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### RESEARCH ARTICLE

#### EFFECT OF INORGANIC AND ORGANIC FERTILIZERS ON FRUIT QUALITY AND YIELD ATTRIBUTES IN GUAVA CV. SARDAR.

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#### Abstract

The present investigation entitled “Effect of inorganic and organic fertilizers on fruit quality and yield attributes in guava cv. Sardar” was carried out in a well maintained Guava orchard, Khalsa College, Amritsar during 2016-17. In the trial, 18 guava trees of cv. Sardar with uniform size and vigour were selected. The selected trees were fertilized with Recommended dose of fertilizers i.e. 600 g urea, 2000 g super phosphate and 1000 g muriate of potash, Vermicompost @ 16 kg/tree, Jeevamrit @ 10 litre/tree, *Azotobacter* and *Azospirillum* @ 100g/tree. Fruits were analyzed for their physical and biochemical parameters at Horticulture laboratory of Department of Horticulture, Khalsa College. It was revealed from the study that trees fertilized with recommended dose of NPK yielded fruits with significant fruit length (9.2 cm), fruit breadth (8.72 cm), fruit weight (222.43 g) and also the fruits attained high organoleptic rating, excellent fruit colour and minimum fruit firmness (2.93 kg/cm<sup>2</sup>). The fruit obtained from trees treated with recommended dose of inorganic fertilizers had maximum TSS (12.19%), reducing sugars (5.43%), total sugars (7.97%), non-reducing sugars (2.54%), ascorbic acid content (203.91 mg/100 g of pulp) and minimum titratable acidity (0.54%). Also, the guava trees under treatment T<sub>1</sub> took minimum days (98.33) for fruit maturation and yielded maximum number of fruits (282.00) per tree with the fruit yield of 62.73 kg. Hence, inorganic fertilizers were found to be the most efficacious in encouraging the quality and yield of Sardar guava fruits.

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#### Introduction:-

Guava (*Psidium guajava* L.) is one of the most important fruit crop of family Myrtaceae and also claimed to be the fourth most important tropical fruit crop in India after mango, banana and citrus (Dutta *et al* 2014). It has assumed significance owing to its hardy nature and prolific bearing even under marginal lands with little care and minimal inputs (Sahu *et al* 2014). It is often called as “poor man’s apple” or “Apple of Tropics” owing to its excellent taste, flavor, high nutritional value and wide adaptability at moderate price (Dhokane and Kadam 2013). It is commonly known for its food and nutritional value throughout the world (Kumar 2012).

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The dispensable use of chemical fertilizers has widened soil imbalance in terms of NPK ratio and overall decline in production capacity of soil (Chhonkar 2008). Integration of organic substrates with chemical fertilizers can have significant effect on the physical, microbiological and chemical properties of soil, which are responsible for supporting plant growth. Use of organic manures along with biofertilizers and crop residues is considered as a cheap source of available nutrient to plants which have beneficial effects on growth, yield and quality of various fruit crops (Katiyar *et al* 2012). Considering economy, energy and environment, it is imperative that plant nutrients should be used effectively by adopting proper nutrient management system to ensure high yield and to sustain the availability in soil at optimum level for getting higher yield and quality fruit production for which nutrient management is necessary (Yadav 1999). Scanty information is available on the effect of biofertilizers and organic manures along with the chemical fertilizers in guava, hence the present investigation entitled “Effect of inorganic and organic fertilizers on fruit quality and yield attributes in guava cv. Sardar” was planned to check out the nutritional schedule with a view to improve the quality and yield of guava fruits.

### Materials and Methods:-

The present investigation entitled “Effect of inorganic and organic fertilizers on fruit quality and yield attributes in guava cv. Sardar” was carried out during 2016-17. The material used for the present experiment were Urea, Superphosphate, Muriate of Potash, Vermicompost, Jeevamrit, *Azotobacter* and *Azospirillum*. In the trail, seven year old guava tree having uniform vigour were selected for the study. The experiment was laid out in Randomized Block Design (RBD) with three replications. Various inorganic and organic fertilizers were applied alone consisting of total six treatments T<sub>1</sub> RDF (600g Urea, 2000g SP, 1000g MOP), T<sub>2</sub> Vermicompost (16 kg/tree), T<sub>3</sub> Jeevamrit (10 l/tree), T<sub>4</sub> *Azotobacter* (100g/tree), T<sub>5</sub> *Azospirillum* (100g/tree) and T<sub>6</sub> Control. As per recommendation by PAU, Ludhiana (Anon 2015) half of inorganic fertilizers were applied in July and remaining half in September, Vermicompost in July, Biofertilizers: *Azotobacter* and *Azospirillum* were applied during second fortnight of August by mixing in soil. However, Jeevamrit was applied in five splits at the interval of 15 days. The observations on fruit length and breadth were measured with Vernier's Calliper, fruit weight with electronic balance, fruit firmness with Penetrometer and organoleptic rating with panel of five judges as per Hedonic scales (1-9 points). TSS of guava fruits was determined by refractometer. The chemical parameters like titratable acidity, total sugars, reducing sugars and ascorbic acid were measured as per standard procedures of AOAC (1990).

### Results and Discussion:-

Maximum fruit length (9.2 cm) was recorded in the fruits harvested from plants treated with recommended dose of fertilizers (T<sub>1</sub>) and was found to be closely followed by treatment T<sub>2</sub> (vermicompost) with fruit length of 8.96 cm. Both the above treatments were found to be significant over the rest of the treatments. However, the plants manured with Vermicompost (T<sub>2</sub>) yielded fruit with fruit length of 8.96 cm, which were found to be at par with the treatment T<sub>5</sub> (8.41 cm). Minimum fruit length (6.93 cm) was recorded under control.

Maximum fruit breadth (8.72 cm) was recorded in plants fertilized with recommended dose of fertilizer (T<sub>1</sub>). The former treatments was found to be statistically at par with treatments T<sub>2</sub> (Vermicompost), T<sub>5</sub> (*Azospirillum*) and T<sub>4</sub> (*Azotobacter*) with fruit breadth of 8.70, 8.35, and 8.34 cm respectively. Whereas minimum fruit breadth (7.8 cm) was recorded under T<sub>6</sub> (control) which was closely followed by T<sub>3</sub> (Jeevamrit) with fruit breadth of 7.94 cm.

The increase in fruit size (length and breadth) might be due to the enhancement of vegetative growth with the application of inorganic fertilizers by which the rate of photosynthesis increased and ultimately the metabolic activities of plant get accelerated, thereby the fruit size improved affectively. Whereas, Vermicompost improves microbial distribution and moisture retention capacity in soil that results in greater enzymatic activities which improves the growth parameters which ultimately reflect in increased fruit size (Binepalet *et al* 2013). The above findings are in accordance with the findings of Athaniet *et al* (2007), Ram *et al* (2007) and Sharma *et al* (2014), Osman and EI- Rahman (2009) in guava, Verma and Chauhan (2013) in apple, Patel and Naik (2010) in Sapota.

Maximum fruit weight (222.43 g) was found in the plants under treatment T<sub>1</sub> (RDF) which was statistically at par with treatments T<sub>5</sub> (*Azospirillum*) and T<sub>2</sub> (Vermicompost) with fruit weight of 220.22g and 218.44g respectively. However, the untreated plants yielded minimum weighed fruits (204.66 g). The increase in fruit weight due to inorganic fertilizers could be due to greater mobility of nutrients to the developing fruits. Whereas the increase in fruit weight by vermicompost might be due to the increase in enzymatic activities in plant metabolic processes which ultimately leads to increase in fruit weight. Similar results were reported by Athaniet *et al*. (2007), Ram *et al*

(2007), Sharma *et al* (2014) in guava and Osman and EI- Rahman (2009), Verma and Chauhan (2013) in apple, Patel and Naik (2010) in Sapota and Lal and Sen (2001) in guava.

Minimum fruit firmness ( $2.93 \text{ kg/cm}^2$ ) was recorded in fruits obtained from plants supplied with recommended dose of fertilizers ( $T_1$ ). The above treatment ( $T_1$ ) was statistically at par with treatments  $T_2$ ,  $T_5$  and  $T_3$  with fruit of 3.08, 3.16 and  $3.19 \text{ kg/cm}^2$  respectively. The reduction in fruit firmness with the use of fertilizers might be due to intensive solubilization of pectin from cell wall to starch breakdown and reduction of turgor (Tucher 1993). Similar results were also found by Chatterjee *et al* (2013) in tomato and Osman and EI- Rahman (2009) in guava.

Maximum points (9.00) were awarded to the fruits obtained from plants treated with treatment  $T_1$  (RDF) and was closely followed by treatments  $T_2$ ,  $T_5$  and  $T_4$  with organoleptic rating of 8.66, 8.33 and 8.00 respectively. While least organoleptic rating 7.33 under treatment  $T_3$  (Jeevamrit). It might be due to the fact that with the application of fertilizers the vegetative parameters improved significantly, which results in higher photosynthesis rate and better translocation of metabolites to the fruits which improves the quality of fruits (Naik and Haribabu 2007). Results of these findings are confined by Umar *et al* (2009) in strawberry, Binapalet *et al* (2013) and Pathak and Ram (2004) in guava.

The best coloured (8.66 PY) guava fruits were obtained under treatment  $T_1$  (RDF) which was followed by treatments  $T_2$  and  $T_5$  respectively with pale yellow (8.33) and yellowish green (8.00) fruits. Least fruit colour development (6.50 G) was noticed in plants under control and was found to be at par with treatments  $T_3$  (7.00 LG) and  $T_4$  (7.33 YG). Similar results were also found by Chatterjee *et al* (2013) in tomato.

From the data it has been observed that minimum days (98.33) were taken by trees for maturation of fruits under treatment  $T_1$  and found to be closely followed by treatment  $T_2$  with maturation time of 99.33 days. However these treatments were found to be significant to all the other treatments, whereas the trees under control took maximum days i.e. 105.33 for fruit maturation. The present results are in line with the findings of Sandhu and Gill (2011) in cape gooseberry.

Significant TSS (12.19%) was recorded in fruits produced from plants treated with recommended dose of fertilizers ( $T_1$ ). The improvement in TSS by the application of recommended dose of NPK may be explained by the fact that phosphorous enters into the composition of phospholipids and nucleic acids, the latter combines with proteins and results in the formation of nucleo-proteins which are the important constituents of the nuclei of the cells. Potassium acts as a catalyst in the formation of more complex substances and in the acceleration of coenzymes are beneficial in the improvement of fruit quality and nitrogen enhances the uptake of phosphorous and potassium (Binapalet *et al* 2013). The minimum TSS (8.80%) was recorded under control and found to be statistically at par with treatment  $T_4$  with TSS content of 9.14 per cent. Results of these findings were also confined by Umar *et al* (2009) in Strawberry, Athaniet *et al* (2007), Ram *et al* (2007) and Sharma *et al* (2014), Sharma *et al* (2013) also reported in guava and Khehra and Bal (2016) in lemon.

Non significant effect on titratable acidity of guava fruits was noticed. Minimum acidic content (0.54%) was recorded in the fruits picked from plants treated with  $T_1$  (RDF). NPK fertilization might helps in the uptake of other nutrients which helps in improving the fruit quality significantly (Sharma *et al* 2014). Similar observations have been reported by Khehra and Bal (2016) in lemon and Saravananet *et al* (2013) in Phalsa. The plants under control yielded highly acidic fruits with titratable acidity of 0.63 per cent.

Maximum TSS: acid ratio (22.51) was recorded under treatment  $T_1$  (RDF) and was closely followed by treatment  $T_2$  (Vermicompost) with TSS: acid ratio of 19.8. However, both the former treatments were found to be significantly superior to rest of the treatments. Increase in TSS: acid ratio is caused by decrease in titratable acidity and increase in TSS contents of fruits which contributed of fruit flavor. Minimum TSS: acid ratio (13.96) was observed under control. These results are in accordance with the findings of Tassaret *et al* (1989), Lal and Sen (2001) and Meenaet *et al* (2005) in guava.

From the data, it has been observed that RDF improved the total sugars in fruits (7.97%) and also found to be statistically at par with treatment  $T_2$  (Vermicompost) with total sugars of 7.63 per cent. Minimum total sugars (7.13%) were registered in fruits obtained from trees under control.

It was noted that trees under treatment T<sub>1</sub> yielded fruits with maximum reducing sugars (5.43 %) and was also followed by treatments T<sub>2</sub>, T<sub>3</sub> and T<sub>5</sub> in line with reducing sugars of 5.35, 5.23 and 5.28 respectively. Minimum reducing sugars (4.74 %) were observed in control.

Maximum non-reducing sugars (2.54 %) were recorded in the fruits harvested from plants treated with T<sub>1</sub> (RDF) and minimum (2.18 %) were recorded under treatment T<sub>3</sub> (Jeevamrit).

The increase in sugar content of fruits by the use of recommended dose of NPK fertilizers might be due to the enhancement in uptake of nutrients which lead to increased catalytic activities by which the complex substances (starch) degrade into simple sugars and thereby improve the fruit quality. The present results are in accordance with the findings of Dutta *et al* (2009), Binepalet *et al* (2013) in guava and Butani and Chovatia (2014) in Banana.

Maximum ascorbic acid content (203.91 mg/100 g pulp) was found in the fruits produced from plants treated with recommended dose of fertilizers (T<sub>1</sub>). It was found to be at par with treatments with T<sub>2</sub> (Vermicompost) and T<sub>5</sub> (*Azospirillum*) with ascorbic acid content of 200.41 and 198.33 mg/100g pulp respectively. Minimum ascorbic acid (189.16 mg/100 g pulp) was recorded under control and was found to be at par with treatments T<sub>3</sub>, T<sub>4</sub> and T<sub>5</sub> with ascorbic acid content of 189.58, 190.41 and 198.33 mg/100 g pulp respectively. Similar observations have also been reported by Dutta *et al* (2009) in guava and Khehra and Bal (2016) in lemon. Increase in nitrogen application has also been found to increase ascorbic acid content in Cape gooseberry (Ali *et al* 2003).

A perusal of data clearly indicates that significantly maximum number of fruits (282.00) was calculated in guava trees under treatment T<sub>1</sub> (RDF) and was followed by treatment T<sub>2</sub> with fruit number of 272.33. Significant maximum fruit yield (62.73 kg/tree) was recorded under treatment T<sub>1</sub>. Minimum fruit yield (45.22 kg/tree) was obtained under Control and was found to be at par with treatment T<sub>3</sub> (Jeevamrit) with fruit yield of 47.66 kg per plant. Significant increase in fruit yield might be attributed to the increased fruit number per plant, fruit size and weight. Moreover, the NPK fertilization might accelerate the process of synthesis and accumulation of food materials, which promotes the hormonal activity and include their synthesis and it ultimately leads to increase in number of fruits and yield. The above findings are in accordance with Dwivedi (2012), Shukla *et al* (2014), Meena *et al* (2013) in Guava, Laxmi *et al* (2015) in tomato, Saravanan *et al* (2013) in Phalsa and Butani *et al* (2013) in Banana.

### Conclusion:-

It is concluded from the present study that fruit quality parameters as well as yield per plant was improved with the use of recommended dose of fertilizers (T<sub>1</sub>). Also the guava trees fertilized with recommended doses of NPK took minimum days for fruit maturation. However, the treatment T<sub>1</sub> (RDF) was found to be statistically at par with the treatment T<sub>2</sub> (Vermicompost) in improving the desired characters of guava fruits. But the input cost of vermicompost should be taken into consideration, it is advised that the RDF has to be used in proper manner to improve the physical, biochemical and yield parameters in guava cv. Sardar.

**Table 1:-** Effect of inorganic and organic fertilizers on physical parameters in guava cv. Sardar

Treatments	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Fruit firmness	Organoleptic rating	Fruit colour	Maturation time (days)	Number of fruit per tree	Yield per tree (kg)
T <sub>1</sub>	9.20	8.72	222.43	2.93	9.00	8.66	98.33	282.00	62.73
T <sub>2</sub>	8.96	8.70	218.44	3.08	8.66	8.33	99.33	272.33	59.49
T <sub>3</sub>	7.65	7.94	207.55	3.19	7.33	7.00	100.66	229.66	47.66
T <sub>4</sub>	7.93	8.34	214.33	3.23	8.00	7.33	101.33	261.33	56.01
T <sub>5</sub>	8.41	8.35	220.22	3.16	8.33	8.00	102.00	265.00	58.35
T <sub>6</sub>	6.93	7.80	204.66	3.58	7.66	6.50	105.33	221.00	45.22
Mean	8.18	8.30	214.60	3.20	8.16	7.64	101.11	255.22	54.91
CD (p=0.05)	0.70	0.42	4.81	0.28	0.87	0.88	1.91	10.65	2.69

**Table 2:-**Effect of inorganic and organic fertilizers on biochemical parameters in guava cv. Sardar

Treatments	TSS (%)	Titrateable acidity (%)	TSS: acidity	Total sugars (%)	Reducing sugars (%)	Non-reducing (%)	Ascorbic acid (mg/100 g of pulp)
T <sub>1</sub>	12.19	0.54	22.51	7.97	5.43	2.54	203.91
T <sub>2</sub>	11.24	0.58	19.80	7.63	5.35	2.28	200.41
T <sub>3</sub>	9.63	0.62	15.64	7.41	5.23	2.18	189.58
T <sub>4</sub>	9.14	0.56	18.33	7.22	4.98	2.24	190.41
T <sub>5</sub>	10.25	0.56	16.43	7.55	5.28	2.27	198.33
T <sub>6</sub>	8.80	0.63	13.96	7.13	4.67	2.46	189.33
Mean	10.21	0.58	17.78	7.49	5.16	2.33	195.33
CD (p=0.05)	0.37	NS	2.96	0.398	0.36	NS	10.12

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