) where its fruit yield is 9.5 tons ha⁻¹ and 1.28 million tons per season (Ibrahim *et al.*, 2011). The average yield in Pakistan is far below than other *Citrus* producing countries like Brazil where it is 40 to 60 tons ha⁻¹ (Ibrahim *et al.*, 2011). In Pakistan, Kinnow is preferably grown under natural environmental conditions so as to maintain its original flavor and quality intact. *Citrus* orchards in Pakistan are facing problem of fruit size, color, quality and excessive premature fruit drop which is due to the deficiencies of essential nutrients (Ibrahim *et al.*, 2007). Nutrient deficiency disturbs the production of plant growth regulators controlling size, color and premature fruit dropping. Excessive premature fruit dropping in fruit crops is also dependent on other factors like high temperatures and water deficits, insect/pest attack, and wind velocity of the area (Ibrahim *et al.*, 2007; Ashraf *et al.*, 2012; Razi *et al.*, 2011). *Citrus* trees produce profuse flowers which develop into fruits that are later shed off necessarily to reduce heavy fruit load, so that the fruits remaining on trees

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can be sustained. The abovementioned factors cause fruit drop and application of nutrients or plant growth regulators is recommended to reduce premature fruit drop (Modise *et al.*, 2009, Ashraf *et al.*, 2012). Flower/fruit dropping was recorded at a thesis which continued up to the time of harvest (Modise *et al.*, 2009). Kinnow mandarin (easy peel *Citrus*) has assumed special economic importance and export demand is being acknowledged for its high juice content, special flavor, delicious taste and as a rich source of vitamin-C. In per capita terms, annual availability of *Citrus* is nearly 12.5 kg, of which share of Kinnow is about 8 kg. A consumption of 8 kg per capita implies the availability of 1206 mg of vitamin-C, 1520 mg of calcium, 684 mg of phosphorous and nearly 16 mg of iron per head during the *Citrus* production season. It is exceptionally nutritious as 12 oz. (354.84 mL) of orange juice contains approximately 110 percent of recommended dietary allowance (RDA) of vitamin-C. Additionally, it also provides vitamin A, B1, B6, calcium, folic acid, iron, magnesium and potassium. An average orange fruit yields 60 calories. Besides these functional ingredients, oranges are also rich in beta-carotene and bioflavonoid and these all components are essential elements in healthy diet (Ahmad *et al.*, 2012).

The average yield of Kinnow in Pakistan is far less than other *Citrus* producing countries of the world like USA and Australia. The main reasons for low productivity are excessive winter leaf drop, poor fruit set and fruit drop at different stages of fruit development. Proper fertilization is an essential feature for enhancing the productivity of *Citrus* fruits (Ghafoor *et al.*, 2010). In this regard scientists reported that combined application of NPK before initiation of new growth increased the yield by 28.5 percent but fruit acidity was also increased. The application of foliar fertilizer at three different stages (pre-flowering stage, physiological fruit drop stage and fruitlet development stage) had positive effects. Application of NPK with different combinations before time of flowering improved fruit quality and size (Ghafoor *et al.*, 2010). The application of macronutrients particularly nitrogen, phosphorus and potassium plays important role in yield, as well as fruit quality (Hammami *et al.*, 2010). The soluble solid contents of fruits of sprayed trees were increased by 1.5-1.9 percent with better colour and flavour. The juice of Kinnow mandarin is found to be very refreshing, delicious and soothing (Ahmed *et al.*, 2007).

Similarly, effect of micronutrients on fruit quality has been highlighted by other researchers (Lester *et al.*, 2010). The use of growth regulators has become an important component of agro-technical procedures for most of the cultivated plants especially fruit plants (Almeida *et al.*, 2004). The auxins and gibberellins are used to control fruit drop in *Citrus* and improve fruit quality, however, in Pakistan these practices are very limited. The quality of *Citrus*/Kinnow mandarin primarily depends upon the pre-harvest management practices being followed in orchards.

In view of foregoing facts a study was initiated to compare the quality of fruit from different orchards following various pre-harvest management practices in district Sargodha. These findings would show that how pre-harvest management practices affect the quality of Kinnow mandarin under agro-environmental conditions of Punjab province, Pakistan.

Kinnow is grown in the Punjab province of Pakistan. Out of the total area under fruits is 29.55 is under *Citrus* and out of total area under *Citrus*, 60% is under Kinnow. The total production of Kinnow increased from 1609 thousand tons in 1990-91 to 1830 thousand ton in 2001-2002 (Ahmad and Mustafa, 2006). Kinnow has assumed special economic importance for its high juice contents especially Vitamin C. In per capita terms, annual *Citrus* that is available is nearly 12.5kg, of which share of Kinnow is 8kg. A consumption of 8kg per capita implies the availability of 1206mg of vitamin C. The average yield of Kinnow in Pakistan is less than other *Citrus* producing countries like USA and Australia. that reasons for low production is due to continuous winter leaf drops, poor fruit setting and fruit drop a the stage of fruit development (Ahmad *et al.*, 2012). Today Pakistan stands at 13th and 10th position among top *Citrus* producing and exporting countries of the world respectively. Average yield of *Citrus* in Pakistan is about 10 t ha⁻¹ which is far less than world average *Citrus* yield 30 t ha⁻¹. Annually 1.7 MMT *Citrus* is produced from a total area of 185 thousand hectares in Pakistan. The *Citrus* industry in Pakistan is usually known as Kinnow (Salem *et al.*, 2008). Ascorbic acid content varies due to some factors which include maturity stage, environmental changes, ripening stage, variety of *Citrus* fruits as well as temperature (Tareen *et al.*, 2015). Vitamin C is known as ascorbic acid, and it is beneficial in our food as it has antioxidant properties

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and also curative properties. It makes connection in tissue, bones, and blood vessels in our body. Vitamin C strengthens our defense system against the oxygen reactive species and also preventing from the tissue damage. It is mostly used in the cure of some harmful diseases like hemorrhagic disorder, wound healing (Okiei et al., 2009).

MATERIALS AND METHODS

A. Chemical

The chemicals used for the experimental purpose included distilled water, potassium iodide-5 grams, potassium iodate -0.268grams, conc. sulphuric acid -30 ml, starch solution-10 drops and standard ascorbic acid 0.25grams.

B. Sample Collection and Preparation

Citrus reticulata (Kinnow) were collected from different tehsils of Sargodha (Bhalwal, kotmomin, Silanwali). The fruits were blended with a blender each and was filtered by using muslin cloth and made up to 100 ml with distilled water

Preparation of Reagents and Estimation of Ascorbic Acid

1% starch indicator was prepared by adding 0.50g soluble starch to 50 ml of distilled water. Mix well and then cool it before use.

Iodine solution was prepared by mixing 5.00g potassium iodide and 0.268g potassium iodate were dissolved into 500ml beaker with 200 ml of distilled water. 30ml of 3 molar sulfuric acid was added into the beaker and then diluted with distilled water upto 500 ml solution.

Vitamin C standard solution was prepared by dissolving 0.250 g ascorbic acid in the beaker with 100 ml of distilled water. The solution was transferred into 250 ml volumetric flask and diluted to 250ml with distilled water.

Standardization of iodine solution with vitamin C standard solution was by pipetting 25ml of vitamin C solution a 125ml Erlenmeyer flask. 10 drops of 1% starch solution were added and then titrated against iodine solution until blue black color was observed. Titrations were repeated in three times. The volume of each fruits sample used was measured and concentration of ascorbic acid per 100 ml fruits was calculated using;

$$\text{Concentration of ascorbic acid used in mg/100ml} = \frac{\text{concentration} \left(\frac{\text{mg}}{\text{ml}} \right) \text{standard}}{\text{weight of sample}} \times 1000$$

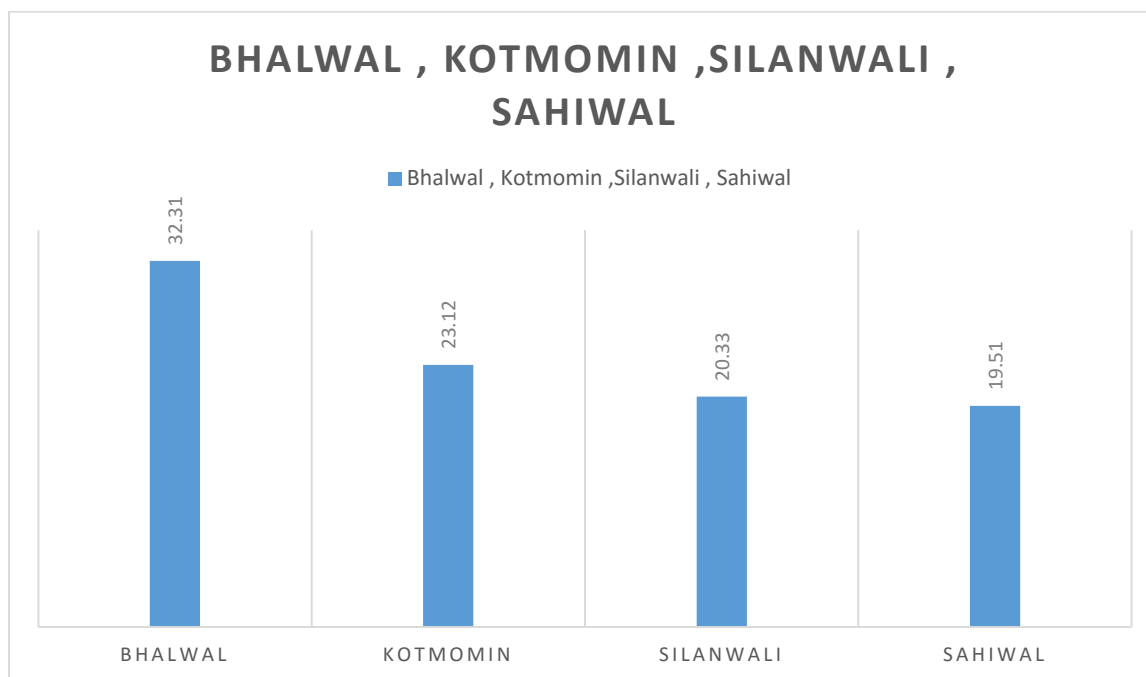
RESULT AND DISCUSSION

Ascorbic acid content in *Citrus reticulata* (Kinnow) fruit varied significantly by all selected tehsils of District Sargodha. The highest Ascorbic acid concentration of *Citrus reticulata* was observed in tehsil Bhalwal i.e. 32.31mg/ml and lowest ascorbic acid concentration of was observed in tehsils kotmomin is 23.12mg/ml and tehsil Silanwali that i.e. 20.33mg/ml and tehsil Sahiwal i.e. 19.51mg/ml. Fluctuation in Ascorbic acid concentration in all different tehsils of Sargodha may be due to fluctuation in different environmental factors like soil composition humidity temperature pH etc.

Table 1: Spatial Variations in Ascorbic Acid Concentration in *Citrus reticulata* (Kinnow) Collected from Bhalwal, Kotmomin, Silanwali and Sahiwal

Variation in Ascorbic Acid Concentration	
Bhalwal	32.31mg/ml
Kotmomin	23.12mg/ml
Silanwali	20.33mg/ml
Sahiwal	19.51mg/ml

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Conclusion

The highest ascorbic acid concentration in *Citrus reticulata* was observed in tehsil Bhalwal is 32.31mg/ml and lowest ascorbic acid concentration was observed in *Citrus reticulata* collected from Silanwali Kotmomin and Sahiwal.

Our results reveal that ascorbic acid concentration in *Citrus reticulata* of Bhalwal is high and it mean it is valuable source of health promoting constituents, the results also encourage the cultivation of different kinds of *Citrus* and other fruits in the local environment of the Kingdom. Our results also reveal that the *Citrus reticulata* of Bhalwal is very helpful in different diseases.

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