CHAPTER II

REVIEW OF LITERATURE

During the past few years research has been in progress in certain fruit crops, towards the practical use of plant growth regulators in order to improve the fruit set, growth, yield and quality of fruits. Therefore, the present experiment entitled “Effect of plant growth regulators on flowering, yield and quality of sapota [Manilkara achras (Mill.) Forsberg] cv. Kalipatti” was planned. The attempt is made to review the research work carried out on sapota and other similar fruit crops under the following heads:

2.1 Effect of CCC
2.2 Effect of NAA
2.3 Effect of GA$_3$

2.1 EFFECT OF CCC

Bajwa (1979) revealed that two spray of CCC 2000 ppm at 10 days interval on Thompson Seedless grapevines at 20 days before full bloom produced higher number of bunches per vines (581) as compared to control (420).

Pal et al. (1983) conducted a field experiment to show the fruit diameter of Kinnow mandarin fruits, at fortnightly intervals from 10 June until harvest on 6 January, following a single spray of 2, 4-D at 10 or 20 ppm, GA$_3$ at 10, 50 or 100 ppm or Cycocel at 100, 250 or 500 ppm on 9 June. Fruit size was enhanced by CCC at 250 ppm.

Singh and Ram (1983) applied some chemicals on mango cv. Dashehari at three different stages to twelve year old trees. First spray was done at 3rd week of February, second on Pea stage at first week of April and third on marble stage at last week of April. NAA at 40 ppm gave the best fruit retention (125 %) when applied at the pre-bloom (71%) stage at the pea stage CCC at 200 ppm gave the best results.

Kumar and Singh (1984) carried out an experiment on nine year old ‘Thompson seedless’ grape vine sprayed at the full bloom stage at 10th April. Results
revealed that the treated wine with 250 ppm CCC gave maximum bunch weight (339.0 g), berry weight (1.10 g), berry volume (0.68 cc).

Delvadia et al. (1994) reported that the application of CCC 400 ppm at fruit bud differentiation stage produced 29.8 and 33.3 per cent more flowers than control in both the years in sapota.

Brahmachari et al. (1995) observed that NAA, PCPA, 2, 4, 5-T (each at 25 or 50 ppm), gibberellic acid (GA, 50 or 100 ppm), kinetin (20 or 40 ppm) and CCC (250 or 500 ppm) as sprays before flowering and after fruit set to six year old trees of guava cv. Sardar. CCC at 500 ppm induced the highest number of flowers per shoot (9.87 %), fruit set (44.86%), fruit retention (15.66%).

Jain and Dashora (2004) found that guava cv. Sardar indicated 1000 ppm CCC (34.42%) treatments. However, mean minimum days taken to initiation of flowering (29.00), maximum number of flowers per shoots (7.77/shoot), maximum fruit set (71.17%), highest fruits retention (73.16%) with minimum days taken to harvesting (115.33) and maximum yield (63.83 kg plant\(^{-1}\) or 17.74 tonnes ha\(^{-1}\)) were recorded in 500 ppm paclobutrazol (PBZ) treatment as compared to control. Foliar spray done by first spray of June and last spray was mid-August.

Kher et al. (2005) conducted an experiment to evaluate the effects of pre harvest application of plant growth regulators on the quality of guava cv. Sardar fruits under Jammu condition. The treatments comprised of single application of GA\(_3\) (30, 60, 90 and 120 ppm) and CCC (chloromequat) (300, 600, 900 and 1200 ppm) sprayed at 30 days before harvest and single application of NAA (20, 40, 60 and 80 ppm) sprayed at 15 days before harvest. The treatments had increased the fruit weight, except CCC 120 ppm.

Nambisan et al. (2007) The effects of CCC (100, 150 or 200 ppm), NAA (10, 20 or 30 ppm), 2,4-D (10, 20 or 30 ppm) and GA\(_3\) (10, 20 or 30 ppm) on the yield of sapota were studied in Rahuri by Nimbisan et al. (2007) The number of fruits per shoot was highest with application of 200 ppm CCC.

Narayan et al. (2013) found the guava cv. Allahabad safeda maximum number of flower (16) per shoot, highest fruit set (93.13%) and maximum numbers of fruit per shoot at harvest (6.2) in guava cv. Allahabad safeda were found with 1000 ppm CCC. All the treatments were sprayed before flowering in the March. The maximum fruit length (9.8 cm), fruit girth (10.23 cm), fruit weight (182 g) and
volume (178.3 cc) and minimum fruit drop (38.8%) and yield (37.1 kg/plant) were recorded under 50 ppm GA$_3$.

Bhujbal et al. (2013) found that sapota cv. Kalipati grafted on khirni CCC at 450 ppm significantly increased the number of flowers per shoot (9.87), and number of fruits per tree (2625 fruit tree$^{-1}$), fruit set (44.85%), number of fruit per shoot (4.446). Sprayed at done month before flowering and at pea stage.

### 2.2 EFFECT OF NAA

Das and Mahapatra (1975) reported that application of planofix (containing NAA 100 and 300 ppm) increased fruit set when applied before flowering in 'Kalipatti' sapota. Moreover, planofix 300 ppm gave highest fruit retention as compared to control.

Rajput et al. (1977) conducted an experiment at guava cv. Allahabad Safeda at Banaras Hindu University, Varanasi to study the effect of IBA and NAA (40 and 80 ppm each) and GA$_3$ (15 and 30 ppm) on flowering, fruiting and quality of guava, foliar spray was done by mid-January and found that NAA at 80 ppm showed superior in improving in almost all characters like fruit set (76.60%), fruit retention (47.16%), number of leaves per shoot (11.46), yield (58.83 kg/plant) of guava.

Rathod (1977) reported that NAA at 50 and 100 ppm recorded average fruit weight of 52.37 g and 5214 gin sapota cv. Kalipatti, respectively as compared to control (50.59 g). However, fruit weight was decreased with 25 and 75 ppm NAA and found to be 49.88 and 48.01 g.

Singh (1977) observed that the application of 40 ppm NAA in November, March and May in mango cv. Dashehari proved most effective for fruit set and higher fruit retention at all the stages of application.

Aravinda Kishan et al. (1979) stated that application of planofix (containing NAA at 10, 20 and 30 ppm) during marble stage of fruit development in mango gave maximum fruit set at 20 ppm as against 19 per cent in control.

Khimani (1980) observed the influence of plant growth regulators on fruit set and retention of different cvs. of mango and found that all the concentrations of NAA at (10, 20 and 30) ppm gave better fruit set over control. However, NAA at 20 ppm was significantly superior than rest of the treatments in case of cultivar Alphonso.
Rathod and Amin (1981) revealed that application of NAA of 25, 50, 75 and 100 ppm thrice at flowering and 15 days interval later improved fruit set in Kalipatti variety of sapota. NAA 50 ppm gave 7.7 per cent higher fruit set over control and NAA 100 ppm was found best for fruit retention, which was 5.3 per cent higher than control.

Prakash and Ram (1984) obtained 360-400 per cent increase in fruit retention over control in subsequent year with 50 ppm NAA applied at flower bud differentiation stage on 'Chausa' mango.

Sandhu and Thind (1988) reported that NAA at 10 ppm applied at fruit set stage caused faster fruit growth in terms of size, weight and stone during 80-150 days of fruit development of ber cv. Umran.

Ganvit (1989) recorded higher fruit set and fruit retention with the application of NAA of 100 ppm in sapota cv. Kalipatti.

Delvadia et al. (1994) reported that NAA 100 ppm and GA₃ 50 ppm at flowering stage increased fruit set and fruit retention over control. However, NAA was most effective for fruit retention when applied at pea stage in sapota.

Singh et al. (1994) revealed that spray of urea and NAA combination on mango cv. Langra at pea stage increased diameter as well as fruit yield as compared to control.

Brahmachari et al. (1995) sprayed NAA (25 or 50 ppm) on ‘Sardar’ guava at flowering and again one month later and found that all levels of NAA enhanced fruit quality. NAA at 50 ppm increased total soluble solids (11.4 °Brix), ascorbic acid (180.66 mg/100g pulp) and sugar content (9.94%) but reduced fruit acidity (0.22%) in terms of citric acid.

Kulkarni et al. (1995) conducted an experiment on effect of cultural and chemical treatment on yield and physico-chemical characteristics of custard apple and noted that NAA @ 30 ppm proved best for improvement of total sugar on custard apple.

Brahamachri et al. (1997) studied the effect of (NAA 20 and 40 ppm) on guava cv. Allahabad safeda trees were sprayed twice. (once before flowering and again a month after fruit set), the first foliar spray was done at first week of May and the second at full bloom stage and third spray was given after completion of fruit set on 3rd week of June. They found increase in total soluble solid (12.14 °Brix), minimum
acidity (0.341 %), increase total sugar (6.82 %), reducing sugar (4.08 %), ascorbic acid (137.87 %), pectin (0.65 %).

Choudhary et al. (1997) carried out an experiment on 10 year old guava cv. L-49 trees, which were sprayed twice (last week of April and 2nd weeks later) with NAA (200, 250, 300 ppm) and noted the highest fruit yield (42.394 kg tree⁻¹) with 250 ppm NAA.

Yadav et al. (2001) observed the effect of foliar application of growth regulator, i.e. NAA (20, 40 and 60 ppm), were made on 15th years-old guava trees cv. L-49. The foliar spray was applied at the time when the fruit size was bigger than walnut size (9th of November). They repeated that 60 ppm NAA increase total soluble solid (12.9 °Brix), ascorbic acid (191.00 mg/100 g) total sugar (6.80%).

Sudhvani and Ravi Sanker (2002) reported that the application of alar @ 500 ppm at 20 days before harvest of fruit increase shelf life and minimized the weight loss and spoilage of mango fruit cv. Baneshan.

Dubey et al. (2002) studied the effects of various concentrations of NAA (125, 250 and 750 ppm) on yield of guava cv. Allahabad Safeda. Treatment with 250 ppm NAA resulted in the highest yield (45 kg tree⁻¹) occurs during the winter season when foliar spray was done by first week of June and 2nd spray was done by last week of July.

Singh et al. (2002) studied the response of foliar application of growth regulators and nutrients in Ber cv. Umran. The foliar spray of NAA 10 ppm at full bloom stage at 40 and 120 days after first spray increased maximum total sugar (12.28 %), non-reducing sugar (6.49%), and ascorbic acid (4.37%).

Yadav (2002) observed that the spraying of guava cv. L-49 with NAA 10 ppm resulted in the greatest fruit diameter (5.03 cm), fruit weight (88.9 g), flesh weight (83.6 g), number of fruits per tree (666) and fruit yield (56.9 kg), and in the lowest fruit specific gravity (0.976%), seed weight per fruit (3.06 g) and number of days required for change in fruit colour (26.60).

Singh and Yadav (2003) revealed that the foliar spray of urea (0, 1.0 and 2.0 %) and NAA (0, 10, 20 and 30 ppm) was done on ber cv. Gola at fruit setting stage (10th and 12th october) and repeated after one month (10th and 12th November). The sparing of NAA 20 ppm could be increase in total soluble solid (9.44 °Brix), ascorbic acid (168.66 mg/100 g pulp), reducing sugar (4.24%), total sugar (10.69%).
Review of Literature

Azher et al. (2004) concentration of 2, 4-D, GA₃ and NAA on kinnow mandarin were applied during the last week of November, 2005 to check pre harvest fruit drop and improvement in yield and quality. Exogenous application of growth regulators significantly decreased pre harvest fruit drop percentage, leading to increase in total number of fruit per plant, fruit weight (110.66 g). Juice percentage (52.16 g), total soluble solid (11.10 °Brix), acidity (1.23), vitamin-C (24.03), reducing sugars (3.33%) and non-reducing sugar percentage (2.55%). While no effect was observed on fruit size. Auxin (2,4-D and NAA) performed better compared to gibberellins.

Jain and Dashora (2004) found that guava cv. Sardar indicated 60 days after treatment the mean maximum increase in shoot length (36.25%) was observed in 100 ppm NAA treatment followed by 200 ppm NAA (36.23%) and maximum increase in shoot diameter (34.95%). Foliar spray done by first spray June and last spray was mid-August.

Iqbal et al. (2005) revealed that NAA significantly reduced pre-harvest fruit drop in guava cv. Red flesh and maximum reduction in fruit drop (8.83%) was observed with 45 ppm NAA followed by 30, 60, 75 and 90 NAA ppm. Maximum yield (44.80 kg per treatment) was recorded in case of 45 ppm NAA closely followed by 60 ppm NAA (44.60 kg) when sprayed before flowering. NAA application increased all these ingredients except acidity which was reduced. Maximum pulp/seed ratio (11.31), total soluble solids (11.00%) and total sugars (7.45%) were recorded in 45 ppm NAA treatment.

Kumar et al. (2005) observed that the highest shelf life of fruit, lowest physiological loss in weight, spoilage of fruit and better quality of aonla fruit 21 days after harvest during storage period with post-harvest application of 1% calcium chloride.

Suleman et al. (2006) revealed that all the chemicals reduced the yield of rainy season crop significantly over control and subsequently increased the yield of winter season crop of guava cv. Sardar NAA (600 ppm) application produced maximum winter crop yield (359.3 q ha⁻¹) followed by the application of 15 per cent urea (356.2 q ha⁻¹). The higher concentrations of urea were found very effective in improving the fruit quality and resulted in maximum TSS (14.0%), ascorbic acid (342.2 mg/100 g), total sugars (10.20%) and pectin (1.59%) content in the winter crop.
Chavan et al. (2009) noted that NAA 150 ppm produced more number of flowers (54.00), highest fruit set (43.13 %), higher retention (over fruit set) at pea stage (18.77%) and at lag phase (17.21 %), produced maximum number of fruits (2633.00) and yield (115.02 kg tree\(^{-1}\)) followed by NAA 100 ppm while the lowest performance was observed in control in sapota cv. Kalipati.

Kacha et al. (2007) found that NAA 200 ppm phalsa recorded maximum height of bush (177.33 cm) and length of shoot (99.17 cm) followed by NAA 150 ppm in phalsa. An application of NAA 150 ppm significantly increased number of flowers per shoot (151.21), number of fruits per shoot (60.74), 100 fruits weight (49.80 g), juice percentage (57.78%) and minimum seed percentage (30.44%) and the maximum yield (1.71 kg tree\(^{-1}\)) NAA 200 ppm. By first spray was done in last week of January and second was done in 2nd week of February.

Ingale et al. (2008) conducted trial on effect of plant growth regulators on the performance of sapota (Manilkara achras) cv. Kalipatti at Navsari, Gujarat and they resulted NAA at 100 ppm significantly increased fruit set.

Katiyar et al. (2008) observed the effect of nutrient and plant growth regulators on physio-chemical parameter and yield of kharif season guava cv. L-49 and revealed that the length (5.84 cm), diameter (6.52 cm), total soluble solid (12.31°Brix), minimum acidity (0.47%) total sugar (8.28%), NAA 100 ppm.

Agrawal and Dikshit (2010) conducted an experiment to study the effect of plant growth regulator on quality characters of sapota cv. Cricket Ball. They found that the foliar application of NAA 100 ppm significantly increased total soluble solid (20.67 °Brix), reducing sugar (10.66%), non-reducing sugar (5.96%) and total sugars (15.76%) in sapota fruit.

Bhujbal et al. (2013) found that sapota cv. Kalipati grafted on khirni treatment NAA 150 ppm increase by the number of seed per fruit (1.468), weight of seed (1.229 g), total sugar (16.24%), reducing sugar (10.28%). sprayed at done month before flowering and at pea stage.

Agnihotri et al. (2011) revealed that foliar spray of crop regulating chemical was done on 24th May 2010 and same spray is repeated after 10 days guava cv. Chittidar. Treatment 60 ppm 2,4-D increases canopy spread (0.78 m), volume of fruit (185.38 ml), pulp thickness, pulp weight (175.57g), pulp percent (96.6), diameter of fruit (7.34cm), average fruit weight (181.71g) and reduce the seed percentage (6.3%) and seed pulp ratio (0.07%) which ultimately increase the yield (41.19 kg tree\(^{-1}\))
Various quality parameter *viz.*, total sugar (7.49%), reducing sugar (4.73%), TSS (11.42 °Brix) were also improved with application of same treatment in. Maximum fruit length at harvest (7.30 cm) and TSS: acid ratio (37.80) and minimum acidity (0.27%) as well as seed weight (5.43g) were recorded under foliar application of 300 ppm NAA.

Garasiya *et al.* (2013) revealed that an application of NAA 40 ppm as well as NAA 20 ppm was found the most effective in increasing more number of fruit per tree (440). These treatments also increased the ascorbic acid (180.30 mg/100g pulp of fruit), total sugar (6.44%), reducing sugar (3.79%) and yield (66.39kg/tree) of guava cv. L-49, first spray at last week of June and second spray at second week of July.

Goswami *et al.* (2013) observed that pomegranate cv. Sinduri application of NAA 50 ppm was found effective in increasing number of fruits per tree (4550), fruit weight (2000 g), fruit yield (10.08 kg⁻¹), number of hermaphrodite flower (45.00%), number of stem per plant (2.89%) and minimum fruits drop per plant (45.00%). First spray of 2,4-D, NAA, GA₃ and ethrel treatments just after pruning, in 2nd fortnight of September and 2nd spray of GA₃ 25 ppm was done at the time of minimum 20 number of fruit sets on the plant were used.

Anawal and Suresh (2014) indicated that NAA 40 ppm was found effective in increasing number of fruits per tree (62.44), fruit length (8.66 cm), fruit diameter (8.71 cm), fruit weight (262.23 g), fruit volume (255.44 ml), total soluble solid (16.76°B), total sugars (15.58%), reducing sugars (13.83%), non-reducing sugars (1.75%) against control in pomegranate cv. Bhagwa. The growth regulators were sprayed during the initiation of new sprouts.

### 2.3 EFFECT OF GA₃

Krishnamurti *et al.* (1959) studied the effect of different concentration of GA₃ *viz.*, 10, 25 and 50 ppm on fruit set, size and quality in pusa seedless variety of grape. They have noticed that GA₃ at lower concentration of 10 ppm (76.50%) and 25 ppm (59.11%) increased fruit set.

Nijjar and Gill (1971) found that the GA₃ 75 ppm applied at the berry development stage gave the maximum bunch length (18.35 cm), berry (17.86%), total soluble solid (20 %), acidity (0.50%), on Perlette variety of grape. Application of foliar spray three stage, 1st in full bloom, 2nd full bloom and the day following full bloom, 3rd full bloom and week following full bloom.
Chundawat and Randhawa (1972) studied the effect of GA$_3$ at (250, 500 and 1000) ppm applied at full bloom stage on 'Saharanpur Special' cultivar of grape and obtained best results with higher concentration of GA$_3$.

Ranjitkumar et al. (1975) observed the beneficial effect of GA$_3$ on sweet lime cv. Tanaka and found that GA$_3$ 500 ppm increase fruit size (5.65 cm) when spray was done by the last week of July. There was increase in total soluble solids (8.45 °Brix) and ascorbic acid content (56.00 mg/100 ml/juice) of fruit juice but the fruit maturity was delayed.

Patil et al. (1980) reported that application of 45 ppm GA$_3$ at pin head stage improved bunch length (20.5 cm), and berry weight (410 g), berry volume (383.9 ml), and juice content (80%) in grapes cv. perlette.

Pandey et al. (1987) evaluated the effect of plant growth regulators at varying concentrations on ripening and quality of mango fruits cv. Dashehari. Maximum total sugar (11.89%) and minimum acidity (0.10%) were noted in plant treated with 2, 4-5-T, P at 200 ppm, they also reported that fruit weight (247.89g) and diameter (7.15cm) were the highest under GA$_3$ 100 ppm treatment.

Biswa et al. (1988) sprayed GA$_3$ (50 and 100 ppm) on guava cv. L-49 at 30 days after fruit set in the rainy and spring seasons and they found that GA$_3$ at 100 ppm when applied before flowering showed maximum fruit weight (152.27 g) and fruit size (6.52 cm) in spring.

Thakur et al. (1990) studied the effect of plant growth regulators on two cultivars of Litchi with five foliar sprays was done in between September to January. GA$_3$ at 50 ppm proved to be the best treatment for fruit length (4.19 cm), fruit set of panicle (298.95), diameter of fruit (3.29 cm), aril (68.12%), and fruit retention of panicle (21.10).

Lakshmanan et al. (1992) studied the foliar spraying of Gibberellic acid at 25, 50, 75 and 100 ppm on different grape varieties viz., Tas-e-Ganesh, Thompson seedless and Arkavathi. GA$_3$ 50 ppm increase the total soluble solids (17.2 °Brix) improved longer bunches (27.36 cm), berry length was high (3.04 cm), bunch weight (0.954 kg), spraying was given twice once at calyptras fall stage and other pea stage.

Ray et al. (1992) found significantly increased in length, diameter as well as weight of sapota fruit cv. Cricket Ball with the spray of GA3 100 ppm.
Kumar and Singh (1993) found that pre-harvest spray of GA$_3$ in mango cv. Amrapalli significantly improved fruit quality *i.e.*, total soluble solids (14.80 Brix) and reducing sugar percent (4.35%) without marked increase in pre-harvest fruit drop (58.00%) as compared to control.

Brahmachari *et al.* (1997) studied the effect of GA$_3$ (50 or 100 ppm) on ‘Sardar’ Guava sprayed twice, (once before flowering and again a month after fruit set). The first foliar spray was done first week of May and the second at full bloom stage at third spray was given after completion of fruit set 3$^{rd}$ week of June. GA$_3$ 100 ppm increase fruit set (89.65%), length of fruit (6.76 cm), diameter of fruit (7.04 cm), weight of fruit (171.76 g), and yield of fruit (57.99 kg$^{-1}$).

Kaur *et al.* (1997) observed that the foliar application at GA$_3$ 15 ppm reduced in fruit drop (51.43%) from (63.04%) significantly improved in Kinnow Mandarin over control.

Yadav *et al.* (2001) observed the effect of foliar application of growth regulator, *i.e.* NAA (20, 40 and 60 ppm), GA$_3$ (50, 100 and 150 ppm) and GA$_3$ 150 ppm increase the yield (68 kg tree$^{-1}$), minimum acidity of guava fruit (0.38%). Were made on 15$^{th}$ years-old guava trees cv. L-49. The foliar spray was applied at the time when the fruit size was bigger than walnut size (9$^{th}$ of November). 25 fruit of uniform size tagged before foliar spray for further observation.

Brahmachari and Rani (2001) reported that GA3 100 ppm was best for enhancing fruit setting, retention and reduced cracking of litchi, while it was minimum with GA$_3$ 50 ppm.

Rani and Brahmachari (2004) reported the effect of growth substances and calcium compounds on fruit retention, growth and yield of ‘Amrapali’ Mango. Plant sprayed with GA$_3$ 200 ppm recorded maximum fruit weight (167.41 g), fruit length (8.6 cm), and volume (165 ml) and pulp weight (166.67 gm).

Ahmad and Zargar (2005) concluded that foliar spray of GA$_3$ at 50 ppm increased bunch weight (225.43 g), bunch length (19.66 cm), berry weight (2.10 g) and number of berries per bunch (171) over control in grape cv. Perlette when sprayed at 50 per cent bloom.

Singh and Sharma (2005) observed the foliar application of GA$_3$, SADH and NAA on red delicious apple and application of GA$_3$ @ 50 ppm resulted in increased fruit size over control.
Benjawan et al. (2006) reported that the application of GA3 at a rate of 12.50 ppm per plant on mango cv. Srisaket 007 increased the fruit flesh content, fruit thickness, individual fruit weight and titrable acidity of flesh of fruits and also significantly increased in length of the mango fruits.

Birendra-Prasad et al. (2006) studied the effects GA3 (50, 100, 150 or 200 ppm) on mango cv. Amrapali an fruit yield and composition. The highest fruit yield (9.5 kg tree\(^{-1}\)) was obtained with 100 ppm GA3.

Yadav et al. (2006) reported the maximum fruit retention (57.27%), fruit length (6.07 cm), fruit width (5.92 cm), fruit weight (98.48 kg), fruit yield (48.63 kg/tree), by application of GA3 100 ppm in guava cv. L-49. Total soluble solids (11.70°Brix), ascorbic acid (172.00 mg/100 g), reducing sugar (3.98%), non-reducing (3.53%), total sugars (7.51%) and minimum fruit drop (42.23%), acidity (0.30%) were recorded with foliar application of borex0.4 per cent followed by zinc sulphate 0.8%.

Eman et al. (2007) revealed that GA3 sprays at 20 ppm were more effective than that at 10 ppm in term of fruit set (86.76%), fruit retention and yield (42.55 kg plant\(^{-1}\)) as well as fruit weight (102.08 g) in orange tree cv. Washington navel.

Abhijit et al. (2010) revealed that GA3 100 ppm was most effective in improving yield per plant (3.05 kg), yield per hectare (7.63 t ha\(^{-1}\)) and hundred fruit weight (61.48g).

Patel et al. (2010) studied that the highest number of fruits (166) in custard apple cv. Sindhan, the plant growth regulators were sprayed four times at twenty-one days interval. The first spray was done on 1st week of May in both the years. Irrigation was given one day before spray. Fruit yield (3363 kg\(^{-1}\)), fruit diameter (7.40 cm) and fruit pulp (97.22 g) were also recorded in GA3 50 ppm.

Patel et al. (2011) noted that GA3 @ 50 ppm was founded most effective for extending the shelf life, lowest acidity, highest TSS, total sugar and total carotene in fruit in custard apple.

Bhowmick and Banik (2011) revealed the mango cv. Himsagar tree maximum fruit retention (7.25%) as well as maximum number of fruits at harvest (790.17/tree) was recorded with NAA at 40 ppm and maximum yield (217.24 kg/tree) was obtained with GA3 at 40 ppm and lowest fruit retention percentage and yield was recorded with control. Maximum fruit length (9.28 cm), fruit breadth (7.31 cm) and fruit weight (283.38 g) were recorded with GA3 at 40 ppm.
Reddy and Prasad (2012) revealed that the GA₃ at 25, 50 and 75 ppm and control (water spray) were sprayed three times starting at full bloom and, subsequently, at 45 and 90 days after fruit set in pomegranate cv. Ganesh increase the fruit length (8.69 cm), fruit diameter (8.74 cm), fruit volume (282.30 ml), fruit weight (250.43 g), number of fruit (56.11/plant), yield (14.00 kg tree⁻¹).

Garasiya et al. (2013) revealed that the application of GA₃ (50 and 100 ppm) increased fruit weight (148.27 g), fruit volume (123.56 g), fruit diameter (5.43 cm), and also found minimum number of seed per fruit (300.87) with GA₃ 50 ppm in guava cv. L-49. First spray at last week of June and second spray at second week of July.

Sharma and Tiwari (2013) revealed that foliar spray of NAA 100 ppm proved best to increase the plant height (0.63 m), canopy spread in E-W (0.81 m), N-S (0.85 m), and canopy height (0.57 m) in guava cv. chittidar. First foliar spray of growth regulators on crop was done 20 August 2012 and same spray was repeated after 30 days. In case of reproductive parameters, minimum fruit drop (42.96%) and maximum fruit retention (51.40%) was recorded with the application of GA₃ 150 ppm. Maximum fruit volume (174.6 ml), fruit length (6.54 cm) and diameter (5.74 cm) at harvest, number of fruit per plant (251.1), average fruit weight (223.37 g) and yield (56.10 kg tree⁻¹) were recorded with foliar spray of NAA 100 ppm.

Narayan et al. (2013) found that the guava cv. Allahabad Safeda noted maximum fruit length (9.8 cm), fruit girth (10.23 cm), fruit weight (182 g) volume (178.3 cc) minimum fruit drop (38.8%) and yield (37.1 kg plant⁻¹) were recorded under 50 ppm GA₃ treatments which was sprayed before flowering in the March.

Brijesh et al. (2014) revealed that maximum fruit set (45.75%) and minimum fruit drop (57.00%) with 50 ppm GA₃ and control treatment, respectively in winter season guava. Borax 0.4 per cent and GA₃ 50 ppm can be recommended to guava grower to obtaining better yield (38.13 kg/plant) and quality of guava cv. L-49.

Daberao et al. (2016) carried out an experiment on effect of growth promoting substances on the fruit quality of rejuvenated sapota orchard. The treatment 50 ppm GA₃ gave the best quality fruits in the rejuvenated sapota orchard. Some treatment showed maximum peel weight (18.30 g), pulp weight (106.56 g), total soluble solids (22.150 °Brix), total sugars (19.01 %) and seed weight (1.50 g) whereas control (No spray) gave minimum peel weight (12.13 g), pulp weight (67.660 g), total soluble solids (17.12 °Brix), total sugars (17.20%) and seed weight (1.23 g) and non-significant results were observed for fruit moisture and acidity of the fruits.