USE OF CHEMICALS AND GROWTH REGUALTORS ON FRUIT RETENTION AND QUALITY OF MANGO CV. RATNA

BY
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DISSERTATION

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IN

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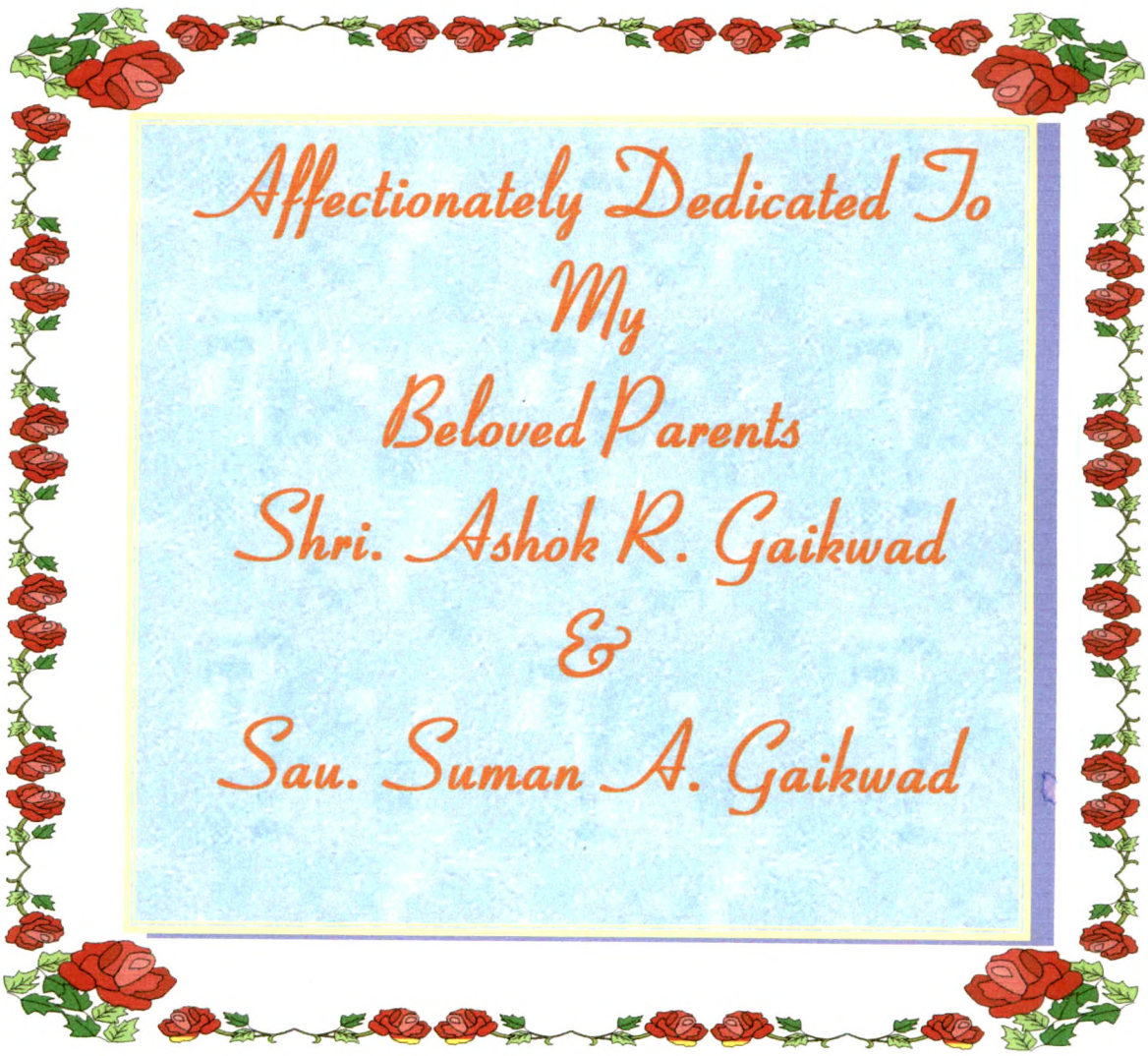
Affectionately Dedicated To
My
Beloved Parents
Shri. Ashok R. Gaikwad
&
Sau. Suman A. Gaikwad

CANDIDATE'S DECLARATION

I hereby declare that the dissertation

or part thereof, has not been

previously submitted by

me for a degree of

any University.

Gaikwad.

Place : PARBHANI
Date : 16/06/2007

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CERTIFICATE-I

This is to certify that the dissertation entitled **"USE OF CHEMICALS AND GROWTH REGUALTORS ON FRUIT RETENTION AND QUALITY OF MANGO CV. RATNA"** submitted by Shri. **GAIKWAD NANDKISHOR ASHOK** to the Marathwada Agricultural University, Parbhani in partial fulfilment of the requirement for the degree of **MASTER OF SCIENCE** in the subject of **HORTICULTURE** is record of original and bonafide research work carried out by him under my guidance and supervision. It is of sufficiently high standard to warrant its presentation for the award of the said degree.

I also certify that the dissertation or part thereof has not been previously submitted by him for a degree of any University.

Place : PARBHANI
Date : 16/06/2007

(B.N. Shinde)
Research Guide

CERTIFICATE-II

This is to certify that the dissertation entitled **"USE OF CHEMICALS AND GROWTH REGUALTORS ON FRUIT RETENTION AND QUALITY OF MANGO CV. RATNA"** submitted by Shri **GAIKWAD NANDKISHOR ASHOK** to the Marathwada Agricultural University, Parbhani in partial fulfilment of the requirement for the degree of **MASTER OF SCIENCE** in the subject of **HORTICULTURE** has been approved by the student's advisory committee after viva-voce examination in collaboration with the external examiner.

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Gaikwad

Place : PARBHANI **(N.A. Gaikwad)**
Date : 18/06/2007

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ABBREVIATIONS

cm	:	Centimeter
%	:	Per cent
/	:	Per
CC	:	Cubic centimeter
CCC	:	Cycocel
CD	:	Critical difference
Conc.	:	Concentration
Cv	:	Cultivar
et al	:	And others
etc.	:	Etceteras
Fig	:	Figure
g	:	Gram
GA	:	Gibberellic acid
Ha	:	hectares
hrs	:	hours
i.e.	:	That is
KNO_3	:	Potassium nitrate
mg	:	Milligram
ml	:	millilitres
MT	:	Metric tonnes
N	:	North
NAA	:	Napthalene acetic acid
No.	:	Number
NS	:	Non-significant
^oC	:	Degree celcius
ppm	:	part per million
q	:	Quintal
SE	:	Standard error
TSS	:	Total soluble solids
Var.	:	Variety
viz.,	:	Namely

Introduction

Chapter-1

INTRODUCTION

Mango (*Mangifera indica* L.) is the king of fruits as it is popularly known in India and commands a unique position in the Indian Horticulture. It is the native to India (Indo-Burma region). It has great adaptability and thrives in a wide range of climatic and soil conditions. It is grown throughout the length and breadth of the country under a wide range of agro-climatic situations except temperate regions. It has low cost of cultivation and maintenance.

Botanically mango belongs to family *Anacardiaceae* and cultivated mango belongs to *Mangifera indica* species and Wild mango belong to *Mangifera khasiana* and *Mangifera sylvatica* which are said to be existed in India.

Mango fruit is rich in vitamin A and C also a good source of calcium and phosphorus. Mango fruit is considered invigorating, refreshing and fattening. It has been under cultivation in Indian sub continent for more than 4000 years (De Candolle, 1884). Mango orchards were extensively established by Mugal rulers in Indo-gangetic plains.

In India, the area under mango fruit crop is about 16,00,000 ha during 2005 and production is about 1,08,00,000 MT and productivity is 6.75 tonnes/ha (Anonymous, 2005).

In Maharashtra the area under mango fruit crop is about 1,81,000 ha in year 2002-03 and production is about 6,16,000 MT and productivity is 3.4 tonnes/ha (Anonymous, 2004).

Mango fruit is used in all its stages of development. The unripe fruit is used for making pickles and chutney. Ripe fruit is mainly used for table purpose and is partly converted into squash, jam, preserves, mango leather and amchur. There is also scope for diversification by making other products like mango bar, mango jelly and mango ice-cream.

Marathwada region is famous for mango plantation mostly of seedling origin. It is extensively grown in almost all districts of Marathwada region particularly Aurangabad, Beed and Nanded districts. There is good collection of mango varieties at Shankarpurwadi near Khultabad. The orchard of Himayat Bagh is the collection of mango made by the Nizam (Anonymous, 1984).

Among these varieties, Ratna is the hybrid variety selected for the research purpose. It is a cross between Neelum and Alphanso. It has regular bearing habit. This hybrid has no disorder like spongy tissue and fibre. This hybrid was developed by RFRS, Vengurla (M.S.).

In recent and past, the gardens of Ratna are developed in the Marathwada region. But there is no research work carried out on ''Use of chemicals and growth regulators on fruit retention and quality of mango Cv. Ratna", therefore, this type of experiment was undertaken.

In order to increase the production and to generate the employment in rural areas, the Central and State Government has launched an ambitious programme for Horticulture Development through schemes like 'National Horticulture Mission' during the year 2005 and Employment Guarantee Scheme (EGS) during the year 1990-91. The main object of

these schemes is to increase area under different fruit crops, through providing subsidy to the farmers for growing fruit crops. Hence, it is expected that, the area under mango will increase in few years and incentive lot of interest and enthusiasm has been created among the farmers for fruit growing.

In mango cultivation, there are some problems. Fruit drop constitutes major problem in mango production. The natural fruit drop in mango is rather too high amounting about 99 per cent at various stages of growth (Singh *et al.*, 1986).

Immature fruits are dropped due to formation of abscission layer across the pedicel, beside external factors like heat, water and mineral supply, diseases and pests. There are certain internal factors like concentration of auxins is of importance which is governing the abscission layer formation (Maurya and singh, 1979).

The fruit drop is the major problem in mango cultivation. The application of plant growth regulators at the proper time has been found effective in controlling fruit drop.

In Horticulture, the use of plant growth regulators is well known. Efforts were also made by numerous research workers for reducing the fruit drop in mango by using growth regulators such as NAA in some important commercial varieties i.e. Dashehari, Langra, Neelum and Chausa under various agro-climatic conditions (Roy *et al.*, 1963; Maurya *et al.*, 1973; Pal *et al.*, 1979; Singh, 1979 and Singh *et al.*, 1986).

In mango, numerous workers have used foliar urea application in varying concentration for reducing the fruit drop in other varieties such as

Amrapali, Deshehari, Langra etc. under Varanasi and Lucknow conditions (Singh, 1979 and Singh *et al.*, 1991).

Foliar application of NAA, urea and KNO_3 also reduce the fruit drop and significantly increase the fruit set and fruit retention in mango (Sharma *et al.*, 1990). The triacontanol a bioenzyme is also used to improve fruit retention in mango but not on commercial scale,because most of the mango growers are unaware about its property of fruit retention. Konhar and Singh, (1988) showed that,use of triacontanol on cashewnut, which gives the highest fruit retention as compared to some other growth regulators.

There is no research work carried out on the use of NAA, KNO3, urea and triacontanol to improve the fruit retention and quality of mango fruit in variety Ratna. Therefore, the present investigation involving spray of NAA, KNO_3, urea and triacontanol was undertaken in variety Ratna with the following objectives.

1. To study the effect of chemicals and growth regulators on fruit retention problem in Ratna.
2. To know the effect of chemicals and growth regulators on physical characters of Ratna.
3. To determine the effect of chemicals and growth regulators on chemical characters of Ratna.

Review of Literature

Chapter-2

REVIEW OF LITERATURE

An attempt has been made to present a brief review on the influence of NAA, KNO_3, urea and triacontanol on fruit drop, fruit retention and quality of mango fruits.

Though the occurrence of fruit drop in mango has been found to be a continuous one, most of the drop occurs after fruit setting. Fruit drop problem in mango have assumed a great significance in almost every mango growing areas (Chadda and Singh, 1963).

The use of plant growth regulators during recent years has become a common practice for increasing fruit set and controlling the fruit drop to obtain higher yield (Prasad and Pathak, 1972; Maurya *et al.*, 1973, Singh and Ram, 1983).

Use of chemicals and growth regulators on fruit retention and quality of mango varieties have been studied in past in different parts of the country and is reviewed under suitable heads.

2.1 Effect on fruit set

Arvindakshan *et al.* (1979) studied the effect of planofix on fruit set in mango variety Neelum. Planofix (containing NAA) at 10, 20 and 30 ppm was applied twice at 5 days intervals in 1st, 2nd or 3rd week after fertilization during the mustard, pea and marble stage, respectively. Planofix improved fruitset compared with control. The most effective stage

of application was the marble stage which gave 28.2 per cent fruit set at optimum concentration of 20 ppm. Fruit set at 10 and 30 ppm was 27.8 and 24.0 per cent respectively and in control it was 19.28 per cent.

Rajput and Singh (1983) concluded that mango trees Cv. Dashehari when treated with urea and GA_3, Fruit set (62.8 per cent), fruit retention (3.17 per cent) and yield per panicle (265 g) increased when compared with control.

Sharma *et al.* (1990) reported that the urea (2 or 4 per cent), KNO_3 (1.5 or 3 per cent) and NAA at 40 ppm significantly increased fruit set and reduced percentage of fruit drop. The effects increased with application rate of each case in cv. Langra.

Chandel and Jindal (1991) revealed that Japanese plum sprayed with triacontanol 10 ppm significantly increase percentage of fruit set as compared to control.

Baghel and Tiwari (2003) an experiment was conducted on mango tree, reported that application of the individual and integrated effect of urea and NAA on flowering and total number of fruits per tree showed that combined application of 6 per cent urea and 150 ppm NAA was found superior for total number of fruits per tree but maximum fruitset was recorded under combined application of 4 per cent urea and 150 ppm NAA in this study.

2.2 Effect on Fruit drop

Singh (1974) observed that an application of 4 per cent urea to be effective in variety Chausa for reducing fruit drop in both off and on years.

Pal *et al.* (1979) reported that average percentage of fruit drop in variety Dashehari was reduced to 42.05 per cent with the application of 20 ppm NAA as compared to control (50.12 per cent) under Lucknow condition.

Rawash *et al.* (1983) observed that the spraying of 40 ppm NAA on 1 April significantly reduced the fruit drop compared with control in cultivars Langra and Ewais under Lucknow condition, while Minimum fruit drop was observed on panicles treated with NAA 20 ppm in Alphanso mango under Konkan condition.

Usha and Peter (1988) noted highest reduction in flower drop in chilli during summer season with 4 sprays of triacontanol as vipul at 0.5 ppm and in the monsoon with NAA at 15 ppm as foliar spray.

Atul Chandra (1996) found that a spray of 2 per cent urea solution in mid April reduced the incidence of post setting (April) drop by 17.98 per cent and 45.84 per cent in varieties Dashehari and Langra, respectively compared to water sprayed control.

Rathod (2002) concluded that triacontanol 500 ppm should be sprayed at flowering, pea stage and marble stage result in increased fruit retention and reduced the extent of fruit drop and also increases weight, length, breadth and volume of fruit while NAA 60 ppm increased the

mesocarp per cent and reduced the endocarp per cent and urea 1.5 per cent increases the per cent exocarp.

2.3 Effect on fruit retention

Shrivastava (1962) reported that total percentage of fruit retained till harvest was 9.60 per cent under the treatment NAA 50 ppm as compared with 1.1 per cent in control, given seven days after fruit set in cultivar Dashehari.

Prasad and Pathak (1972) found that the most effective treatment for increasing the fruit retention was 25 ppm NAA in variety Dashehari which recorded maximum retention of fruits (8.65 per cent) over control (2.20 per cent).

Maurya *et al.* (1973) observed that the application of NAA 40 ppm at pea stage of fruit development caused the greatest fruit retention (7.70 per cent) over control (5.05 per cent) in variety Dashehari.

Singh (1974) reported that foliar spray of 4 per cent urea retained highest fruits per panicle (0.66) till harvest as compared to control (0.26).

Maurya and Singh (1979) reported that the highest fruit retention as compared to control was recorded with the concentration 40 ppm NAA sprayed at pea stage in variety Langra.

Singh (1979) reported maximum retention of fruits per panicle (0.90) in variety Dashehari with 40 ppm NAA as compared to control (0.66) under Varanasi condition.

Singh and Ram (1983) found 300 per cent retention with spray of NAA 40 ppm in the variety Dashehari. It is further reported that higher concentration of NAA was required at pea stage than that of at pre bloom and marble stage under Pantnagar condition in cultivar Dashehari.

Rajput and Singh (1983) observed that preflowering spray of 6 per cent urea to be more effective in retaining highest percentage of fruits per panicle (2.57 per cent) as compared to control (2.17 per cent) in the variety Dashehari under Varanasi condition.

Prakash and Ram (1986) observed that application of 50 ppm NAA at mustard and premature stage increased fruit retention by 300 per cent and 230 per cent respectively over control, respectively in variety Chausa. The mean numbers of fruits per panicle at harvest at mustard and premature stage were 0.40 and 0.33 respectively as compared to control (0.10) under Nainital condition (U.P.).

Baghel *et al.* (1987a) obtained highest fruit retention till harvest with 6 per cent urea spray (4.29 per cent) over control treatment (2.61 per cent) in variety Sunderja under Jabalpur condition. They further found the preflowering spray of NAA at 120 ppm more effective giving highest percentage of fruit retention (3.58 per cent) over control (2.61 per cent) in variety Sunderja under Jabalpur condition.

Konhar and Singh (1988) revealed that treatment of growth regulators like Maxtalol (Triacontanol), ethrel (ehtephon) and planofix (NAA) as sprays given first time on 21st December and three time more at fifteen day interval on ten year old cashew variety 'No. 1' resulted in

highest percentage of fruit retention (25.8 per cent) was obtained with nutron (Triacontanol) at 500 ppm followed by ethrel (ethophon) at 50 ppm (25.4 per cent) and planofix (NAA) at 45 ppm (22.8 per cent). The control percentage was 7.28.

Naqvi *et al.* (1990) reported that the mango trees Cv. Dashehari were sprayed with 20 mg NAA per litre, 100 mg $AgNO_3$ per liter or 100 mg $CO(NO_3)2$ per liter when fruits attained pea and marble size, the treatments increased fruit retention at all concentration tested.

Singh *et al.* (1991) obtained highest fruit retention (11.35 per cent) with 3 per cent urea spray over control (8.22 per cent) in variety Amrapali under Varanasi condition.

Sharma (1995) concluded that foliar application of triacontanol at 7.5 ppm 4 weeks after transplanting was the most effective in improving yield per hectare in tomato fruits.

2.4 Effect on fruit size

Chadha and Singh (1963) observed that application of NAA at 20 ppm increased fruit length and breadth by 18.92 per cent and 30.73 per cent, respectively over control in mango variety Langra.

Veera and Das (1971) reported that maximum length (22.77 cm) and breadth (9.51 cm) of fruit, was found under 40 ppm NAA spray treatment as compared to control (10.42 cm and 8.63 cm) in variety respectively in variety Banganpalli.

Prasad and Pathak (1972) reported that maximum length (10.05 cm) and breadth (5.61 cm) was found in 25 ppm NAA treatment

compared to control (7.12 cm and 4.27 cm, respectively) in variety Dashehari under Saharanpur condition.

Maurya *et al.* (1973) revealed that maximum length (8.14 cm) and diameter (6.42 cm) was found with the application of 20 ppm NAA compared to control (7.11 cm and 5.09 cm, respectively) in the variety Dashehari under Varanasi condition.

Singh and Tripathi (1978) observed and increase in the fruit size of mango Cv. Banarasi Langra as a result of foliar spray of KNO_3. The length and diameter of fruit increased (9.2 and 7.0 cm) respectively significantly due to 40 ppm NAA as a foliar application as compared to control (8.6 and 6.7 cm).

Mishra and Singh (1984) reported that fruit size increased significantly in mango fruit with the application of NAA in cultivar Chausa.

Singh *et al.* (1986) reported that maximum fruit length and diameter (8.64 cm and 6.47 cm, respectively) was obtained with 5 ppm NAA when sprayed thrice at full bloom, pea and marble stage compared to control treatment (7.74 cm and 6.25 cm, respectively) in mango variety Langra under Kanpur condition.

Baghel *et al.* (1987b) observed that preflowering spray of NAA at 150 ppm resulted in increased length (12.05 cm) and breadth (7.47 cm) of fruit in variety Sunderja as compared to control (11.49 cm and 7.15 cm, respectively) under Jabalpur condition. They further reported that the preflowering spray of urea at 6 per cent gave maximum fruit length (12.59

cm) and diameter (7.60 cm) as compared to control treatment (11.49 cm and 7.15 cm, respectively) in variety Sunderja under Jabalpur condition.

Sharma *et al.* (1990) found significant increase in length and diameter of fruit (9.2 cm and 7.0 cm) as a result of 40 ppm NAA foliar spray as compared to control, which gave 8.60 cm and 6.70 cm respectively in variety Langra under Jabalpur condition.

Singh *et al.* (1991) found 5 per cent urea spray more effective in increasing length (9.58 cm) and breadth (6.27 cm) in variety Amrapali over control (6.27 cm and 4.12 cm, respectively) under Varanasi condition.

Barua (1998) tried triacontanol at 2.5, 5.0, 7.5 and 10.0 ppm at the pit hardening stage in Santa Rosa plums and founds all the forms of triacontanol increased the volume of fruits.

Gupta and Brahmachari (2004) recorded maximum fruit length (9.92 cm) and diameter (7.89 cm) with urea 4 per cent, as compared to control minimum length (8.41 cm) and diameter (6.32 cm) in variety Bombai under Bhagalpur condition.

2.5 Effect on fruit weight

Veera and Das (1971) recorded highest average fruit weight i.e. 438.15 g in variety Banganpalli under 40 ppm NAA spray treatment as compared to control (324.80 g) under Andhra Pradesh condition.

Prasad and Pathak (1972) observed 25 ppm NAA to be most effective to increase fruit weight (172.93 g) as compared to control (110.89 cm) in variety Dashehari under Saharanpur condition.

Singh (1975) reported that 4 per cent urea spray significantly increase fresh fruit weight (250.16 g) as compared to control (237.82 g) in variety Chausa under Varanasi condition.

Singh and Tripathi (1978) reported increase in the fruit weight of mango Cv. Banarasi Langra as a result of foliar spray of KNO_3. They also observed that 40 ppm NAA spray significantly increased fruit weight (163.9 g/fruit) as compared to control (157.0 g/fruit).

Baghel *et al.* (1987b) observed that the application of preflowering spray of NAA 150 ppm gave the highest fruit weight (230.93 g) in variety Sunderja under Jabalpur condition.

Sharma *et al.* (1990) recorded maximum fruit weight (174.9 g) in 4 per cent urea spray as compared to 148.4 g in control in variety Langra under Jabalpur condition.

Singh *et al.* (1991) observed highest fruit weight (135.95 g) with 5 per cent urea spray over control (112.32 g) in variety Amrapali at Varanasi.

Nargis Jahan *et al.* (1997) observed that in okra number of fruits per plant, fruit weight, yield per plant etc. were significantly influenced by maxtalol (triacontanol) at 0.5 ppm concentration.

Barua (1998) reported that application of triacontanol at 2.5, 5.0, 7.5 and 10.0 ppm at pit hardening stage in Santa Rosa plums increase in fruit weight as compared to control.

Gupta and Brahmachari (2004) obtained maximum fruit weight (230.5g) with urea 4 per cent while minimum (163.4g) was under control in variety Bombai under Bhagalpur condition.

2.6 Effect on Total Soluble Solids (T.S.S.)

Veera and Das (1971) reported that highest TSS (18.55 per cent) with 40 ppm spray in variety Banganapalli as compared to control (16.68 per cent) under A.P. condition

Prasad and Pathak (1972) reported that maximum increase in TSS (22.5 per cent) with 25 ppm NAA treatment as compared to control (19.00 per cent) in variety Dashehari.

Maurya *et al.* (1973) reported that highest TSS (24.00 per cent) was found with 60 ppm NAA over control (22.00 per cent) in variety Dashehari under Varanasi condition.

Singh *et al.* (1975) reported that the TSS was highest with 4 per cent urea spray (14.20 per cent) over control treatment (13.04 per cent) in variety Chausa.

Singh *et al.* (1977) noted that increase in TSS from 11.9 per cent to 14.1 per cent with 2 per cent urea spray in variety Langra in Bangladesh.

Singh (1979) reported that with the spray of 5 per cent potassium nitrate, there was increase in TSS (19.5 per cent) in variety Langra than that of control under Banarasi condition.

Singh *et al.* (1979) found highest TSS (15.6 per cent) in fruit receiving 4 per cent urea sprays as compared to control in variety Langra.

Sharma *et al.* (1990) recorded maximum TSS (19.77 per cent) as a result of 4 per cent urea spray as compared to control (18.50 per cent).

Singh *et al.* (1991) reported that the spray of 5 per cent urea resulted in increasing TSS (20.35 per cent) in variety Amrapali under Varanasi condition.

Gupta and Brahmachari (2004) obtained maximum (21.03 per cent) increase in TSS with 40 ppm NAA and minimum (19.00 per cent) decrease in control in variety Bombai under Bhagalpur condition.

2.7 Effect on Acidity

Veera and Das (1971) reported lowest acidity (0.245 per cent) with 40 ppm NAA spray in variety Banganapalli compared to control (0.256 per cent) under A.P. condition.

Prasad and Pathak (1972) reported maximum decrease in acidity (0.04 per cent) was found in 25 ppm NAA treatment as compared to control (0.078 per cent) in variety Dashehari.

Maurya *et al.* (1973) reported lowest acidity percentage (0.13 per cent) was found in 60 ppm NAA as compared to control (0.18 per cent) in variety Dashehari under Varanasi condition.

Singh (1979) reported decrease in acidity (0.240 per cent) with 3 per cent spray of potassium nitrate in variety Langra than that of control under Banarasi condition.

Sharma *et al.* (1990) recorded minimum acidity i.e. (0.272 per cent) with 4 per cent urea spray as compared to unsprayed control (0.294 per cent) in variety Langra under Jabalpur condition.

Singh *et al.* (1991) reported that the spray of 5per cent urea resulted in decreasing acidity percentage (0.12 per cent) as compared to control treatment (0.23 per cent) in variety Amrapali under Varanasi condition.

Gupta and Brahmachari (2004) obtained minimum acidity (0.2847 per cent) with NAA 40 ppm while maximum acidity (0.3169 per cent) was recorded under control in variety Bombai under Bhagalpur condition.

Material and Methods

Chapter-3

MATERIALS AND METHODS

The present investigation was carried out to ascertain the usefulness of NAA, KNO_3, urea and triacontanol spray to control the fruit drop and increase fruit retention and quality in mango cultivar Ratna.

3.1 Experimental site

The present investigation was conducted during 2006-2007 on grafted mango cultivars grown at mango orchard belonging to Shri. S.B. Shinde at village Paralgavan near Parbhani.

3.2 Location and climate

Parbhani is situated at 19° 16' North latitude and 74° 47' East longitude and 409 meters above mean sea level. The climate is generally dry for eight months of the year and wet during South-West monsoon season. The mean rainfall is approximately 826.6 mm and is received from June to September. Rainfall is not well distributed in all the parts of district and year. The maximum temperature in summer month goes up to 40°C. The cold weather commences from the middle of November when temperature starts falling and minimum temperature goes down up to 7°C. Thus Parbhani is fairly cool in winter and sufficiently hot in summer, the mean relative humidity ranges from 12 to 90 per cent.

The meteorological data in respect of maximum and minimum temperature, rainfall, humidity and bright sunshine hours as

Plate 1. General view of the mango orchard Cv. Ratna

recorded at Agricultural Meteorological Observatory, Marathwada Krishi Vidyapeeth, Parbhani during 2006-2007 is presented in Annexure-I.

3.3 Soil

The orchard was established on well drained, black cotton soil, and topography of land was fairly levelled. The soil had moderate moisture retention capacity (Table 1).

Table 1. Physico-chemical analysis of soil of experimental orchard.

Owner : Shri. S.B. Shinde (Paralgavan).

Character	Horizon depth (cm)		
	0-30	30-60	60-90
Available N (%)	0.008	0.008	0.007
Available P (%)	0.002	0.002	0.001
Available K (%)	0.035	0.035	0.034
Organic carbon (%)	0.6	0.7	0.6
pH	7.0	7.0	7.0

3.4 Materials

The orchard was established by procuring uniform mango grafts of Ratna, Pairi, Parbhani Bhushan, Totapuri, Fazli and Neelum cultivars from Central Nursery, Marathwada Agricultural University, Parbhani during 1991-92.

The trees were planted at spacing 10 m x 10 m. These grafts were maintained with uniform horticultural practices. Out of above cultivars Ratna was selected to study the Use of NAA, KNO_3, urea and triacontanol on fruit retention and quality.

3.5 Experimental details

3.5.1 Details of layout

The experiment entitled, "Use of chemicals and growth regulators on fruit retention and quality of mango Cv. Ratna." was laid out in Randomised Block Design with thirteen treatments.

Design : Randomised Block design

Replications : Three

Treatments : Thirteen

Treatment details:

i) T_0 Control

ii) T_1 NAA 50 ppm

iii) T_2 NAA 75 ppm

iv) T_3 NAA 100 ppm

v) T_4 KNO_3 2 %

vi) T_5 KNO_3 4 %

vii) T_6 KNO_3 6 %

viii) T_7 Urea 2 %

ix) T_8 Urea2.5 %

x) T_9 Urea 3 %

xi) T_{10} Triacontanol 500 ppm

xii) T_{11} Triacontanol 750 ppm

xiii) T_{12} Triacontanol 1000 ppm

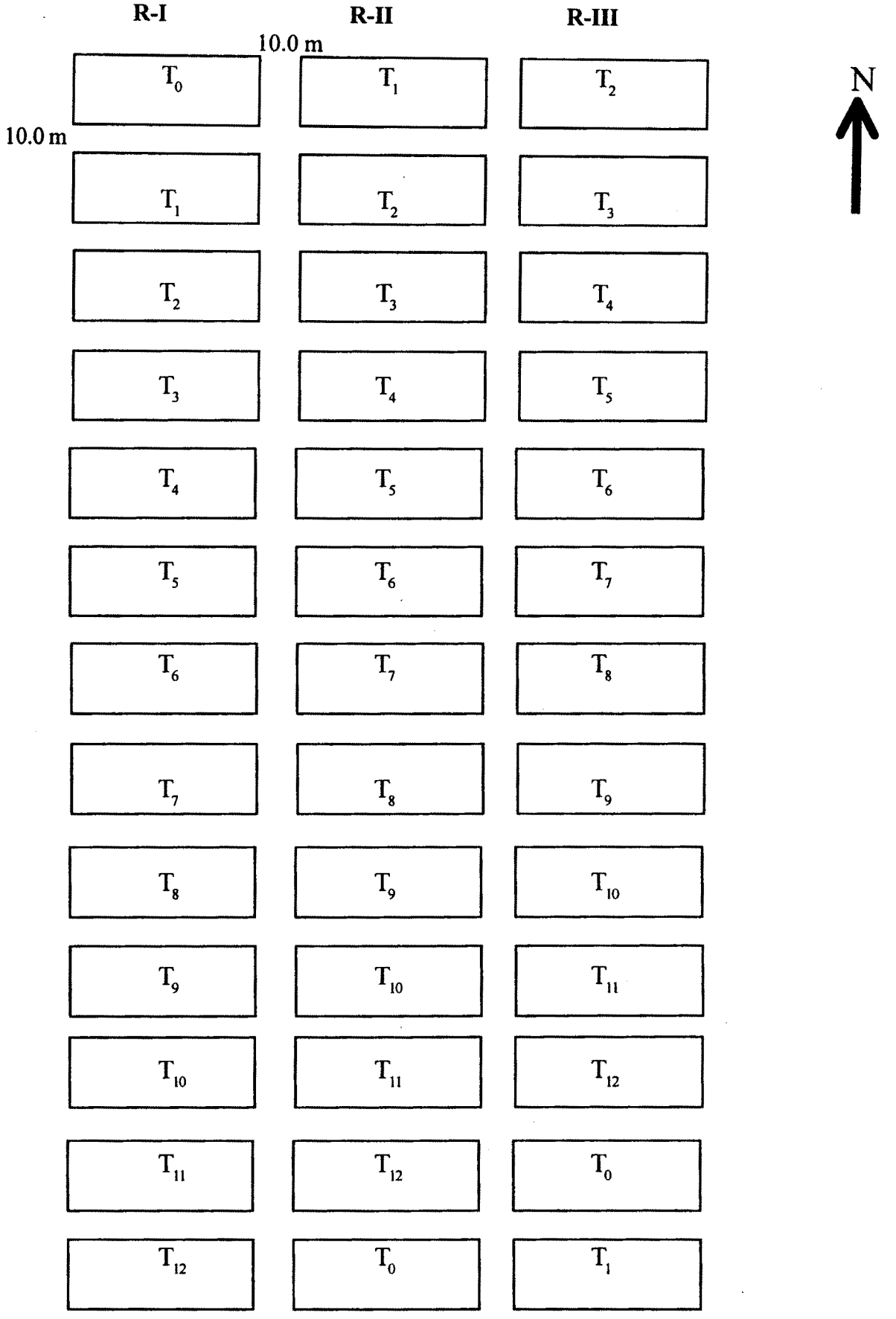


Fig. 1. LAYOUT OF AN EXPERIMENTAL PLOT

3.5.2 Selection of trees

Thirty nine uniform growing trees were selected randomly leaving border rows.

3.5.3 Selection of panicles

For recording the observations on the various Parameters, 4 uniform bearing panicles on the North, South, East and West site of the tree were selected during peak period of flowering randomly on each tree and tagged with labels.

3.5.4 Treatment application

The chemicals as per the treatments, were applied as a foliar spray to panicles at full bloom stage (flowering), pea size stage and at marble size stage of fruits with the help of Ganesh hand sprayer. The sprayer was thoroughly washed with distilled water after application of every chemical and growth regulator.

3.6 Observations

Following observations were recorded during the present investigation.

3.6.1 Fruit set per panicle

Randomly four panicle from all the sides were selected on each tree and average number of fruit set per panicle were recorded.

3.6.2 Fruit retention

For recording the observations on fruit retention the panicles from all sides of the tree were tagged with aluminum plates. The

observations of fruit retention per panicle were recorded at each stage. The stages were:

1. Pea size stage
2. Marble size stage
3. Half grown stage
4. Full grown stage.

3.6.3 Physical characters of fruits

Four fully mature four fruits, one from each treated panicle was use for recording the observation and average was calculated.

3.6.3.1 Size of fruits (cm)

For measuring the size of fruits the length and breadth of fruits were calculated by Vernier calliper and given in cm.

3.6.3.2 Weight of fruits (g)

Four fruits one from each treated panicle were selected. Weight of each fruit was noted on electronic balance. Average for each treatment in (g) was calculated.

3.6.3.3 Volume of fruits (cc)

The volume of each fruit was estimated by water displacement method. The average was calculated for each treatment and given in cc.

3.6.3.4 Per cent of mesocarp (pulp)

The pulp was extracted by hand and knife and weight was recorded and presented as percentage of total fruit weight.

3.6.3.5 Per cent of exocarp (skin)

The skin was removed, made free from pulp and weight was taken and calculated as percentage of total fruit weight.

3.6.3.6 Per cent of endocarp (stone)

The stone was cleaned so that, no pulp remained adhering with the stone and the weight of stone was taken.

3.6.3.7 Specific gravity

The specific gravity was taken by dividing the weight of the fruit by its volume.

$$\text{Specific gravity} = \frac{\text{Weight of the fruit}}{\text{Volume of the fruit}}$$

3.6.4 Chemical characters of fruits

3.6.4.1 Per cent of total soluble solids (TSS per cent)

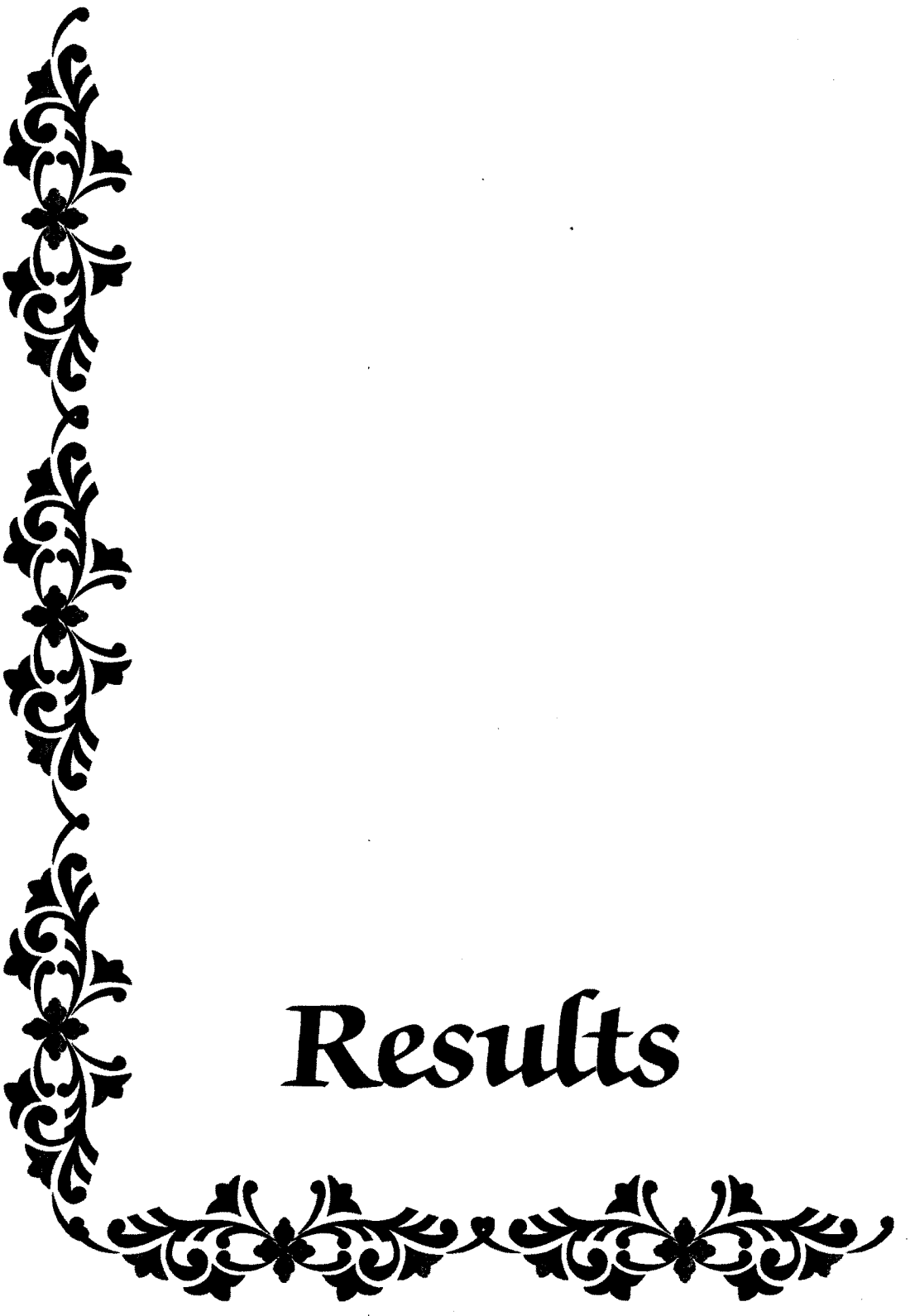
After harvesting of mango fruits, fully ripe mango fruit was taken and cut with the help of knife and from this pulp of mango fruits 2 to 3 drops of mango juice was taken on hand refractometer. The total soluble solids was recorded by using hand refractometer and expressed in brix. The average was calculated from each treatment and given in per cent.

3.6.4.2 Acidity (per cent)

The acidity was estimated by using A.O.A.C. method. Diluted pulp of mango fruit (1:10) was titrated with 0.1 N NaOH using phenolphthalein as an indicator. The average was calculated from each treatment and given in per cent.

3.7 Statistical analysis

The data obtained in respect of various observations was subjected to the statistical analysis as per procedure given by Panse and Sukhatme (1967) for randomised block design and critical difference has been calculated at 5 per cent level of significance.



Results

Chapter-4

RESULTS

Use of chemicals and growth regulators on fruit retention and quality of mango cultivar Ratna was studied and experimental results are presented in suitable headings. Mean values obtained from all the observations for each character are presented in the form of tables and briefly explained with the help of graphs.

4.1 Fruit set (number of fruits per panicle)

Perusal of data from Table 2 revealed that, all the chemicals and growth regulators found better in increasing fruit set per panicle as compared to control.

Statistically maximum fruit set per panicle was observed in treatment T_{12} (triacontanol 1000 ppm) i.e. 83.66 per cent and found significantly superior over rest of all the treatments. Treatment T_{11} (triacontanol 750 ppm) which was at par with treatments T_1 (NAA 50 ppm), T_2 (NAA 75 ppm) and treatment T_4 (KNO_3 2 per cent). Treatments T_6 (KNO_3 6 per cent) and T_4 (KNO_3 2 per cent) were at par with each other. Treatments T_9 (urea 3 per cent) and T_{10} (triacontanol 500 ppm) were at par with each other. Treatments T_3 (NAA 100 ppm) and T_{10} (triacontanol 500 ppm) were at par with each other. Treatment s T_3 (NAA 100 ppm), T_8 (urea 2.5 per cent), T_5 (KNO_3 4 per cent) and T_7 (urea 2 per cent) were at par with each other.

Statistically minimum per cent of fruit set per panicle was observed in T_0 (control) i.e. 54.33 per cent.

Table 2. Effect of spraying chemicals and growth regulators on per cent fruit set per panicle

Tr. No.	Treatments	Per cent fruit set
T_0	Control	54.33 (47.47)
T_1	NAA 50 ppm	77.64 (61.79)
T_2	NAA 75 ppm	74.81 (59.88)
T_3	NAA 100 ppm	63.30 (52.71)
T_4	KNO_3 2 %	73.82 (59.23)
T_5	KNO_3 4 %	62.43 (52.19)
T_6	KNO_3 6 %	72.12 (58.13)
T_7	Urea 2 %	60.85 (51.26)
T_8	Urea2.5 %	62.58 (52.28)
T_9	Urea 3 %	66.86 (54.85)
T_{10}	Triacontanol 500 ppm	65.54 (54.05)
T_{11}	Triacontanol 750 ppm	79.69 (63.22)
T_{12}	Triacontanol 1000 ppm	83.66 (66.18)
	Mean	69.04 (56.40)
	SE $\pm$	0.88
	CD at 5%	2.58

Figures in parentheses are angular transformed values.

Plate 2. Flowering stage of the mango tree Cv. Ratna

Plate 3. Half grown stage of fruit development Cv. Ratna

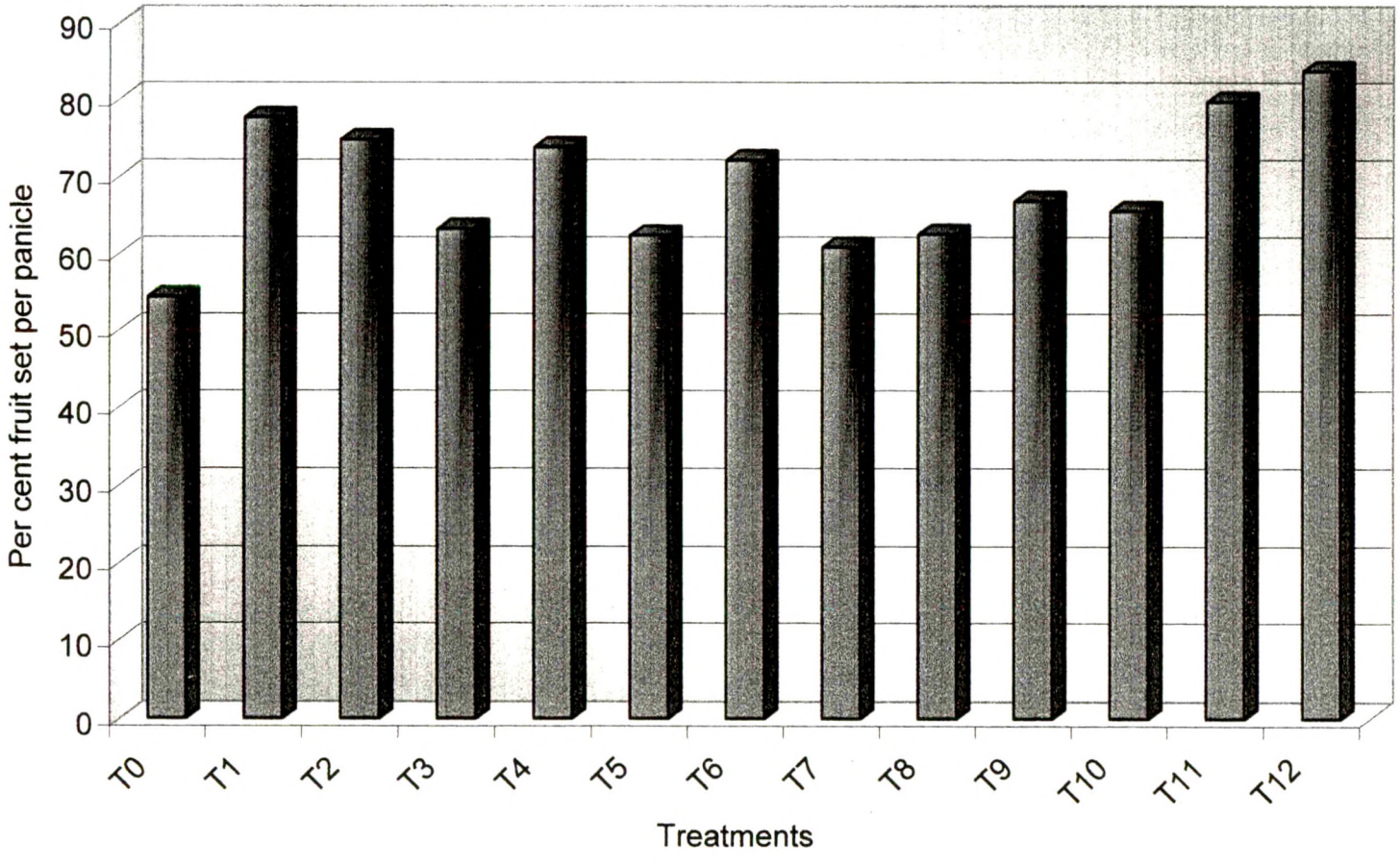


Fig. 2. Effect of spraying chemicals and growth regulators on per cent fruit set per panicle

4.2 Fruit retention at pea stage (per cent fruits per panicle)

Data from the Table 3 revealed that,all the chemicals and growth regulators showed statistically maximum fruit retention at pea stage, which was observed in treatment T_{12} (triacontanol 1000 ppm) i.e. 47.34 per cent which was at par with T_{11} (triacontanol 750 ppm) and treatment T_1 (NAA 50 ppm) but significantly superior over rest of the treatments. Treatment T_2 (NAA 75 ppm) and treatment T_{10} (triacontanol 500 ppm) were at par with each other. Treatments T_3 (NAA 50 ppm), T_5 (KNO_3 4 per cent), T_6 (KNO_3 6 per cent), T_7 (urea 2 per cent) and T_8 (urea 2.5 per cent) were at par with each other. Treatments T_8 (urea 2.5 per cent), T_7 (urea 2 per cent) and T_4 (KNO_3 2 per cent) were at par with each other. Treatment T_9 (urea 3 per cent) which was significantly superior over T_0 (control).

Statistically minimum fruit retention at pea stage was observed in T_0 (control) i.e. 32.84 per cent.

4.3 Fruit retention at marble stage (per cent fruits per panicle)

Data from table 4 showed that,statistically maximum fruit retention at marble stage was noticed in treatment T_{12} (triacontanol 1000 ppm) i.e. 18.53 per cent which was significantly superior over rest of the treatments except T_{11} (triacontanol 750 ppm), T_1 (NAA 50 ppm) and T_2 (NAA 75 ppm). Treatments T_2 (NAA 75 ppm), T_1 (NAA 50 ppm), T_3 (NAA 100 ppm), T_5 (KNO_3 4 per cent) and T_{11} (triacontanol 750 ppm) were at par with each other. Treatments T_1 (NAA 50 ppm), T_2 (NAA 75 ppm), T_3 (NAA 100 ppm), T_4 (KNO_3 2 per cent) and T_5 (KNO_3 4 per cent) were at par with each other. Treatments T_2 (NAA 75 ppm), T_3 (NAA 100

Table 3. Effect of spraying chemicals and growth regulators on per cent fruit retention at pea stage

Tr. No.	Treatments	Per cent fruit retention
T_0	Control	32.84 (34.95)
T_1	NAA 50 ppm	45.51 (42.42)
T_2	NAA 75 ppm	42.57 (40.07)
T_3	NAA 100 ppm	40.21 (39.34)
T_4	KNO_3 2 %	37.82 (37.94)
T_5	KNO_3 4 %	39.63 (39.00)
T_6	KNO_3 6 %	39.01 (38.64)
T_7	Urea 2 %	38.10 (38.10)
T_8	Urea2.5 %	38.48 (38.33)
T_9	Urea 3 %	35.49 (36.55)
T_{10}	Triacontanol 500 ppm	41.35 (40.01)
T_{11}	Triacontanol 750 ppm	45.60 (42.46)
T_{12}	Triacontanol 1000 ppm	47.34 (43.46)
	Mean	40.30 (39.38)
	SE $\pm$	0.73
	CD at 5%	2.13

Figures in parentheses are angular transformed values.

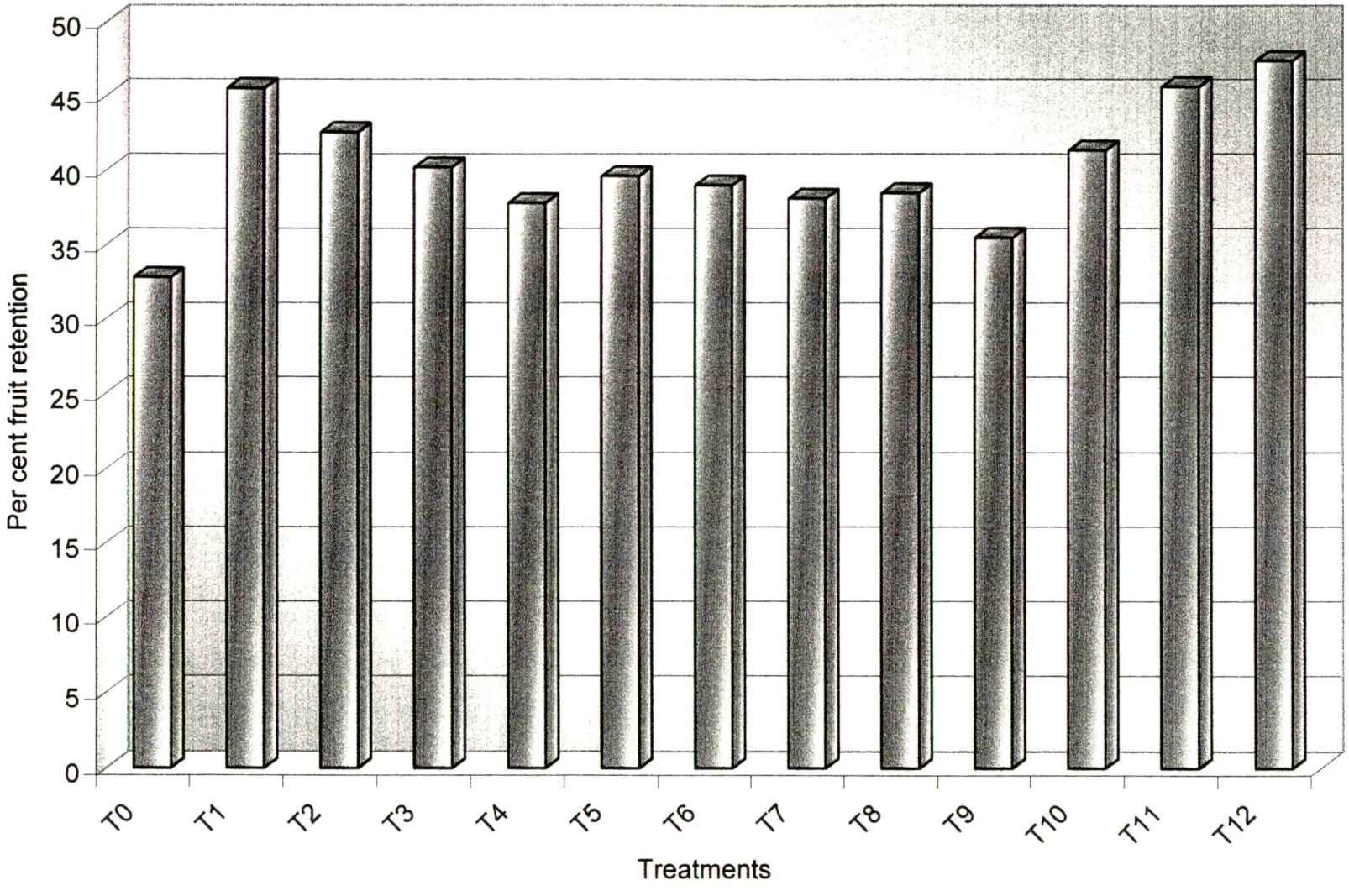


Fig. 3. Effect of spraying chemicals and growth regulators on per cent fruit retention at pea stage

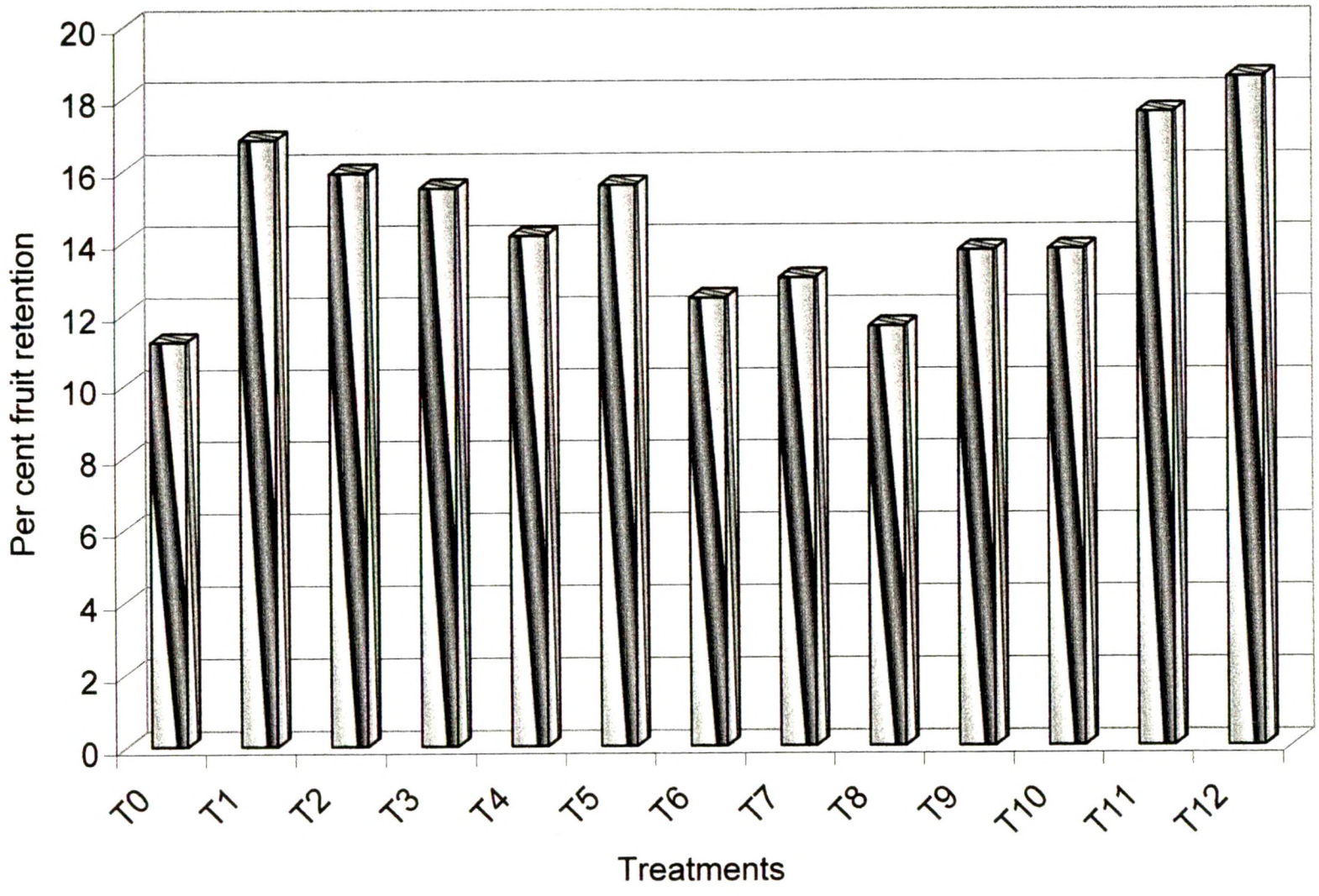


Fig. 4. Effect of spraying chemicals and growth regulators on per cent fruit retention at marbal stage

Table 4. Effect of spraying chemicals and growth regulators on per cent fruit retention at marble stage

Tr. No.	Treatments	Per cent fruit retention
T_0	Control	11.21 (19.51)
T_1	NAA 50 ppm	16.83 (24.18)
T_2	NAA 75 ppm	15.90 (23.46)
T_3	NAA 100 ppm	15.48 (23.13)
T_4	KNO_3 2 %	14.14 (22.05)
T_5	KNO_3 4 %	15.56 (23.18)
T_6	KNO_3 6 %	12.40 (20.57)
T_7	Urea 2 %	12.95 (21.04)
T_8	Urea2.5 %	11.62 (19.87)
T_9	Urea 3 %	13.72 (21.70)
T_{10}	Triacontanol 500 ppm	13.75 (21.73)
T_{11}	Triacontanol 750 ppm	17.55 (24.73)
T_{12}	Triacontanol 1000 ppm	18.53 (25.47)
	Mean	14.58 (22.35)
	SE $\pm$	0.96
	CD at 5%	2.81

Figures in parentheses are angular transformed values.

ppm), T_4 (KNO_3 2 per cent), T_5 (KNO_3 4 per cent), T_9 (urea 3 per cent) and T_{10} (triacontanol 500 ppm) were at par with each other. Treatments T_3 (NAA 100 ppm), T_4 (KNO_3 2 per cent), T_7 (urea 2 per cent), T_9 (urea 3 per cent), T_{10} (triacontanol 500 ppm) were at par with each other. Treatments T_4 (KNO_3 2 per cent), T_6 (KNO_3 6 per cent), T_7 (urea 2 per cent), T_8 (urea 2.5 per cent), T_9 (urea 3 per cent) and T_{10} (triacontanol 500 ppm) were at par with each other.

Statistically minimum fruit retention at marble stage was noticed in T_0 (control) i.e. 11.21 per cent which was at par with treatments T_{10} (triacontanol 500 ppm), T_9 (urea 3 per cent), T_8 (urea 2.5 per cent) and T_7 (urea 2 per cent).

4.4 Fruit retention at half grown stage (per cent fruit per panicle)

Data from Table 5 revealed that, statistically highest fruit retention at half grown stage was observed in treatment T_{12} (triacontanol 1000 ppm) i.e. 5.05 per cent, which was significantly superior over rest of the treatments but at par with treatments T_{11} (triacontanol 750 ppm), T_1 (NAA 50 ppm) and T_2 (NAA 75 ppm). Treatments T_1 (NAA 50 ppm), T_2 (NAA 75 ppm), T_3 (NAa 100 ppm), T_4 (KNO_3 2 per cent), T_5 (KNO_3 4 per cent), T_6 (KNO_3 6 per cent), T_7 (urea 2 per cent), T_8 (urea 2.5 per cent), T_9 (urea 3 per cent), T_{10} (triacontanol 500 ppm) and T_{11} (triacontanol 750 ppm) were at par with each other.

Statistically lowest fruit retention at half grown fruit stage was observed in T_0 (control) i.e. 2.86 per cent, which was at par with treatments T_5 (KNO_3 4 per cent), T_3 (NAA 100 ppm), T_4 (KNO_3 2 per

Table 5. Effect of spraying chemicals and growth regulators on per cent fruit retention at half grown stage

Tr. No.	Treatments	Per cent fruit retention
T_0	Control	2.86 (9.67)
T_1	NAA 50 ppm	4.12(11.85)
T_2	NAA 75 ppm	4.08 (11.64)
T_3	NAA 100 ppm	3.48 (10.74)
T_4	KNO_3 2 %	3.83 (11.28)
T_5	KNO_3 4 %	3.93 (11.39)
T_6	KNO_3 6 %	3.69 (11.06)
T_7	Urea 2 %	3.57 (10.88)
T_8	Urea2.5 %	3.51 (10.79)
T_9	Urea 3 %	3.72 (11.10)
T_{10}	Triacontanol 500 ppm	3.49 (10.73)
T_{11}	Triacontanol 750 ppm	4.13 (11.68)
T_{12}	Triacontanol 1000 ppm	5.05 (12.98)
	Mean	3.81 (11.21)
	SE $\pm$	0.36
	CD at 5%	1.07

Figures in parentheses are angular transformed values.

cent), T_6 (KNO_3 6 per cent), T_7 (urea 2 per cent), T_8 (urea 2.5 per cent), T_9 (urea 3 per cent), T_{10} (triacontanol 750 ppm).

4.5 Fruit retention at full grown stage (per cent fruits per panicle)

Perusal of data from Table 6 showed that, highest fruit retention at full grown fruit stage was noticed in treatment T_{12} (triacontanol 100 ppm) i.e. 3.57 per cent which was at par with treatments T_1 (NAA 50 ppm), T_2 (NAA 75 ppm), T_3 (NAA 100 ppm), T_4 (KNO_3 2 per cent), T_5 (KNO_3 4 per cent), T_6 (KNO_3 6 per cent), T_7 (urea 2 per cent), T_8 (urea 2.5 per cent), T_9 (urea 3 per cent), T_{10} (triacontanol (500 ppm) and T_{11} (triacontanol 750 ppm). Statistically lowest fruit retention at full grown fruit stage was noticed in treatment T_0 (control) i.e. 1.74 per cent which was at par with treatments T_2 (NAA 75 ppm), T_3 (NAA 100 ppm), T_4 (KNO_3 2 per cent), T_5 (KNO_3 4 per cent), T_6 (KNO_3 6 per cent), T_7 (urea 2 per cent), T_8 (urea 2.5 per cent), T_9 (urea 3 per cent) and T_{10} (triacontanol 500 ppm).

4.6 Length of fruit (cm)

Persual of data from Table 7 indicated that, statistically highest length of fruit was observed in treatment T_{12} (triacontanol 1000 ppm) i.e. 10.79 cm which was significantly superior over rest of the treatments except T_{11} (triacontanol 750 ppm), T_1 (NAA 50 ppm), T_2 (NAA 75 ppm), T_{10} (triacontanol 500 ppm), T_3 (NAA 100 ppm) and T_4 (KNO_3 2 per cent) because these treatments were at par with T_{12} (triacontanol 1000 ppm). Treatments T_{11} (triacontanol 750 ppm), T_{10} (triacontanol 500 ppm), T_1 (NAA 50 ppm), T_2 (NAA 75 ppm), T_3 (NAA 100 ppm) and T_4 (KNO_3 2 per cent) were at par with each other. Treatments T_6 (KNO_3 6 per cent), T_5

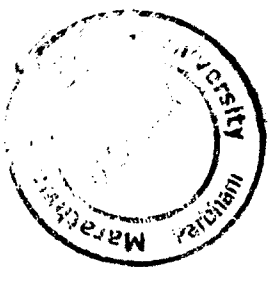


Table 6. Effect of spraying chemicals and growth regulators on per cent fruit retention at full grown stage

Tr. No.	Treatments	Per cent fruit retention
T_0	Control	1.74 (7.49)
T_1	NAA 50 ppm	3.34 (10.51)
T_2	NAA 75 ppm	2.67 (9.35)
T_3	NAA 100 ppm	2.34 (8.76)
T_4	KNO_3 2 %	2.37 (8.83)
T_5	KNO_3 4 %	2.58 (9.21)
T_6	KNO_3 6 %	2.56 (9.18)
T_7	Urea 2 %	2.29 (8.67)
T_8	Urea2.5 %	2.39 (8.86)
T_9	Urea 3 %	2.52 (9.12)
T_{10}	Triacontanol 500 ppm	2.43 (8.95)
T_{11}	Triacontanol 750 ppm	3.41 (10.59)
T_{12}	Triacontanol 1000 ppm	3.57 (10.87)
	Mean	2.63 (9.26)
	SE $\pm$	0.53
	CD at 5%	1.55

Figures in parentheses are angular transformed values.

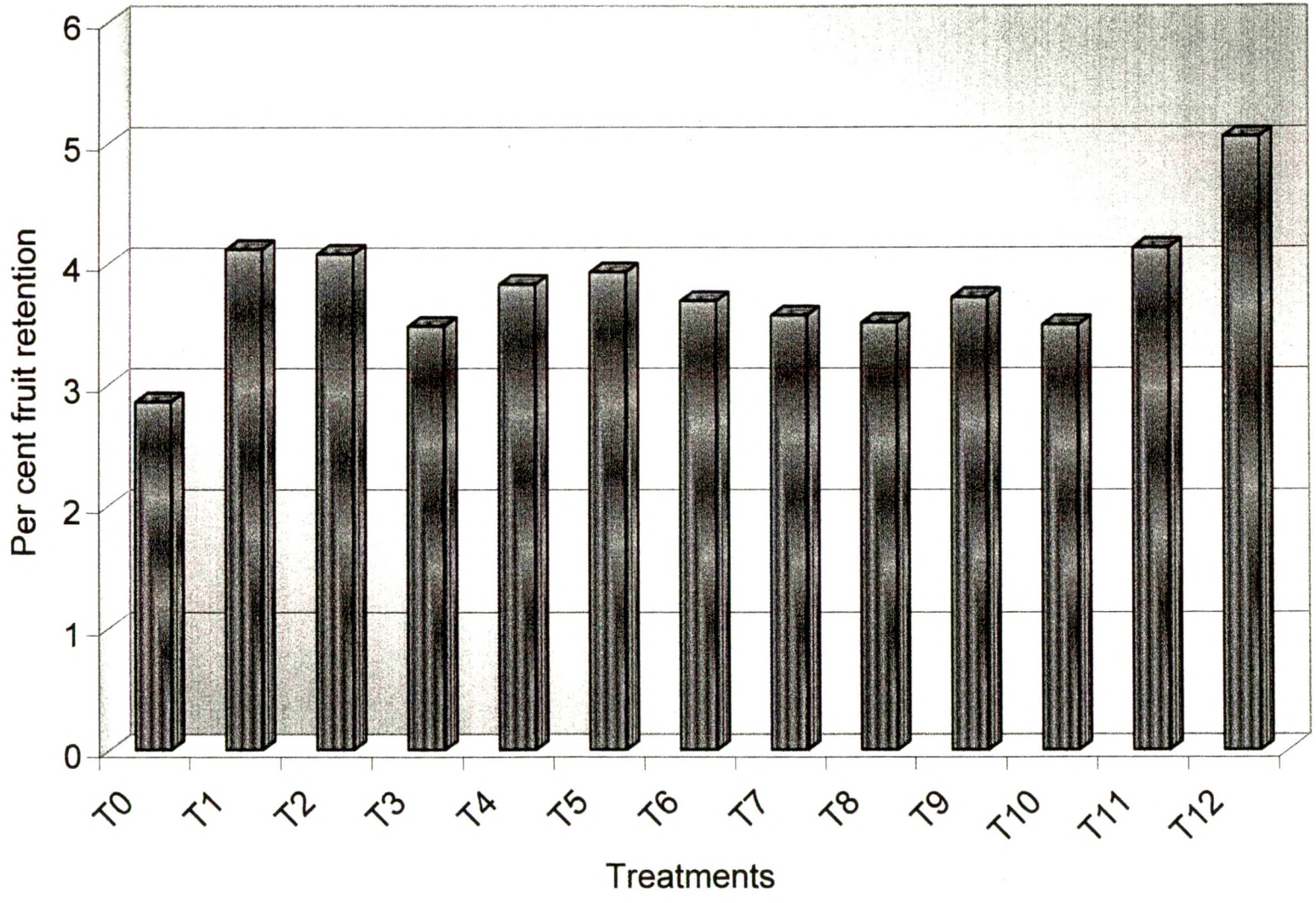


Fig. 5. Effect of spraying chemicals and growth regulators on per cent fruit retention at half grown stage

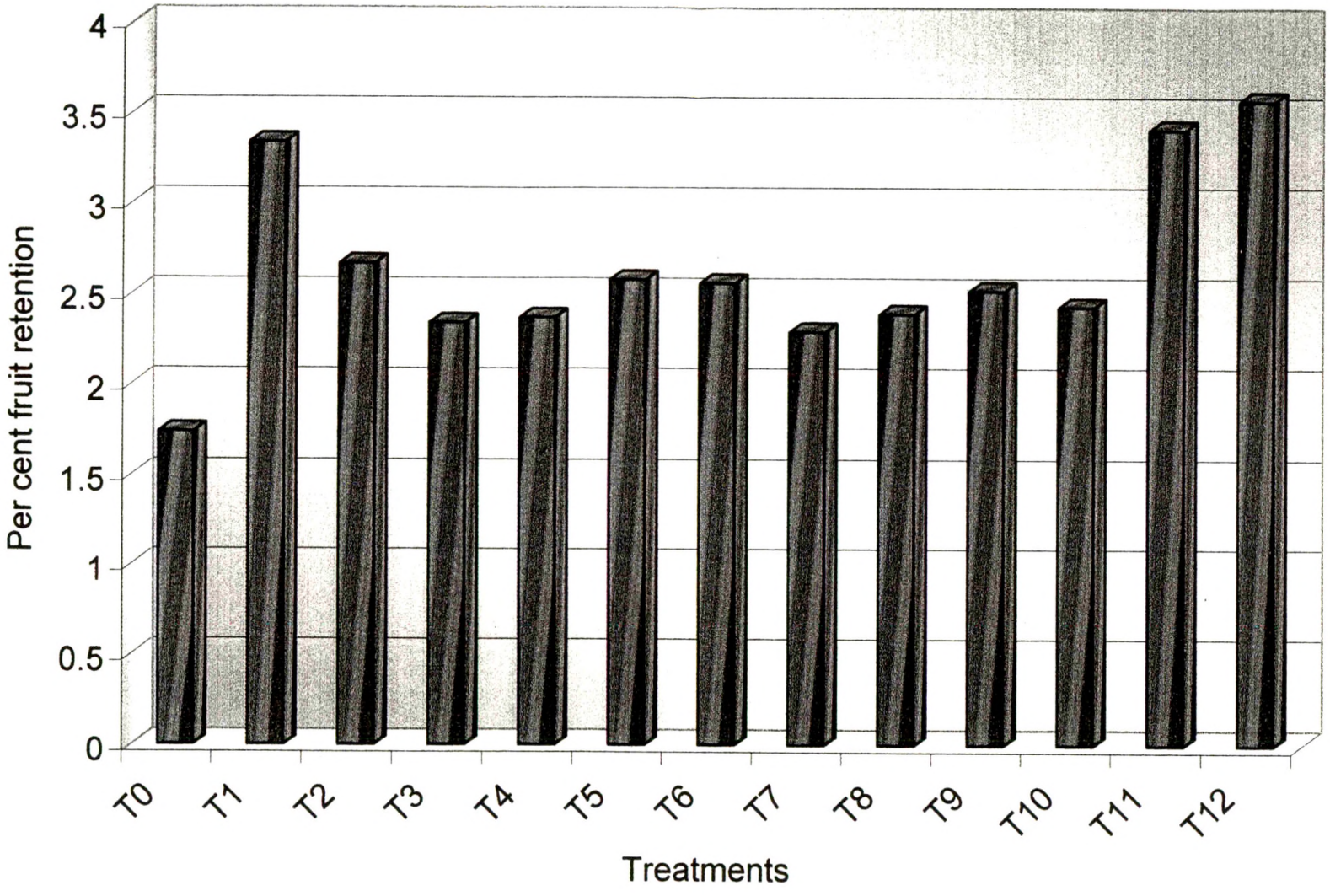


Fig. 6. Effect of spraying chemicals and growth regulators on per cent fruit retention at full grown stage

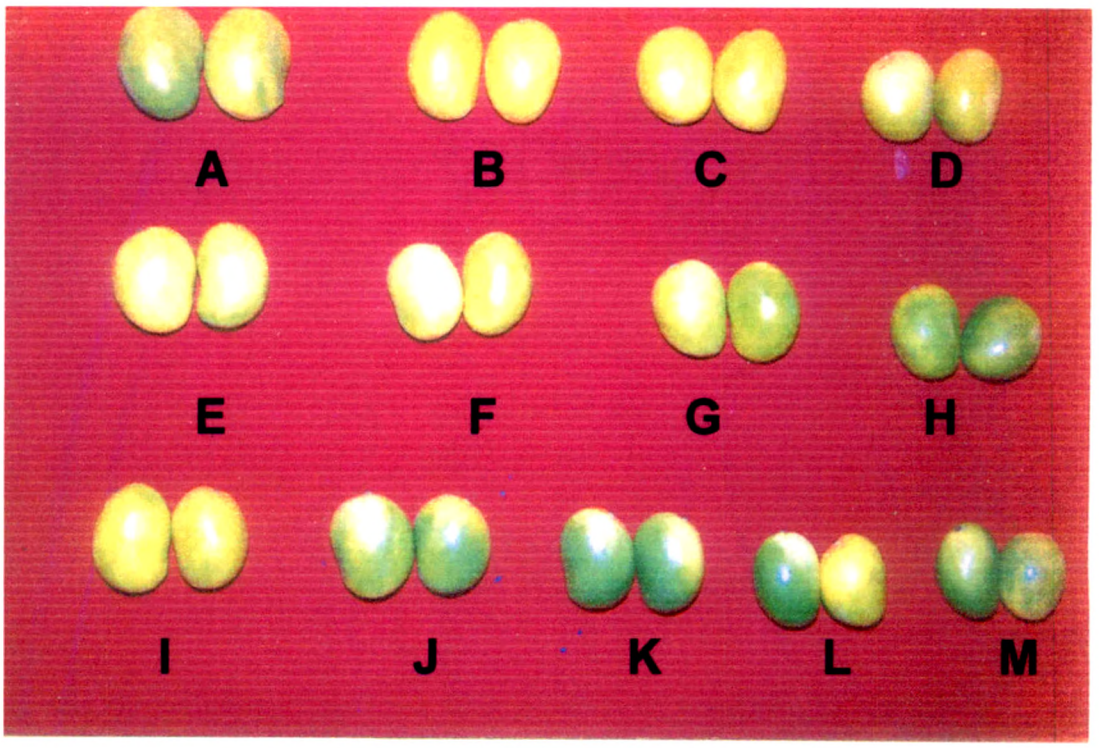


Plate 4. Effect of chemicals and growth regulators spray on fruit size

A	Triacontanol 1000 ppm	T_{12}
B	Triacontanol 750 ppm	T_{11}
C	NAA 50 ppm	T_1
D	NAA 75 ppm	T_2
E	Triacontanol 500 ppm	T_{10}
F	NAA 100 ppm	T_3
G	KNO_3 2 %	T_4
H	KNO_3 6 %	T_6
I	Urea 3 %	T_9
J	KNO_3 4 %	T_5
K	Urea2.5 %	T_8
L	Urea 2 %	T_7
M	Control	T_0

Table 7. Effect of spraying chemicals and growth regulators on fruit length (cm)

Tr. No.	Treatments	Fruit length (cm)
T_0	Control	8.46
T_1	NAA 50 ppm	10.53
T_2	NAA 75 ppm	10.32
T_3	NAA 100 ppm	9.86
T_4	KNO_3 2 %	9.80
T_5	KNO_3 4 %	9.41
T_6	KNO_3 6 %	9.64
T_7	Urea 2 %	9.19
T_8	Urea2.5 %	9.30
T_9	Urea 3 %	9.49
T_{10}	Triacontanol 500 ppm	10.06
T_{11}	Triacontanol 750 ppm	10.69
T_{12}	Triacontanol 1000 ppm	10.79
	Mean	9.81
	SE $\pm$	0.35
	CD at 5%	1.02

(KNO_3 4 per cent), T_7 (urea 2 per cent), T_8 (urea 2.5 per cent) and T_9 (urea 3 per cent) were at par with each other. Statistically lowest length of fruit was observed in treatment T_0 (control) i.e. 8.46 cm which was at par with treatments T_5 (KNO_3 4 per cent), T_7 (urea 2 per cent) and T_8 (urea 2.5 per cent).

4.7 Breadth of fruit (cm)

Persual of data from Table 8 revealed that, statistically maximum breadth of fruit was noticed in treatment T_{12} (triacontanol 1000 ppm) i.e. 8.80 cm which was superior over rest of the treatments except T_{11} (triacontanol 750 ppm), T_1 (NAA 50 ppm), T_2 (NAA 75 ppm), T_{10} (triacontanol) 500 ppm) and T_3 (NAA 100 ppm) because these treatments were at par with treatment T_{12} (triacontanol 1000 ppm). Statistically minimum breadth of fruit was observed in treatment T_0 (control) i.e. 7.13 cm which was at par with treatments T_{10} (triacontanol 500 ppm), T_9 (urea 3 per cent), T_8 (urea 2.5 per cent), T_7 (urea 2 per cent), T_6 (KNO_3 6 per cent), T_5 (KNO_3 4 per cent), T_4 (KNO_3 2 per cent) and T_3 (NAA 100 ppm).

4.8 Weight of fruit (g)

Persual of data from Table 9 revealed that,statistically highest weight of fruit was noticed in treatment T_{12} (triacontanol 1000 ppm) i.e. 334.71 g which was significantly superior over all other treatments. Treatments T_{11} (triacontanol 750 ppm) and T_1 (NAA 50 ppm) was at par with each other. Treatments T_1 (NAA 50 ppm) was at par with T_2 (NAA 75 ppm). Treatment T_3 (NAA 100 ppm) and T_4 (KNO_3 2 per cent) was at par with each other. Treatments T_4 (KNO_3 2 per cent) and T_6 (KNO_3 6 per cent) was at par with each other. Treatment T_6 (KNO_3 6 per cent) was at

Table 8. Effect of spraying chemicals and growth regulators on fruit breadth (cm)

Tr. No.	Treatments	Fruit length (cm)
T_0	Control	7.13
T_1	NAA 50 ppm	8.45
T_2	NAA 75 ppm	8.30
T_3	NAA 100 ppm	7.97
T_4	KNO_3 2 %	7.79
T_5	KNO_3 4 %	7.77
T_6	KNO_3 6 %	7.64
T_7	Urea 2 %	7.29
T_8	Urea2.5 %	7.46
T_9	Urea 3 %	7.30
T_{10}	Triacontanol 500 ppm	8.05
T_{11}	Triacontanol 750 ppm	8.71
T_{12}	Triacontanol 1000 ppm	8.80
	Mean	7.89
	SE $\pm$	0.31
	CD at 5%	0.92

Table 9. Effect of spraying chemicals and growth regulators on fruit weight (g)

Tr. No.	Treatments	Fruit length (cm)
T_0	Control	164.11
T_1	NAA 50 ppm	304.06
T_2	NAA 75 ppm	294.31
T_3	NAA 100 ppm	244.61
T_4	KNO_3 2 %	228.73
T_5	KNO_3 4 %	203.97
T_6	KNO_3 6 %	215.47
T_7	Urea 2 %	175.03
T_8	Urea2.5 %	189.60
T_9	Urea 3 %	194.96
T_{10}	Triacontanol 500 ppm	273.80
T_{11}	Triacontanol 750 ppm	314.82
T_{12}	Triacontanol 1000 ppm	334.71
	Mean	241.40
	SE $\pm$	6.35
	CD at 5%	18.50

par with T_5 (KNO_3 4 per cent). Treatments T_5 (KNO_3 4 per cent), T_8 (urea 2.5 per cent) and T_9 (urea 3 per cent) were at par with each other. Treatment T_8 (urea 2.5 per cent) which was at par with T_7 (urea 2 per cent).

Statistically lowest weight of fruit was observed in treatment T_0 (control) i.e. 164.11 g which was at par with treatment T_7 (urea 2 per cent).

4.9 Volume of fruit (cc)

Data presented in Table 10 showed that,statistically highest volume of fruit was observed in treatment T_{12} (triacontanol 1000 ppm) i.e. 328.14 cc which was significantly superior over all other treatments. Treatment T_{11} (triacontanol 750 ppm) was significantly superior over other treatments except T_{12} (triacontanol 1000 ppm). Treatments T_1 (NAA 50 ppm) and T_2 (NAA 75 ppm) which was at par with each other. Treatment T_3 (NAA 100 ppm) was at par with treatment T_4 (KNO_3 2 per cent). Treatment T_4 (KNO_3 2 per cent) was at par with treatment T_6 (KNO_3 6 per cent). Treatment T_5 (KNO_3 4 per cent) was at par with treatment T_6 (KNO_3 6 per cent), T_5 (KNO_3 4 per cent), T_8 (urea 2.5 per cent) and T_9 (urea 3 per cent) were at par with each other. Treatments T_8 (urea 2.5 per cent) and T_7 (urea 2 per cent) were at par with each other.

Statistically lowest volume of fruit was observed in treatment T_0 (control) i.e. 162.48 cc which was at par with treatment T_7 (urea 2 per cent).

4.10 Per cent pulp (mesocarp) in fruit (g)

Data presented in Table 11 revealed that,statistically highest pulp per cent was observed in treatment T_{11} (triacontanol 750 ppm) i.e.

Table 10. Effect of spraying chemicals and growth regulators on fruit volume (cc)

Tr. No.	Treatments	Fruit length (cm)
T_0	Control	162.48
T_1	NAA 50 ppm	289.09
T_2	NAA 75 ppm	288.53
T_3	NAA 100 ppm	239.81
T_4	KNO_3 2 %	224.24
T_5	KNO_3 4 %	199.97
T_6	KNO_3 6 %	211.24
T_7	Urea 2 %	173.29
T_8	Urea2.5 %	187.55
T_9	Urea 3 %	191.13
T_{10}	Triacontanol 500 ppm	268.43
T_{11}	Triacontanol 750 ppm	308.64
T_{12}	Triacontanol 1000 ppm	328.14
	Mean	237.04
	SE $\pm$	6.22
	CD at 5%	18.15

Table 11. Effect of spraying chemicals and growth regulators on pulp (mesocarp) per cent

Tr. No.	Treatments	Per cent pulp (mesocarp)
T_0	Control	51.14 (45.64)
T_1	NAA 50 ppm	57.71 (49.42)
T_2	NAA 75 ppm	58.77 (50.04)
T_3	NAA 100 ppm	59.05 (50.20)
T_4	KNO_3 2 %	57.89 (49.53)
T_5	KNO_3 4 %	56.95 (48.98)
T_6	KNO_3 6 %	54.47 (47.55)
T_7	Urea 2 %	58.67 (49.98)
T_8	Urea2.5 %	58.54 (49.91)
T_9	Urea 3 %	58.43 (49.84)
T_{10}	Triacontanol 500 ppm	59.27 (50.33)
T_{11}	Triacontanol 750 ppm	59.44 (50.43)
T_{12}	Triacontanol 1000 ppm	59.21 (50.30)
	Mean	57.65 (49.40)
	SE $\pm$	0.42
	CD at 5%	1.23

Figures in parentheses are angular transformed values.

59.44 g which was significantly superior over rest of the treatments. Treatments T_{12} (triacontanol 1000 ppm), T_{10} (triacontanol 500 ppm) and T_3 (NAA 100 ppm) were at par with each other. Treatments T_2 (NAA 75 ppm), T_3 (NAA 100 ppm) and T_7 (urea 2 per cent) were at par with each other. Treatments T_9 (urea 3 per cent), T_8 (urea 2.5 per cent) and T_7 (urea 2 per cent) were at par with each other. Treatment T_1 (NAA 50 ppm) was at par with treatment T_4 (KNO_3 2 per cent).

Statistically lower pulp per cent was observed in treatment T_0 (control) i.e. 51.14 g.

4.11 Per cent skin (exocarp) in fruit (g)

Persual of data from Table 12 revealed that, statistically highest skin per cent was observed in treatment T_0 (control) i.e. 23.38 g. Treatments T_7 (urea 2 per cent), T_8 (urea 2.5 per cent) and T_9 (urea 3 per cent) were at par with each other. Treatment T_{11} (triacontanol 750 ppm) was at par with treatment T_{12} (triacontanol 1000 ppm). Treatments T_3 (NAA 100 ppm), T_4 (KNO_3 2 per cent) and T_5 (KNO_3 4 per cent) were at par with each other. Statistically lowest skin per cent was observed in treatment T_{10} (triacontanol 500 ppm) i.e. 18.27 g which was at par with treatment T_2 (NAA 75 ppm).

4.12 Per cent stone (endocarp) in fruit (g)

Data presented in Table 13 indicated that, statistically highest stone per cent was noticed in treatment T_0 (control) i.e. 25.48 g. Treatment T_6 (KNO_3 6 per cent) was at par with treatment T_5 (KNO_3 4 per cent). Treatment T_2 (NAA 75 ppm) which was at par with treatment T_4 (KNO_3 2 per cent). Treatments T_1 (NAA 50 ppm), T_3 (NAA 100 ppm), T_7 (urea 2

Table 12. Effect of spraying chemicals and growth regulators on skin (exocarp) per cent

Tr. No.	Treatments	Per cent pulp (exocarp)
T_0	Control	23.38 (28.90)
T_1	NAA 50 ppm	20.40 (26.82)
T_2	NAA 75 ppm	18.43 (25.40)
T_3	NAA 100 ppm	19.09 (25.89)
T_4	KNO_3 2 %	19.01 (25.83)
T_5	KNO_3 4 %	18.98 (25.79)
T_6	KNO_3 6 %	20.99 (27.24)
T_7	Urea 2 %	19.74 (26.35)
T_8	Urea2.5 %	19.69 (26.32)
T_9	Urea 3 %	19.99 (26.53)
T_{10}	Triacontanol 500 ppm	18.27 (25.28)
T_{11}	Triacontanol 750 ppm	19.26 (26.01)
T_{12}	Triacontanol 1000 ppm	19.57 (26.23)
	Mean	19.75 (26.35)
	SE $\pm$	0.11
	CD at 5%	0.33

Figures in parentheses are angular transformed values.

Table 13. Effect of spraying chemicals and growth regulators on stone (endocarp) per cent

Tr. No.	Treatments	Per cent pulp (endocarp)
T_0	Control	25.48 (30.29)
T_1	NAA 50 ppm	21.89 (27.87)
T_2	NAA 75 ppm	22.80 (28.49)
T_3	NAA 100 ppm	21.86 (27.85)
T_4	KNO_3 2 %	23.10 (28.71)
T_5	KNO_3 4 %	24.07 (29.36)
T_6	KNO_3 6 %	24.24 (29.48)
T_7	Urea 2 %	21.59 (27.67)
T_8	Urea2.5 %	21.77 (27.79)
T_9	Urea 3 %	21.58 (27.65)
T_{10}	Triacontanol 500 ppm	22.46 (28.26)
T_{11}	Triacontanol 750 ppm	21.30 (27.45)
T_{12}	Triacontanol 1000 ppm	21.22 (27.41)
	Mean	22.56 (28.33)
	SE $\pm$	0.10
	CD at 5%	0.31

Figures in parentheses are angular transformed values.

per cent), T_8 (urea 2.5 per cent) and T_9 (urea 3 per cent) were at par with each other. Statistically lowest stone per cent was noticed in treatment T_{12} (triacontanol 1000 ppm) i.e. 21.22 g which was at par with treatment T_{11} (triacontanol 750 ppm).

4.13 Specific gravity of fruit

Data presented in Table 14 indicated that, there was no significant effect of chemical and growth regulators sprays on the specific gravity of fruit.

4.14 Per cent of total soluble solids in fruit (TSS)

Persual of data from Table 15 revealed that, statistically, maximum per cent of total soluble solids was observed in treatment T_{12} (triacontanol 1000 ppm) i.e. 18.84 per cent, which was superior over rest of the treatments but at par with treatments T_{11} (triacontanol 750 ppm) and T_1 (NAA 50 ppm). Treatments T_2 (NAA 75 ppm), T_3 (NAA 100 ppm) and T_5 (KNO_3 4 per cent) were at par with each other. Treatment T_6 (KNO_3 6 per cent) which was at par with treatment T_9 (urea 3 per cent). Treatment T_{10} (triacontanol 500 ppm) was at par with treatment T_9 (urea 3 per cent). Statistically minimum per cent of total soluble solids was observed in treatment T_0 (control) i.e. 15.69 per cent.

4.15 Per cent of acidity in fruit

Data presented in Table 16 indicated that, maximum acidity was observed in treatment T_0 (control) i.e. 0.30 per cent. Treatments T_1 (NAA 50 ppm), T_4 (KNO_3 2 per cent), T_5 (KNO_3 4 per cent), T_6 (KNO_3 6 per cent), T_8 (urea 2.5 per cent), T_{10} (triacontanol 500 ppm) and T_{11} (triacontanol 750 ppm) were at par with each other.

Table 14. Effect of spraying chemicals and growth regulators on specific gravity of fruit

Tr. No.	Treatments	Specific gravity
T_0	Control	1.01
T_1	NAA 50 ppm	1.02
T_2	NAA 75 ppm	1.02
T_3	NAA 100 ppm	1.02
T_4	KNO_3 2 %	1.02
T_5	KNO_3 4 %	1.02
T_6	KNO_3 6 %	1.02
T_7	Urea 2 %	1.01
T_8	Urea2.5 %	1.01
T_9	Urea 3 %	1.02
T_{10}	Triacontanol 500 ppm	1.02
T_{11}	Triacontanol 750 ppm	1.02
T_{12}	Triacontanol 1000 ppm	1.02
	Mean	1.01
	SE $\pm$	0.005
	CD at 5%	NS

Table 15. Effect of spraying chemicals and growth regulators on total soluble solids (TSS)

Tr. No.	Treatments	Per cent total soluble solids (TSS)
T_0	Control	15.69 (23.32)
T_1	NAA 50 ppm	18.66 (25.58)
T_2	NAA 75 ppm	18.42 (25.40)
T_3	NAA 100 ppm	18.10 (25.16)
T_4	KNO_3 2 %	17.75 (24.89)
T_5	KNO_3 4 %	27.75 (24.89)
T_6	KNO_3 6 %	17.16 (24.46)
T_7	Urea 2 %	16.28 (23.78)
T_8	Urea2.5 %	16.10 (23.88)
T_9	Urea 3 %	16.92 (24.27)
T_{10}	Triacontanol 500 ppm	16.76 (24.15)
T_{11}	Triacontanol 750 ppm	18.72 (25.62)
T_{12}	Triacontanol 1000 ppm	18.84 (25.71)
	Mean	17.53 (24.73)
	SE $\pm$	0.11
	CD at 5%	0.32

Figures in parentheses are angular transformed values.

Table 16. Effect of spraying chemicals and growth regulators on per cent of acidity

Tr. No.	Treatments	Per cent total soluble solids (TSS)
T_0	Control	0.30 (3.17)
T_1	NAA 50 ppm	0.28 (3.08)
T_2	NAA 75 ppm	0.27 (3.01)
T_3	NAA 100 ppm	0.27 (3.01)
T_4	KNO_3 2 %	0.28 (3.05)
T_5	KNO_3 4 %	0.28 (3.03)
T_6	KNO_3 6 %	0.28 (3.03)
T_7	Urea 2 %	0.29 (3.08)
T_8	Urea2.5 %	0.28 (3.05)
T_9	Urea 3 %	0.27 (3.01)
T_{10}	Triacontanol 500 ppm	0.28 (3.06)
T_{11}	Triacontanol 750 ppm	0.28 (3.03)
T_{12}	Triacontanol 1000 ppm	0.27 (3.01)
	Mean	0.27 (3.05)
	SE $\pm$	0.01
	CD at 5%	0.05

Figures in parentheses are angular transformed values.

Statistically minimum per cent of acidity was observed in treatment T_{12} (triacontanol 1000 ppm) i.e. 0.27 per cent which was at par with treatments T_2 (NAA 75 ppm), T_3 (NAA 100 ppm) and T_9 (urea 3 per cent).

Discussion

Chapter-5

DISCUSSION

Mango being a tropical crop, it grows well under semitropical conditions in most parts of India. Mango is also subject to heavy and continues fruit drop. Wagle (1928) and Mukherjee (1949) reported heavy drops of hermaphrodite flowers and young fruits amounting to 99 per cent or more. The causes of fruits drop are not very clearly understood. Besides external factors like climatic conditions, varietal behaviour, nutritional status of the trees, intensity of fruiting and pathological conditions, there are certain internal factors also amongst which concentration of auxins is of prime importance governing the abscission layer formation (Maurya *et al.*, 1973).

A simple and proper control measure of reducing the fruit drop in mango will help in ensuring higher yield and lot of income to the mango growers. The results of the present study are discussed below.

5.1 Effect of chemicals and growth regulators on fruit set

The experiment revealed that the useful role of growth regulators and chemicals tested on increasing the fruit set in mango cultivar Ratna. Similar, observations have been recorded by various workers (Chandel and Jindal, 1991, Sharma *et al.*, 1990, Salsay-Asrat *et al.*, 1992, Bartolini *et al.* 1993). In the conducted experiment triacontanol 1000 ppm (T_{12}) was found to be the statistically superior treatment in increasing fruit set followed by triacontanol 750 ppm (T_{11}) treatment. Chandel and Jindal,

(1991) showed same results in Japanese plum with triacontanol 10 ppm and they found significantly more fruit set percentage as compared to untreated control.

Bartolini *et al.*, (1993) reported that,spray of triacontanol 100 ppm and NAA 100 ppm shows greatest fruit set in olive as compared to untreated control. Salsay-Asrat *et al.* (1992) revealed that, spray of triacontanol on coffee (*coffee Arabica* L.) at 0.075 % gave the greatest percentage fruit set (78.11 vs 61.63 for water sprayed controls).

Triacontanol is a primary alcohol extracted from alfa alfa that can increase growth of plant (Pandey and Sinha, 1999). Triacontanol also results in uptake of nutrients. This increase growth and nutrient uptake brought about by triacontanol can unable the plant to nourish more number of fruits by reducing competition among developing fruit lets which is evident in increased fruit set.

In the present study NAA 50 ppm (T_1) and NAA 75 ppm (T_2) treatments was found next better treatments. There was continues increase in fruit set due to spraying NAA. Same results have been reported by Arvindkashan *et al.* (1979) with the application of planofix at 20 ppm increase the fruit set of mango.

Auxin like NAA results in increased fruit set. Auxin play in important role in flowering (Pandey and Sinha, 1999). A high correlation was noticed between low auxin content in shoots when high fruit drop was noticed (Ram and Sirohi, 1981) observed that during the period of first drop (within 14 days of pollination), the newly set fruit contain comparatively

lower level of auxin and higher ABA like inhibitors. While Chako *et al.* (1972) reported that low level of auxin could be possible reason for heavy fruit drop. Sprays of auxin particularly NAA at times when their indigenous content in fruits are less thus can help in reducing fruit drop leading to increased fruit set.

During initial fruit set there is high competition between developing fruits for nutrient especially nitrogen therefore, sprays of urea and potassium nitrate in developing panicle can reduce this competition and thus increase fruit set. Sharma *et al.*, (1990) found that, urea (2 to 4 %), KNO_3 1.5 or 3 % and NAA 40 ppm significantly increase the fruit set.

5.2 Effect of chemicals and growth regulators on fruit retention

The result obtained in this investigation revealed that, the triacontanol, a bioenzyme at 1000 ppm retain statistically more fruits per panicle i.e. 47.34, 18.53, 5.05 and 3.57 at different stages of fruit development viz., pea size stage, marble size stage, half grown stage and full grown stage, respectively than control. Second best treatment was triacontanol 750 ppm (T_{11}) at same stages and third best treatment was NAA 50(T_1) ppm at same stages. All the chemicals and growth regulators have beneficial effect with regard to better fruit retention at pea, marble, half grown and full grown stages.

Konhar *et al.*, (1988) reported that, the highest fruit retention in cashewnut (*Anacardium occidentale*) at triacontanol 500 ppm and NAA 45 ppm.

Triacontanol results in uptake of nutrients. This increased growth and nutrient uptake brought about by triacontanol can able the plant to bear more number of fruits.

The beneficial effects of chemicals and growth regulators in fruit drop and retaining more fruits have been reported earlier. Atul Chandra (1996) found usefulness of 2 per cent urea sprays in Cv. Langra and Dashehari of mango for reducing the fruit drop. Sharma *et al.,* (1990) reported that urea (2 or 4 per cent) and KNO_3 (1.5 or 3 per cent) significantly reduced the fruit drop.

Among three concentrations of NAA 50, 75 and 100 ppm, 50 ppm shows better results than other concentrations of NAA. Triacontanol 1000 ppm shows highest fruit retention in comparison to other chemicals and growth regulators. This, thus confirm that 1000 ppm of triacontanol concentration is more effective at different stages of fruit development.

Auxin content in mango fruits during 2-3 weeks after pollination is low and the ability of fruits to mobilize food material is poor due to low auxin level which results in fruit drop. At this stage the competition among developing fruits starts and the fruits which compete less successfully are forced to drop (Chacko *et al.*, 1972).

Luckwill (1948 and 1952) has worked out that, the auxin is produced at the time of fruit set upon fertilization at the successive development of endosperms and embryo. He showed that spells of fruit abscission occurs between each of these production waves and after the last one as the fruit and seed reaches to maturity. Effectiveness of auxin

application is influenced by various factors such as absorption, translocation, environmental factors and status of the plant (Leopold, 1955).

These findings are in close conformity with the results reported by Shrivastava (1962), Chadha and Singh (1963), Maurya *et al.*, (1973), Singh (1979) in variety Dashehari, Maurya and Singh (1979) and Sharma *et al.*, (1990) in variety Langra and Prakash and Ram (1986) in variety Chausa, who suggested that higher concentration of NAA i.e. 40-60 ppm will be effective in controlling fruit drop.

Randhava and Chadha (1994) have reported that,there was heavy fruit set in the hermaphrodite flowers and the fruit drop occurred at different stages of fruit development. The phenomenon of fruit drop in mango is a continuous process. In early stages, when the fruits are small and numerous their rate of growth is very high and consequently competition between the growing fruits for nutritional and water requirement is very high. However, when growth rate declines and fruit number is reduced, the competition is also greatly reduced due to heavy competition between the growing fruits the abscission layer in fruit pedicel is developed in case of fruit lacking behind competition.

The abscission layer is formed prior to fruit drop. One cause of formation of abscission layer is reduction in indigenous auxins. If the auxins are supplied exogenously then the process of formation of abscission layer can be delayed and thereby the fruit drop can be reduced. Thus in present study the chemicals and growth regulators sprays might have found beneficial in reducing the fruit drop.

The urea and KNO_3 sprays on the panicle might have reduced the competition between developing mango fruits for nutrition.

5.3 Effect of chemicals and growth regulators on weight of fruit

In present experiment it was observed that higher weight of fruit was recorded in treatment (T_{12}) triacontanol 1000 ppm, which was significantly superior over rest of the treatments.

Barua (1998) also revealed that application of triacontanol at 2.5, 5.0, 7.5 and 10 ppm at pit hardening stage in Santa Rosa plum result in increased fruit weight as compared to untreated control.

Second best treatment i.e. (T_{11}) triacontanol 750 ppm shows high fruit weight. Treatment (T_1) NAA 50 ppm and (T_2) NAA 75 ppm was the next best treatments shows high fruit weight. The results obtained in this investigation as concerned to weight are in close conformity with the results obtained by Veera and Das (1971), Prasad and Pathak (1972), Singh(1975).

In present study it was revealed that concentration of treatments triacontanol 1000 ppm, triacontanol 750 ppm, NAA 50 ppm, and NAA 75 ppm are best than urea, KNO_3 where as urea and KNO3 are also better than control.

This increase in fruit weight might be due to the property of auxin to stimulate cell division, cell elongation and cell enlargement. Auxin bring about cell wall extension by activation proton pump inside the cell causing loosening of cell wall leading to increased water uptake and

increase the cell volume they also cause cell wall material synthesis by enzyme modification and activation. Auxin also promotes growth increased protein and nucleic acid synthesis (Pandey and Sinha, 1999). All these factors in combination results in increased fruit growth when auxin is applied exogenously leading to larger size fruit with increased in weight.

5.4 Effect of chemicals and growth regulators on per cent mesocarp, exocarp and endocarp.

As per the results from present investigation, statistically maximum mesocarp per cent was noticed in triacontanol 750 ppm (59.44 per cent) followed by triacontanol 500 ppm (59.27 per cent).The third best result was observed in triacontanol 1000 ppm i.e. 59.21 per cent and NAA at high concentration i.e. 100 ppm gave best results. In case of per cent endocarp smallest stone was seen in triacontanol 1000 ppm i.e. 21.22 per cent and largest in control (T_0) i.e. 25.48 per cent. When we deal with exocarp per cent of fruit it was seen that triacontanol 500 ppm (T_{10}) showed minimum exocarp per cent i.e. 18.27 per cent and maximum exocarp percentage observed in treatment (T_0) control i.e. 23.38 per cent, followed by treatment (T_6) KNO_3 6 per cent i.e. 20.99 per cent.

Sharma *et al.* (1990) reported that,4 per cent spray of urea resulted significantly more pulp percentage (73.8) followed by 2 per cent urea spray (70.0). Lowest pulp percentage (67.5) was observed under control. Similarly, the application of NAA also increased the pulp percentage. 60 ppm NAA spray resulted significantly higher pulp percentage (71.8) as compared to control (69.7). The application of urea

had decreased the peel percentage, 4 per cent spray of urea resulted significantly more peel percentage (13.2) as compared to control (16.8). The application of KNO_3 and NAA separately not influenced peel percentage significantly.

Triacontanol (T_0) 1000 ppm gave smallest stone per cent and next better treatment were triacontanol (T_{11}) 750 ppm, urea (T_9) 3 per cent and urea (T_7) 2 per cent.

Sharma *et al.* (1990) reported that,the application of NAA, KNO_3 or urea alone significantly decreased the stone percentage.

5.5 Effect of chemicals and growth regulators on physical characters and quality of fruit

The results obtained from present investigation shows that all the chemicals and growth regulators were found effective in increasing length, breadth and volume of fruit than control, but there was no significant effect of chemicals and growth regulators on specific gravity of fruit.

Triacontanol a bioenzyme at 1000 ppm gave highest fruit length, breadth and volume 10.79 cm, 8.80 cm and 328.14 cc, respectively. Triacontanol at 750 ppm and NAA 50 ppm was found next best treatments. All the levels of urea and KNO_3 show greater length, breadth and volume of fruit in comparison of untreated control.

The increase in fruit size was mostly because of increase in volume of cells of mesocarp. Leopold (1955) examined the basis of the auxin effects on apricot fruit size and found that the gain in size was accountable as an increase in cell volume.

Prasad and Pathak, (1972) observed that,there was increase in size and weight of mango fruit, when the methyl ester of NAA was sprayed on newly set fruits. Singh *et al.* (1977) found that,the treatment of foliar spray of urea at 1 or 2 per cent increased the fruit size.

Singh (1980) also suggested that growth regulators and nitrogen proved to be useful for improving the fruit quality.

In present investigation highest total soluble solids was found in treatment T_{12} (triacontanol 1000 ppm) i.e. 18.84 per cent and the next best treatment was T_{11} (triacontanol 750 ppm) i.e. 18.72 per cent, lowest TSS was observed in T_0 (control) i.e. 15.69 per cent. Regarding to acidity, lowest acidity was found in treatments T_{12} (triacontanol 1000 ppm), T_2 (NAA 75 ppm), T_3 (NAA 100 ppm) and T_9 (urea 3 %) i.e. 0.27 %. The highest acidity was found in T_0 (control) i.e. 0.30 %.

Bartolini *et al.* (1993) reported foliar spray on olive with triacontanol at 100 ppm gave higher flesh percentage (72.5 per cent) and high stone ratio, these fruits were significantly larger than those from other treatment.

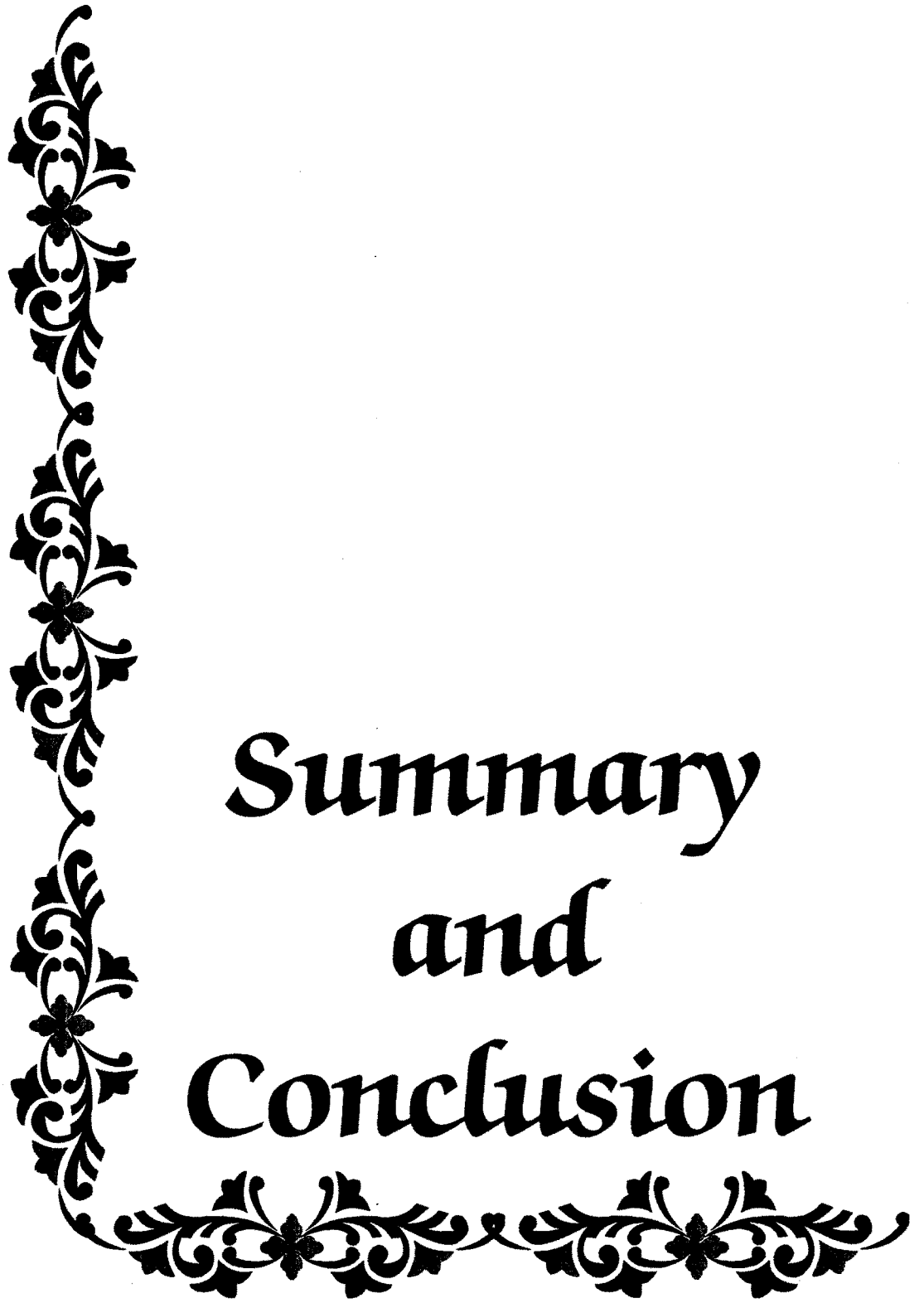
Chandel and Jindal (1991) reported application of 10 ppm triacontanol significantly increased fruit size compared with the control.

Barua (1998) reported application of triacontanol increase the fruit volume of the Santa Rosa plum.

The studies on effect of spray of growth regulator on quality aspects are very few in mango. The factors influencing physical characters of fruit are many and in a crop like mango spray of urea, NAA, KNO_3 and

triacontanol alone may not be solution. However, more detailed work in this bold seeded fruit is necessary to study the effect of growth regulators on quality.

The application of growth regulator at initial fruit development stage might have started the initial fruit development at faster rate than control. Thus the advantage of better start for the treated fruits might have caused an increase in size and weight of fruit than control.



Summary and Conclusion

Chapter-6

SUMMARY AND CONCLUSION

The present investigation entitled "Use of chemicals and growth regulators on fruit retention and quality of mango Cv. Ratna" were undertaken at mango orchard located at village Paralgavan near Parbhani during 2006-2007. An experiment was laid out in Randomised block design with one variety Ratna along with thirteen treatments of chemicals and growth regulators at flowering, pea stage and at marble stage of fruit growth with three replications. The chemical treatments containing NAA (50, 75, and 100 ppm), KNO_3 (2, 4, and 6 per cent), urea (2, 2.5 and 3 per cent) and triacontanol (500, 750, and 1000 ppm) with control. The observation on fruit set, fruit retention at pea, marble, half grown and full grown stages, size, weight and per cent pulp (mesocarp), skin (exocarp) and stone (endocarp), specific gravity, per cent of total soluble solids and per cent of acidity were recorded. The result obtained are as under.

Fruit set

All the chemicals and growth regulators treatments increased the fruit set than untreated control. The maximum fruit set was noticed in treatment Triacontanol 1000 ppm followed by triacontanol 750 ppm, NAA 50 ppm, NAA 75 ppm, KNO_3 and urea than that of control.

Fruit retention

Pea stage

The chemicals and growth regulators treatments minimizes the fruit drop and there by maximizes the fruit retention at all the four stages of fruit development as compared to control.

Treatment of triacontanol at 1000 ppm gives highest fruit retention at pea stage. Next to it triacontanol 750 ppm followed by NAA 50 ppm, NAA 75 ppm, KNO_3 and urea treatment.

Marble stage

Triacontanol 1000 ppm gave more retention of fruit next to it triacontanol 750 ppm and next better treatment was NAA 50 ppm, NAA 75 ppm next by KNO_3, urea which shows better results than that of control.

Half grown stage

The maximum fruit retention at this stage was found in treatment triacontanol 1000 ppm followed by triacontanol 750 ppm. Second best treatment was NAA 50 ppm, NAA 75 ppm, KNO_3 and Urea showed better results as compared to control.

Full grown stage

Triacontanol at 1000 ppm showed maximum fruit per panicle followed by triacontanol 750 ppm, NAA 50 and NAA 75 ppm, KNO_3 and urea than that of control.

Physical characters of fruit

All the chemical treatments gave maximum desirable physical characters like length, breadth, volume and weight treatment of triacontanol

at 1000 ppm shows highest length, breadth, weight and volume of fruit followed by treatment triacontanol 750 ppm and NAA 50 ppm next toit NAA 75 ppm.

Per cent mesocarp

In case of mesocarp per cent, treatment T_{11} (triacontanol 750 ppm) shows greater mesocarp per cent followed by treatment T_{10} (triacontanol 500 ppm) and T_{12} (triacontanol 1000 ppm).

Per cent endocarp

Maximum endocarp per cent was observed in treatment T_0 (control) followed by treatment T_6 (KNO3 6%). Minimum endocarp per cent was found in treatment T_{12} (triacontanol 1000 ppm).

Per cent exocarp

Minimum skin per cent was observed in treatment T_{10} (triaocntanol 500 ppm) and maximum skin per cent was observed in treatment T_0 (control).

Chemical characters of fruit

Per cent total soluble solids (TSS)

Highest per cent of total soluble solids was found in treatment T_{12} (triacontanol 1000 ppm) followed by treatment T_{11} (triacontanol 750 ppm). Lowest per cent of total soluble solids was found in treatment T_0 (control).

Per cent acidity

Lowest per cent of acidity was found in treatments T_{12} (triacontanol 1000 ppm), T_2 (NAA 75 ppm), T_3 (NAA 100 ppm) and T_9 (urea 3 %). Highest per cent of acidity was found in treatment T_0 (control).

CONCLUSION

From the various treatments tried for maximum fruit set and its retention at pea stage, marble stage, half grown stage and full grown stage in the mango variety Ratna under Parbhani condition, only triacontanol 1000 ppm spray at various stages of fruit development result in increased fruit retention and reduced the extent of fruit drop.

It has been also observed that triacontanol increased weight, length, breadth, volume of fruit and percentage of mesocarp. While, decreased the percentage of endocarp and exocarp of the fruits. The other chemical treatments i.e. NAA, KNO_3 and urea at various concentrations also play an important role in improving the quality characters and retention of fruits.

It is evident from the present findings triacontanol 1000 ppm followed by triacontanol 750 ppm increased the total soluble solids, while triacontanol 1000 ppm, NAA 75 ppm, NAA 100 ppm and urea 3 per cent reduces the acidity.

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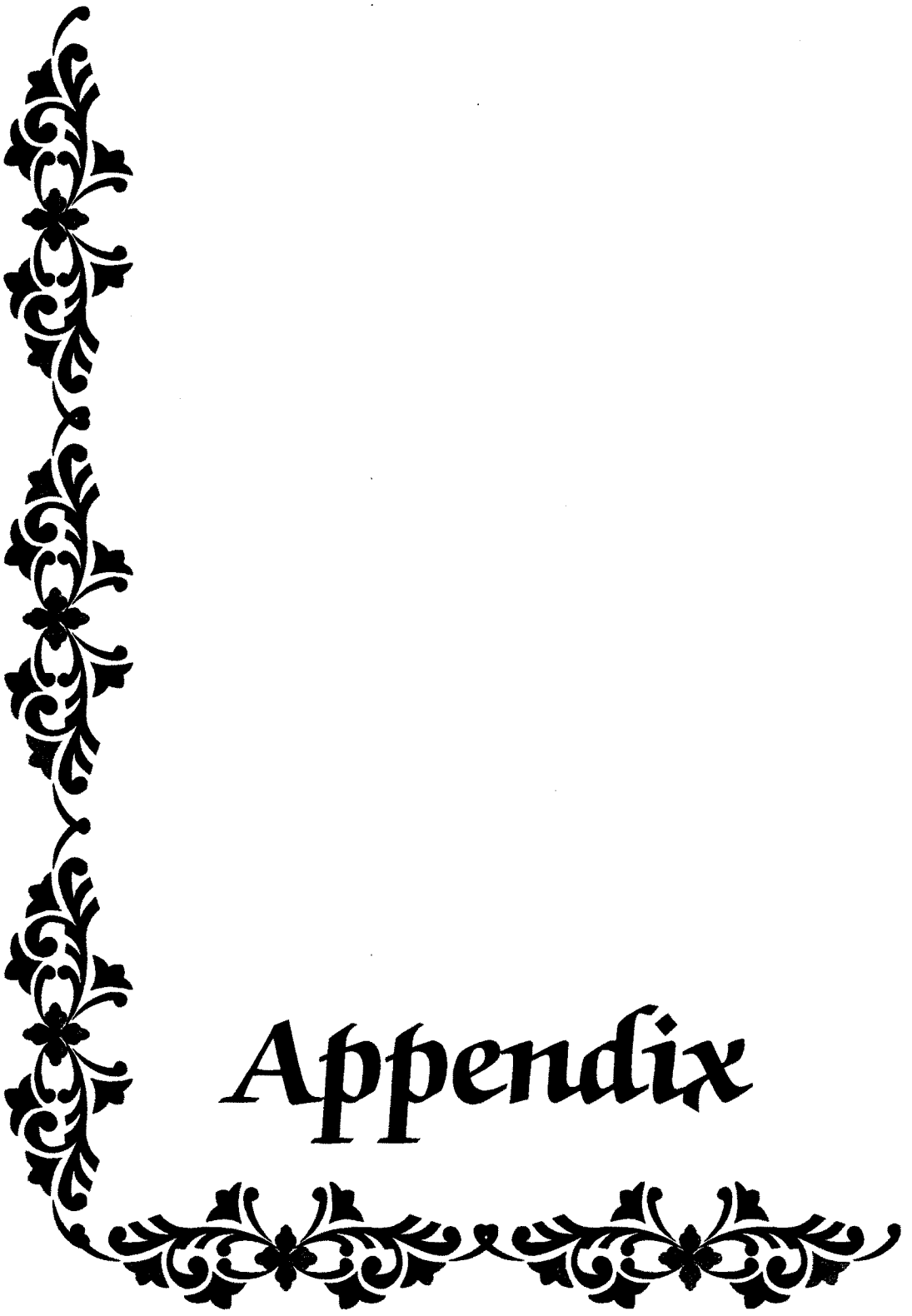

Appendix

APPENDIX-I : Weekly weather data for the year 2006-2007 at Parbhani

MW	Dates	RF (mm)	Temp °C		Humidity %		EVP (mm)	BSS (Hrs.)	W.S. (kmph)
			Max.	Min.	AM	PM			
01	01-07 Jan.	0.0	28.9	8.7	76	34	4.8	10.2	3.4
02	08-14 Jan.	0.0	29.9	9.2	72	32	5.0	10.6	2.6
03	15-21 Jan	0.0	32.4	13.5	71	28	5.1	10.4	2.3
04	22-28 Jan	0.0	28.3	7.4	76	23	4.8	11.0	4.5
05	29-04 Feb.	0.0	31.0	9.4	71	24	5.3	10.9	2.9
06	05-11 Feb	0.0	31.8	9.4	67	21	5.2	10.9	2.7
07	12-18 Feb.	0.0	33.8	12.2	58	20	5.3	10.9	2.6
08	19-25 Feb.	0.0	36.7	15.0	53	18	6.6	10.9	2.9
09	26-04 Mar.	16.2	36.0	17.5	60	32	6.3	9.8	4.5
10	05-11 Mar.	20.7	31.9	16.9	88	44	5.6	9.0	5.6
11	12-18 Mar.	0.0	31.3	21.5	83	36	5.4	10.3	4.4
12	19-25 Mar.	0.0	36.1	16.3	55	17	7.1	11.2	4.3
13	26-01 Apr.	0.0	38.1	18.9	51	15	7.7	10.7	3.6
14	02-08 Apr.	0.0	39.7	18.5	46	15	9.0	11.5	4.1
15	09-15 Apr.	0.0	40.4	20.8	47	16	9.2	10.0	3.9
16	16-22 Apr.	0.0	37.9	19.3	49	19	9.5	10.8	5.3
17	23-29 Apr.	0.0	40.7	21.8	42	16	10.4	11.0	4.8
18	30-06 May	0.0	42.5	24.0	40	14	12.0	10.7	5.6
19	07-13 May	0.0	43.1	22.5	43	15	12.7	11.8	6.7
20	14-20 May	4.2	41.7	22.2	51	20	12.2	11.6	7.4
21	21-27 May	28.1	37.6	22.5	71	43	9.0	8.8	9.6
22	28-03 June	0.0	36.2	23.2	66	40	7.6	8.1	7.2
23	04-10 June	0.0	36.8	24.3	66	36	9.3	9.3	9.0
24	11-17 June	7.2	37.9	25.8	60	30	9.8	8.9	7.7
25	18-24 June	57.0	36.6	23.1	78	43	7.4	7.1	5.9
26	25-01 July	66.2	32.4	23.4	87	64	4.4	5.0	5.2
27	02-08 July	71.7	31.3	23.2	86	64	4.1	4.4	8.0
28	09-15 July	0.0	33.7	23.8	79	53	5.8	4.9	8.1
29	16-22 July	12.8	32.0	22.4	80	64	4.6	3.8	7.1
30	23-29 July	12.0	31.1	22.2	85	67	3.8	2.5	6.6
31	30-05 Aug	182.1	28.4	21.5	88	83	2.6	1.4	7.2
32	06-12 Aug	271.1	27.6	21.6	86	72	2.8	3.3	6.8
33	13-19 Aug	1.6	31.0	22.2	82	61	3.9	5.2	5.9
34	20-26 Aug	1.6	31.7	20.9	79	57	4.4	7.6	5.2
35	27-02 Sept	3.0	31.1	21.0	84	56	4.3	4.4	7.8
36	03-09 Sep	13.6	32.9	22.6	79	57	5.0	9.2	5.2
37	10-16 Sep	16.7	32.0	22.1	85	65	4.3	8.2	3.3
38	17-23 Sep	54.1	30.9	21.6	93	69	3.6	3.7	3.7
39	24-30 Sep	66.4	31.2	21.2	89	75	3.6	7.5	4.9
40	01-07 Oct.	31.4	30.2	21.4	82	65	3.6	4.6	3.4
41	08-14 Oct.	18.8	33.4	19.9	83	46	4.7	10.0	2.1
42	15-21 Oct.	0.0	34.1	17.9	76	40	5.2	10.6	2.5
43	22-28 Oct.	0.0	32.9	15.6	79	40	4.9	10.3	3.4
44	29-04 Nov.	38.0	29.7	18.6	86	58	4.7	6.2	4.8
45	05-11 Nov.	0.0	30.5	16.5	81	51	4.8	8.7	3.1
46	12-18 Nov.	0.0	31.4	12.8	81	43	4.9	10.8	3.9
47	19-25 Nov.	0.0	30.3	14.1	82	49	4.2	7.7	2.2
48	26-02 Dec.	0.0	31.9	15.5	79	43	4.6	9.6	1.7
49	03-09 Dec.	0.0	31.0	12.8	79	36	4.6	10.1	2.5
50	10-16 Dec.	0.0	30.0	10.7	80	32	4.7	10.4	2.5
51	17-23 Dec.	0.0	29.0	8.8	77	40	4.1	10.1	2.7
52	24-31 Dec.	0.0	27.5	7.3	79	35	3.9	9.0	2.8
	Total	994.6							

APPENDIX-I : Contd....

MW	Dates	RF (mm)	Temp °C		Humidity %		EVP (mm)	BSS (Hrs.)	W.S. (kmph)
			Max.	Min.	AM	PM			
01	01-07 Jan.	0.0	28.8	9.0	78	37	4.1	10.3	2.7
02	08-14 Jan.	0.0	29.0	010.7	74	36	4.1	10.3	2.9
03	15-21 Jan	0.0	30.9	10.9	75	28	4.2	10.4	2.7
04	22-28 Jan	0.0	31.7	12.6	72	29	4.4	10.6	3.1
05	29-04 Feb.	0.0	32.5	15.1	72	27	5.7	10.2	3.8
06	05-11 Feb	0.0	33.3	14.9	72	24	5.9	10.3	3.5
07	12-18 Feb.	0.0	30.7	12.8	73	30	6.0	10.5	4.7
08	19-25 Feb.	0.0	32.1	13.1	70	23	6.3	10.9	4.7
09	26-04 Mar.	0.0	33.6	15.0	66	22	6.6	11.0	4.3
10	05-11 Mar.	0.0	9.9	4.9	18	3	1.9	3	1.2