## *Original Research Article*

## EFFECT OF VARYING LEVELS AND APPLICATIONS OF NUTRIENT FERTILIZERS ON YIELD AND QUALITY OF CUSTARD APPLE

## (*Annona squamosa* L.)

**ABSTRACT**

The present investigation was undertaken with an objective to assess the nutrient dose and their effect on growth, yield and quality of custard apple. The experiment was conducted on 10-year-old custard apple orchard in mrig bahar at Instructional Cum Research Orchard Arid Zone Fruit Project, Department of Horticulture, M.P.K.V., Rahuri, Dist. Ahmednagar during 2017-18 (Trial-I) and 2018- 19 (Trial-II). Treatments comprising the combinations of three different levels of nitrogen (0,250,350 g N/plant/year), phosphorus (0,125,175 g P205/plant/year) and potassium (0,125,175 g K20/plant/year) in all possible 27 combinations was split in different growth stages, were replicated two times in Factorial Randomized Block Design. Nitrogen, phosphorus and potassium were applied in the form of urea, single super phosphate and muriate of potash respectively. The application of FYM @ 20 kg + PSB @ 25 g + *Azotobacter* @ 15 g + *Trichoderma* @ 15 g per plant and the treatment N1P2K1 i.e. 250:175:125 g N:P2O5:K2O g/plant dose of inorganic fertilizers with scheduling of nutrient viz., 50 % N, 50 % P2O5 and 50 % K2O as a basal application, 20 % N, 50 % P2O5 and 25 % K2O at fruit set stage, 20% N and 25 % K2O at lemon size fruit stage and 10 % N at one month before harvesting has given highest number of fruits per plant**,** average weight of fruit (g), pulp percentage, fruit set %, yield (kg/plant) and quality of custard apple of Cv. Balanagar.

**KEYWORDS:** Custard apple, Balanced Nutrients, Fertilizer.

 **INTRODUCTION**

Custard apple (*Annona squamosa* L.) is a deciduous, subtropical fruit, consumed in many countries throughout the world (Manica, 1994). Custard apple a member of family Annonaceae, is believed to be introduced in India from tropical South America (Beerh, 1972). It has several synonymous such as Sithaphal, Sharifa, Sugar apple, Sweet sop *etc.* and more than 70 species come under the genus *Annona* of which only six of them produces edible fruits. In India, custard apple is grown on hilly rocks with minimum inputs (Rajput, 1985). Among the various factors responsible for increasing crop production, the use of balanced fertilizers at appropriate time plays a vital role in enhancing productivity. It is generally recognized that out of total fertilizers application only about 50 to 60 per cent of the total nutrient enter the plant system with the rest being wasted by either leaching or volatilization.

Use of various organic manures and fertilizers is a good practice to maintain physico-chemical and biological properties of the soil. However, use of organic matter cannot provide required nutrients including micronutrients, but it will improve physical condition of soil, aeration and better root growth. Likewise, an excessive and indiscriminate use of chemical fertilizers results in considerable deterioration of soil health. It also disturbs the soil microorganisms and reduces pH of soil. Nutrient management is a production system which favours the maximum use of organic material and required quantity of inorganic fertilizers to maintain soil fertility and productivity.

**RESEARCH METHODS**

The research was conducted on ten-year-old custard apple plant orchard Cv. Balanagar in Mrig bahar during 2017-18 and 2018-19 at Instructional Cum Research Orchard Arid Zone Fruit Project, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri (M.S.). In this experiment, the plants were kept in to the rest period (Bahar treatment). The pruning was carried out in month of February. Manuring and fertilization has been done simultaneously before giving first light irrigation to the orchard. Experimental plants were supplied with common dose of limiting micro nutrients as per the soil test + FYM @ 20 kg+ PSB @ 25 g + *Azotobacter* @ 15 g + *Trichoderma* @ 15 g/ plant. Single common spray of 0.5 % Borax on 30 days after first irrigation was given to each plant. The experiment was laid out in a factorial randomized block design with 27 treatments combination and each treatment was replicated twice with four fertilizers applications stages.

**Table 1. Details of the different levels of treatment used in the study.**

#### Nitrogen Phosphorus Potassium

N0 = 0 g N/plant P0 = 0 g P2O5/plant K0 = 0 g K2O/plant

N1= 250 g N/plant P1= 125 gP2O5/plant K1= 125 g K2O /plant

N2= 350 g N/plant P2= 175 g P2O5/plant K2= 175 g K2O /plant

#### Table 2. Details of the different application stages used in the study.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sr.****No.** | **Stages** | **Days after Ist irrigation** | **N %****per plant** | **P2O5 %****per plant** | **K2O %****per plant** |
| 1. | Basal application | 0 | 50 | 50 | 50 |
| 2. | Fruit set | 30 | 20 | 50 | 25 |
| 3. | At lemon size fruit | 90 | 20 | - | 25 |
| 4. | One month before harvest | 120 | 10 | - | - |

**Yield and Quality parameters were worked out as follows.**

**Number of Fruit per Plant**

The matured fruits harvested from a plant were counted at each harvest. The total numbers of fruits of all picking were counted and recorded as number of fruits per plant.

#### Average Weight of Fruit (g)

Total fruits from each treatment combination tree were picked and weight of all fruits of each treatment was recorded separately on digital weighing balance. The average weight (g) of each treatment was computed by dividing the total weight of harvested fruits (g) by total number of fruits in each treatment.

#### Fruit Rind (%)

The rind percentage was worked out by dividing the average weight of rind per fruit by the average weight of fruit.

 Average weight of rind per fruit (g)

Rind percentage = 100

 Average weight of fruit (g)

#### Fruit Pulp (%)

The pulp percentage was worked out by dividing the average weight of pulp per fruit by the average weight of fruit.

 Average weight of pulp per fruit (g)

Pulp percentage = 100

 Average weight of fruit (g)

#### Fruit Seed (%)

The seed percentage was worked out by dividing the weight of seeds per fruit by the weight of fruit.

 Average weight of seed per fruit (g)

 Seed Percentage = ------------------------------100

 Average weight of fruit (g)

#### Fruit Set (%)

The percentage of fruit set was calculated by dividing total number of set fruit per plant by total number of flowers per plant multiplied by 100.

 Total number of set fruit per plant

Fruit Set Percentage = 100

 Total number of flowers per plant

#### Fruit Yield (kg/plant)

The yield of custard apple fruits was calculated by multiplication of av. number of fruit to av. Weight of fruit and divided by 1000.

Average number of fruit x Weight of fruit (g)

 Yield (kg/plant) = ---------------------------------------------------

 1000

**TSS (0Brix)**

The total soluble solids (TSS) were recorded by the Hand Refractometer (Erma Tokyo A032) by taking a drop of juice on prism of the Refractometer and the readings were recorded for respective treatments. The prism of Refractometer was washed with distilled water and wiped by muslin cloth after recording each observation (A.O.A.C., 1995).

#### Acidity (%)

Acidity of the juice was determined by titration with 0.1N sodium hydroxide as described by Ranganna (1997).

Five mL of juice was taken in conical flask. About 10 ml of water was added to it and was titrated against standard 0.1 N sodium hydroxide solution using phenolphthalein as an indicator until permanent faint pink colour developed. Acidity was calculated and expressed in terms of anhydrous citric acid as per cent.

Reading x Normality of NaOH x Eq. weight of Citric acid Titrable acidity (%) = -----------------------------------------------------------------------

Volume of sample taken x 1000

**RESULT AND DISCUSSION**

The important results have been illustrated with the help of suitable figures. On the basis of the results obtained, an effort has been made to explain the possible reasons of differences obtained due to different treatments. The results have been discussed in the light of literature available for the different observations under study.

**Table 3.**

|  |  |  |
| --- | --- | --- |
| **Number of Fruit per Plant** | Average Weight of Fruit (g) | Fruit Rind (%) |
| **Treatments** | **2017** | **2018** | **2017** | **2018** | **2017** | **2018** |
| N0P0K0 | 93.50 | 86.50 | 185.43 | 185.18 | 48.56 | 47.95 |
| N0P0K1 | 89.50 | 94.50 | 188.41 | 187.49 | 48.05 | 47.74 |
| N0P0K2 | 90.00 | 96.50 | 193.56 | 191.03 | 47.41 | 47.36 |
| N0P1K0 | 91.00 | 98.00 | 197.46 | 190.81 | 47.07 | 47.07 |
| N0P1K1 | 95.50 | 100.00 | 197.25 | 205.07 | 47.32 | 47.36 |
| N0P1K2 | 90.50 | 98.00 | 206.69 | 206.23 | 47.22 | 47.13 |
| N0P2K0 | 94.50 | 97.00 | 202.56 | 203.33 | 46.90 | 46.86 |
| N0P2K1 | 96.00 | 102.50 | 205.95 | 204.71 | 47.32 | 47.32 |
| N0P2K2 | 99.00 | 82.50 | 209.49 | 208.57 | 46.72 | 47.10 |
| N1P0K0 | 104.50 | 99.00 | 210.09 | 216.74 | 46.16 | 45.81 |
| N1P0K1 | 113.50 | 103.00 | 212.40 | 219.92 | 46.83 | 44.84 |
| N1P0K2 | 103.50 | 104.50 | 215.85 | 220.86 | 46.60 | 44.85 |
| N1P1K0 | 113.50 | 116.50 | 215.27 | 217.89 | 45.30 | 45.57 |
| N1P1K1 | 127.50 | 127.00 | 224.22 | 222.92 | 44.48 | 44.99 |
| N1P1K2 | 120.50 | 124.50 | 229.81 | 229.80 | 44.22 | 43.70 |
| N1P2K0 | 110.00 | 119.00 | 215.51 | 213.94 | 45.90 | 45.53 |
| N1P2K1 | 129.00 | 127.50 | 237.17 | 226.92 | 42.61 | 44.63 |
| N1P2K2 | 122.50 | 122.50 | 240.77 | 231.73 | 42.24 | 44.68 |
| N2P0K0 | 105.50 | 103.00 | 206.40 | 205.07 | 46.72 | 46.35 |
| N2P0K1 | 106.50 | 107.50 | 209.77 | 206.23 | 47.44 | 46.92 |
| N2P0K2 | 110.50 | 105.50 | 208.85 | 208.21 | 46.53 | 45.96 |
| N2P1K0 | 105.50 | 106.00 | 211.89 | 208.57 | 46.90 | 45.86 |
| N2P1K1 | 116.50 | 120.50 | 218.85 | 221.40 | 45.74 | 45.28 |
| N2P1K2 | 115.00 | 117.50 | 219.18 | 222.56 | 45.50 | 45.03 |
| N2P2K0 | 111.50 | 108.50 | 207.33 | 221.86 | 46.72 | 44.95 |
| N2P2K1 | 115.50 | 115.00 | 217.89 | 226.32 | 45.39 | 44.63 |
| N2P2K2 | 115.00 | 114.50 | 218.74 | 226.62 | 45.50 | 44.69 |
| **SE(m) ±** | 1.89 | 1.92 | 2.02 | 1.57 | 0.52 | 0.37 |
| **CD 5%** | NS | 5.39 | NS | 4.41 | NS | NS |
| **GM** | 106.87 | 107.30 | 211.33 | 212.22 | 46.19 | 45.93 |

**Table 4.**

|  |  |  |
| --- | --- | --- |
| Fruit Pulp (%) | Fruit Seed (%) | Fruit Set (%) |
| **Treatments** | **2017** | **2018** | **2017** | **2018** | **2017** | **2018** |
| N0P0K0 | 31.40 | 31.95 | 14.33 | 14.82 | 11.11 | 11.46 |
| N0P0K1 | 32.67 | 33.22 | 14.18 | 14.51 | 11.15 | 11.84 |
| N0P0K2 | 32.78 | 33.33 | 13.82 | 14.20 | 11.15 | 11.83 |
| N0P1K0 | 31.45 | 32.00 | 13.80 | 14.02 | 11.15 | 11.85 |
| N0P1K1 | 33.40 | 33.95 | 13.40 | 13.13 | 11.17 | 11.86 |
| N0P1K2 | 33.77 | 34.32 | 12.43 | 12.82 | 11.17 | 11.86 |
| N0P2K0 | 31.84 | 32.39 | 13.05 | 13.16 | 11.17 | 11.86 |
| N0P2K1 | 33.55 | 34.10 | 12.53 | 13.01 | 11.18 | 11.87 |
| N0P2K2 | 34.13 | 34.68 | 12.79 | 12.75 | 11.20 | 11.89 |
| N1P0K0 | 35.01 | 36.44 | 12.11 | 12.45 | 11.17 | 11.30 |
| N1P0K1 | 35.29 | 36.72 | 11.72 | 12.15 | 11.19 | 11.31 |
| N1P0K2 | 35.34 | 36.77 | 11.75 | 11.78 | 11.17 | 11.29 |
| N1P1K0 | 35.73 | 37.16 | 11.49 | 12.01 | 11.30 | 11.29 |
| N1P1K1 | 36.55 | 37.98 | 10.41 | 11.09 | 11.45 | 12.32 |
| N1P1K2 | 36.62 | 38.05 | 10.61 | 10.89 | 11.35 | 12.09 |
| N1P2K0 | 35.39 | 36.82 | 11.16 | 11.88 | 11.29 | 11.20 |
| N1P2K1 | 36.80 | 38.23 | 10.23 | 10.98 | 12.37 | 11.93 |
| N1P2K2 | 37.02 | 38.45 | 9.94 | 10.73 | 12.35 | 11.81 |
| N2P0K0 | 34.49 | 35.63 | 12.34 | 12.83 | 11.96 | 11.89 |
| N2P0K1 | 35.02 | 36.16 | 11.99 | 12.58 | 12.03 | 11.74 |
| N2P0K2 | 35.27 | 36.41 | 12.20 | 12.48 | 12.19 | 11.22 |
| N2P1K0 | 34.62 | 35.76 | 11.61 | 12.34 | 12.24 | 11.23 |
| N2P1K1 | 35.91 | 37.05 | 10.91 | 11.48 | 12.30 | 11.35 |
| N2P1K2 | 36.16 | 37.30 | 10.96 | 11.49 | 12.31 | 11.43 |
| N2P2K0 | 35.02 | 36.16 | 11.98 | 11.78 | 12.08 | 11.17 |
| N2P2K1 | 35.95 | 37.09 | 11.09 | 11.29 | 12.49 | 11.45 |
| N2P2K2 | 36.32 | 37.46 | 10.98 | 11.26 | 12.29 | 11.35 |
| **SE(m) ±** | 0.06 | 0.08 | 0.17 | 0.16 | 0.23 | 0.22 |
| **CD 5%** | 0.17 | 0.24 | NS | NS | NS | NS |
| **GM** | 34.72 | 35.76 | 11.99 | 12.37 | 11.63 | 11.62 |

**Table 5.**

|  |  |  |
| --- | --- | --- |
| Fruit Yield (kg/plant) | **TSS (0Brix)** | Acidity (%) |
| **Treatments** | **2017** | **2018** | **2017** | **2018** | **2017** | **2018** |
| N0P0K0 | 17.35 | 16.02 | 19.72 | 19.98 | 0.38 | 0.38 |
| N0P0K1 | 16.85 | 17.72 | 19.91 | 20.11 | 0.38 | 0.38 |
| N0P0K2 | 17.43 | 18.44 | 19.99 | 20.18 | 0.38 | 0.38 |
| N0P1K0 | 17.96 | 18.69 | 19.88 | 20.07 | 0.38 | 0.38 |
| N0P1K1 | 18.84 | 20.50 | 20.22 | 20.41 | 0.38 | 0.38 |
| N0P1K2 | 18.70 | 20.21 | 20.36 | 20.55 | 0.38 | 0.38 |
| N0P2K0 | 19.16 | 19.73 | 19.93 | 20.12 | 0.38 | 0.38 |
| N0P2K1 | 19.77 | 20.98 | 20.60 | 20.79 | 0.38 | 0.38 |
| N0P2K2 | 20.74 | 17.21 | 20.74 | 20.93 | 0.38 | 0.38 |
| N1P0K0 | 21.95 | 21.45 | 22.11 | 22.43 | 0.38 | 0.38 |
| N1P0K1 | 24.10 | 22.65 | 22.98 | 23.33 | 0.38 | 0.37 |
| N1P0K2 | 22.34 | 23.07 | 23.14 | 23.48 | 0.38 | 0.37 |
| N1P1K0 | 24.43 | 25.38 | 22.49 | 23.81 | 0.38 | 0.37 |
| N1P1K1 | 28.59 | 28.31 | 24.57 | 24.93 | 0.37 | 0.37 |
| N1P1K2 | 27.61 | 28.61 | 22.56 | 24.89 | 0.37 | 0.37 |
| N1P2K0 | 23.70 | 25.46 | 24.46 | 23.02 | 0.38 | 0.37 |
| N1P2K1 | 30.59 | 28.93 | 24.52 | 24.78 | 0.36 | 0.37 |
| N1P2K2 | 29.50 | 28.39 | 24.42 | 24.22 | 0.36 | 0.37 |
| N2P0K0 | 21.77 | 21.12 | 20.43 | 21.18 | 0.38 | 0.38 |
| N2P0K1 | 22.35 | 22.17 | 22.04 | 22.29 | 0.38 | 0.37 |
| N2P0K2 | 23.08 | 21.97 | 22.66 | 22.91 | 0.38 | 0.37 |
| N2P1K0 | 22.35 | 22.11 | 21.96 | 22.21 | 0.38 | 0.37 |
| N2P1K1 | 25.49 | 26.68 | 23.94 | 24.19 | 0.37 | 0.36 |
| N2P1K2 | 25.21 | 26.15 | 23.91 | 24.16 | 0.37 | 0.36 |
| N2P2K0 | 23.12 | 24.07 | 22.38 | 22.63 | 0.38 | 0.37 |
| N2P2K1 | 25.16 | 26.02 | 23.85 | 24.10 | 0.36 | 0.36 |
| N2P2K2 | 25.15 | 25.94 | 23.96 | 24.21 | 0.36 | 0.36 |
| **SE(m) ±** | 0.48 | 0.40 | 0.12 | 0.14 | 0.00 | 0.01 |
| **CD 5%** | 1.38 | 1.15 | 0.34 | 0.38 | NS | NS |
| **GM** | 22.72 | 22.89 | 22.14 | 22.44 | 0.37 | 0.37 |

The NPK interaction was not significant during 2017 as well as in the pooled analysis but in year 2018 analysis was found to be significant. The N1P2K1 combination with N1- 250 g N /plant, P2-175 g P2O5/plant and K1-125 g K2O/plant which recorded maximum number of fruits/plant of 127.50 in year 2018. However, significantly minimum number of fruits /plant of 86.50 in year 2018 were recorded in N0P0K0 combination with N0-0 g N /plant, P0-0 g P2O5/plant and K0-0 g K2O/plant.

Increasing number of fruits it’s depending on other factors such as pollination, flower formation and fruit set. Balance nutrient dose has to be maintained soil-crop system and it has also take care of all other factors of production and make allowances for residual effects of past fertilizers application. Too much nitrogen fertilizers results in excess vegetative growth and reduce the reproductive growth which otherwise are needed to maintain large yield of fruits (Ganeshamurthy *et al.,* 2015). The balanced dose of fertilizer was presumed to be more effective in controlling physiological parameters.

The NPK interaction effects on average weight of fruit were found to be significant during year 2018 and pooled analysis but in year 2017 were found to be non- significant. The N1P2K2 combination with N1-250 g N /plant, P2-175 g P2O5/plant and K2- 175 g K2O/plant which recorded maximum average weight of fruit of (231.73 and 236.25 g) in year 2018 and pooled analysis results respectively. The N1P2K2 combination was observed to be at par with N1P1K2 having N1-250 g N /plant, P1-125 g P2O5/plant and K2- 175 g K2O/plant. However, significantly minimum average weight of fruit of (185.18 and 185.30 g) in year 2018 and pooled analysis results respectively were recorded in N0P0K0 combination with N0-0 g N /plant, P0-0 g P2O5/plant and K0-0 g K2O/plant.

Balance nutrient dose has to be maintained soil-crop system and it has also taken care of all other factors of production and make allowances for residual effects of past fertilizers application. Too much nitrogen fertilizers results in excess vegetative growth and reduce the reproductive growth which otherwise are needed to maintain large yield of fruits (Ganeshamurthy *et al.,* 2015). The intermediate dose of fertilizer was presumed to be more effective in controlling physiological parameters resulting in increased average weight of fruit. The present investigations are in confirmation with Dhillon *et al.* (2011) in pomegranate.

The NPK interaction effects on rind percentage of fruits were found to be non-significant during both the years as well as in the pooled analysis. The N1P2K2 treatment combinations were recorded minimum rind percentage of fruits 44.46 per cent. The possible reason for the above trend might be due to the higher potassium levels was mainly due to increase in pulp weight and pulp percentage which was the consequence of satisfactory activity of the enzymes involved in starch and protein synthesis under adequate supply of K. Similar findings have also been reported by Shinde *et al.* (2009) in mango.

The NPK interaction effects on pulp percentage of fruits were found to be significant during both the years and in pooled results. The N1P2K2 combination with N1- 250 g N /plant, P2-175 g P2O5/plant and K2-175 g K2O/plant which recorded maximum pulp percentage of fruit of 37.02, 38.45 and 37.23 per cent in both the years and in pooled results, respectively. The N1P2K2 combination was observed to be at par with N1P2K1 having N1-250 g N/plant, P2-175 g P2O5/plant and K1-125 g K2O/plant. However, significantly minimum pulp percentage of fruit of 31.40, 31.95 and 31.67 per cent in both the years and in pooled results, respectively were recorded in N0P0K0 combination with N0- 0 g N /plant, P0-0 g P2O5/plant and K0-0 g K2O/plant.

The increase in pulp weight and pulp percentage of fruits might be on account of incorporation of organic manures and biofertilizers and inorganic fertilizers. Organic manures and biofertilizers have direct role in nitrogen fixation, production of phytohormones like substances and increased uptake of nutrients hence quality improvement reflected in fruit character (Baviskar *et al.,* 2011). These observations are in agreement with the findings of Madhavi *et al.* (2008) in mango, Patel *et al.* (2010) in sapota and Baviskar *et al.* (2011) in sapota.

The NPK interaction effects on seed percentage of fruit were found to be non-significant during both the years as well as in the pooled analysis. Minimum fruit seed percentage were recorded in N1P2K2 treatment combinations 9.94, 10.73 and 10.33 per cent in both the years study as well as pooled analysis and maximum seed percentage were recorded in N0P0K0.

In custard apple, the fruits having higher number of seeds would not fetch higher price in market as it likely to be failed to attract the consumer, therefore lesser of number of seeds per fruit preferred for Table and processing purposes. The possible reason for the above trend might be due to the organic + inorganic fertilizers dose was presumed to be more effective in controlling physiological parameters resulting in increased fruit weight, pulp percentage and fruit quality.

The NPK treatment combination effects on fruit set percentage were found to be non-significant during both the years study as well as in the pooled analysis. Maximum fruit set percentage were recorded in N2P2K1 levels 12.49, 11.35 and 11.97 per cent during 2017, 2018 as well as pooled analysis, respectively and minimum fruit set percentage were recorded in N0P0K0 level.

Higher level of applied nitrogen and phosphorus recorded maximum number of flowers per shoot with higher fruit set and least fruit drop over medium level and no application. Similar trend was also observed with potassium application over control. It is seen that NPK interactions had non-significant effect on number of flowers and fruit set percentage. The possible reason for the above trend might be due to the fact that nitrogen is component of chlorophyll and potash help in chlorophyll formation that regulate the build-up of proper C:N ratio, which control the flowering and fruiting of plant (Baviskar *et al*., 2018) . These results also confirm the earlier findings of Kumar *et al*. (2008) and Singh *et al*. (2008) in guava.

The NPK interaction effects on fruit yield per plant were found to be significant during both the years and in pooled results. The N1P2K1 combination with N1- 250 g N /plant, P2-175 g P2O5/plant and K1-125 g K2O/plant which recorded maximum fruit yield per plant of 30.59, 28.93 and 29.76 kg in both the years and in pooled results, respectively. The N1P2K1 combination was observed to be at par with N1P2K2 having N1- 250 g N /plant, P2-175 g P2O5/plant and K2-175 g K2O/plant and N1P1K1 having N1-250 g N /plant, P1-125 g P2O5/plant and K1-125 g K2O/plant. However, significantly minimum fruit yield per plant of 17.35, 16.02 and 16.69 kg in both the years and in pooled results, respectively were recorded in N0P0K0 combination with N0-0 g N /plant, P0-0 g P2O5/plant and K0-0 g K2O/plant.

The intermediate levels of N and K dose resulted in better fruit yield of pear as compared to lower and higher levels of N and K fertilizers (Gill *et al.,* 2017). The greater number of fruits or fruit yield might be due to role of nitrogen, phosphorus and potassium in various metabolic processes, which improved fruit bud differentiation, flower intensity, higher fruit set and fruit retention (Khan *et al.,* 2018). The present investigations are in confirmation with Baviskar *et al.* (2018) in guava.

The NPK interaction effects on total soluble solid of fruit were found to be significant during both the year and in pooled results. The N1P1K1 combination with N1- 250 g N /plant, P1-125 g P2O5/plant and K1-125 g K2O/plant which recorded maximum total soluble solid of fruit of 24.57, 24.93 and 24.75oBrix in both the years and in pooled results, respectively. The N1P1K1 combination was observed to be at par with N1P2K1 having N1-250 g N /plant, P2-175 g P2O5/plant and K1-125 g K2O/plant. However, significantly minimum total soluble solid of fruit of 19.72, 19.98 and 19.85o Brix in both the years and in pooled results, respectively were recorded in N0P0K0 combination with N0-0 g N /plant, P0-0 g P2O5/plant and K0-0 g K2O/plant.

The significant improvement in quality of traits like TSS, total sugar and lowest titrable acidity was may be due to the known fact that NPK are capable of supplying adequate macro plant nutrients which play major role in quality improvement through desirable enzymatic change taking place during growth of the plants. Similar results were reported by Waghmare *et al*. (2018b) in custard apple.

The NPK interaction effects on acidity of fruit were found to be non-significant during both the years and in pooled results. The N2P2K2 combination with N2- 350 g N /plant and P2-175 g P2O5/plant and K2-175 g K2O/plant recorded lowest acidity 0.36 per cent. Acidity of fruit juice showed a declining trend with an increase in levels of N and K fertilizers (Gill *et al.,* 2017). Overall, no significant effect due to either of nitrogen, phosphorus and potassium levels combinations on acidity of fruit juice. The present investigations are in confirmation with Dhillon *et al.* (2011).

**CONCLUSION**

The application of FYM @ 20 kg + PSB @ 25 g + *Azotobacter* @ 15 g + *Trichoderma* @ 15 g per plant and the treatment N1P2K1 i.e. 250:175:125 g N:P2O5:K2O g/plant dose of inorganic fertilizers with scheduling of nutrient viz., 50 % N, 50 % P2O5 and 50 % K2O as a basal application, 20 % N, 50 % P2O5 and 25 % K2O at fruit set stage, 20% N and 25 % K2O at lemon size fruit stage and 10 % N at one month before harvesting has given highest number of fruits per plant**,** average weight of fruit (g), pulp percentage, fruit set %, yield (kg/plant) and quality of custard apple of Cv. Balanagar.

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