CHAPTER-V
DISCUSSION

The present investigation entitled “Effect of plant growth regulators on flowering, yield and quality of sapota [Manilkara achras (Mill.) Forsberg] cv. Kalipatti” was carried out at Fruit Research Station, Lal Baugh, Department of Horticulture, Junagadh Agricultural University, Junagadh during the 2016-17, has lead to some important revelations are discussed in this chapter. The appropriate reasons with observed variation recorded during the present study are explained. Relevant supporting studies have been quoted and the results reported by other researcher have also been contradicted with the findings of the present study. The results of the investigation have been highlighted on the following aspects.

5.1 Flowering parameters

5.2 Yield and yield attributing parameters

5.3 Quality parameters

5.4 Economics

5.1 Flowering parameters

The mean data on the flowering parameters viz., number of buds per shoot, number of bud drop per shoot [Table 4.1], number of flowers per shoot and number of fruit set per shoot [Table 4.2] as influenced by different growth regulators were found significant. Whereas, fruit set (%) [Table 4.4], fruit drop (%) and fruit retention (%) [Table 4.4] were found non-significant.

The maximum number of buds per shoot (12.08) and minimum number of bud drop per shoot (2.30) were noted in treatment T7 [CCC 450 ppm (FBD stage) + NAA 150 ppm (Pea stage) + GA3 50 ppm (Fruit development stage)] and it was at par with treatment T5 [CCC 450 ppm (FBD stage) + NAA 100 ppm (Pea stage) + GA3 50 ppm (Fruit development stage)] (11.52), (2.37). It might be due to plants remain physiologically more active to build up sufficient food stock for the developing buds by creating favorable C/N ratio in terminals shoot. Chlorocholine Chloride (CCC) is gibberellins biosynthesis inhibitor involved in the inhibition of
cyclization of geranylgeranyl pyrophosphate to copalyll pyrophosphate. The chemical control of the plant growth to reduce the size through the use of plant growth regulators is a common practice to make a plant more compact and commercially more acceptable. A number of synthetic compounds are known to manage shoot growth in higher plants without being phytotoxic or causing malformation or damage. Similar finding was also confirmed by 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. Similar result were also obtained by Nimbisan et al. (2007), Bhujbal et al. (2013) in sapota, Singh and Ram (1983) in mango and Jain and Dashora (2004), Narayan et al. (2013), and Bramchari et al. (1995) reported that GA₃ 100 ppm was best for enhancing fruit setting, Brijesh et al. (2014) revealed that maximum fruit set and minimum fruit drop with 50 ppm GA₃ in guava.

The maximum number of fruit set per shoot (4.42) and number of flower per shoot (9.78) were noted in treatment T₇ [CCC 450 ppm (FBD stage) + NAA 150 ppm (Pea stage) + GA₃ 50 ppm (Fruit development stage)], however, it was found at par with treatment T₅ [CCC 450 ppm (FBD stage) + NAA 100 ppm (Pea stage) + GA₃ 50 ppm (Fruit development stage)] (4.03), (9.15). It might be due to presence of auxin in abscission zone may be the major different to maximum development of fruits and number of flower per shoot. The significance of exogenous application of auxin in fruit setting has been well recognized in number of fruit crops. The effect of NAA on plant growth is greatly dependent on the time of admission and concentration. NAA has been shown to greatly increase cellulose fibre formation in plants. In majority of fruit plants fruit drop is controlled by spraying of NAA in different concentration. At after fertilization. Rathod (1977), Rathod and Amin (1981), Nimbisan et al. (2007), Chavan et al. (2009) Similar finding were also confirmed by Ganvit (1989), Bramchari et al. (1995), Narayan et al. (2013), Brijesh et al. (2014) in guava, Kacha et al. (2007) in phalsa 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, Bhujbal et al. (2013) found that sapota cv. Kalipatti grafted on khirni CCC at 450 ppm significantly increased the number of flowers per shoot in sapota, Khimani (1980), Singh and Ram (1983) in mango, Jain and Dashora (2004) found that guava cv. Sardar indicated 1000 ppm CCC treatments. However,
mean minimum days taken to initiation of flowering and maximum number of flowers per shoots.

5.2 Yield and yield attributing parameters

The mean data on the yield and yield attributed parameters viz., number of fruit per tree and average fruit weight (g) [Table 4.5], fruit length (cm), fruit width (cm) and fruit circumference (cm) [Table 4.6], fruit volume (cm$^3$) [Table 4.7], fruit yield (kg per tree) and fruit yield (tonnes per ha) [Table 4.8] influenced by different growth regulators were found significant. Whereas, maturity days [Table 4.7], number of seeds per fruit and seed weight (g) [Table 4.9] were found non-significant.

The maximum fruit length (6.62 cm), fruit width (5.59 cm) and fruit circumference (20.10 cm) were noted in treatment T$_7$ [CCC 450 ppm (FBD stage) + NAA 150 ppm (Pea stage) + GA$_3$ 50 ppm (Fruit development stage)], however, it was found at par with treatment T$_5$ [CCC 450 ppm (FBD stage) + NAA 100 ppm (Pea stage) + GA$_3$ 50 ppm (Fruit development stage)] (6.22), (5.13), (19.15) and T$_3$ [CCC 350 ppm (FBD stage) + NAA 150 ppm (Pea stage) + GA$_3$ 50 ppm (Fruit development stage)] (6.17), (5.11), (19.13). Yield is complex character which depends on yield contributing characters. An increase in yield per plant is affected by two factors. It is mainly due to increase in number of fruits and also by increase in weight of individual fruit. In the present investigation it was observed that the treatments of various growth regulating chemical were most effective in increasing the fruit production mainly through increase in fruit number in the year of experimentation. The number of fruit and yield per tree were increased with increase in concentration of cycocel. The higher concentration of CCC (450 ppm) significantly increased the number of fruits and yield per tree. It might be due to the activity of cell enlargement and division photosynthesis activity which later may have increase the free passage of solutes to fruits. Gibberellins control fruit development in various ways and at different developmental stages. Fruit development is a complex and tightly regulated process. Growing fruits are very active metabolically and act as strong sinks for nutrients with hormones possibly modulating the process. The development of a fruit can be separated into phases that include pre-pollination, pollination, fertilization and fruit set, post fruit set, ripening and senescence. The successful fertilization of the ovule is
followed by cell division and cell expansion resulting in the growth of the fruit. Gibberellins are known to influence both cell division and cell enlargement.

The results were confirmed by Brahmachari et al. (1997) Katiyar et al. (2008) and Yadav (2002), Yadav et al. (2006), Reddy and Prasad (2012) Anawal and Suresh (2014) in pomegranate, Thakur et al. (1990) in litchi, Patel et al. (2010) in custard apple Ray et al. (1992) found significantly increase in length, diameter as well as weight of sapota fruit cv. Cricket Ball with the spray of GA$_3$ 100 ppm in sapota,. Narayan et al. (2013) found the guava cv. Allahabad Safeda the maximum fruit length, fruit girth in guava.

In present investigation maximum fruit volume (69.63 cm$^3$) and fruit weight (93.77 g) were noted in treatment T$_7$ [CCC 450 ppm (FBD stage) + NAA 150 ppm (Pea stage) + GA$_3$ 50 ppm (Fruit development stage)], however, it was found at par with treatment T$_5$ [CCC 450 ppm (FBD stage) + NAA 100 ppm (Pea stage) + GA$_3$ 50 ppm (Fruit development stage)] (68.18), (90.90) and T$_3$ [CCC 350 ppm (FBD stage) + NAA 150 ppm (Pea stage) + GA$_3$ 50 ppm (Fruit development stage)] (67.92), (89.30). The increase in fruit volume and fruit weight, might be due to accelerated rate of cell division and cell enlargement and more intercellular space with the application of higher concentration of growth substance. Similar results were obtain by Anawal and Suresh (2014) in pomegranate, Narayan et al. (2013). Biswas 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 showed maximum fruit weight, Garasiya et al. (2013) revealed that the application of GA$_3$ (50 and 100 ppm) increased fruit weight, fruit volume and fruit diameter in guava, Kumar and Singh (1984) and Patil et al. (1980) in grape.

In the present study, it was observed that maximum fruit yield (63.91 kg per plant) and fruit yield (6.39 tonnes per ha) were noted in treatment T$_7$ [CCC 450 ppm (FBD stage) + NAA 150 ppm (Pea stage) + GA$_3$ 50 ppm (Fruit development stage)], however, it was found at par with treatment T$_5$ [CCC 450 ppm (FBD stage) + NAA 100 ppm (Pea stage) + GA$_3$ 50 ppm (Fruit development stage)] (55.18), (5.52) and T$_3$ [CCC 350 ppm (FBD stage) + NAA 150 ppm (Pea stage) + GA$_3$ 50 ppm (Fruit development stage)] (54.94), (5.39). It might be due to rapid cell division and cell enlargement. The number of leaves per shoot was highly correlated with yield which indicated that yield increased with the increased number of leaves per shoot. This
might be due to the fact that leaves accelerate the physiological processes and also act as a source for photosynthesis. Similar result were also found by Yadav (2002), Rajput et al. (1977), Narayan et al. (2013) and Agnihotri et al. (2011), Reddy and Prasad (2012), Goswami et al. (2013) in pomegranate, Bhowmik and banik (2011) in mango, Eman et al. (2007) in orange, Abhijit et al. (2010) in phalsa, Patel et al. (2010) in custard apple, Yadav (2001) observed the effect of foliar application of growth regulator, i.e. NAA (20, 40 and GA₃ (50, 100 and 150 ppm) and were GA₃ 150 ppm increase the yield, Abhijit et al. (2010) revealed that GA₃ 100 ppm was most effective in improving yield per plant and yield per hectare in guava, Birenra Prasad et al. (2006) studied the effects GA₃ (50, 100, 150 or 200 ppm) on mango cv. Amrapali fruit yield and composition. The highest fruit yield was obtained with 100 ppm GA₃.

5.3 Quality parameters

The mean data on the quality parameters viz., T.S.S. (⁰Brix) and reducing sugar (%) [Table 4.10], total sugar (%) and non-reducing sugar (%) [Table 4.11]. The data revealed that the variation in T.S.S. (⁰Brix), reducing sugar (%), total sugar (%) and non-reducing sugar (%) were observed non-significant due to foliar application of different growth substance.

5.4 Economics

The net realization was worked out from the yield of sapota by taking into consideration the prevailing prices of sapota fruit and inputs used during the experimentation. The treatment [CCC 450 ppm (FBD stage) + NAA 150 ppm (Pea stage) + GA₃ 50 ppm (Fruit development stage)] gave maximum net realization (44081 Rs. ha⁻¹)

The data regarding cost benefit ratio value were calculated from gross realization and total expenditure incurred. The application of [CCC 450 ppm (FBD stage) + NAA 150 ppm (Pea stage) + GA₃ 50 ppm (Fruit development stage)] treatment gave highest (1:1.85) Cost Benefit Ratio. There was most economical. These result are in close conformity with finding of Delvadia et al. (1994).