

Original Research Article

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## Effect of Pruning and Plant Growth Regulator on Plant Growth and Fruit Yield of Sapota (*Manilkara zapota* L.) cv. Cricket Ball

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### ABSTRACT

An experiment was carried out during 2017-18 in Horticulture Research Station, Bhubaneswar under Department of Fruit Science & Horticulture Technology, College of Agriculture, Orissa University of Agriculture & Technology to find out the effect of pruning and plant growth regulator like GA<sub>3</sub>, IAA, NAA, 2,4-D on plant growth and fruit yield rejuvenated sapota plant. Variation due to divergence in genotypes was found significant so far as the morphometric is concerned highest leaf chlorophyll content (27.85SPAD), canopy spread (11.988m in E-W and 10.51m in N-S directions), number of flowers per shoot (9.61), fruit drop (60.406%) were observed in unpruned tree. Whereas maximum leaf area (47.616cm<sup>2</sup>), fruit set (13.498%) were observed in primary branch pruned trees. Among the growth regulators and NAA@50ppm produced highest leaf area (45.974cm<sup>2</sup>), no. of flowers per shoot (8.886), fruit set (15.032%), no. of fruits per plant (119.4), yield (14.906kg/tree) Whereas GA<sub>3</sub>@20ppm produced highest chlorophyll content (25.46SPAD), canopy spread (9.814m in E-W & 8.808m in N-S), fruit weight (134.494g). Hence it is concluded that growth regulator NAA@50ppm influences the yield attributes like fruit set and fruit retention. The treatment combination tip clipping of terminal shoots followed by spraying of NAA@50ppm produced highest fruit yield (19.48kg/tree) and was the best among all other treatment.

#### Keywords

Pruning, Plant growth regulator, Chlorophyll, Canopy spread, Leaf area, Yield

#### Article Info

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### Introduction

Sapota produces a large number of flowers throughout the year in different flushes. The fruit quality of October-November flowering (Hasth bahar), which matures during August-September is somewhat poor as against July-August (Mrig bahar) flowering.

The crop of July-August flowering matures in April-May, when the price is comparatively lucrative. The major problem confronting

sapota crop is heavy flower and fruit drop (Patil and Narwadkar, 1974; Farooqui and Rao, 1976). Thus the regulation of flowering is one of the most important practical aspect of sapota cultivation.

India is considered to be the largest producer of sapota in the world. In India at present the total area and production under sapota is estimated as 107,000 hectares and 1294,000 metric tonnes with a productivity of 12.1 mt/ha (National Horticulture Board 2015-16).

The productivity is very high in Karnataka and Gujarat. It has become most popular fruit crop in Gujarat, Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh and Kerala.

Standardization of canopy management by way of training or pruning to maintain the tree size and to increase productivity has tremendous scope in high density planting of sapota. In senile plant, the yield is decreasing drastically and alternatively vegetative growth increases exponentially. So in order to balance the vegetative and reproductive growth of sapota plant, pruning of branches is felt necessary although fruiting occurs on newly emerged shoots. So to get fruiting from old, unproductive plants pruning is a very good and successive phenomenon for farmers to get some benefit.

Growth regulating chemicals govern all stages of crop development by using these at particular stage of fruit growth and development to have its maximum effect. Different groups of plant growth regulators like auxins, gibberellins and growth retardants at various concentrations have been reported to influence the flowering, fruit set, fruit retention, ripening advancement characters and quality characters of several fruit crops (Das and Mohapatra, 1976). Induction of flowering through chemical means is one way of tackling the problem of excessive vegetative growth and erratic flowering habit (Khader and Rao, 1983). Among the various causes of fruit drop, the simplest one is hormonal imbalance i.e. decline in the level of endogenous auxins (Addicot and Lynch, 1995).

Among the synthetic auxins tested in this regards, the NAA has been found to be the most effective in chickoo. Keeping this in view, an experiment on “Effect of pruning and plant growth regulator on plant growth and fruit yield of sapota (*Manilkara zapota* L.) cv.

Cricket Ball” was designed with the following cutting edge objectives

To study the effect of pruning and plant growth regulator like GA<sub>3</sub>, IAA, NAA, 2, 4-D on plant growth and fruit yield rejuvenated sapota plant.

## **Materials and Methods**

Horticulture Research Station, Bhubaneswar under Department of Fruit Science and Horticulture Technology, College of Agriculture, Orissa University of Agriculture and Technology during the year 2017-18. The experiment was laid out in a split plot design with twenty five treatments replicated twice. In the main plot five levels of pruning and sub plot five levels of growth regulators were studied for their sole and interaction effect. However the 1<sup>st</sup> pruning was done in 55 years old sapota plant in the year 2013 but subsequently in the present year only 4 healthy shoots with good crotch angle were selected to maintain the primary branch of the pruned tree.

Remaining shoots were thinned out periodically to develop a sturdy framework with open centre system. In secondary and tertiary branch pruned trees, thinning was done. Five levels of pruning were (P<sub>1</sub>) control, (P<sub>2</sub>) tip clipping of terminal shoots, (P<sub>3</sub>) pruning of tertiary branches, (P<sub>4</sub>) pruning of secondary branches, (P<sub>5</sub>) pruning of primary branches and five levels of growth regulators were (G<sub>1</sub>) control, (G<sub>2</sub>) 20 ppm GA<sub>3</sub>, (G<sub>3</sub>) 50 ppm NAA, (G<sub>4</sub>) 100 ppm IAA, (G<sub>5</sub>) 20 ppm 2,4-D as foliar spraying. Observations were taken Leaf area (cm<sup>2</sup>), Chlorophyll content (SPAD), Canopy spread (E-W and N-S), as Growth observations and Yield and yield contributing characters are Number of flowers per shoot, Fruit set percentage (%), Fruit drop percentage (%), Number of fruits per plant, Fruit yield (kg/plant), and analysis and

interpretation of data were done by using the method given by Gomez and Gomez (1984) in split plot design.

## Results and Discussion

Maximum leaf area (47.616cm<sup>2</sup>) was observed in P5 followed by P4 (46.436cm<sup>2</sup>) and minimum leaf area (39.994cm<sup>2</sup>) found in P1 (39.994cm<sup>2</sup>). Similarly maximum leaf area (45.974cm<sup>2</sup>) was found in G3 and minimum leaf area (42.766cm<sup>2</sup>) found in G1. This is due to the removal of apical dominance of the woody stems triggering a numerous no. of new shoots to sprang up. Similar findings were reported by Adhikari *et al.*, (2015) in guava and Sahoo *et al.*, (2017) in sapota. Maximum chlorophyll content (27.85 SPAD) was found in P1 and minimum chlorophyll content (22.416 SPAD) found in P5. Similarly maximum chlorophyll content (25.46 SPAD) was found in G2 followed by G3 (25.008SPAD) and minimum (23.886 SPAD) found in G1.

The reason being the younger leaves contain the pigment in lesser density than the older leaves. The unpruned trees bear dark green foliage whereas the pruned ones bear light green foliage. Pruning directly stimulates the formation of enlarged leaves, mesophyll size and moisture content as well as lengthen the period of stomata opening. This results a lower chlorophyll content in leaves of pruned trees. These corroborates with the findings of Sharma *et al.*, (2006) in mango and Sahoo *et al.*, (2017) in sapota.

Maximum canopy area in E-W direction (11.988m) was observed in P1 and minimum canopy area (4.848m) found in P5. In N-S direction (10.51m) was observed in P1 (10.466m) and minimum canopy area (4.614m) found in P5. Maximum canopy area (9.814m) in E-W direction was found in G2 and minimum canopy area (7.448m) found in

G1. In N-S direction maximum canopy area (8.808m) found in G2 and minimum canopy area (6.852m) found in G1. This may be due to the conspicuous effect of the growth regulator in elongation of the internode by stimulating the cell division and cell elongation in the meristematic region. These findings agree with that of Brar (2010) and Garhwal *et al.*, (2015).

Average maximum no. of flowers per shoot (9.61) found in P1 and minimum no. of flowers per shoot (4.24) found in P5. Maximum no. of flowers per shoot (8.886) was found in and minimum no. of flowers per shoot 6.478 found in G1. It seems to have helped to increase the fruit set either by improving pollen germination or by helping the growth of pollen tubes and thus facilitate in timely fertilization before the stigma loses its receptivity or the style becomes non-functional. Chavan *et al.*, (2009) worked found NAA 150 ppm produced more number of flowers (54.0) per shoot in sapota.

Maximum fruit set (13.498%) was found in P5 and minimum percent (9.958%) found in P1. Similarly G3 recorded maximum fruit set (15.032%) and minimum (9.652%) found in G1. Minimum fruit drop (51.98%) recorded in P5 and maximum (60.406%) found in P1. Similarly minimum fruit drop (50.564%) was found in G3 and maximum (60.752%) in G1). It is found from the result that both auxin and GA enhanced the flower and fruit retention percent but auxin group (NAA and 2, 4-D) are more efficient than gibberellin.

This might be due to anti-abscission property of auxin. Abscisic acid causes dissolution of middle lamella and primary walls of the cell at the base of pedicel and peduncle which leads to detachment of plant organ. However auxin counter acts with the ABA and ethylene and enhanced the Auxin: ABA ratio that ultimately prevents fruit drop (Table 1 and 2).

**Table.1** Effect of pruning on plant growth and fruit yield of sapota (*Manilkara zapota* L.) cv. cricket ball

S.I No	Leaf area (cm <sup>2</sup> )	Chlorophyll content (SPAD)	Canopy spread) (E-W)	Canopy spread (N-S)	Number of flowers per shoot	Fruit set percentage (%)	Fruit drop percentage (%)	Number of fruits per plant	Fruit yield (kg/plant)
P1	46.25	26.75	10.91	9.48	8.3	11.28	61.1	132.5	13.69
P2	47.51	27.85	13.4	11.36	9.27	12.43	51.69	152.5	19.05
P3	49.35	26.74	12.57	11.29	11.37	17.49	45.1	163.5	19.48
P4	46.65	25.75	11.38	10.02	8.46	11.91	53.47	136.5	15.68
P5	48.32	26.42	11.68	10.41	10.65	14.38	48.54	142	16.25
Mean	47.616	26.702	11.988	10.51	9.61	13.498	51.98	154.4	16.83
SEm (±)	0.072	0.089	0.023	0.09	0.251	0.081	0.069	4.874	0.652
CD (5%)	0.284	0.349	0.089	0.353	0.986	0.318	0.272	19.137	2.56

**Table.2** Effect of plant growth regulator on plant growth and fruit yield of sapota (*Manilkara zapota* L.) cv. cricket ball

S.I No	Leaf area (cm <sup>2</sup> )	Chlorophyll content (SPAD)	Canopy spread (E-W)	Canopy spread (N-S)	Number of flowers per shoot	Fruit set percentage (%)	Fruit drop percentage (%)	Number of fruits per plant	Fruit yield (kg/plant)
G1	41.32	27.85	13.4	11.36	11.37	12.16	56.27	152	16.01
G2	44.8	26.7	13.42	12.32	10.35	13.33	55.36	163.5	19.48
G3	46.59	25.2	10.16	9.65	9.98	15.72	49.26	143	19.35
G4	47.81	24.09	6.54	5.73	7.28	16.46	47.64	112	15.82
G5	49.35	23.46	5.55	47.98	5.54	17.49	45.1	26.5	3.87
Mean	45.974	25.46	9.814	8.808	8.904	15.032	50.726	119.4	14.906
SEm (±)	0.097	0.145	0.03	0.079	0.134	0.075	0.065	1.448	0.183
CD (5%)	0.287	0.429	0.087	0.234	0.396	0.221	0.192	4.272	0.541

Highest no. of fruits (145.4) found in P2 and lowest no. of fruits (19.7) in P5. Similarly G3 recorded the highest no. of fruits (119.4) and lowest no. of fruits were recorded in G1 (88.3). It might be due to GA mediating process for faster translocation and mobilization of stored metabolites or photosynthates from source to sink. It may be due to involvement of auxins in cell division and translocation of food material.

These findings corroborates with Agrawal and Dikshit (2008), Ingale *et al.*, (2008), Chavan *et al.*, (2009), Bhujbal *et al.*, (2013), Garhwal

*et al.*, (2015), Joshi *et al.*, (2015) and Sahoo *et al.*, (2017).

Maximum yield (16.83kg/plant) observed in P2 and minimum yield (2.606kg/plant) found in P5. Similarly highest yield (14.906kg/plant) observed in G3 and lowest yield (9.574kg/plant) in G1. This is because with increased in number of fruits per tree that ultimately increased the yield/tree and yield/ha. Agrawal and Dikshit (2008) reported that the application of NAA considerably increased number of fruits as well as yield than GA.

Primary pruning of old senile branches resulted a better leaf area than unpruned tree providing more scope for photosynthesis. Furthermore the fruit set and retention percentage remained highest due to enhanced photosynthesis and accumulation of food reserves. Spraying of growth regulators on sapota crop resulted that NAA@50ppm stimulates the leaf area, no. of flowers per shoot, fruit set %, fruit retention %, no. of fruits per plant and yield with minimum fruit drop.

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