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Effect of different level of pruning on growth, yield and fruit quality of sapota *cv.* Cricket ball under coastal zone of Odisha

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Abstract
In due course of time very old trees are becoming senile and unproductive. In order to mitigate this problem, an experiment on "Effect of Different Level of Pruning on Growth, Yield and Fruit Quality of Sapota *cv.* Cricket Ball under Coastal Zone of Odisha" was carried out at central farm, College of Agriculture, Orissa University of Agriculture & Technology, Bhubaneswar during the year 2013-2016. Trees were prune in five different levels followed by five different type of hormone were sprayed on 55 year old trees. The experiment was laid out in Split plot Design in which pruning was under main plot whereas spraying of plant growth hormones were kept in sub-plot. Trees were pruned in 2013 and at regular interval different growth observations like tree canopy spread and leaf chlorophyll content; yield contributing characters like Fruit set percentage (%), Days required from flowering to harvesting, Fruit yield (kg/plant), Fruit volume (cc), Fruit weight (g) and Physico-chemical quality of fruit like Total soluble solids (°Brix), Acidity (%), Total sugar content (%), Fruit moisture (%) and pH of fruit were taken under study. Initial two year there was no yield observed in the primary and secondary branch pruned plant. During the investigation period, maximum yield was obtained in tip clipped of terminal shoot (P2). With increase in level of pruning, yield decreased but fruit volume, fruit weight and fruit set % were increased. Highest total sugar, TSS were recorded in treatment P5 (1º branched pruned tree) whereas highest Titrable acidity was found in unpruned tree (P1). Both moisture % and pH of ripe sapota fruit were non-significant to different level of pruning.

Keywords: Canopy spread, pruning, sapota, TSS, yield

Introduction
Sapota (*Manilkara zapota*) is one of the important fruit crop belongs to the family Sapotaceae. It is a native of Mexico and Central America and is now grown on a commercial basis in India, Philippines, Sri Lanka, Venezuela, Mexico, Malaysia, Guatemala, and some other Central American countries. It has many names, such as chikku, sapota plum, Sapodilla or prickly pear. How and when this fruit was introduced into India is not very well known but Ghlowad village in Thane district of Maharashtra state has the evidence of first sapota plantation in 1898 (Cheema *et al*., 1954) [4]. India is the largest producer of sapota fruit with current production area around 1,77,000 ha, annual production around 1,7,44,000 metric tons and productivity is 9.9 MT/HA. (NHB, 2014) [1]. In India sapota is commercially grown in the Maharashtra, Gujarat, Karnataka, Andra Pradesh, Tamil Nadu and West Bengal states. Maharashtra leads in area (73,000Ha) and producing (474500 MT) of sapota, whereas Karnataka leads in productivity (11.7MT/HA). Orissa occupied the 7th position in production of sapota in India. It covers the area of about 3,400 ha and producing 15,600 MT of fruits. The productivity of sapota is 4.7 MT/HA, which is much below than national average productivity 9.9MT/HA (NHB, 2014) [1].

Raw sapota fruits are astringent, while ripe fruits are sweet. Mature fruits are used for making mixed fruit jams and provide a valuable source of raw material for the manufacture of industrial glucose, pectin, and natural fruit jellies. They also are canned as slices. Fully ripened sapota fruit pulp is eaten as a dessert fruit. The fruit skin also can be eaten, and is richer in nutritive value than the pulp (Gopalan *et al.,* 1985) [5].

Sapota starts bearing early from second or third year of planting but economical yields can be obtained from seventh year onwards. Under tropical conditions, flowers are seen almost throughout the year. After few years tree starts decline both in quality and quantity of produce.

As a result of which orcharding becomes economically non-viable and non-remunerative. In India 30-35 per cent area under fruit crops is occupied by old, dense and diseased orchards. For overcoming the problem of unproductive and uneconomic orchards existing in abundance, large scale uprooting and replacement with new plantations (rehabilitation) will be a long term and expensive strategy. Therefore research efforts are initiated to standardize a technology for restoring the production potential of existing plantations by a technique called Rejuvenation.

Rejuvenation is done by Pruning which involve in the removal of unproductive plant parts to achieve a desirable architecture of the canopy. The pruning is done to restrict excessive vegetative growth and to maintain a balance between leaf/fruit ratio, fruit size, fruit colour and other quality attributes.

Keeping this in view, the study was under taken on "Rejuvenation study on Sapota plant *cv.* Cricket Ball under coastal zone of Odisha" during 2013-16 with the objective to find out suitable level of pruning for rejuvenating 55 year old aged sapota plant.

Material and Methods

The experiment entitled "Effect of Different Level of Pruning on Growth, Yield and Fruit Quality of Sapota *cv.* Cricket Ball under Coastal Zone of Odisha" was carried out at central farm, College of Agriculture, Orissa University of Agriculture & Technology during the year 2013-2016. The investigation was undertaken on uniform 55 year old plants of sapota variety Cricket Ball.

The research was laid out in a Split plot Design in which pruning was kept under main plot whereas spraying of plant growth hormones were kept in sub-plot. In main plot, five different level of pruning was done such as control (P1), tip clipping of terminal shoot (P2), pruning of tertiary branches (P3), pruning of secondary branches (P4), and pruning of primary branch pruning (P5). In sub-plot five different plant growth hormones in different concentration like water spray (G1), GA3@20ppm (G2), NAA@50ppm (G3), IAA@100ppm (G4) and 2,4-D@20ppm (G5) were sprayed after flowering during February and July month. The flowering of December-February and June-August season were utilized for the studies. All the plants were nourished uniformly by providing the similar cultural practices such as ploughing, harrowing, fertilization, irrigation and plant protection measures during the entire period of studies.

Pruning was done during November, 2013. There were fifteen numbers of rows and in each row have ten plants. Randomly three rows were given same level of pruning treatment. The branches to be pruned were marked previously with chalk. Then pruning was done through saw pruner and pole pruner. After pruning the cut portions were pasted with slurry of Blitox50 in order to prevent microbial infection.

Plants of each treatment were selected and marked and kept under observations for recording various observations. Ten shoots randomly from all direction of each tree were tagged and used for recording the observations on the various vegetative parameters such as Chlorophyll content, Canopy spread (E-W & N-S); Yield and yield contributing characters like, Fruit set percentage (%), Days required from flowering to harvesting, Fruit yield (kg/plant), Fruit volume (cc), Fruit weight (g) and Physico-chemical quality of fruit like Total soluble solids (°Brix), Acidity (%),Total sugar content (%),Fruit moisture (%) and pH of fruit. Pooled data of 2015 and 2016 are presented in tables.

Results & Discussion

Rejuvenation of old senile sapota plant has great positive impact on plant growth, fruit yield and fruit quality under coastal zone of Odisha. This technique improved the fruit quality and yield.

1. Effect of different level of pruning on vegetative parameters of plant

i) Chlorophyll content (SPAD) in leaf: from this experiment it was found that the leaf chlorophyll content is greatly influenced by pruning intensity. Maximum chlorophyll content (26.65 SPAD) was observed in the treatment T1 (control). Whereas, lowest leaf chlorophyll content (22.38 SPAD) was found the treatment T5 (Primary branch pruning). Similar result also reported by Sharma *et al.* (2006) [14] in mango tree.

ii) Canopy spread (E-W & N-S): tree spread was very much influenced by the different level of pruning. Maximum canopy area was found in unpruned tree (T1) followed by tip clipping of terminal shoots (P2). But maximum increased in shoot length 0.51M in E-W & 0.46 M in N-S were observed the treatment T5 (Primary branch pruning). Whereas, lowest rate of increase in shoot length 0.31M in E-W and 0.26M in N-S were recorded in the treatment T1 (Control). More vigorous growth in the primary and secondary branch pruned plant might be due to lower number of growing points as compare to unpruned trees. Ultimately, these few growing shoots got more quantity of nutrients and water as compared to other treatments. Because of huge numbers of growing points in unpruned trees, there is more competition for nutrients among existing shoots, which resulted in lowest average growth in shoot length. Lal and Mishra (2008) [8] reported similar pattern of tree spread in mango tree.

2. Effect of different level of pruning on yield and yield contributing characters

i) Fruit set percentage (%): Different level of pruning has significant effect on fruit set % of sapota tree. There was increase in fruit set % with increase in the intensity of pruning level. Highest % of fruit set (13.54%) was observed the treatment T5 (Primary branch pruning) which was at par with the treatment T4 (Secondary branch pruning) that is 13.01%. Whereas, lowest fruit set percent (9.88%) was found in the unpruned tree (T1- Control). Pruning restores the balance between vegetative and reproductive growth of plant. There by decreases in competition among the flower for nutrient and plant hormone; and increases the auxin content in flowering shoot of first & second order pruned tree, may be the probable reason of high flower set %. This finding is well supported by Salem *et al.* (2008) [11] in mandarin tree and Shaban A.E.A. (2009) [12] in guava plant.

ii) Days required from flowering to harvesting: Duration of fruit maturity was significantly influenced by different level of pruning. Fruit mature duration was decreased with increased in intensity of pruning. Minimum days (190.63 days) taken to fruit mature was found in the treatment T5 (Primary branch pruning) which was at par with the treatment T4 (190.80days) and maximum days taken by the treatment T1 (198.70days) to fruit mature. As the pruning intensity increases, number of fruits per plant decreases. So, the inter fruit competition for nutrient is decreased and; fruit size increases and leaf/fruit ratio increases that enhanced the fruit maturation at a faster rate. Lawande *et al.* (2014) [9] reported; sever pruned plant taken minimum time to fruit mature

followed by moderately pruned plant and maximum duration taken in unpruned plant in jamun tree.

iii) Fruit yield (kg/plant): From the last three year after pruning, significantly higher fruit yield (16.01 kg) was recorded in the treatment P2 (tip clipping of terminal shoot) which might be due to presence of large number of mature shoots which received ample of solar radiation and accumulated more photosynthates for normal bearing. However, during initial two years no fruiting was observed in the primary and secondary branch pruned trees. This might be due to complete removal of shoots due to pruning operation and development of new shoots that has taken two years for attaining the maturity for flowering and fruiting. On 3rd year first and second order pruned tree started bearing and the yield was 1.56 kg/plant and 10.69 kg/plant, respectively. This finding is well supported by Lal & Mishra (2008) [8].

iv) Fruit weight (g): Pruning significantly influence the fruit size and weight. Fruit weight was increased with the increase in level of pruning intensity. Highest fruit weight (139.27g) was observed in treatment P5 followed by P4 (137.15g). As the pruning intensity increases the number of fruits per plant decreases. So, developing fruit gets ample of nutrient and plant hormone that increases fruit size. This may be the reason of highest fruit weight observed in P5 and lowest fruit weight (98.78g) in P1. Bhagawati *et al.* (2015) [2] conducted a case study in guava on effect of Pruning Intensities on the Performance of Fruit Plants under Mid-Hill Condition of Eastern Himalayas. They found highest fruit weight in sever pruned tree.

v) Fruit volume (cc): Similarly fruit weight, fruit volume was also increased with pruning severity. Highest fruit volume (118.88cc) was recorded in treatment P5 which was at par with the treatment P4 (118.43cc). Rather (2006) [10] reported that the fruit volume (280.57 and 305.06 cm3) was attained by medium pruning regime as compared to 102.30 and 111.17 cm3 fruit volume in control during 2004 & 2005 respectively in apple.

3. Effect of different level of pruning on physico-chemical quality of fruit:

i) Total soluble solids (°Brix): pruning enhanced the fruit quality measured in terms of increased total soluble solids in sapota. Maximum TSS (24.67°B) was recorded in the treatment P5 which was at par with the treatment P4 (24.64 °B). Whereas lowest TSS (22.98°B) was observed in the treatment P1 (control). The increased rate of photosynthesis due to more penetration of sun light into the interior tree canopy that increased the TSS content in the fruit harvested from pruned trees. Bhagawati R. *et al.* (2015) [2] observed highest TSS (10^0B) in sever pruned guava plants as compare to moderate & light pruning in guava under mid-hill condition of eastern Himalayas.

ii) Titrable Acidity (%): acidity of fruit significantly influenced by different degree pruning treatments. Lowest acidity (0.163%) was observed in the treatment P5. Whereas, maximum acidity (0.177%) was recorded in unpruned tree, treatment P1. Bhagawati R. *et al.* (2015) [2] noted lowest acidity (0.197) in sever pruned guava plants as compare to moderate (0.201%) & light pruning (0.211%). However, Sharma (2014) reported that the effect of pruning intensities on acidity were non-significant in apple.

iii) Total sugar content (%): Highest total sugar content (19.52%) in the fruit was recorded in the treatment P5. Whereas, lowest total sugar (17.97%) in fruit was observed in control (P1). Higher Total sugar in the first order and second order pruned tree may be due to increased leaf to fruit ratio which attribute towards more synthesis of carbohydrates other metabolites and their translocation to the fruit tissues. This finding is well supported by Bhagawati R. *et al.* (2015) [2] in guava & Singh *et al.* (2010) [15] in mango.

iv) Fruit moisture (%): The moisture content of the sapota fruit at maturity ranges from 72.86% to 73.48. However, it was found that moisture content in fruit was not significantly influenced by different level of pruning intensity. Kumar *et al.* (2010) [6] also reported similar result in peach.

v) pH of fruit: It was observed that pH of fruit was ranges between 5.36 to 5.40. But the pH of sapota fruit was found statistically not significant to different degree of pruning treatments; it showed non-significant to pruning treatment. Bindon *et al.* (2008) [3] reported similar finding in grape.

Table 1: Effect of different level of pruning on vegetative parameters of plant

Treatments	Chlorophyll content (SPAD)	Tree spread (M)	
		E-W	N-S
P_1 (Control)	26.65	0.31	0.26
P_2 (Tip clipping of terminal shoot)	25.82	0.34	0.29
P_3 (pruning of 3° branches)	24.62	0.40	0.35
P_4 (pruning of 2° branches)	23.58	0.46	0.41
P_5 (pruning of 1° branches)	22.38	0.51	0.46
Mean	24.61	0.40	0.35
S.E ±	0.143	0.007	0.009
CD@5%	0.466	0.023	0.031
C.V.	2.950	8.154	8.014

Table 2: Effect of different level of pruning on yield and yield contributing characters:

Treatments	Fruit set (%)	Days required from flowering to harvesting	Fruit yield (kg/plant)	Fruit volume (cc)	Fruit weight (g)
P_1	9.88	198.70	12.79	79.35	98.78
P_2	10.76	196.10	16.01	91.78	113.72
P_3	12.55	192.67	14.90	108.60	128.77
P_4	13.01	190.80	10.69	118.43	137.15
P_5	13.54	190.63	1.56	118.88	139.27
Mean	11.95	193.78	11.19	103.40	123.54
S.E ±	0.648	0.452	0.133	0.785	0.700
CD@5%	2.113	1.473	0.433	2.560	2.286
C.V.	26.015	1.0389	6.993	3.433	2.177

Table 3: Effect of different level of pruning on physico-chemical quality of fruit:

Treatments	TSS (°Brix)	Acidity (%)	Total sugar content (%)	Fruit moisture (%)	pH
P_1	22.98	0.177	17.97	72.92	5.39
P_2	23.76	0.172	18.35	73.28	5.38
P_3	24.37	0.161	18.93	73.48	5.36
P_4	24.64	0.155	19.54	73.34	5.36
P_5	24.67	0.149	19.53	72.86	5.41
Mean	24.08	0.163	18.86	73.17	5.38
S.E ±	0.066	0.001	0.117	0.136	0.009
CD@5%	0.217	0.005	0.383	0.444	0.030
C.V.	1.015	3.282	2.238	1.010	1.163

Conclusion

Initial two years, there was no yield recorded in the primary and secondary branched pruned tree. During three years of study, it was found that maximum yield was in tip clipped of terminal shoot (P2). Maximum fruit set %, fruit weight and fruit volume were observed in treatment P5. Minimum time required for fruit mature was taken in the treatment P5. Highest total sugar & TSS were found in treatment P5 followed by P4. The Titrable acidity in unpruned tree was highest and minimum was recorded in treatment P5. However, fruit moisture & pH were found non-significant to different level of pruning. It was observed that the yield of tertiary pruned tree showed an increasing trend in yield. From this study it is concluded that pruning restore the reproductive potential of plant and also improved the fruit quality. It can be predicted that the yield of P5 & P4 might go ahead over the rest treatments after 4-5 years.

Reference

1. Anonymous Database. Area, production, productivity of major fruit crops in India., 2014. www. nhb.gov.in
2. Bhagawati R, Bhagawati K, Choudhary VK. Effect of Pruning Intensities on the Performance of Fruit Plants under Mid-Hill Condition of Eastern Himalayas: Case Study on Guava. International Letters of Natural Sciences Vol. 2015; 46:46-5.
3. Bindon KA, Dry PR, Loveys BR. The Interactive Effect of Pruning Level and Irrigation Strategy on Grape Berry Ripening and Composition in *Vitis vinifera* L. cv. Shiraz. S. Afr. J. Enol. Vitic. 2008, 29(2).
4. Cheema CS, Bhat SS, Naik KC. Commercial fruits of lx India with special reference to West India. MacMillan and Co., Bombay (M.S.) India, 1954.
5. Gopalan C, Ramashastri BV, Balasubramanyam SC. Nutritive value of Indian Foods. Ansari Nagar, New Delhi, India: Indian Council of Medical Research, 1985, 1-59.
6. Kumar M, Rawat V, Rawat JMS. Effect of pruning intensity on peach yield and fruit quality. Scientia Horticulturae. 2010; 125(3):218-221.
7. Lakshminarayana S, Subramanyam H. Physical, chemical and physiological changes in sapota fruit [*Achras sapota* Linn. (Sapotaceae)] during development and ripening, J Food Sci Tech, 1966; 3:151-154.
8. Lal B, Mishra D. Studies on pruning in mango for rejuvenation. Indian J. Hort. 2008; 65(4):405-408.
9. Lawande KE, Haldankar PM, Dalvi NV, Parulekar YR. Effect of Pruning on Flowering and Yield of Jamun cv. Konkan Bahadoli. Journal of Plant Studies, 2014; 3(1).
10. Rather GH Combined influence of pruning regimes and fertilizer application on production and quality of apple (*Malus x domestica* Borkh.) cv. Red Delicious. Ph. D Thesis submitted to Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar, India, 2006.
11. Salem AT, Hasseb GM, Kamel HM Effect of pruning severity on vegetative growth, flowering and fruit setting of Balady mandarin trees. Egypt. J. Appl. Sci. 2008; 23:285-296.
12. Shaban AEA, Haseeb GMM. Effect of Pruning Severity and Spraying Some Chemical Substances on Growth and Fruiting of Guava Trees. American-Eurasian J. Agric. & Environ. Sci., 2009; 5(6):825-831.
13. Sharma LK, Effect of varied pruning intensities on the growth, yield and fruit quality of starking delicious apple under Mid-hill conditions of Himachal Pradesh, India. Agric. Sci. Digest., 2014; 34(4):293-295.
14. Sharma RR, Singh R, Singh DB. Influence of pruning intensity on light penetration and leaf physiology in high-density orchards of mango trees. Fruits. 2006; 61:117-123.
15. Singh SK, Sharma RR. Effects of Pruning Intensity on the Biochemical Status of Shoot Buds in Three Mango (*Mangifera indica* L.) Cultivars Planted at High Density. Journal of Horticultural Science and Biotechnology, 2010; 85(6):483-490.