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## Effect of organic and inorganic fertilizers on fruit set, yield and economics of sapota (*Manilkara achras* Forsberg) Var. Kalipatti

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### Abstract

The field experiment was conducted at Department of Horticulture, Vasant Rao Naik Marathwada Agriculture University, Parbhani during the year 2009-10. The experiment was laid out in randomized block design with three replication and ten treatments. In this investigation the sapota tree were applied with different organic and inorganic fertilizers and their combination namely T<sub>1</sub> (100% RDF), T<sub>7</sub> (100% FYM), T<sub>3</sub> (100% Vermicompost), T<sub>4</sub> (50% FYM + 50% Vermicompost), T<sub>5</sub> (75% RDF + 25% FYM), T<sub>6</sub> (50% RDF + 50% FYM), T<sub>7</sub> (25% RDF + 75% FYM), T<sub>8</sub> (75% RDF + 25% Vermicompost), T<sub>9</sub> (50% RDF + 50% Vermicompost) and T<sub>10</sub> (25% RDF + 75% Vermicompost). The effects of these treatments were noted on vegetative growth, reproductive growth, fruit quality and yield attributes of sapota. The results of experimentation on confirmed the efficiency of integration of organic and chemical fertilizers for better growth, yield of sapota. The application of 50% RDF + 50% Vermicompost enhanced the vegetative and reproductive growth as well as yield attributes. However, the recommended dose of inorganic fertilizers (100% RDF) showed wider cost-benefit ratio than that of 50% RDF + 50% Vermicompost.

**Keywords:** Sapota, Kalipatti, FYM, RBD Vermicompost

### Introduction

Sapota (*Manilkara achras*), it is a native of tropical America and probably originated in the southern Mexico (Papenoe, 1974) [8]. It is not known when sapota first introduced to India, but sapota cultivation was taken up for the first time in Maharashtra in 1898 in a village named Gholwad & district Thane (Chadha 1993) [6].

Sapota is a good source of digestible sugar which ranges from 12 to 18 percent. Composition of ripe sapota per 100 g of edible portion is moisture 73.7 g, carbohydrates 21.4 g, protein 0.7 g, fat 1.1 g, calcium 28.0 mg and phosphorus 27.0 mg (Shanmugavelu and Srinivasan, 1973) [9]. Area of this fruit is on ascendancy due to high production per unit area, liking to Indian palate, continuous fruiting throughout the year in humid climate and hardy nature of crop against biotic and abiotic stresses. Sapota has become one of the important fruit in southern and western parts of country due to its wild range of adaptability, low production costs and reasonably high economic returns with very low pest and diseases susceptibility (Singh, 1991) [10].

In 1953, the area under this crop was 800 ha. Only but now area increases also in non-coastal area of country. India is leading producer of sapota and area under sapota is estimated to be 156 lakh ha. With a production of 1308 million tonnes (Anonymous, 2009) [1, 2]. In Maharashtra an area of sapota is about 65.4 lakh ha. Concentrated in coastal region particularly in Thane district. Production of Maharashtra is about 298.7 million tonnes. There is significant increase in area from 1990, an account of implementation of EGS scheme. However, in Marathwada area under this crop is increasing recently at and very rapid rate it is 0.11 lakh ha with production of 41,072 metric tonnes (Anonymous 2009) [1, 2]. Now the sapota crop is included in the scheme of National Horticulture Mission from 2005. The Kalipatti cultivar is the main choice of the farmers and therefore, 99 percent area under sapota is under this cultivar. Sapota crop is highly responsive to fertilizers (Durrani *et al.*, 1982) [7].

Experiments conducted at the Regional Fruit Research Station, Gujarat Agricultural University, Navsari indicated that sapota crops needs N, P and K nutrients for higher fruits production with better quality (Anon., 1984) [4]. On organic manure for sapota orchardists is 200kg FYM/tree for getting highest production of fruits and net return.

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Sapota fruit demand good nutrition and respond well to fertilization. Among major nutrient, nitrogen is most important element, which influences growth and productivity of sapota. At present condition it is not possible to completely eliminate the use of chemical fertilizers. For this dose of chemical fertilizer need to be gradually reduced and balanced by increasing the use of optimum quantity of organic manures particularly FYM, sheep manure and poultry manures etc. Organic manures are the soil store house for nitrogen supply to plant. There is very little inorganic nitrogen in soil and much of it is obtained by the conversion of organic forms.

Sapota is a major important fruit crop grown in Maharashtra, Gujarat, Karnataka, Tamilnadu, Andhra Pradesh and Kerala. It gives fruits throughout the year. Use of various organic manures and fertilizers is a good practice to obtain higher yield with good quality fruits. To meet the requirements recommended for different fruit crops, it could either be through inorganic source or organic source but each one has its limitation and favour. General consensus is that it should be desirable to use 50-50 percent inorganic and organic fertilizer for better yield. An excessive and indiscriminate use of chemical fertilizers and pesticides has resulted in considerable deterioration of soil health. It disturbs the soil microorganisms, reduces pH and built up of  $P_2O_5$  and  $K_2O$  causing reduction in soil health; increase the fertilizer cost and awareness of environmental pollution due to continuous use of chemical fertilizer. It should be restricted on the other

hand people demand better quality fruits which can be produce and by using organic manure alone.

Addition of organic matter will not only provide required nutrients including micronutrient also improve physical condition of soil, improve aeration, providing scope for better root growth and production. It is a sound practice for sustainable horticulture base on low external chemical input. Organic farming is a production system which favours maximum use of organic material (crop residues, animal excreta, legumes on and off farm organic wastes, bio pesticides etc.) and discourages the use of synthetically produced agro inputs for maintaining soil productivity and fertility and pest management under conditions of sustainable natural resources and healthy environment.

### Material and Methods

The present investigation was conducted at the Department of Horticulture, Vasant Rao Naik Marathwada Agricultural University, Parbhani during the year 2009-10. The experimental trees used were 35 years old grafts of chiku var. Kalipatti on Khirni (*Manilkara hexandra*) root stock spaced at 10x10 metres.

### Treatment details

Treatment details the different treatment combinations of organic and inorganic fertilizer were ten, as given below in Table 1.

**Table 1:** Treatment details

| Tr. No.         | Treatment details                        |
|-----------------|--|
| T <sub>1</sub>  | 100% RDF viz., 1000:500:500 NPK (g/tree) |
| T <sub>2</sub>  | 100% FYM                                 |
| T <sub>3</sub>  | 100% Vermicompost                        |
| T <sub>4</sub>  | 50% FYM + 50% Vermicompost               |
| T <sub>5</sub>  | 75% RDF + 25% FYM                        |
| T <sub>6</sub>  | 50% RDF + 50% FYM                        |
| T <sub>7</sub>  | 25% RDF + 75% FYM                        |
| T <sub>8</sub>  | 75% RDF + 25% Vermicompost               |
| T <sub>9</sub>  | 50% RDF + 50% Vermicompost               |
| T <sub>10</sub> | 25% RDF + 75% Vermicompost               |

### Recommended dose of fertilizers

1. Recommended dose of N, P and K @ 1000:500:500 g/tree.
2. Dose of FYM application calculated on the basis of their nitrogen content. (NPK of FYM - 0.5:0.2:0.5).
3. Dose of Vermicompost application calculated on the basis of their Nitrogen content. (NPK of Vermicompost – 3: 1.0:1.5).

### Results and Discussion

#### Fruit Set

Data on percent flower drop and fruit set are presented in Table 2. All the organic and inorganic fertilizers increased the fruit set. The flower drop was significantly reduced by treatment T<sub>9</sub> (50% RDF + 50% Vermicompost) which ultimately increased fruit set and was found significantly superior over T<sub>4</sub>, T<sub>3</sub> and T<sub>7</sub> while treatments T<sub>6</sub>, T<sub>1</sub>, T<sub>8</sub>, T<sub>5</sub> and T<sub>10</sub> were at par with T<sub>9</sub>. The treatment (50% RDF + 50% Vermicompost) found 56.72 percent flower drop and increased the 43, 28 percent fruit set.

**Table 2:** Effect of organic and inorganic fertilizers on percent fruit set

| Tr. No.         | Treatment details                        | Fruit set (%) |
|-----------------|--|---------------|
| T <sub>1</sub>  | 100% RDF viz., 1000:500:500 NPK (g/tree) | 42.17         |
| T <sub>2</sub>  | 100% FYM                                 | 36.80         |
| T <sub>3</sub>  | 100% Vermicompost                        | 37.70         |
| T <sub>4</sub>  | 50% FYM + 50% Vermicompost               | 37.30         |
| T <sub>5</sub>  | 75% RDF + 25% FYM                        | 40.57         |
| T <sub>6</sub>  | 50% RDF + 50% FYM                        | 43.13         |
| T <sub>7</sub>  | 25% RDF + 75% FYM                        | 38.80         |
| T <sub>8</sub>  | 75% RDF + 25% Vermicompost               | 42.33         |
| T <sub>9</sub>  | 50% RDF + 50% Vermicompost               | 43.28         |
| T <sub>10</sub> | 25% RDF + 75% Vermicompost               | 40.70         |
|                 | Mean                                     | 40.28         |
|                 | SE <sub>±</sub>                          | 1.44          |
|                 | CD at 5%                                 | 4.27          |

### Yield

The organic and inorganic fertilizers at various combinations were influenced the physical parameters of fruit. Those are given under separate heads.

Weight of fruit (g) Data presented in Table 3 revealed that the treatments of organic and inorganic fertilizers showed significant effects in respect of weight of fruit.

**Table 3:** Effect of organic and inorganic fertilizers on weight of fruit (g)

| Tr. No.         | Treatment details                        | Weight of fruit (g) |
|-----------------|--|---------------------|
| T <sub>1</sub>  | 100% RDF viz., 1000:500:500 NPK (g/tree) | 81.74               |
| T <sub>2</sub>  | 100% FYM                                 | 87.77               |
| T <sub>3</sub>  | 100% Vermicompost                        | 85.76               |
| T <sub>4</sub>  | 50% FYM + 50% Vermicompost               | 86.43               |
| T <sub>5</sub>  | 75% RDF + 25% FYM                        | 82.69               |
| T <sub>6</sub>  | 50% RDF + 50% FYM                        | 81.00               |
| T <sub>7</sub>  | 25% RDF + 75% FYM                        | 84.50               |
| T <sub>8</sub>  | 75% RDF + 25% Vermicompost               | 82.04               |
| T <sub>9</sub>  | 50% RDF + 50% Vermicompost               | 80.32               |
| T <sub>10</sub> | 25% RDF + 75% Vermicompost               | 82.96               |
|                 | Mean                                     | 83.52               |
|                 | SE <sub>±</sub>                          | 0.92                |
|                 | CD at 5%                                 | 2.74                |

The treatment T<sub>2</sub> (100% FYM) showed significantly more weight of fruit than all other treatments except, the treatments T<sub>4</sub> and T<sub>3</sub> which were found to be statistically at par with the treatments T<sub>2</sub>. The treatment T<sub>2</sub>-100% FYM recorded maximum weight of fruit (87.77g) followed by the treatment T<sub>4</sub>-50% FYM + 50% Vermicompost (86.43g). However, minimum weight of fruit was observed in treatment T<sub>9</sub>- 50% RDF + 50% Vermicompost (80.32g) and treatments T<sub>6</sub>, T<sub>1</sub>, T<sub>8</sub>, T<sub>5</sub> and T<sub>10</sub> which were found at par to each other. The data regarding the yield was significantly influenced by the organic and inorganic fertilizers at various combinations.

### Yield (kg/tree)

The data revealed that there were significant effects of organic and inorganic fertilizers on fruit yield per tree are presented in Table 4, Maximum yield was recorded in treatment T<sub>9</sub>-50% RDF + 50% Vermicompost (206.45 kg/tree) which was statistically at par with T<sub>6</sub>- 50% RDF + 50% FYM (198.78 kg/tree). The treatment T<sub>9</sub> was significantly superior over all remaining treatments. Minimum yield per tree was recorded in treatment T<sub>2</sub>-100% FYM (172.18 kg/tree) and was at par with T<sub>4</sub>, T<sub>3</sub>, T<sub>7</sub> and T<sub>10</sub>.

**Table 4:** Effect of organic and Inorganic fertilizers on yield (kg/tree) and (qt/hectare)

| Tr. No.         | Treatment details                        | Yield (kg/tree) | Yield (qt/hectare) |
|-----------------|--|-----------------|--------------------|
| T <sub>1</sub>  | 100% RDF viz., 1000:500:500 NPK (g/tree) | 191.52          | 1915.2             |
| T <sub>2</sub>  | 100% FYM                                 | 172.18          | 1721.8             |
| T <sub>3</sub>  | 100% Vermicompost                        | 175.93          | 1759.3             |
| T <sub>4</sub>  | 50% FYM + 50% Vermicompost               | 174.77          | 1747.7             |
| T <sub>5</sub>  | 75% RDF + 25% FYM                        | 181.68          | 1816.8             |
| T <sub>6</sub>  | 50% RDF + 50% FYM                        | 198.78          | 1987.8             |
| T <sub>7</sub>  | 25% RDF + 75% FYM                        | 178.05          | 1780.5             |
| T <sub>8</sub>  | 75% RDF + 25% Vermicompost               | 184.67          | 1846.7             |
| T <sub>9</sub>  | 50% RDF + 50% Vermicompost               | 206.45          | 2064.5             |
| T <sub>10</sub> | 25% RDF + 75% Vermicompost               | 179.51          | 1795.1             |
|                 | Mean                                     | 184.35          | 1843.5             |
|                 | SE <sub>±</sub>                          | 3.11            | 31.1               |
|                 | CD at 5%                                 | 9.25            | 92.5               |

### Yield (qt/hectare)

From the data presented in Table 4, It was found that total yield per hectare was influenced by organic and inorganic fertilizers i.e. chemical fertilizers. FYM, Vermicompost and their combinations. Maximum yield was recorded in treatment T<sub>9</sub>-50% RDF + 50% Vermicompost (206.45 qt/hectare) which was statistically at par with T<sub>6</sub>-50%RDF+50%FYM (198.78 qt/hectare). The treatment T<sub>9</sub> was significantly superior over all remaining treatments. Minimum yield per hectare was recorded in treatment T<sub>2</sub>- 100% FYM (172.18 qt/hectare) and was at par with T<sub>4</sub>, T<sub>3</sub>, T<sub>7</sub> and T<sub>10</sub>.

### Economics

The study of charted economics of experiment (Table 5) revealed some interesting points.

### Cost: benefit ratio

The wider cost benefit ratio (1:11.58) was observed under (100%RDF) in treatment T<sub>1</sub> followed by (50% RDF + 50% Vermicompost) in treatment T<sub>9</sub> (1:10.77). Through application of treatment T<sub>9</sub> (50% RDF + 50% Vermicompost) the cost benefit ratio was less wider as compared to treatment T<sub>1</sub> (100%RDF), but in respect of tree health, quality of produce and soil health treatment 50% RDF + 50% Vermicompost was superior over 100% RDF.

**Table 5:** Economics of different treatments for cultivation of sapota.

| Tr. No.         | Treatment details                        | Treatment cost (Rs/ha) | Cost of cultivation (Rs/ha) | Total cost (Rs/ha) | Yield (q/ha) | Gross returns (Rs/ha) | Net returns (Rs/ha) | CBR     |
|-----------------|--|------------------------|-----------------------------|--------------------|--------------|-----------------------|---------------------|---------|
| T <sub>1</sub>  | 100% RDF viz., 1000:500:500 NPK (g/tree) | 2318                   | 22480                       | 24798              | 191.52       | 287280                | 262482              | 1:11.58 |
| T <sub>2</sub>  | 100% FYM                                 | 40000                  | 22480                       | 62480              | 172.18       | 258270                | 195790              | 1:4.13  |
| T <sub>3</sub>  | 100% Vermicompost                        | 10200                  | 22480                       | 32680              | 175.93       | 263895                | 231215              | 1:8.07  |
| T <sub>4</sub>  | 50% FYM + 50% Vermicompost               | 25100                  | 22480                       | 47580              | 174.77       | 262155                | 214575              | 1:5.50  |
| T <sub>5</sub>  | 75% RDF + 25% FYM                        | 11738.5                | 22480                       | 34218.5            | 181.68       | 272520                | 238301.5            | 1:7.96  |
| T <sub>6</sub>  | 50% RDF + 50% FYM                        | 21159                  | 22480                       | 43639              | 198.78       | 298170                | 254531              | 1:6.83  |
| T <sub>7</sub>  | 25% RDF + 75% FYM                        | 4288.5                 | 22480                       | 26768.5            | 178.05       | 267074                | 240306.5            | 1:9.98  |
| T <sub>8</sub>  | 75% RDF + 25% Vermicompost               | 30579.5                | 22480                       | 53059.5            | 184.67       | 277005                | 223945.5            | 1:5.22  |
| T <sub>9</sub>  | 50% RDF + 50% Vermicompost               | 6259                   | 22480                       | 28739              | 206.45       | 309675                | 280936              | 1:10.77 |
| T <sub>10</sub> | 25% RDF + 75% Vermicompost               | 8229.5                 | 22480                       | 30709.5            | 179.51       | 269265                | 238555              | 1:8.76  |

Wholesale price of sapota @ Rs. 15/kg.

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