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Influence of organic and inorganic fertilizers on flower drop, fruit set, fruit drop, furit retention and yield of sapota (*Manilkara achras* Forsberg) var. Kalipatti

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Abstract
The field experiment was conducted at Department of Horticulture, Marathwada Agriculture University, Parbhani. during the year 2009-10. The experiment was laid out in simple 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_1 (100% RDF), T_7 (100 % FYM), T_3 (100 % Vermicompost), T_4 (50% FYM + 50% Vermicompost), T_5 (75%RDF+ 25% FYM), T_6 (50% RDF + 50% FYM), T_7 (25% RDF + 75% FYM), T_8 (75% RDF + 25% Vermicompost), T_9 (50% RDF + 50% Vermicompost) and T_{10} (25% RDF + 75% Vermicompost). The treatment (50% RDF + 50% Vermicompost) found 56.72 per cent flower drop and increased the 43.28 Percent fruit set. The treatment T_9 (50% RDF + 50% Vermicompost) has recorded significantly reduced fruit drop (82.83 percent) and increased fruit retention (17.17 percent). The application of 50% RDF + 50% Vermicompost enhanced the vegetative and reproductive growth as well as yield attributes.

Keywords: Sapota, Kalipatti, FYM, RBD, flower drop vermicompost, fruit retention

1. 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).

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). 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) [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) [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 per cent 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 200 kg FYM/tree for getting highest production of fruits and net return (Anon., 2003a).

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.

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.

2. Material and Methods

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

Treatment Details

Different treatments and their combinations of organic and inorganic fertilizer, as given below in Table 1.

Table 1: Treatment details

Tr. No.	Treatment details
T_1	100% RDF viz., 1000:500:500 NPK (g/tree)
T_2	100% FYM
T_3	100% Vermicompost
T_4	50% FYM + 50% Vermicompost
T_5	75% RDF + 25% FYM
T_6	50% RDF + 50% FYM
T_7	25% RDF + 75% FYM
T_8	75% RDF + 25% Vermicompost
T_9	50% RDF + 50% Vermicompost
T_{10}	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).

3. Results and Discussion

Flower drop and fruit set

Data on per cent flower drop and fruit set are presented in Table 2.

All the organic and inorganic fertilizers reduced the flower drop and increased the fruit set. The flower drop was significantly reduced by treatment T_9 (50% RDF + 50% Vermicompost) which ultimately increased fruit set and was found significantly superior over T_4, T_3 and T_7 while treatments T_6, T_1, T_8, T_5 and T_{10} were at par with T_9. The treatment (50% RDF + 50% Vermicompost) found 56.72 per cent flower drop and increased the 43.28 Percent fruit set.

Higher percentage of flower drop was found in treatment T_2-100 % FYM (63.20 Percent), while T_4, T_3 and T_7 were at par with it.

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

Tr. No.	Treatment details	Flower drop (%)	Fruit set (%)
T_1	100% RDF viz., 1000:500:500 NPK (g/tree)	57.83	42.17
T_2	100% FYM	63.20	36.80
T_3	100% Vermicompost	62.30	37.70
T_4	50% FYM + 50% Vermicompost	62.70	37.30
T_5	75% RDF + 25% FYM	59.43	40.57
T_6	50% RDF + 50% FYM	56.87	43.13
T_7	25% RDF + 75% FYM	61.20	38.80
T_8	75% RDF + 25% Vermicompost	57.67	42.33
T_9	50% RDF + 50% Vermicompost	56.72	43.28
T_{10}	25% RDF + 75% Vermicompost	59.30	40.70
	Mean	59.72	40.28
	SE+	1.44	1.44
	CD at 5%	4.27	4.27

Fruit drop and fruit retention

It is evident from the data presented in Table 3 that the application of organic and inorganic fertilizers influenced the fruit drop and increases the fruit retention.

Table 3: Effect of organic and inorganic fertilizers on percent fruit drop and fruit retention

Tr. No.	Treatment details	Fruit Drop (%)	Fruit Retention (%)
T_1	100% RDF viz., 1000:500:500 NPK (g/tree)	84.09	15.91
T_2	100% FYM	87.10	12.02
T_3	100% Vermicompost	87.03	12.97
T_4	50% FYM + 50% Vermicompost	87.98	12.90
T_5	75% RDF + 25% FYM	84.96	15.04
T_6	50% RDF + 50% FYM	83.03	16.97
T_7	25% RDF + 75% FYM	86.12	13.88

T_8	75% RDF + 25% Vermicompost	84.30	15.70
T_9	50% RDF + 50% Vermicompost	82.83	17.17
T_{10}	25% RDF + 75% Vermicompost	85.15	14.85
	Mean	85.26	14.74
	SE+	0.68	0.68
	CD at 5%	2.03	2.03

The Table 3 Revealed that the treatment T_2 (100 % FYM) has highest fruit drop 87.98 percent and ultimately resulted poor fruit retention 12.02 percent. The treatments T_4, T_3 and T_7 were at par with T_2. The treatment T_9 (50% RDF + 50% Vermicompost) was found significantly superior over T_4, T_3, T_7, T_{10} and T_5. The treatment T_6, T_1 and T_8 were at par with T_9.The treatment T_9 (50% RDF + 50% Vermicompost) has recorded significantly reduced fruit drop (82.83 percent) and increased fruit retention (17.17 percent).

Yield

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

Weight of fruit (g) Data presented in Table 4 revealed that the treatments of organic and inorganic fertilizers showed significant effects in respect of weight of fruit.

Table 4: Effect of organic and inorganic fertilizers on weight of fruit (g)

Tr. No.	Treatment details	Weight of fruit (g)
T_1	100% RDF viz., 1000:500:500 NPK (g/tree)	81.74
T_2	100% FYM	87.77
T_3	100% Vermicompost	85.76
T_4	50% FYM + 50% Vermicompost	86.43
T_5	75% RDF + 25% FYM	82.69
T_6	50% RDF + 50% FYM	81.00
T_7	25% RDF + 75% FYM	84.50
T_8	75% RDF + 25% Vermicompost	82.04
T_9	50% RDF + 50% Vermicompost	80.32
T_{10}	25% RDF + 75% Vermicompost	82.96
	Mean	83.52
	SE+	0.92
	CD at 5%	2.74

The treatment T_2 (100 % FYM) showed significantly more weight of fruit than all other treatments except, the treatments T_4 and T_3 which were found to be statistically at par with the treatments T_2. The treatment T_2-100 % FYM recorded maximum weight of fruit (87.77g) followed by the treatment T_4-50% FYM + 50% Vermicompost (86.43g). However, minimum weight of fruit was observed in treatment T_9- 50% RDF + 50% Vermicompost (80.32g) and treatments T_6, T_1, T_8, T_5 and T_{10} 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 5, Maximum yield was recorded in treatment T_9-50% RDF + 50% Vermicompost (206.45 kg/tree) which was statistically at par with T_6- 50% RDF + 50% FYM (198.78 kg/tree). The treatment T_9 was significantly superior over all reaming treatments. Minimum yield per tree was recorded in treatment T_2-100% FYM (172.18 kg/tree) and was at par with T_4, T_3, T_7 and T_{10}.

Table 5: Effect of organic and Inorganic fertilizers on yield (kg/tree) and (qt/hectare)

Tr. No.	Treatment details	Yield (kg/tree)	Yield (qt/hectare)
T_1	100% RDF viz., 1000:500:500 NPK (g/tree)	191.52	1915.2
T_2	100% FYM	172.18	1721.8
T_3	100% Vermicompost	175.93	1759.3
T_4	50% FYM + 50% Vermicompost	174.77	1747.7
T_5	75% RDF + 25% FYM	181.68	1816.8
T_6	50% RDF + 50% FYM	198.78	1987.8
T_7	25% RDF + 75% FYM	178.05	1780.5
T_8	75% RDF + 25% Vermicompost	184.67	1846.7
T_9	50% RDF + 50% Vermicompost	206.45	2064.5
T_{10}	25% RDF + 75% Vermicompost	179.51	1795.1
	Mean	184.35	1843.5
	SE+	3.11	31.1
	CD at 5%	9.25	92.5

Yield (qt/hectare)

From the data presented in Table 5, 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_9-50% RDF + 50% Vermicompost (206.45 qt/hectare) which was statistically at par with T_6-50%RDF+50%FYM (198.78 qt/hectare). The treatment T_9 was significantly superior over all reaming treatments. Minimum yield per hectare was recorded in treatment T_2- 100% FYM (172.18 qt/hectare) and was at par with T_4, T_3, T_7 and T_{10}.

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