INFLUENCE OF DEBLOSSOMING AND DEFOLIATION ON VEGETATIVE AND REPRODUCTIVE GROWTH OF GUAVA

THESIS

Submitted to
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola
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MASTER OF SCIENCE
IN
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(FRUIT SCIENCE)

By
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DECLARATION OF STUDENT

I hereby declare that the experimental work and its interpretation of the thesis entitled **"INFLUENCE OF DEBLOSSOMING AND DEFOLIATION ON VEGETATIVE AND REPRODUCTIVE GROWTH OF GUAVA"** or part thereof has neither been submitted for any other Degree or Diploma of any University, nor the data have been derived from any thesis or publication of any University or scientific organization. The sources of materials used and all assistance received during the course of investigation have been duly acknowledged.

Place: Akola

Date: 9/06/ 2015

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CERTIFICATE

This is to certify that the thesis entitled **"INFLUENCE OF DEBLOSSOMING AND DEFOLIATION ON VEGETATIVE AND REPRODUCTIVE GROWTH OF GUAVA"** submitted in partial fulfilment of the requirements for the degree of **"Master of Science in Horticulture (Fruit Science)"** of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola is a record of bonafide research work carried out by **Wagh Amol Vitthal** under my guidance and supervision.

The subject of the thesis has been approved by the Student's Advisory Committee.

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%	-	Per cent
/	-	Per
^{0}B	-	Degree Brix
^{0}C	-	Degree Celsius
CD	-	Critical difference
cm	-	Centimeter
cm^2	-	Centimeter square
cv.	-	Cultivar
et al.	-	et alia (And others)
etc.	-	Etcetera
E-W	-	East-West
Fig.	-	Figure
g	-	Gram
HCl	-	Hydrochloric acid
ha	-	Hectare
i.e	-	That is
kg	-	Kilogram
m	-	Meter
m^2	-	Square meter
m^3	-	Cubic meter
mg	-	mili gram
ml	-	Milli liter
mm	-	Milli meter
MT	-	Mertic tones
N.A.A.	-	Napthalene Acetic Acid
NaOH	-	Sodium Hydroxide
No.	-	Number
N-S	-	North-South
NS	-	Non significant
PPM	-	Parts per million
RBD	-	Randomized Block Design
SE (m)±	-	Standard error of mean
Sig.	-	Significant
TSS	-	Total Soluble Solids
viz.,	-	Videlicet (Namely)
Wt.	-	Weight

(F) THESIS ABSTRACT

a) Title of the thesis	:	**"INFLUENCE OF DEBLOSSOMING AND DEFOLIATION ON VEGETATIVE AND REPRODUCTIVE GROWTH OF GUAVA"**
b) Name of student	:	**Wagh Amol Vitthal**
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ABSTRACT

An experiment entitled, "Influence of deblossoming and defoliation on vegetative and reproductive growth of guava" was carried out during 2014-15 at, Main Garden guava orchard, Department of Horticulture, Dr. P.D.K.V, Akola.

The experiment was laid out in Randomized Block Design with five treatments and four replications. The different deblossoming

and defoliation treatments *viz;* T_1-100% deblossoming (January-February) + 100% defoliation (Last week of April), T_2-50% deblossoming (January-February) + 50% defoliation (Last week of April), T_3-100% deblossoming (January-February) + No defoliation T_4-50% deblossoming (January-February) + No defoliation and T_5-Control were used in research programme. The deblossoming of rainy crop of guava was done in the month of January-February and defoliation was done in the last week of April.

Observations on growth, flowering, yield and quality parameters were recorded periodically. The vegetative growth in respect of plant height, plant spread, days to emergence of vegetative flush, leaf area were observed during the study. Flowering parameters like days required for initiation of flowering, days required from flowering to harvesting were recorded. Yield parameters were counted in terms of fruit set percentage, fruit weight per tree, fruit size, fruit volume, number of fruits per tree. Quality parameters include, Total Soluble Solids, acidity percentage, ascorbic acid content, total sugars and pectin content.

Results obtained in the present investigation revealed that, the plant height (3.03m) and plant spread (3.10m^2) was maximum in treatment in T_3 (100% deblossoming + No defoliation). The maximum leaf area (54.73cm^2) and days required for emergence of vegetative flush (15.12) was minimum in the treatment T_1 (100% deblossoming + 100 % defoliation).Days required for initiation of flowering (104.62) and days required from flowering to harvesting (124.50) was minimum in treatment T_3 (100% deblossoming + No defoliation).

The fruit set (85.12%), fruit weight (186.37g), fruit size, fruit volume (179.11cc) and number of fruits per tree (168.12) was maximum in treatment T_3. (100% deblossoming + No defoliation).

Total Soluble Solids(11.92^{0}B), ascorbic acid (214.62 mg/100g), total sugars (8.01%) and pectin content (0.85%) in guava fruit was found maximum in the treatment T_3 (100% deblossoming + No defoliation).

In overall study of present investigation it was observed that deblossoming can be effectively used for regulation of rainy crop of guava to increase yield and quality of winter season guava.

CHAPTER I

INTRODUCTION

1.1 Background Information

Guava (*Psidium guajava* L.) is one of the important fruit crop of tropical and subtropical region of India. It is hardy crop and can be grown satisfactorily on marginal soil with minimum care. It is popularly known as 'Apple of Tropics' due to cheapness and nutritive value in addition to its availability in the market. It claims to be fourth important fruit in area and fifth in production after banana, mango, citrus and papaya.

Guava belongs to family Myrtaceae and originated from Tropical America and seems to have been growing from Mexico to Peru. The genus *Psidium* contains 150 species. Guava is large shrub or a small spreading tree with a thin trunk and scaly multicoloured bark. Young shoots are quadrangular with almost sessile, opposite, light green, simple, oval leaves. Flowers are white, epigenous and develop on current season growth in a cymes or solitary in leaf axils. Fruits are round to pyriform and vary drastically in size. Fruit is berry surrounded by calyx lobes, varied shapes globose, ovoid or pyriform, colour is pale green to bright yellow or red; flesh white, yellow, pink or red. Seeds are numerous embedded in pulp (Bose *et al.* 2002).

Hundred gram of guava pulp is rich source of vitamin C (75-260 mg) and pectin (0.5-1.8%). Fruit contain moisture (77.9 - 86.9%), dry matter (12.3 - 26.3%), ash (0.5 - 1.02%), crude fat (0.10 - 0.70%), crude protein (0.82 - 1.45%) and crude fiber (2 - 7.2%), fructose (59%), glucose (36%), and sucrose (5%) are predominant sugars in ripe guava. Guava is also a fair source of vitamin A, iron, calcium and phosphorus. It processed into variety of products such as jam, jelly, cheese, toffee, juice, squash, wine, dried fruit and canned slices.

Guava is successfully grown under both tropical and subtropical climate and being a hardy plant it gives assure yield with minimum care. It was spread rapidly throughout the world's tropics by Spanish and Portuguese. At present the major guava producing countries are Southern Asian countries, Hawaiian Islands, Cuba and India. The major guava producing states of India are Madhya Pradesh, Maharashtra, Uttar Pradesh, Bihar, Andhra Pradesh, West Bengal, and Punjab.

It is 4th most important fruit crop in India with a production of 3198 thousand MT from an area 236 thousand ha with productivity 13.6 MT/ha. India exported 1180 MT of guava of rupees 3.51 crores during 2012-13. In Maharashtra total area under guava is 39 thousand hectare with 305 thousand MT production and 7.8 MT/ha productivity However, Madhya Pradesh is largest guava producing state of the country and Maharashtra is a second largest producer of guava in India (Anon., 2013).

Guava is one of the hardy, prolific bearer and highly remunerative. The fruit is extensively used in fruit processing industry and many delicious products such as jam, jelly and excellent salad pudding are prepared from the shell of ripe fruit crop. The greatest commercial use is for jelly preparation (Adsule and Kadam, 1995). The common sour wild guava makes the best jelly. Guava can also be canned in sugar or made into fruit butter. In some countries leaveas are used for curing dirrhoea and also for dyeing and tanning.

Guava is adapted to areas with hot summers and cool winters. Temperatures of up to 45^{0}C can be tolerated; although the highest yields are usually recorded at mean temperature of 23^0 to 28^0 C. Guava can be grown successfully from sea level up to an altitude of 1000-1500m. The trees are also adapted to summer, winter and rainfall conditions. They are more drought resistant than most tropical trees and grow best in areas of annual rainfall of 1000 mm. It can be grown satisfactorily on marginal soil with least management. It can grow and produce fruits on soils considered too poor for most fruits. Guava can thrive on light soils with a pH value as low as 4.5 and on soils with pH value up to 8.2.

In the region having equable climate, the guava tree shows a high potential for vegetative growth and flowering and rarely undergo dormancy and that too for a short period. Therefore, plant produces fruits in all seasons of the year. The quality of the fruit varies with the season of cropping. Apart from the need to have better quality fruits, it is better to have the fruits in such a season when fruit is in greater demand with good quality and assured market availability.

1.2 Importance and need of the study

The guava tree has ability to flower and fruit throughout the year with three different flowering season that is January-February flowering (*Ambia bahar*), June-July (*Mrig bahar*) flowering, October-November (*Hasta bahar*) flowering. The fruits of January-February flowering become ready in the month of June-July called as rainy season crop and the fruits of June-July flowering become ready in the month of October to December called as winter season crop. (Rathore and Singh, 1976).

The crop produced of guava during rainy season is inferior, insipid in taste, small in size, poor in quality and also attacked by many pest and diseases. On the other hand winter season crop is superior in quality, free from diseases and pest. (Mohammed *et al.* 2006).Therefore adoption of winter season crop has been recommended by most of the workers (Gandhi, 1963). The winter season crop are preferred due to high fruit quality (Mitra *et al.* 1982; Dubey *et al.* 2002).In order to have good winter season crop, regulation of rainy crop was done by various means. The rainy crop has to be deblossomed to encourage the winter season crop by various workers in the past. (Rathore 1975; Mitra *et al.1982*, Singh and Singh 1994).Defoliation also found to be effective way to stimulate new growth and influence fruiting, yield and quality of guava (Singh *et al.* 1996[a]).

Deblossoming can be considered as the more severe form of fruit thinning. The idea is to conserve the reserve of the shoot which would be adopted later during development of fruits. The deblossomed tree puts on new vegetative growth which helps to increase number of flowers and fruits on next season.

Defoliation can be used to stimulate new growth and influence fruiting in guava. Several workers have reported increase in yield, fruit size and qualitative attributes of guava as a result of defoliation. This improvement attributed to better light penetration within guava trees may enable for improved fruit yield and quality. Singh *et al.* (1999) observed complete removal of leaves promoted flower bud differentiation. Defoliation of shoots at different times of the year influenced flower bud differentiation. Defoliated shoots put forth terminal extension or axillary growth, while in undefoliated ones only terminal growth took place. There is a strong indication that in guava, defoliation plays a favorable role in flower bud formation (Singh *et al.* 1996[a]).

Among different tree management practices affecting yield and productivity of guava in rainy season the management of fruit fly attack is the most serious issue. Severe fruit fly infestation by *Bactocera dorsalis* adversely affect crop resulting in significant loss to most of the guava growers.

There is a distinct quality difference in the fruit produced in different seasons and winter is considered more favorable for quality guava production. Guava fetches a very attractive price in market and the consumers get a supply of this luscious and nutritive fruit during winter, when there is a general scarcity of fruits.

The main crop which ripens in winter is better in quality as compared to rainy season crop which has insipid and poor keeping quality. The rainy season fruits also get spoiled rapidly with loss of glossy appearance and discoloration from blemishes, desiccation, loss of firmness, protopectin and vitamin after harvest. To obtain a good winter season crop, it is desirable to prolong and regulate the rainy season crop. Keeping this view the present investigation "Influence of deblossoming and defoliation on vegetative and reproductive growth of guava" was carried out with the following objectives.

1.3 Objectives

1. To study the effect of deblossoming and defoliation on vegetative and reproductive growth of guava.
2. To find out suitable deblossoming and defoliation treatment for better vegetative growth, reproductive growth and fruit yield of guava.

1.4 Hypothesis

In Maharashtra region the guava tree bears fruits almost round the year with three different flowering seasons. The fruits of January-February flowering (*Ambia bahar*) called as rainy crop, June-July flowering (*Mrig bahar*) called winter crop and October-November flowering (*Hasta bahar*) called as summer crop. The fruiting of rainy crop takes place in the month of July-September, fruiting of winter crop takes place in the month of October-December and summer crop fruiting takes place in February-April. Summer season crop (*Hasta bahar*) is not very common in guava (Radha and Mathew, 2007).

The fruit produced of guava during rainy season is poor in quality, having insipid taste, low keeping quality and highly susceptible to disease and pest specially the attack of fruit fly is the most serious issue in guava crop production. The monetary return of rainy season crop is low due to poor price and poor demand in the market than the winter season guava crop which is better in quality, fetches higher price. The various efforts have been made to deblossom rainy crop and increase winter season crop yield (Mohammed *et al.* 2006). Therefore there was a need to develope effective technique in such a way that only quality fruits should be harvested in winter season.

Various efforts have been made from time to time for regulation of rainy crop and to increase production of winter season crop.

1.5 Scope and limitations of the study

The fruit growers particularly of this region, at present have no authentic information about proper means to regulate the rainy crop of guava in a such a way that higher yield with better quality fruits are obtained during winter season by eliminating poor quality rainy crop. Since the orchardist are looking forward to simple, efficient and cost effective method of crop regulation through which higher returns with better quality fruit production can be ensured. Hence, a study was conducted to develop economically efficient crop regulation technique for concentrating production of quality guava fruits during winter season.

Generally various crop regulating technique are used for regulation of rainy crop and have yield maximization in winter crop, such as deblossoming of flowers of rainy crop by using different chemicals, restrict watering of tress from February to May, in addition to withholding irrigation, exposing of feeding roots and pruning of fibrous one also practiced in some areas. These methods are not well suitable and economically efficient (Radha and Mathew, 2007).

This necessitates to find out some suitable technique to deblossom the rainy season crop of guava in a view to get bumper winter crop. In present study the influence of deblossoming and defoliation was investigated on vegetative and reproductive growth of guava. The study was undertaken to find out some most economical and suitable method.

Keeping this view, an experiment entitled, "Influence of deblossoming and defoliation on vegetative and reproductive growth of guava" was conducted.

CHAPTER II

REVIEW OF LITERATURE

Guava (*Psidium guajava* L.) is one of the important fruit crop of tropical and subtropical region of India. It is a hardy crop and can be grown satisfactorily on marginal soil with minimum care. It can grow and produce flower throughout the year. There are several reports on growth flowering and fruiting behavior of guava cultivar under different agro climatic condition. Guava produces three crops in a year but taking one crop of winter season is beneficial through crop regulation. In India guava bears flowers three times in a year i.e. spring, rainy and autumn season (Rathore and Singh, 1976). The fruit produced in rainy season are poor in quality, insipid and watery and do not keep well. Production of poor quality fruits are further abbreviated by fruit fly attack. On the other hand the winter crop has ordinarily desired due to better quality fruits, it contains higher vitamin C than rainy season crop (Mohammad *et al.* 2006).

Various workers have tried to modify cropping pattern of guava crop with different treatments. Crop regulation in guava was done by number of ways and means are adopted from time to time in different places of the country. Pruning of roots, digging of soil, withholding of water followed by manuring and watering have been advocated to avoid rainy crop and getting good crop in a winter (Hayes, 1957).

Efforts have also been made to regulate the rainy crop of guava and get profitable winter crop by various treatments (Rathore 1975). Several workers also attempted the regulation of flowering by manual deblossoming and defoliation (Khan *et al.* 2011), and flower and fruit thinning manually (Tahir and Hamid, 2002).

In the present experiment to regulate and prolong rainy crop and to get the profitable winter crop the deblossoming and defoliation of rainy crop of guava was done manually. Keeping this interest in view, the literature pertaining on these aspects on guava and other fruit crops has been reviewed in this chapter under appropriate heading and subheading.

2.1 Influence of deblossoming and defoliation on growth parameters of plant.

2.2 Influence of deblossoming and defoliation on flowering parameters of plant.

2.3 Influence of deblossoming and defoliation on yield parameters of the plant.

2.4 Influence of deblossoming and defoliation on qualitative parameters of plant.

2.1 Influence of deblossoming and defoliation on growth parameters of plant

2.1.1 Influence on plant height

Kumar and Hoda (1977) observed that hand deblossoming of summer season flower of guava resulted in increase in plant height of next season.

Gaur *et al.* (2005) conducted an experiment of crop regulation treatments in guava cv. Sardar by using different chemicals and found that there is increase in height.

Singh (2010) conducted an experiment of; use growth regulators for deblossoming of guava plants and observed that there was a significant impact on height of guava trees. Tree height in all the treated plants was increased.

Agnihotri *et al.* (2013) conducted an experiment at Mandsaur (Madhya Pradesh) on five year old guava tree cv. Chittidar for crop regulation in guava by various growth regulators and observed that there is maximum increment in plant height.

2.1.2 Influence on mean plant spread

Kumar and Hoda (1977) observed that hand deblossoming of summer season flowering of guava resulted in increase in mean plant spread in guava as compared to control in winter season.

Singh (2010) observed that plant spread along East-West and North-South was influenced significantly by various growth regulator treatments, it affects on vegetative growth of guava, and all the treatments increased the plant spread.

Agnihotri *et al.* (2013) observed that in crop regulation of guava plant spread in N-S and E-W direction with foliar application of 60 ppm 2, 4-D increased the endogenous auxin level that resulted in cell elongation and enhanced vegetative growth.

2.1.3 Influence on days to emergence of vegetative flush

Rajput et *al.* (1986) observed that, in guava new leaves emerged between 16 to 23 days from the time of total defoliation and 50% blooming occurred 21 to 27 days after emergence of new leaves.

Nanra *et al.* (2001) conducted an experiment in order to observe the effect of chemicals, *viz.* KI, KNO3 and urea on defloration, defoliation and leaf emergence on Sardar guava in rainy crop. Maximum defloration and defoliation of rainy crop was caused by KI (0.5%) followed by urea sprays. The days taken for the emergence of leaves were the highest in control and minimum of 19 days taken by trees sprayed with both the level of urea.

Khan *et al.* (2011) observed that days required for emergence of vegetative flush were significantly influenced by different levels of defoliation and deblossoming. Results indicated that 100% defoliation and 100% deblossoming showed better performance for leaves emergence in comparison to control.

2.1.4 Influence on leaf area

Singh and Singh (2007) conducted an experiment on rejuvenated guava and found that maximum leaf area was found in defoliated tree than other treatments.

Khan *et al.* (2011) carried out an experiment of defoliation and deblossoming on guava, and revealed that minimum leaf area obtained in 0% defoliation + 100% deblossoming, it might be due to higher leaf number and leaf age as compared to all other treatments. While in 100% defoliated + 100% deblossomed plants, maximum leaf area is achieved.

Agnihotri *et al.* (2013) conducted an experiment of crop regulation in guava by using plant growth regulator and found that the morphological characters of the tree were significantly influenced by different crop regulating treatments, maximum leaf area found after application of different crop regulating chemicals, it may be due to immediate absorption of auxins, which increased the endogenous auxin level that resulted in cell elongation and enhanced vegetative growth.

2.2 Influence of deblossoming and defoliation on flowering parameters of plants.

2.2.1 Influence on days required for initiation of flowering

Rajput *et al.* (1986) conducted an experiment of crop regulation in guava and reported that application of urea 10 to 20 % caused deblossoming and defoliation of rainy crop, resulted that days required for initiation of flowering was earlier in winter season than the other treatments.

Dwivedi *et al.* (1990) carried out an experiment of crop regulation in guava by various concentration of urea causes defoliation and deblossoming of summer season flowering, and resulted that days required for initiation of flowering of winter season is earlier than the control.

Singh and Singh (1994) observed that, deblossoming and defoliation of the rainy crop of guava by urea subsequently increases the profitable winter season crop. Application of double spray of 10 to 20 percent urea on 4 years old guava cv. Sardar removed all flowering and foliage of rainy crop. The highest subsequent flowering obtained was earlier in winter season.

Pervez *et al.* (1999) revealed that deblossoming at full bloom stage of summer season flowering in guava took the least time and control took maximum time for initiation of flowering in winter season.

Singh *et al.* (1999) reported that complete removal of leaves, along with decapitation of shoots, promoted flower bud differentiation in guava. Defoliated shoots put forth terminal extension or axillary growth, while in undefoliated ones only terminal growth took place. There is a strong indication that, in guava leaves play a favorable role in flower bud formation and initiation of flowering was earlier in defoliated shoots as compared to other treatments.

Sahay and Singh (2001) studied the regulation of cropping in guava and reported that different crop regulating treatments causes deblossoming of rainy crop and subsequently resulted early initiation of flowering in winter season crop of guava.

2.2.2 Influence on days required from flowering to harvesting

Chapman and Paxton (1983) conducted an experiment of guava harvest delay by defoliation and found that, defoliation of guava tree in summer increases flowering of winter season crop and days taken from flowering to harvesting was minimum as compared to other treatments.

Rajput *et al.* (1986) carried out an experiment on crop regulation of guava and revealed that application of 10 to 20 % urea caused deblossoming and defoliation of rainy crop of guava and resulted in early flowering of winter season and hence days required from flowering to harvesting was minimum.

Dwivedi *et al.* (1990) found that in crop regulation of guava by various concentration of urea resulted in early flowering and days taken from flowering to harvesting were decreased as compared to other treatments.

Amador *et al.* (1992) stated that spraying of guava trees with 12% urea as a defoliant advanced the harvesting date as compare to other treatments.

Pervez *et al.* (1999) reported that deblossoming of summer season flowering in guava plant at full bloom stage, took the least time and control took maximum time period from flowering to harvesting in winter season crop of guava. Because in control all the reserve foods had been used up and in full bloom nothing was used by the previous crop. Other treatments got the intermediate position.

Sahay and Singh (2001) studied the regulation of cropping in guava and revealed that deblossoming of rainy crop of guava subsequently resulted in early initiation of flowers in winter season and decreased duration of harvesting as compared to the other treatments. Hence days taken from flowering to harvesting were minimum in deblossomed plant as compared to other treatments.

2.3 Influence of deblossoming and defoliation on yield parameters of the plant

2.3.1 Influence on fruit set

Kundu and Mitra (1997) during their experiment on regulation of cropping in guava reported that different deblossoming treatments on rainy crop of guava shows signinificant increase in fruit set of winter season crop over control.

Pervez *et al.* (1999) conducted an experiment of regulation of cropping in guava and revealed that in winter season maximum fruit setting was noted in deblossoming at full bloom stage of summer seson flowering of guava due to proper health and vigour of the tree. Control remained at bottom and gave the least fruit set percentage because all the food reserves of the tree had been used by the previous summer crop.

Lili *et al.* (2000) observed that in Papaya flower and fruit set were reduced by a single defoliation and increased by fruit thinning.

Sahay and Singh (2001) revealed that in guava the highest fruit set in the winter season was obtained with double spray of 15% urea followed by hand deblossoming of summer season flowering of guava.

Tahir and Hamid (2002) reported that maximum fruit set percentage (65.19) was observed in winter season guava crop, where complete thinning of flowers and fruits was practiced in rainy crop and this percentage was reduced in partial thinning and even less in control.

Singh *et al.* (2006) conducted an experiment of hand deblossoming of summer season flowers of guava and found that there was marked increase in fruit set of winter season as compared to control.

Khan *et al.* (2011) carried out an experiment of defoliation and deblossoming of guava, and observed that in winter season highest fruit set (96.9%) was recorded in the trees subjected to 100 % deblossoming with no defoliation and 0% defoliation + 50% deblossoming treatments as compared to control because there had not to be any fruit set during rainy crop on completely deblossomed plants. But it was clearly observed that mean fruit set percentage was 40% more for winter as compared to rainy season crop of guava.

Agnihotri *et al.* (2013) carried out an experiment of crop regulation in guava and revealed that maximum fruit set was reported in winter season crop of guava by deblossoming the rainy crop by application of foliar spray of 200ppm NAA. Increased fruit set can be attributed to deblossoming of rainy crop which increased the carbohydrate content and C/N ratio of leaves and shoot and high carbohydrate was thought to increase fruit set in following winter crop of guava.

2.3.2 Influence on the fruit weight

Mitra *et al.* (1982) conducted an experiment on guava, the flowers of plant were removed in summer season crop by hand deblossoming, the reserved food materials and auxins force the plant to produce more fruit weight in winter season guava crop.

Biswas *et al.* (1989) revealed that flower thinning in guava significantly increased weight of individual fruit but yield was reduced with increasing degree of thinning.

Sheikh and Hulmani (1993) repoted that flower and fruit thinning of guava in rainy crop was found effective to increase individual fruit weight of winter season.

Singh and Singh (1994) observed that the use of urea for deblossoming and defoliation of the rainy crop of guava subsequently increases the profitable winter season crop. Application of double spray of 10 to 20 percent urea to 4 years old guava cv. Sardar removed all flowering and foliage of rainy crop. The highest subsequent fruit obtained was with increased fruit weight.

Pervez *et al.* (1999) carried out an experiment of delossoming of guava and observed that deblossoming of guava tree at full bloom stage reserved the right of its ruling over other treatments by producing fruit with maximum weight. Deblossoming at pink bud stage and deblossoming after 15-days of full bloom are at par. Control produced fruit with least weight because in this case the tree could not provide proper food tor fruit development.

Sahay and Singh (2001) reported that hand deblossoming of guava crop significantly increased average weight of fruit as compared to control.

Dhaliwal *et al.* (2002) carried out an experiment of defoliation on guava crop and reported that, the highest guava fruit weight during the rainy crop was recorded for 15% urea as a defoliant while the highest yield in winter was attributed to 10% urea application.

Dubey *et al.* (2002) conducted experiment of deblossoming and defoliation on guava trees in rainy crop and stated that, fruit weight was lower in rainy season and more in winter season crop because trees of small age up to 3-4 years old might have became stressed due to high defoliation and deblossoming levels.

Das *et al.* (2007) conducted an experiment of 100 and 50% flower removal of rainy crop of guava and resulted significant increase in the fruit weight of winter season crop.

Sahay and Kumari (2008) revealed that, different crop regulating treatments enhanced the fruit weight in winter season guava crop as compared to rainy crop.

Khan *et al.* (2011) observed that in guava different levels of defoliation and deblossoming on summer season flowering reveal significant difference on winter season crop. In winter maximum weight of fruits was obtained at treatment level of 0% defoliation + 50% deblossoming followed by the fruit weight of trees subjected to 50% defoliation + 50% deblossoming. Lowest fruit weight was exhibited by trees subjected to 100% defoliation + 100% deblossoming level in winter season crop as compared to the fruit harvested from control tree. However, winter crop produced 66% more fruits as compared to rainy crop guava.

Agnihotri *et al.* (2013) observed that different crop regulating treatments had significant effect on yield parameters of guava tree. The maximum fruit weight (181.71 g) was recorded with foliar spray of 60 ppm 2, 4-D which might be due to greater elongation and enhanced vegetative growth of guava.

2.3.3 Influence on the fruit size (Length and diameter of fruit)

Singh *et al.* (1996) observed that when flowers were removed from the 11 years old guava tree in summer season, the subsequent winter crop was largest in fruit size.

Troup and Knoll (1996) found that hand thinning of flower in apple with different intensities affected greatly on size of fruit, the maximum fruit size was found with severe flower thinning as compared to control.

Pervez *et al.* (1999) reported that deblossoming at full bloom stage of summer season flowering in guava produces maximum sized fruits in winter season. Control produced smallest sized fruits. Other treatments are at par with each other and no statistical difference could be located.

Sahay and Singh (2001) stated that deblossoming treatments in guava on rainy crop significantly increased fruit size during winter season as compared to the control.

Bariana and Dhaliwal (2002) conducted an experiment on six years old guava trees cv. Sardar planted at 6m apart at Ludhiana condition to induce better winter season crop, by deblossoming the rainy crop by spraying with 10% urea, they found the fruits with maximum length and diameter from the trees harvested in winter season.

Tahir and Hamid (2002) revealed that in guava, maximum fruit size in respect of fruit length and diameter was observed where complete thinning of flowers and fruits was practiced and this percentage was reduced in partial thinning and even less in control.

Das *et al.* (2007) carried out an experiment of deblossoming in guava and observed that 100% and 50% removal of rainy crop of guava resulted in significant increase in fruit size than that in case of no crop removal.

Khan *et al.* (2011) observed that in guava crop fruit size shows significant increase during the whole growth period in winter season as influenced by defoliation and deblossoming. The relationship between different level of defoliation and deblossoming and growth intervals was also found significant during winter season. Maximum fruit size of winter crop was attained at 0% defoliation + 50% deblossoming level followed by the trees as compared to control.

Haji *et al.* (2013) conducted an experiment of crop regulation in guava by hand deblossoming of rainy crop and improve winter season crop, observations on the effect of season on physical characteristics of guava cv. Allahabad safeda revealed that winter season crop attained higher length (7.26 cm) for winter season guava as compared to length (6.23 cm) of rainy season guava, and higher diameter (8.18 cm) for winter season guava as compared to diameter (6.72 cm) of rainy season guava.

2.3.4 Influence on the fruit volume

Singh *et al.* (1996) observed that when flowers were removed from the 11 years old tree of guava in summer season crop, the subsequent winter crop obtained was with larger fruit volume as compared to control.

Tahir and Hamid (2002) revealed that in guava crop maximum fruit volume was observed where complete thinning of flowers and fruits was practiced and this percentage was reduced in partial thinning and even less in control.

Das *et al.* (2007) reported that 100% and 50% removal of summer season flowering of guava resulted in significant increase in fruit volume in winter season than in case of no crop removal.

Sahay and Kumari (2008) reported that in the different crop regulating treatments in guava enhanced the fruit volume in winter season crop as compared to rainy season.

Agnihotri *et al.* (2013) in various crop regulating technique of guava reported that application of various chemicals to deblossom rainy season crop significantly improved the yield parameters of guava tree. The maximum fruit volume was recorded as compare to control.

Haji *et al.* (2013) in an experiment, hand deblossoming of rainy crop of guava found that there was increase in winter crop guava also showed higher fruit volume. The higher fruit volume might be due to the higher fruit size.

Khan *et al.* (2013) observed that hand defoliation and deblossoming of guava trees in summer season affect the fruit volume of winter season crops significantly. Maximum fruit volumes were obtained at 100% and 50% deblossoming levels in winter fruits. However, minimum fruit volumes were observed in control and trees subjected to 100% defoliation and deblossoming levels. It was observed that overall fruit volume was higher in winter as compared to rainy fruits.

Abbas *et al.* (2014) found that deblossoming of rainy crop in guava with NAA significantly increases the fruit volume in winter season as compare to control treatments.

2.3.5 Influence on the number of fruits per tree (Fruit yield per tree)

Kumar and Hoda (1977) was conducted an experiment of deblossoming in guava trees, deblossomeing of guava tree was done by hand or by using one or several chemicals and the effects were compared on the two year yields during the rainy and winter seasons. All treatments reduced cropping in the rainy season and increased winter cropping, deblossoming by hand giving the best results by increasing number of fruits in winter season.

Amador *et al.* (1992) observed that spraying guava trees with 12% urea as a defoliant advanced the harvesting date and increased the number of fruits per tree as compared to other treatments.

Singh and Singh (1994) observed the use of urea for deblossoming and defoliation of the rainy crop and subsequently increases the profitable winter crop in guava. Application of double spray of 10 to 20 percent urea to 4 years old guava cv. Sardar removed all flowering and foliage. The highest subsequent winter crop yield was obtained with more number of fruits.

Bariana and Dhaliwal (2002) observed in an experiment conducted on six years old guava trees cv. Sardar planted at 6m apart at Ludhiana to induce better winter season crop by deblossoming the rainy crop by spraying with 10% urea, the total number of fruits obtained was significantly higher in winter season.

Dhaliwal *et al.* (2002) reported that the highest guava fruit yield during the rainy season crop (54.2 kg tree-1) was recorded for 15% urea as a defoliant while the highest yield in winter (53.6 kg tree-1) was attributed to 10% urea application.

Sahay and Kumar; (2004) conducted an experiment of foliar spray of 16% urea to deblossom and defoliate the rainy crop of guava and found that, the fruit produced in winter season was maximum in number (226.67) as compared to contol. It might be due to production of more number of flowers that can be supported by photosynthesis and remobilization.

Bariana *et al.* (2005) conducted a field study in Ludhiana condition, to determine the effect of different deblossoming chemicals in guava cv. Sardar during the full bloom stage. Plants sprayed with 10% urea resulted in significantly higher number of fruits as compared to other treatments.

Das *et al.* (2007) carried out an experiment of deblossoming in guava cv. Lucknow-49 and reported that 100% manual deblossoming of rainy crop resulted in maximum number of fruits in winter crop which was at par with that in case of 50% removal of rainy crop.

Hojo *et al.* (2007) observed that fruit thinning practices of guava in rainy crop responded maximum fruit numbers (501) in winter season as compare to other treatments.

Mohammed *et al.* (2008) conducted an experiment of chemical deblossoming of rainy crop and shows that there is significant reduction in the fruit yield over control during rainy season. Consequently, there was a significant increase in yield of treated plants in the winter crop. Maximum yield in winter season was recorded with 600 ppm NAA (359.3qt/ha) closely followed by 15 percent urea 356.2qt/ha and minimum with Maleic Hydrazide 1000 ppm.

Khan *et al.* (2011) observed that application of different defoliation and deblossoming levels in rainy and winter season crop of guava did not significantly affect the yield. In winter, highest numbers of fruit were obtained in the trees subjected to 0% defoliation + 50% deblossoming level followed by the trees treated at 50% defoliation + 50% deblossoming level as compared to untreated ones.

Abbas *et al.* (2014) found that deblossoming of rainy crop in guava with 400 ppm NAA significantly increases the total number of fruits per tree in winter season as compare to control treatments.

2.4 Influence of deblossoming and defoliation on qualitative parameters of plant

2.4.1 Influence on the total soluble solids

Biswas *et al.* (1989) revealed that total soluble solids was recorded more in the larger fruits obtained by flower thinning during rainy crop flowering of guava.

Dwivedi *et al.* (1990) conducted the study on crop regulation of guava cv. Sardar and reported that deblossoming of summer flowering of guava significantly increases the TSS content of winter season fruit.

Sardar *et al.* (1996) observed that in guava crop the highest TSS of both mesocarp and endocarp were obtained in winter crop from the plants when deblossomed on rainy crop.

Sahay and Singh (2001) reported that deblossoming of rainy crop of guava with pruning of current shoots and urea spray significantly increased the total soluble solids of fruits in the following winter season compared with the control.

Tahir and Hamid (2002) observed that total soluble solids content was increased in the treatments, where complete flower and fruit thinning while partial thinning and control TSS percentage was decreased.

Michels and Normand (2004) conducted a study of thinning of flowers and observed that un-thinned guava trees resulted in unaffected TSS contents of strawberry guava fruit.

Agnihotri *et al.* (2013) observed that in various crop regulating treatments application of various chemicals significantly improved the fruit quality of guava in terms of total soluble solids.

Khan *et al.* (2013) observed that, hand defoliation and deblossoming of rainy crop significantly affected the TSS of rainy fruits as compared to winter fruits. Maximum ^{0}Brix was recorded in the fruit harvested from untreated trees in rainy as compared to winter in which maximum TSS was recorded at 50% deblossoming. Similarly, winter fruit ^{0}Brix was lower than the rainy fruits.

Abbas *et al.* (2014) in an experiment of effect of NAA on flower and fruit thinning of summer flowering of guava observed that deblossoming of flowers of guava in summer with 200 ppm NAA significantly increases the total soluble solids in winter season as compared to control.

2.4.2 Influence on the acidity

Dubey *et al.* (2002) in his experiment of deblossoming of rainy season crop maximum TSS/ acidity ratio was also reported with foliar spray of 300 ppm NAA. A consistent decrease in acidity content was observed in deblossomed guava crop as compare to other treatments.

Tahir and Hamid (2002) reported with the application of deblossoming, the acidity of the guava fruit was decreased. However, the effect of defoliation and pruning treatments was negligible on titratable acidity percentage of guava fruit juice.

Basu *et al.* (2007) reported that increase in titratable acidity in winter season guava crop at 50% defoliation and deblossoming was might be due to more availability of nutrients in response of rainy treatments.

Agnihotri *et al.* (2013) observed that acidity of guava fruits was reduced by application of all the chemicals, however maximum reduction was noted with foliar spray of 300 ppm NAA. The lower acidity might be due to early ripening of fruits caused by treatment, where acid might have been used during respiration or fastly converted into sugars.

Khan *et al.* (2013) observed that titratable acidity was found non-significantly different at different levels of defoliation and deblossoming. Titratable acidity of fruit juice was found highest in fruit harvested from trees subjected to 50% deblossoming as compared to control in both rainy and winter season crops of guava. The increase in titratable acidity of rainy fruit was might be due to high defoliation and deblossoming levels, attributed to their effects on certain carbohydrate stimulating enzymes.

2.4.3 Influence on the ascorbic acid

Harb (1990) in his experiment yield and quality of guava in Jordan as affected by chemical defoliants on guava shows that defoliation and deblossoming has negligible effects on ascorbic acid content.

Tahir and Hamid, (2002) reported that deblossoming in guava improved the level of ascorbic acid content.

Mohammed *et al.* (2006) in an experiment of chemical deblossoming of guava observed that. there was a significant increase in ascorbic acid content over control especially at higher concentrations. The highest ascorbic acid content found in winter season crop of guava.

Singh and Kingsly (2007) reported that in pomegranate *bahar* regulation there was no significant effect on ascorbic acid of fruits picked during different *bahar* treatments.

Khan *et al.* (2013) observed that ascorbic acid contents reveal non significant differences in winter crop of guava by application of various levels of manual defoliation and deblossoming. In winter crop maximum ascorbic acid contents were observed both at 50% and 100% deblossoming levels, in winter least ascorbic acid contents were recorded in fruit of untreated trees. Defoliation and deblossoming might be play an active role in the production of auxin in plant species as the production of auxin increases ascorbic acid content in fruits.

2.4.4 Influence on the total sugars

Sahay and Singh (2001) reported that deblossoming of summer flowering with pruning of current shoots and urea spray significantly increased the total sugars of fruits in the following winter season compared with the control trees in guava.

Tahir and Hamid (2002) reported that deblossoming of rainy crop improved the fruit quality of winter crop of guava with improved sugars amount.

Dhinesh and Yadav (2004) found best results for total sugar by thinning peach cv. 'Contender' with GA3 at 100 ppm spray.

Basu *et al.* (2007) revealed that, highest total sugars were found in guava trees subjected to 50% defoliation and deblossoming levels may be due to maximum storage of nutrients in the tree branches, which were then utilized by the fruits of winter season crop.

Singh and Kingsly (2007) in pomegranate reported that prior to *bahar* treatments the flowers produced on trees were removed manually, maximum total sugar were found in fruits of September pickings (14.92%) and minimum was recorded (14.55%) in December pickings. Similarly reducing sugars were also found maximum (13.36%) in September pickings and it was recorded minimum in December pickings (12.32%).

Agnihotri *et al.* (2013) observed that application of various chemicals to deblossom rainy crop significantly improved the fruit quality of guava in terms of total sugars, reducing sugar, non reducing sugar.

Haji *et al.* (2013) in an experiment guava crop was regulated by hand deblossoming, found that there was a significant difference in reducing sugars, total sugars and non-reducing sugars content of rainy and winter season guava. The winter season crop exhibited higher percentage of reducing total sugars (7.19% and 9.42%, respectively).This was mainly due to long period of growth for the synthesis of sugars and low rate of catabolism under the low temperature conditions.

Khan *et al.* (2013) observed that the total sugars contents of Guava cv. 'Gola' from trees subjected to defoliation and deblossoming did not show any significant differences in both the rainy and winter season fruit. Highest level of total sugars was found maximum in fruit harvested from trees subjected to 50% defoliation and deblossoming level as compared to control.

2.4.5 Influence on the pectin content

Sahay and Singh (2001) reported that deblossoming of summer flowering in guava with pruning of current shoots and urea spray significantly increased the pectin content of guava fruits in the following winter season crop as compared with the control.

Dubey *et al.* (2002) conducted an experiment of crop regulation in guava and observed that in different crop regulating technique of guava by deblossoming of rainy crop by foliar spray of 12% urea resulted in maximum pectin content during the winter season.

Mohammed *et al.* (2006) carried out an experiment of chemical deblossoming of rainy crop of guava and observed that pectin content was more in winter season crop of guava than in rainy season this may be due to more temperature and humidity during rainy season.

Agnihotri *et al.* (2013) studied the crop regulating technique in guava observed that application of various chemicals to deblossom rainy crop significantly improved the pectin per cent in winter guava crop.

From the literature reviewed it is clear that some of the workers not received tangible results in their investigation but majority of them found effective results. They suggested the different technique for deblossoming and defoliation of the rainy crop of guava and to get more yield and better quality fruits in winter season.

Therefore, the present investigation was carried out to find out a suitable treatment to regulate the rainy crop of guava and have more yield and better quality fruits in winter season.

CHAPTER III

MATERIAL AND METHODS

The experiment entitled "Influence of deblossoming and defoliation on vegetative and reproductive growth of guava" was conducted at Main Garden, guava orchard, Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the year 2014-15.The details of material used and methods adopted during the course of investigation are given in this chapter under appropriate headings and subheadings.

3.1 Climate and Weather Conditions

Akola is situated in sub tropical region between 22^{0}42'N latitude and 77^{0} 02' E longitudes. The altitude of the place is 307.42 m above mean sea level. The climate of Akola is semi arid and characterized by three distinct season viz., hot and dry summer from March to May, warm humid and rainy season from June to October and mild cold winter from November to February. Average annual precipitation on the basis of last fifteen years is 847.30 mm. The meteorological data during the course of investigation for the period from January 2014 to December 2014 recorded at Agro Meteorological observatory.

The metrological data in respect of rainfall, relative humidity, minimum and maximum temperature recorded at University Campus during the period of investigation i.e. January 2014 to December 2014 are furnished in Appendix I and the same depicted graphically in Fig.1

3.2 Material

3.2.1 Experimental details

The experiment was carried out at Main Garden, guava orchard, Department of Horticulture, Dr. PDKV Akola, on uniform size guava crop having spacing of 5 x 5 m of 'L 49' variety. Forty healthy trees, uniform in size and vigour were selected for the trial from guava

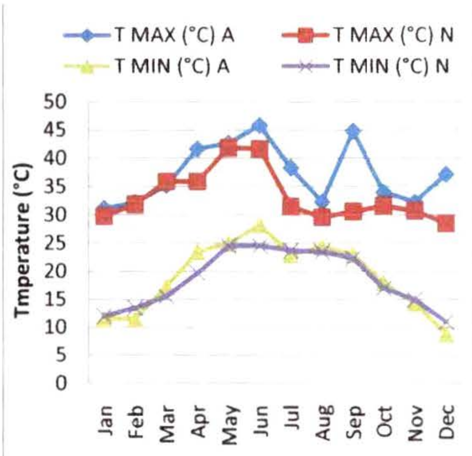


Fig.1(a) Monthly mean temperature

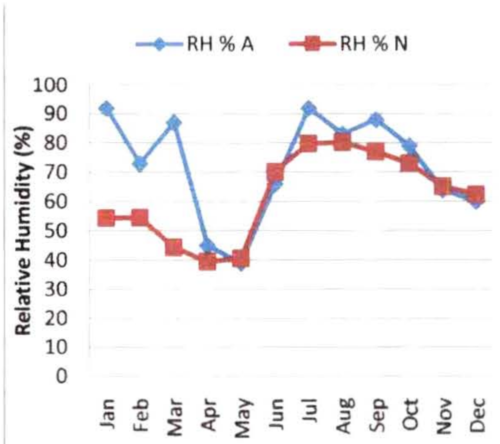


Fig.1(b) Monthly mean relative humidity

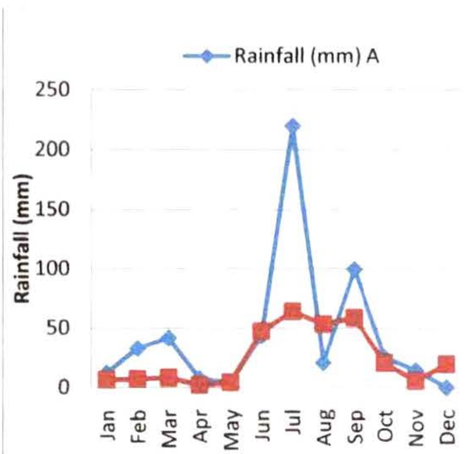


Fig.1(c) Monthly mean rainfall

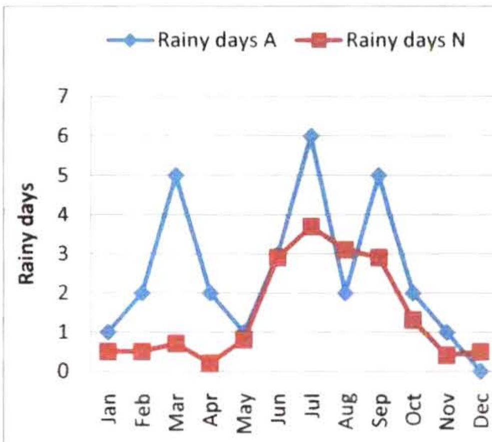


Fig.1(d) Monthly mean rainy days

Fig. 1 Meteorological graphs (Monthly mean temperature, relative humidity, mean rainfall, and mean rainy days)

plantation. All trees were subjected to same cultural practices such as irrigation, nutrition, weeding and insect pest and disease control during the experiment. Deblossming was done in the month of January-February and defoliation was done manually by using pruning scissor in the last week of April.

3.2.2 Details of experimental plot

1)	Crop	: Guava (*Psidium guajava* L.)
2)	Family	: Myrtaceae
3)	Variety	: L-49
3)	Age of experimental plants	: 5 years
4)	Plant spacing	: 5 x 5 m
5)	Number of treatments	: 5 (Five)
6)	Number of Replications	: 4 (Four)
7)	Experimental design	: RBD (Randomized Block Design)
8)	Experimental plants	: 40
9)	Treatment Unit	: Two plants per treatment
10)	Location	: Main Garden, guava orchard, Department of Horticulture , Dr. PDKV, Akola.

3.2.3 Treatment details

T_1-100% Deblossoming (January-February) + 100% defoliation (Last week of April)

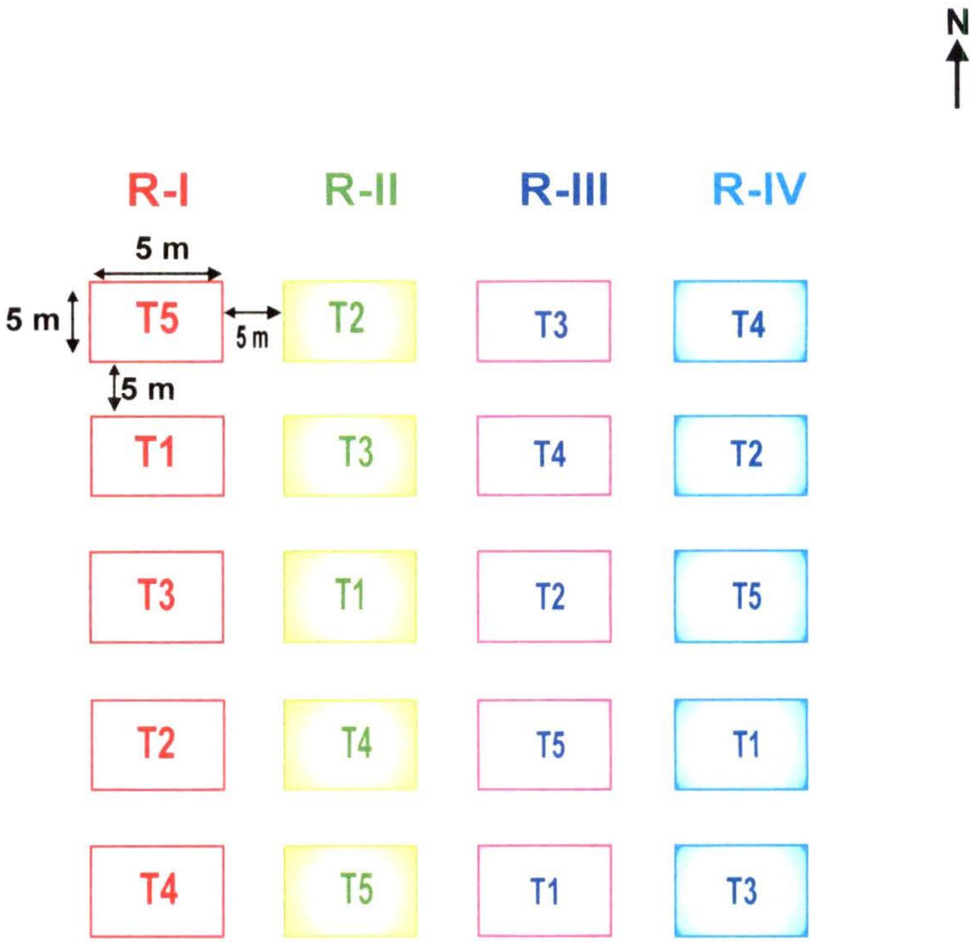
T_2-50% Deblossoming (January-February) + 50% defoliation (Last week of April)

T_3-100% Deblossoming (January-February) + No defoliation

T_4-50% Deblossoming (January-February) + No defoliation

T_5-Control

Plate 1. General view of experimental plot



Design : Randomized Block Design (RBD)
Treatments : (5)
Replications : (4)

Fig. 1. Plan of layout

3.3 Methods

3.3.1 Layout of experiment

The experiment was conducted in Randomized Block Design with five treatments, which were replicated four times.

3.3.2 Orchard management

3.3.2.1 Fertilization

Half dose of nitrogen and full dose of potassium and phosphorous was applied on 1st July 2014 and remaining half dose of nitrogen at fruit set stage i.e. 15th August 2014. Fertilizer applied between the radial distance 100 to 160 cm away from trunk, 15-25 cm deep and then properly covered with soil.

3.3.2.2 Irrigation

The guava field was irrigated regularly during the period of investigation. The irrigation scheduled was maintained as per the critical water requirement period of crop i.e. at flowering, fruit set and fruit development stage.

3.3.2.3 Intercultural operations

Ploughing was done to break the dormancy and to keep the soil loose and check weed growth in rows. The guava field was kept weed free by regular manual weeding and also with tractor mounted implements.

3.3.2.4 Deblossoming

Deblossoming of plant was done manually, treatment wise in the month of January-February. In treatment T_1(100% deblossoming+100% defoliation) and treatment T_3 (100% deblossoming + No defoliation) total number of flowers of rainy crop (January-February flowering) was counted and all were removed. In treatment T_2 (50% deblossoming + 50% defoliation) and T_4 (50% deblossoming + No defoliation) out of total number of flowers 50% flowers were removed.

3.3.2.5 Defoliation

Defoliation was done manually by using pruning scissor in the last week of April. Defoliation was done treatment wise. In treatment T_1(100% deblossoming+100% defoliation) all leaves of plants were removed and in treatment T_2 (50% deblossoming + 50% defoliation) 50% of leaves out of total leaves were removed.

3.4 Details of Observations

Two plants of each treatment selected, marked and kept under observations for recording various observations. The details observations recorded as under.

3.4.1 Growth parameters

3.4.1.1 Plant height (m)

The height of observational plant was measured from ground level to the growing tip with the help of marked bamboo. The plant height was recorded at the time of flowering and recorded as plant height in meter.

3.4.1.2 Mean plant spread (m)

The mean plant spread of selected plants was measured at flowering stage. The plant spread was recorded at twelve noon, with help of meter tape along with East-West and North-South direction and recorded as mean plant spread in meter.

3.4.1.3 Days to emergence of vegetative flush

Days required for the emergence of the vegetative flush after defoliation was counted and recorded.

3.4.1.4 Leaf area (cm^2)

Leaf area of fully grown trees was collected during July-August and was measured with help of leaf area meter and expressed in cm^2.

3.4.2 Flowering parameter

3.4.2.1 Number of flowers per plant (before deblossoming)

Number of flowers present on plant of rainy crop (*Ambia bahar*) before deblossoming was recorded treatment wise; the branches of all the directions were marked and tagged on observational plants. The numbers of flowers born on each shoot of branch were counted and after computing the mean, it was recorded as a number of flowers per plant.

3.4.2.2 Number of deblossomed flowers per plant

Number of deblossomed flowers per plant was counted treatment wise from total number of flowers present on the plant. In treatment T_1 (100% deblossoming + 100 % defoliation) and treatment T_3(100% deblossoming + No defoliation) all flowers present on plant of rainy crop (*Ambia bahar*) were removed. In treatment T_2 (50% deblossoming + 50% defoliation) and treatment T_4 (50% deblossoming + No defoliation) out of the total number of flowers present on plant, 50% flowers were removed.

3.4.2.3 Days required for initiation of flowering

Days required for initiation of flowering are counted from date of deblossoming of rainy crop to commencement of new flowering in winter season.

3.4.2.4 Days required from flowering to harvesting

For recording days required from flowering to harvesting, the date of flower opening of winter season and date of harvesting of fruits was recorded and the days required for harvesting from flowering of guava were counted and after computing it was recorded as a days required for flowering to harvesting.

3.4.3Yield parameter

3.4.3.1 Fruit set (%)

For recording the fruit set on observational plants, the number of flowers born on each tagged shoots and number of fruit set on same shoot counted and calculated. After computing the mean it was recorded as fruit set in percent.

3.4.3.2 Fruit weight (g)

The fruits weight was recorded with the help of electronic balance and mean of fruit weight was calculated and recorded as average fruit weight in gram.

3.4.3.3 Fruit size (Length and diameter of fruit in cm)

The length of each fruit from stalk end to styler was measured with the help of vernier calliper and after computing mean, it was recorded as average length of fruit in centimeter.

Diameter of selected fruits was measured with the help of vernier calliper at maximum thickness and after computing mean, it was recorded as average diameter of fruit in centimeter.

3.4.3.4 Fruit Volume (cc)

Fruit volume was measured by water displacement method and after computing the mean it was recorded as average fruit volume in cubic centimeter.

3.4.3.5 Number of fruits per tree

The fruits harvested from each plant were counted at each harvest. The total numbers of fruits of all picking were calculated and recorded number of fruits per tree.

3.4.3.6 Fruit yield per tree (kg)

The fruits harvested from each observational plant during each harvesting weighed on electronic balance. The total weight of fruit from all harvesting was calculated and recorded as fruit yield per plant in kilogram.

3.4.3.7 Fruit yield per hectare (MT/ ha)

Yield of fruits per hectare was calculated by multiplying average weight of fruits per tree by plants per hectare.

3.4.4 Qualitative Parameters

For recording the fruit quality observations five mature fruits from all directions were randomly selected from each observational plant and same fruits were used for recording the different fruit quality observations.

3.4.4.1 Total Soluble Solids (^{0}brix)

Pulp was extracted from fruits and total fruits and total soluble solids (TSS) were determined using Atago make RX 1000 digital refractometer. A drop of juice was extracted and placed on clean prism of refractometer and the lid was closed. Reading was taken directly from the scale at 20^{0}C temperature and recorded as total solids in ^{0}Brix.

3.4.4.2 Acidity (%)

The total acidity of guava fruits was estimated in terms of citric acid. It was determined by titrating the sample against 0.1 N sodium hydroxide (NaOH) solution from colourless to faint pink. A few drops of 1 percent phenolphthalein were used as an indicator and the percentage of total acidity were calculated by using fallowing formula (A.O.A.C., 1984).

$$\text{Titratable acidity (\%)} = \frac{\text{Titrate} \times \text{normality of alkali} \times \text{equivalent weight of acid}}{\text{Volume of Sample taken for estimation} \times 1000} \times 100$$

3.4.4.3 Ascorbic acid (mg/100g)

Ascorbic acid present in fruit from each treatment was estimated in milligrams of ascorbic acid / 100 g of fruit pulp using the method described by Majumdar and Majumdar,(2003). One gram of the fruit pulp was ground well and blended with 3 percent metaphosphoric acid (HPO3) and volume was made to 100 ml with HPO3. The contents after shaking well were filtered with Whatman No. 1 filter paper. Ten ml of the filtrate was titrated against dye solution of

2,6-dichlorophenol indophenol till light pink colour persisted for at least 15 seconds. The titration values were put in the following formula to calculate ascorbic acid content.

$$\text{Vitamin C (mg/100 g)} = \frac{e \times d \times b}{c \times a} \times 100$$

$$\text{Dye factor (d)} = \frac{0.5}{\text{Average burette reading for standardization of dye solution}}$$

Where,

a=weight of sample

b=volume made with metaphosphoric acid

c=volume of aliquot taken for estimation

d=dye factor

e=average burette reading for sample

3.4.4.4 Total sugars (%)

For estimation of total sugars, extract was prepared from selected fruit pulp. Total sugars were determined by "Dubois method" (Sadasivam and Manickam, 1996). In this method 5 per cent phenol and 96 per cent conc. H_2SO_4 was used to carry out the analysis. Absorbance of the samples was noted at 490 nm on spectrophotometer and graph values were put in the following formula

$$\%\ \text{Total sugar} = \text{Reading from graph } (\mu g ml^{-1}) \times \frac{1}{1000000} \times \frac{100 \times 50}{1} \times \frac{100}{1} \times \frac{100}{\text{Weight of sample taken}}$$

3.4.4.5 Pectin content (%)

The pectin content was estimated with using the method Srivastava and Sanjeev (2002). 50 gm of blended sample was taken in 1000 ml of beaker. In this 400 ml 0.05 N HCl added and heated the content for 2 hours at 80-90^{0}C. Replaced the water by loss of evaporation. Cool and transferred to a 500 ml volumetric flask, and make up the volume and filtered. Pipette a 100 ml aliquot into a conical flask and added 250 ml of distilled water. Neutralized the acid with 1 N NaOH using phenolphthalein as indicator. Added another 10 ml 1 N NaOH and allowed to stand overnight. Then added 50 ml of 1 N acetic acid fallowed by 25 ml of 1 N calcium chloride. Allow to stand for 1 hour, boiled for 1-2minutes and filtered through a previously weighted filter paper. (Wet the paper in hot water, dry in oven at 100^{0}C for 2 hours, cool in desiccator and weight). Washed the precipitate free of chloride with hot water. Dried the precipitate cooled in desiccators and weighed again (Srivastava and Sanjeev, 2002).

$$\text{Pectin (\%) (as calcium pectate)} = \frac{\text{Wt. of precipitate} \times 500 \times 100}{\text{ml. of filtrate} \times \text{Wt. of sample taken for estimation}}$$

3.4.5 Economics of treatments

3.4.5.1 Cost A

It is an actual paid cost for owner cultivars. This cost included the expenditure on the following items.

1) Hired human labour
2) Manures and fertilizers
3) Hired machine charges
4) Establishment cost

3.4.5.2 Cost B

Cost B was estimated as cost A plus rental value of the own land.

3.4.5.3 Cost C

Cost C was estimated as Cost B plus imputed value of family labour. This is the total of all the costs, direct as well as imputed.

3.4.5.4 Gross monetary return (Rs/ha)

The total value of produce i.e. harvested fruits was estimated treatment wise as per prevailing market rates and gross monetary returns was calculated.

3.4.5.5 Net monetary returns (Rs/ha)

Net monetary return was calculated by subtracting the total cost from gross monetary returns treatment wise, since this represent the actual income of the farmer.

3.4.5.6 Benefit cost ratio

The benefit cost ratio was worked out by following formula

$$\text{B: C ratio} = \frac{\text{Gross monetary return}}{\text{Total cost}}$$

3.4.6 Statistical analysis

The data collected on various observations, during the course of investigation were statistically analyzed by Randomized Block Design as suggested by Panse and Sukhatme (1967). The analysis was carried out at Computer Centre, Directorate of Research, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola.

3.4.7 Experimental site

An experiment was carried out at Main Garden, guava orchard, Department of Horticulture and chemical analysis was done at Analytical Laboratory, University Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the year 2014-15.

CHAPTER IV

RESULTS AND DISCUSSION

An experiment entitled "Influence of deblossoming and defoliation on vegetative and reproductive growth of guava" was conducted at Main Garden Guava orchard, Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the year 2014-15 with the following objectives.

1. To study the effect of deblossoming and defoliation on vegetative and reproductive growth of guava.
2. To find out suitable deblossoming and defoliation treatment for better vegetative growth, reproductive growth and fruit yield of guava.

The observations were recorded on various aspects viz., plant growth parameters, flowering parameters, yield parameters and fruit quality parameters. The observations recorded during the course of investigation are presented and discussed in this chapter under appropriate headings and sub headings.

4.1 Influence of deblossoming and defoliation on growth parameters

4.1.1 Influence of deblossoming and defoliation on plant height (m)

The data regarding plant height as influenced by deblossoming and defoliation treatments were recorded and presented in Table 1 and graphically illustrated in Fig.3, indicated that, there was significant difference amongst the different treatments in respect of plant height. It was observed that, the maximum plant height (3.03 m) was observed in treatment T_3 (100% deblossoming + No defoliation) which was statistically at par with treatment T_4 (2.90 m) while minimum plant height (2.51 m) was observed in treatment T_1 (100% deblossoming + 100 % defoliation). The treatment T_3 (100%

deblossoming + No defoliation) shows 9.38 % increased in height than the control.

The maximum plant height was observed in the treatment T_3 (100% deblosssoming + No defoliation) might be due to the deblossoming of summer season flower ultimately resulted in new shoot production by utilizing food material reserved within the tree.

While minimum plant height observed in the treatment T_1 (100% defoliation+ 100% deblossoming) might be due to it require comparatively more time for new shoot production than other treatments. These results are in agreement with the findings of Kumar and Hoda (1977), Singh (2010), and Agnihotri *et al.* (2013) in guava crop.

Table 1. Influence of deblossoming and defoliation on plant height (m)

Treatment		Plant height (m)	Percent increased over control (%)
T_1	100% deblossoming + 100 % defoliation	2.51	-9.38
T_2	50% deblossoming + 50 % defoliation	2.63	-5.05
T_3	100% deblossoming + No defoliation	3.03	9.38
T_4	50% deblossoming + No defoliation	2.90	4.69
T_5	Control	2.77	-
'F' Test		**Sig.**	
SE (m)±		**0.042**	
CD at 5%		**0.130**	

4.1.2 Influence of deblossoming and defoliation on mean plant spread (m)

The data regarding mean plant spread was recorded and presented in Table 2 and graphically shown in Fig.4 revealed that influence of deblossoming and defoliation on mean plant spread showed significant effect. Maximum mean plant spread (3.10 m) was recorded in treatment T_3 (100% deblossoming + No defoliation) which was statistically at par with treatment T_4 (3.01 m) while minimum plant spread (2.58m) was recorded in treatment T_1 (100% deblossoming + 100 % defoliation). The treatment T_3 (100% deblossoming + No defoliation) had 9.54 % more plant spread than the control treatment.

Table 2. Influence of deblossoming and defoliation on mean plant spread (m)

Treatment		Mean Plant Spread (m)	Percent increased over control (%)
T_1	100% deblossoming + 100 % defoliation	2.58	-8.83
T_2	50% deblossoming + 50 % defoliation	2.69	-4.94
T_3	100% deblossoming + No defoliation	3.10	9.54
T_4	50% deblossoming + No defoliation	3.01	6.36
T_5	Control	2.83	-
'F' Test		**Sig.**	
SE (m)±		**0.05**	
CD at 5%		**0.17**	

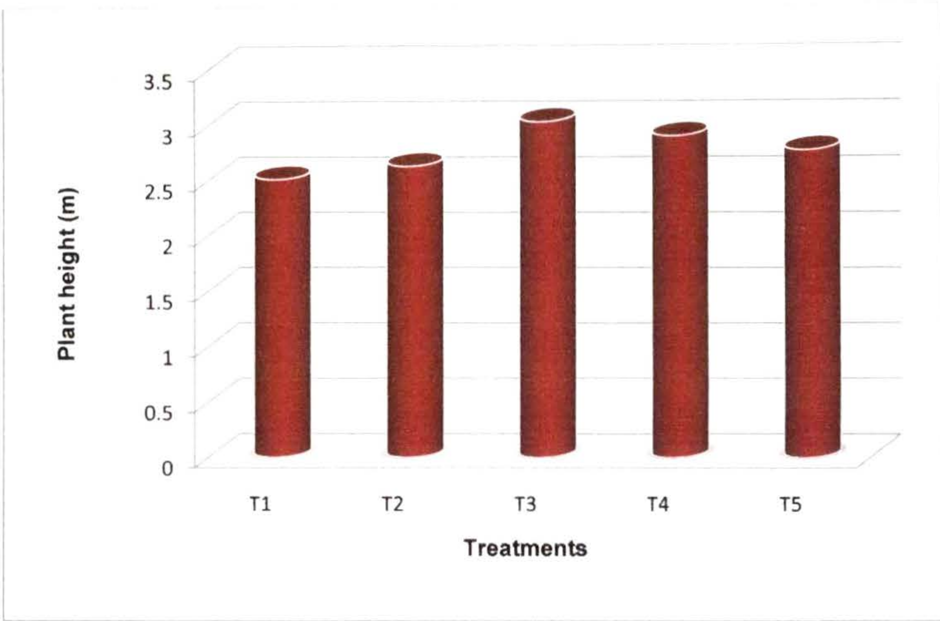


Fig.3 Influence of deblossoming and defoliation on plant height

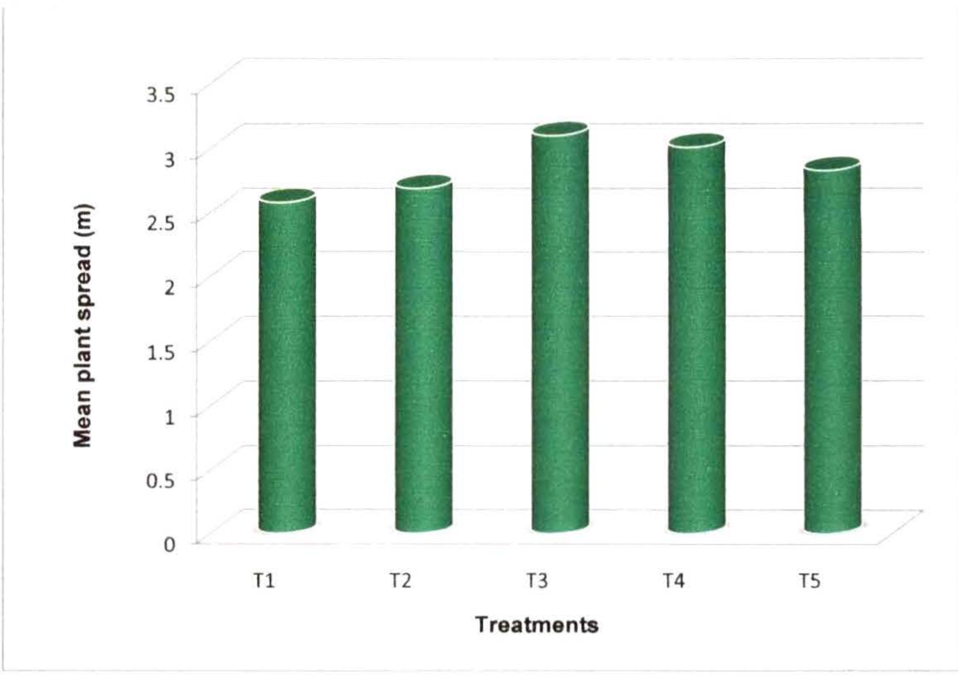


Fig.4 Influence of deblossoming and defoliation on mean plant spread

The maximum mean plant spread was observed in the treatment T_3 (100% deblosssoming + No defoliation) might be due to the deblossoming of rainy crop increases new shoot production. Minimum mean plant spread observed in the treatment T_1 (100% defoliation + 100 % deblossoming) might be due to it require comparatively more time for new shoot production than other treatments. These results are conformity with the findings of Kumar and Hoda (1977), Singh (2010) and Agnihotri *et al.* (2013) who observed that increase in plant spread with deblossoming and defoliation on rainy crop of guava.

4.1.3 Influence of deblossoming and defoliation on days to emergence of vegetative flush

The data regarding days to emergence of vegetative flush after defoliation was recorded and presented in Table 3 and graphically depicted in Fig.5 revealed that, influence of deblossoming and defoliation showed significant effect on days to emergence of vegetative flush. The data clearly indicated that, minimum days (15.12) to emergence of vegetative flush was recorded in treatment T_1 (100% deblossoming + 100 % defoliation) which was statistically at par with treatment T_2 (50% deblossoming + 50 % defoliation) which require (17.5) days while maximum days to emergence of vegetative flush (27.06) was recorded in control treatment. The treatment T_1 (100% deblossoming + 100% defoliation) required comparatively 44.12% less days for emergence of vegetative flush followed by treatment T_2 (50% deblossoming + 50 % defoliation) which required 35.32% less days to emergence of vegetative flush.

Vegetative growth of plants mainly depends upon the nutritional status of plant body which was directly correlated with light penetration and rate of photosynthesis. Hence more carbohydrate reserve in the branches of plant of treatment T_1 (100% deblossoming + 100% defoliation) leads to emergence of vegetative flush earlier than other treatments.

Table 3. **Influence of deblossoming and defoliation on days to emergence of vegetative flush**

Treatment		Days to emergence of vegetative flush	Percent decreased over control (%)
T_1	100% deblossoming + 100 % defoliation	15.12	44.12
T_2	50% deblossoming + 50 % defoliation	17.50	35.32
T_3	100% deblossoming + No defoliation	22.12	18.25
T_4	50% deblossoming + No defoliation	23.75	12.23
T_5	Control	27.06	-
'F' Test		**Sig**	
SE (m)±		**0.80**	
CD at 5%		**2.46**	

These results are in line with the findings of Rajput *et al.* (1986), Nanra *et al.* (2001). Khan *et al.* (2011) also observed that the days required for emergence of vegetative flush was earlier in the treatment 100% defoliation and 100% deblossoming in comparison to other treatments in the experiment of defoliation and deblossoming of guava.

4.1.4 Influence of deblossoming and defoliation on leaf area (cm^2)

The data in respect of leaf area as influenced by deblossoming and defoliation was presented in Table 4 and graphically shown in Fig.6 clearly indicated that, leaf area was significantly influenced by various treatments.

Guava plants under treatment T_1 (100% deblossoming + 100% defoliation) recorded maximum leaf area (54.73 cm^2), which was statistically at par with treatment T_2 (53.3 cm^2) and plants under treatment T_3 (100% deblossoming + No defoliation) recorded minimum (45.76 cm^2) leaf area. The treatment T_1 (100% deblossoming+ 100% defoliation) recorded 8.69% increased in leaf area over control followed by treatment T_2 (50% deblossoming + 50 % defoliation) which shows 5.85% increased over control.

Vegetative growth of plants mainly depends upon the nutritional status of plant body. Maximum leaf area in the trees subjected to T_1 (100% defoliation + 100% deblosssoming) might be due to increased rate of vegetative growth which increased net rate of photosynthesis.

Table 4. Influence of deblossoming and defoliation on leaf area (cm^2)

Treatment		Leaf Area (cm^2)	Percent increased over control (%)
T_1	100% deblossoming + 100 % defoliation	54.73	8.69
T_2	50% deblossoming + 50 % defoliation	53.30	5.85
T_3	100% deblossoming + No defoliation	45.76	-9.11
T_4	50% deblossoming + No defoliation	47.60	-5.46
T_5	Control	50.35	-
'F' Test		**Sig.**	
SE (m)±		**0.53**	
CD at 5%		**1.63**	

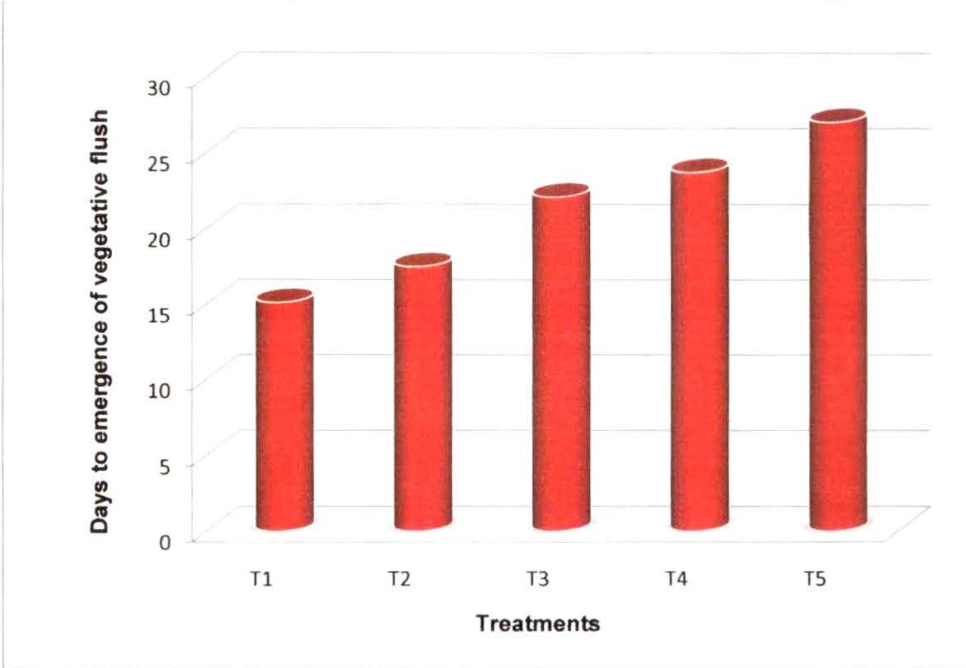


Fig. 5 Influence of deblossoming and defoliation on days to emergence of vegetative flush

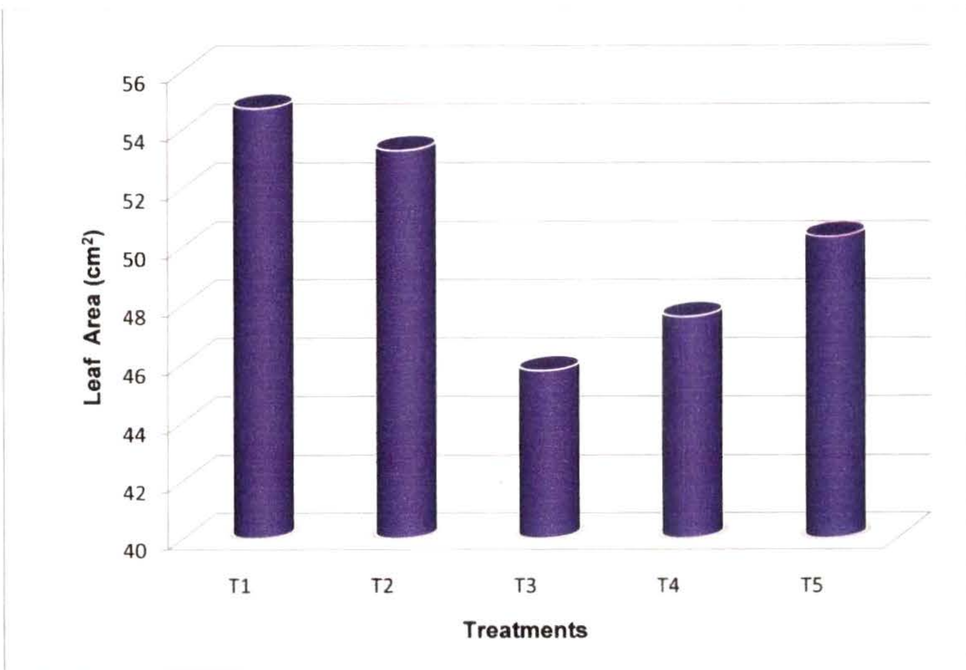


Fig. 6 Influence of deblossoming and defoliation on leaf area

Minimum leaf area obtained in the treatment T_3 (100 % deblossoming + No defoliation) might be due to higher leaf number and leaf age as compared to other treatments. Because these tree were not able to make their food so ultimately size of the leaves decreased. These results of present findings are in line with findings of Singh and Singh (2007), Khan *et al.* (2011) and Agnihotri *et al.* (2013) in guava.

4.2 Influence of deblossoming and defoliation on flowering parameters

4.2.1 Number of flowers per plant (before deblossoming)

The data regarding number of flowers present on plant during summer season before deblossoming were counted and recorded treatment wise. The data regarding number of flower per plant before deblossoming is presented in Annexure I.

4.2.2 Number of deblossomed flowers per plant

The data regarding number of deblosssomed flower per plant were recorded during the time of deblossoming of summer season flowers. The data regarding number of deblossomed flower per plant are presented in Annexure I.

4.2.3 Influence of deblossoming and defoliation on days required for initiation of flowering

The data regarding days required for initiation of flowering in winter season after deblossoming of rainy crop were recorded and presented in Table 5 and graphically illustrated in Fig.7 clearly indicated that, the days required for initiation of flowering in winter season after deblossoming of rainy crop, were significantly influenced by deblossoming and defoliation treatment. The treatment T_3 (100% deblossoming + No defoliation) required minimum number of days (104.62) for initiation of flowering in winter season, after deblossoming of rainy crop, the treatment T_1 (100% deblossoming + 100%defoliation) require (107.37) days. The treatment under control required maximum number of days (116.37) for initiation of flowering. The treatment T_3 (100% deblossoming + No defoliation) required comparatively 10.09 % less time for initiation of flowering as compared to control followed by treatment T_1 (100% deblossoming + 100%defoliation) which required 7.73% less time for initiation of flowering.

The days required for initiation of flowering was minimum in treatment T_3 (100 % deblossoming + No defoliation) was due to deblossoming of rainy crop flowering resulted in accumulation of food material therefore flowering occur earlier in winter season than the control.

Table 5. Influence of deblossoming and defoliation on days required for initiation of flowering

Treatment		Days required for initiation of flowering	Percent decreased over control (%)
T_1	100% deblossoming+ 100 % defoliation	107.37	7.73
T_2	50% deblossoming + 50 % defoliation	110.62	4.94
T_3	100% deblossoming + No defoliation	104.62	10.09
T_4	50 % deblossoming + No defoliation	108.37	6.87
T_5	Control	116.37	-
'F' test		**Sig.**	
SE (m)±		**0.84**	
CD at 5 %		**2.59**	

These results have same line reference with the findings of Rajput *et al.* (1986), Singh and Singh (1994), Pervez *et al.* (1999), Singh *et al.* (1999), Dwivedi *et al.* (1990) and Sahay and Singh (2001) who observed that deblossoming of rainy crop flowering of guava by various crop regulating treatments resulted in early initiation of flowering of winter season crop of guava.

4.2.4 Influence of deblossoming and defoliation on days required from flowering to harvesting

The data regarding days required from flowering to harvesting in winter season was presented in Table 6 and depicted in Fig. 8, it clearly indicated that, days required from flowering to harvesting were significantly influenced by deblossoming and defoliation treatment. The treatment T_3 (100% deblossoming + No defoliation) required minimum number of days (124.50) from flowering to harvesting which is statistically at par with treatment T_1 (100% deblossoming+ 100% defoliation) which required (128.40) days from flowering to harvesting. The maximum number of days (137.12) required from flowering to harvesting was in control treatment. The days required from flowering to harvesting was 9.20 % less in treatment T_3 (100% deblossoming + No defoliation) as compared to control treatment followed by treatment T_1 (100% deblossoming + 100% defoliation) which required 6.35 % less time from flowering to harvesting.

The days required from flowering to harvesting was minimum in treatment T_3 (100% deblossoming + No defoliation) was due to the fact that early initiation of flowering in winter season occur in treatment T_3 therefore treatment T_3 required minimum days from flowering to harvesting as compare to other treatments.

The days taken from flowering to harvesting was maximum in control, because in control all the reserve foods had been used up by previous crop therefore initiation of flowering is late, hence days required from flowering to harvesting were maximum as compare

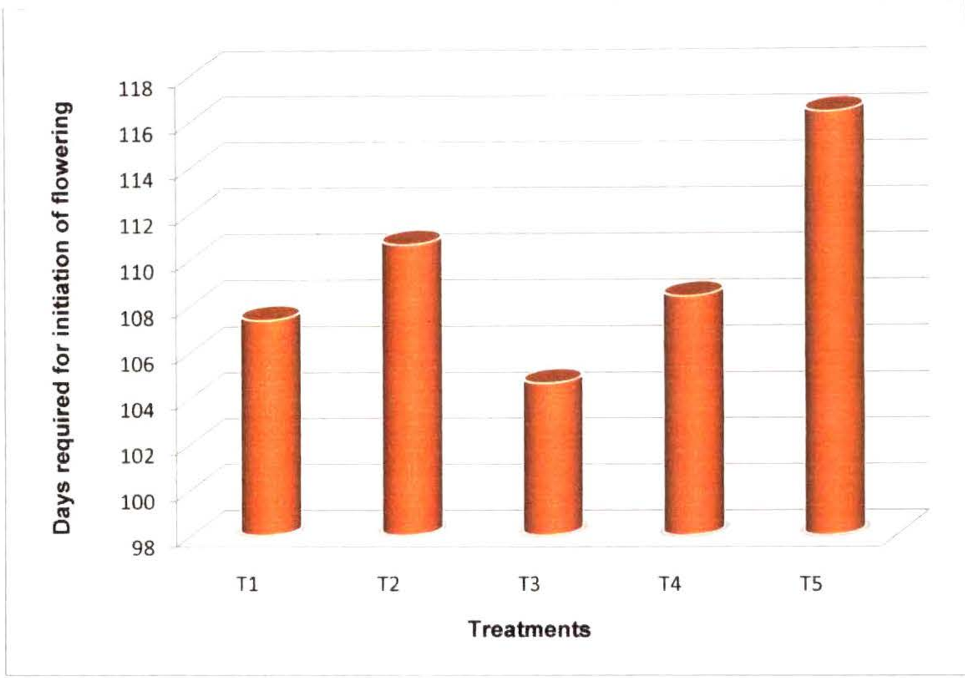


Fig. 7: Influence of deblossoming and defoliation on days required for initiation of flowering

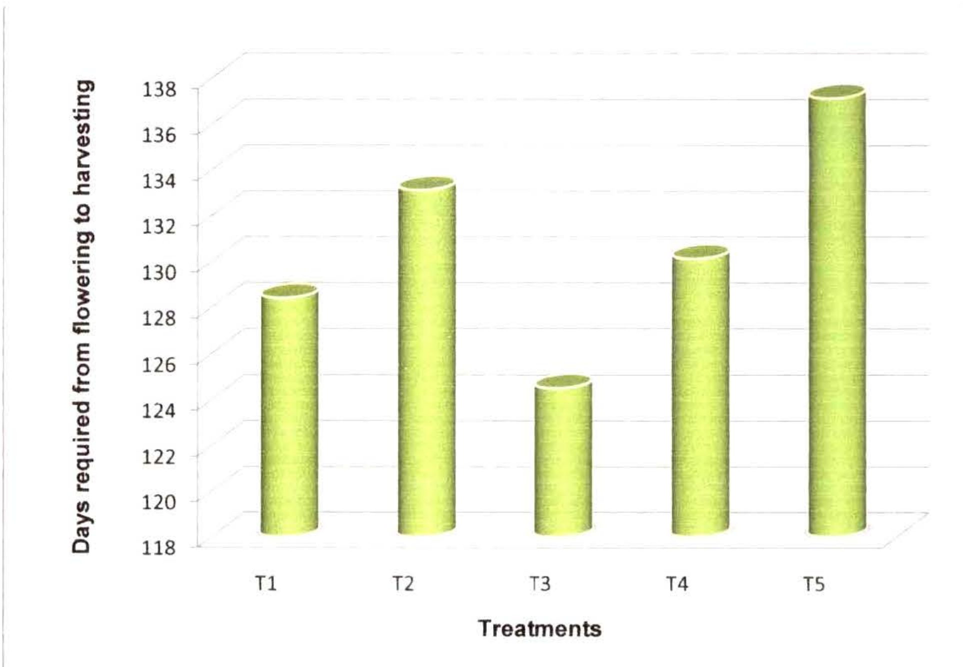


Fig. 8 Influence of deblossoming and defoliation on days required from flowering to harvesting

to other treatments. These results are in close conformity with the findings of Chapman and Paxton (1983), Rajput *et al.* (1986) and Pervez *et al.* (1999) who working with guava reported that deblossoming and defoliation of *ambia bahar* flowering with various treatments resulted in early initiation of flowering which decreased the harvesting period as compare to other treatments.

Table 6. Influence of deblossoming and defoliation on days required from flowering to harvesting

Treatment		Days required from flowering to harvesting	Percent decreased over control (%)
T_1	100% deblossoming+ 100 % defoliation	128.40	6.35
T_2	50% deblossoming + 50 % defoliation	133.12	2.91
T_3	100% deblossoming + No defoliation	124.50	9.20
T_4	50 % deblossoming + No defoliation	130.12	5.10
T_5	Control	137.12	-
'F' test		**Sig.**	
SE (m)±		**1.28**	
CD at 5 %		**3.96**	

4.3 Influence of deblossoming and defoliation on yield parameters

4.3.1 Influence of deblossoming and defoliation on fruit set (%)

The data regarding fruit set as influenced by deblossoming and defoliation treatments were recorded and presented in Table 7 and graphically illustrated in Fig.9 , clearly indicated that, the maximum fruit set (85.12%) was recorded in treatment T_3 (100% deblossoming + No defoliation) followed by treatment T_4 (50% deblossoming + No defoliation) which record (82.43%). However, minimum fruit set (74.43%) was recorded in control treatment.

The treatment T_3 (100% deblossoming + No defoliation) shows 14.36% increased in fruit set over control followed by treatment T_4 (50% deblossoming + No defoliation) which record 10.74% increased in fruit set over control treatment.

Table 7. Influence of deblossoming and defoliation on fruit set (%)

Treatment		Fruit Set (%)	Percent increased over control (%)
T_1	100%deblossomig + 100 % defoliation	79.12 (8.89)	6.30
T_2	50%deblossoming + 50 % defoliation	78.58 (8.86)	5.57
T_3	100% deblossoming + No defoliation	85.12 (9.22)	14.36
T_4	50% deblossoming + No defoliation	82.43 (9.07)	10.74
T_5	Control	74.43 (8.62)	-
'F' test		**Sig.**	
SE (m)±		**0.63**	
CD at 5 %		**1.94**	

Figures in parentheses are square root transformed values

The reason behind maximum fruit set in treatment T_3(100% deblossoming + No defoliation) treatment was that there had not to be any fruit set in rainy crop on completely deblossomed plants so there was reserve nutrients in plant, these nutrients reserve are easily available to the leaves during reproductive growth of tree, which triggered activities of enzymes involved in the formation of sucrose and carbohydrates, increased the carbohydrate content and C/N ratio of leaves and shoot and high carbohydrate was thought to increase fruit set in following winter crop of guava (Vargas *et al.* 1998).

These results are in agreement with the findings of Kundu and Mitra (1997), Singh *et al.* (2006), Khan *et al.* (2011) and Agnihotri *et al.* (2013) who reported during their experiment on regulation of cropping in guava that, different deblossoming treatments on rainy crop of guava shows signinificant increase in fruit set in winter season over control.

4.3.2 Influence of deblossoming and defoliation on fruit weight (g)

Data in respect of fruit weight per tree as influenced by deblossoming and defoliation treatments were recorded and presented in Table 8 and graphically illustrated in Fig. 10, clearly indicated that, there was significant increase in fruit weight by various treatments. The data presented in Table 9 revealed that significantly maximum fruit weight (186.37 g) recorded under treatment T_3 (100% deblossoming + No defoliation) followed by treatment T_4 (50% deblossoming + No defoliation) which record (179.62 g) fruit weight, while minimum fruit weight (131.80 g) was recorded in control treatment.

The treatment T_3 (100% deblossoming + No defoliation) showed 22.11% increase in fruit weight over control followed by treatment T_4 (50% deblossoming + No defoliation) which record 17.69% increase in fruit weight as compared to control. Increase in fruit weight during the winter season crop after the application of defoliation and deblossoming treatment on rainy crop might be due to maximum

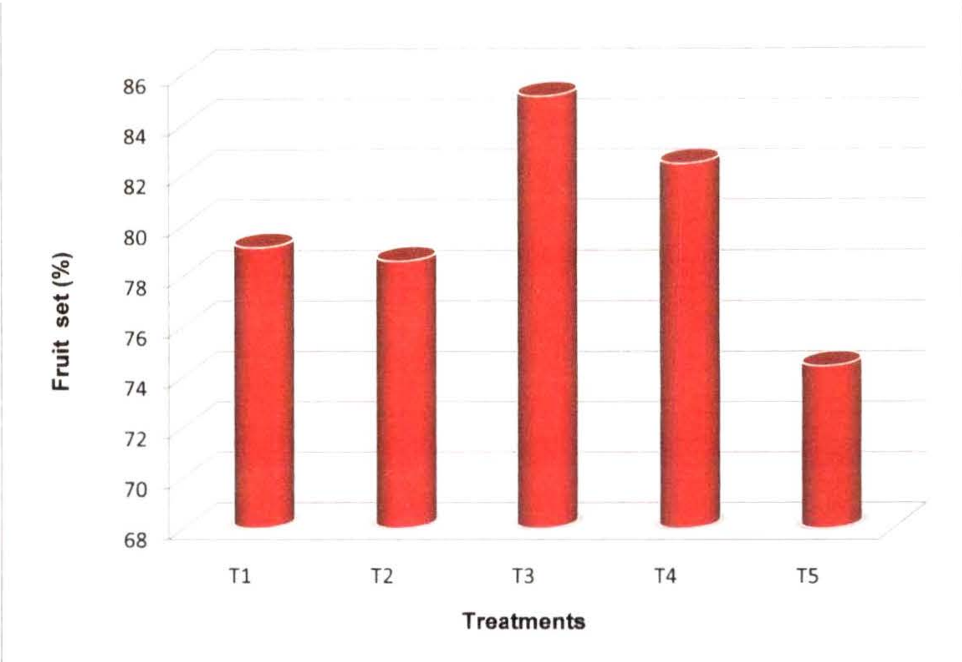


Fig. 9 Influence of deblossoming and defoliation on fruit set

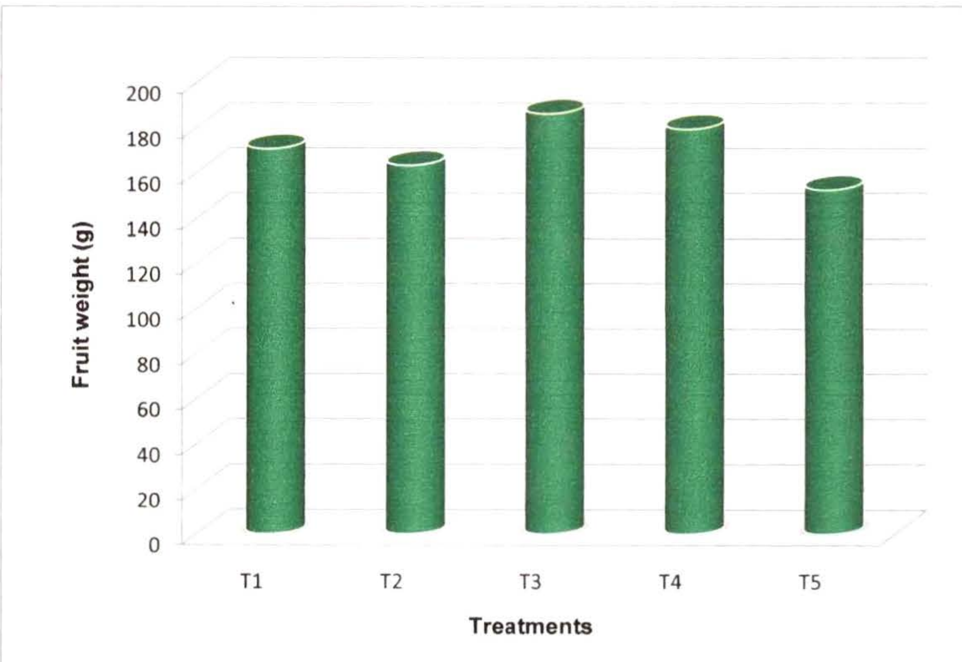


Fig. 10 Influence of deblossoming and defoliation on fruit weight

food reserve available to the fruits during their growth and development.

These results are similar with the findings of Mitra *et al.* (1982), Pervez *et al.* (1999), Sheikh and Hulmani (1993), Dubey *et al.* (2002),Dhaliwal *et al.* (2002), Das *et al.* (2007), Singh *et al.* (2006) who observed that deblossoming of rainy crop of guava by various treatments increases fruit weight in next season as compared to other treatments.

Table 8. Influence of deblossoming and defoliation on fruit weight (g)

Treatment		Fruit weight (g)	Percent increased over control (%)
T_1	100%deblossomig + 100 % defoliation	170.72	11.85
T_2	50%deblossoming + 50 % defoliation	163.37	7.04
T_3	100% deblossoming + No defoliation	186.37	22.11
T_4	50% deblossoming + No defoliation	179.62	17.69
T_5	Control	152.62	-
'F' test		**Sig.**	
SE (m)±		**1.36**	
CD at 5 %		**4.20**	

4.3.3 Influence of deblossoming and defoliation on fruit size (Length and diameter of fruit)

The data regarding fruit size (length and diameter) influenced by different deblossoming and defoliation treatment showed significant variation.

The data presented in Table 9 and depicted in Fig. 11 revealed that in treatment T_3 (100% deblossoming + No defoliation) recorded maximum fruit length (7.32 cm) and diameter (7.58 cm) which was at par with treatment T_4 (50% deblossoming + No defoliation). While minimum fruit length (5.90) and diameter (6.08cm) was observed in control treatment.

The difference in the fruit size might be due to intensity of deblossoming of flower which affects the crop load. Increase in the fruit size during winter crop after the summer application of defoliation and deblossoming might be due to maximum food reserves available to the fruits during their growth and development.

Table 9. Influence of deblossoming and defoliation on fruit size (Length and diameter of fruit)

Treatment		Fruit Size			
		Length of fruit (cm)	Percent increased over control (%)	Diameter of fruit (cm)	Percent increased over control (%)
T_1	100% deblossomig + 100 % defoliation	6.71	13.72	6.93	13.98
T_2	50% deblossoming + 50 % defoliation	6.33	7.28	6.48	6.57
T_3	100% deblossoming + No defoliation	7.32	24.06	7.58	24.67
T_4	50% deblossoming + No defoliation	6.88	16.61	7.17	17.92
T_5	Control	5.90	-	6.08	-
'F' test		Sig.		Sig.	
SE (m)±		0.16		0.20	
CD at 5 %		0.50		0.62	

T1

T2

T3

T4

T5

Plate 2. Size of fruits under different treatments

These results are in conformity with the findings of Khan *et al.* (2013) who found that highest fruit size was achived in winter season at 100% deblossoming with no defoliation while minimum fruit size in respect of fruit length and diameter was observed in the control treatment. Troup and Knoll (1996) found similar resuts in apple. Sahay and Singh (2001), Tahir and Hamid (2002), Das *et al.* (2007) also found similar findings with an experiment of crop regulation in guava.

4.3.4 Influence of deblossoming and defoliation on fruit volume (cc)

The data regarding the fruit volume influenced significantly by deblossoming and defoliation treatment and showed significant variation in fruit volume, which was presented in Table 10.

Table 10. Influence of deblossoming and defoliation on fruit volume (cc)

Treatment		Fruit Volume (cc)	Percent increased over control (%)
T_1	100%deblossomig + 100 % defoliation	165.38	12.57
T_2	50%deblossoming + 50 % defoliation	157.20	7.00
T_3	100% deblossoming + No defoliation	179.11	21.91
T_4	50% deblossoming + No defoliation	173.37	18.01
T_5	Control	146.91	-
'F' test		**Sig.**	
SE (m)±		**1.74**	
CD at 5 %		**5.37**	

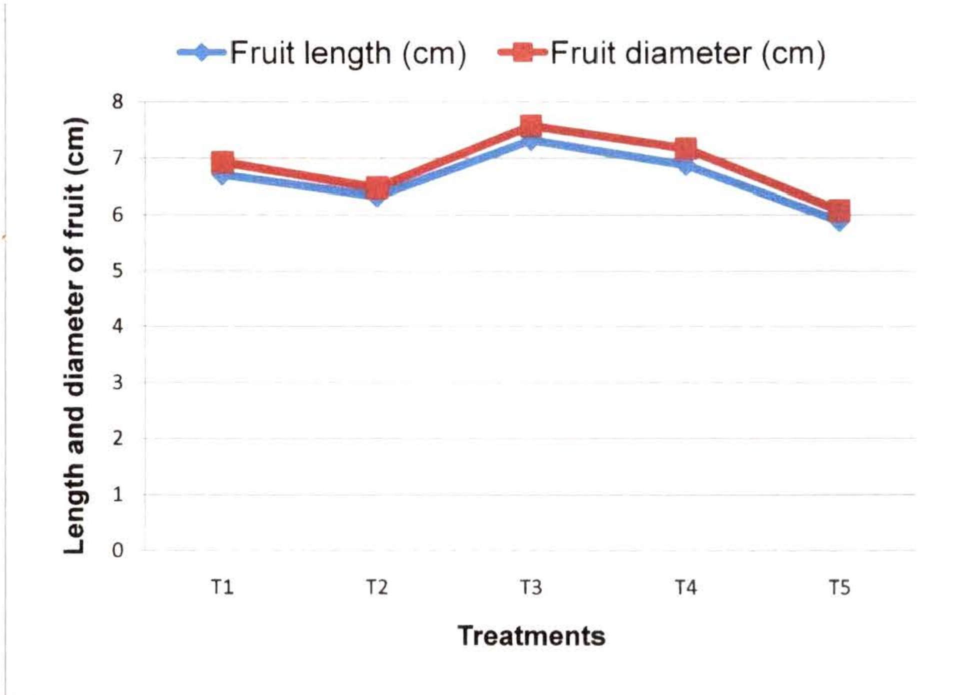


Fig. 11 Influence of deblossoming and defoliation on fruit size

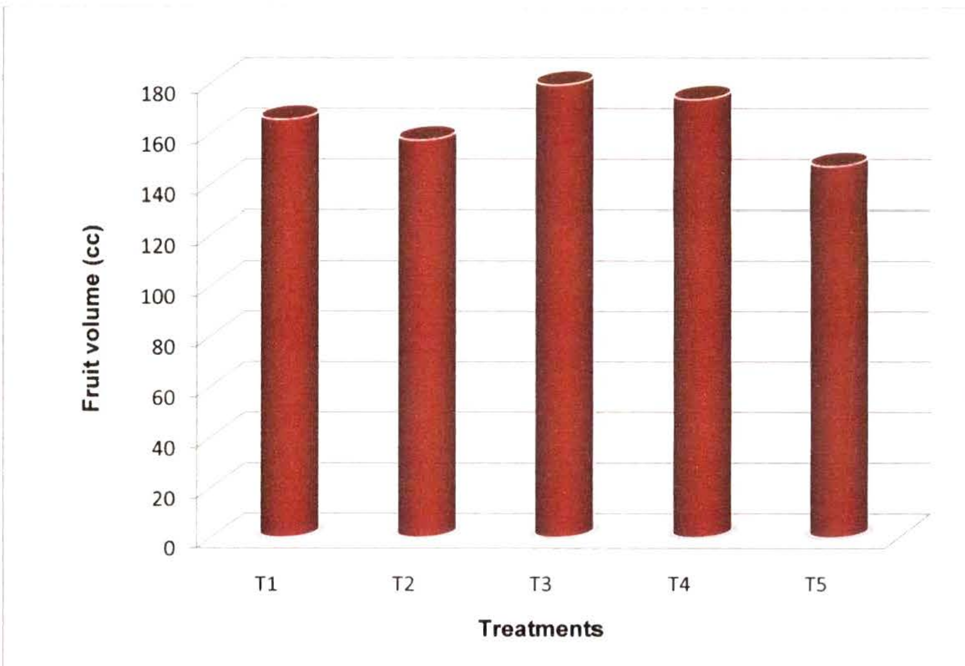


Fig. 12 Influence of deblossoming and defoliation on fruit volume

The data presented in Table 10 and graphically shown in Fig.12 indicated that, significantly maximum fruit volume (179.11 cc) was recorded in treatment T_3 (100% deblossoming+ No defoliation) followed by T_4 (173.37cc) and T_1 (165.38 cc) whereas, minimum fruit volume was recorded in treatment control. (146.91cc).The treatment T_3 (100% deblossoming+ No defoliation) showed 21.91 % increased in fruit volume over control followed by treatment T_4 (50% deblossoming + No defoliation) which record 18.01 % increased in fruit volume over control treatment.

The increased in fruit volume in treatment T_3 (100% deblossoming + No defoliation) might be due to higher fruit size. These findings are in agreement with observations recorded by of Sahay and Kumari (2008) and Haji *et al.* (2012) who found that crop regulation of rainy crop increases fruit volume of subsequent winter season crop. Khan *et al.* (2013) also found the similar findings with hand defoliation and deblossoming of guava tree affect significantly fruit volume of the crop. Maximum fruit volume was observed in the trees subjected to 100 % deblossoming and 50% deblossoming. However minimum fruit volume was observed in control.

4.3.5 Influence of deblossoming and defoliation on number of fruits per tree

The data regarding the number of fruits per tree was recorded and presented in Table 11 and graphically illustrated in Fig. 13, was clearly indicated that, the number of fruits per tree was significantly influenced by various deblossoming and defoliation treatments. The maximum number of fruits harvested per plant (168.12) was recorded in treatment T_3 (100% deblossoming + 100% defoliation) followed with treatment T_4 (50% deblossoming+ No defoliation) which record (159.75) fruits, while minimum number of fruits (139) was recorded in control treatment. The treatment T_3 (100% deblossoming + No defoliation) record 47.81% increased in yield over control followed by treatment T_4 (50% deblossoming+ No defoliation) which record 35.41% increased in yield over control treatment.

As the flowers were removed rainy crop of guava, the reserved food materials and auxins force the plant to produce more flowers of winter crop due to production of more number of flowers that can be supported by photosynthesis and remobilization produce more number of fruits per tree. The maximum fruit was observed in the treatment T_3 (168.12) might be due to fact that the more food reserve are available to the plant.

These results are similar with the findings of Hojo *et al.* (2007) who reported that flower and fruit thinning of rainy crop of guava reported maximum number of fruits in next season. Kumar and Hoda (1977), Bariana *et al.* (2005), Das *et al.* (2007), Mohammed *et al.* (2008) and Agnihotri *et al.* (2013) who also observed the similar findings in guava.

Table 11. Influence of deblossoming and defoliation on number of fruits per tree

Treatment		Number of fruits per tree	Fruit Yield per tree (kg)	Yield per hectare (MT/ha)	Percent increased over control(%)
T_1	100%deblossomig + 100 % defoliation	149.12	25.45	10.17	20.07
T_2	50%deblossoming + 50 % defoliation	158.37	25.87	10.34	22.07
T_3	100%deblossoming + No defoliation	168.12	31.33	12.52	47.81
T_4	50% deblossoming + No defoliation	159.75	28.69	11.47	35.41
T_5	Control	139.00	21.20	8.47	-
'F' test		**Sig.**	**Sig.**	**Sig.**	
SE (m)±		**1.06**	**0.28**	**0.11**	
CD at 5 %		**3.29**	**0.87**	**0.35**	

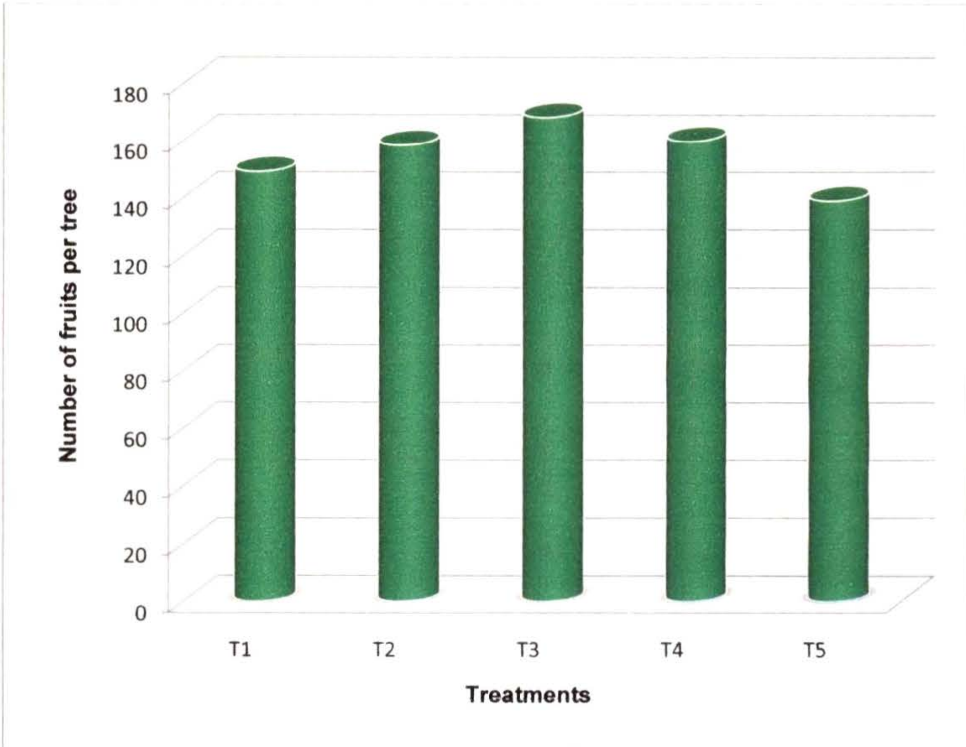


Fig. 13 Influence of deblossoming and defoliation on number of fruits per tree

4.4 Influence of deblossoming and defoliation on qualitative parameters

4.4.1 Influence of deblossoming and defoliation on total soluble solids (^{0}brix)

The data regarding total soluble solids as influenced by various deblossoming and defoliation treatments shows significant variation.

The data presented in Table 12 and graphically illustrated in Fig. 14 indicated that, the highest TSS (11.92°B) was recorded in freshly harvested fruits from the trees which received from treatment T_3(100% deblossoming +No defoliation) which was found statistically at par with T_4 (10.44°B) whereas lowest TSS (9.37°B) was recorded in untreated plants. Treatment T_3 (100% deblossoming +No defoliation) record highest TSS which was 27.21% more than the control followed by treatment T_4 (50% deblossoming + No defoliation) which record 11.41% increased in TSS over control treatment.

The chemical composition of fruit in respect of total soluble solids in the present study showed an increasing trend with increase in deblossoming and defoliation treatment, the improvement in total soluble solids of fruits obtained from deblossoming and defoliated trees might be due to abundant availability of photosynthates for lesser number of fruits leads to quick metabolic transformation of starch into soluble sugars and increases total soluble solids of winter season fruits (Dubey *et al.* 2002).

These results are conformity with the findings of Mitra *et al.* (1982),Sheikh and Hulmani (1983), Dwivedi *et al.* (1990), Sahay and Singh (2001), Sahay and Kumar (2004) and Agnihotri *et al.* (2013), who observed that deblossoming of summer season flowers by various deblossoming treatments increases TSS content of winter season guava fruit.

Table 12. Influence of deblossoming and defoliation on total soluble solids (^{0}brix)

Treatment		Total Soluble Solids TSS (^{0}brix)	Percent increased over control (%)
T_1	100% deblossoming + 100 % defoliation	9.92	5.86
T_2	50% deblossoming + 50 % defoliation	10.11	7.89
T_3	100% deblossoming + No defoliation	11.92	27.21
T_4	50% deblossoming + No defoliation	10.44	11.41
T_5	Control	9.37	-
'F' test		**Sig.**	
SE (m)±		**0.31**	
CD at 5 %		**0.97**	

4.4.2 Influence of deblossoming and defoliation on acidity (%)

The data regarding fruit acidity as influenced by various deblossoming and defoliation treatments were recorded and presented in Table 13.

The data from presented on Table 13 and illustrated in Fig. 15 indicated that, the deblossoming and defoliation treatment showed significant variation. maximum acidity (0.43%) was noticed in control, which is statistically at par with treatment T_2 (50% deblossoming + 50% defoliation) which recorded (0.41%) acidity while minimum acidity (0.34%) was recorded in treatment T_3 (100% deblossoming + No defoliation).The minimum acidity was recorded in treatment T_3 (100% deblossoming + No defoliation) which is 20.93% less than the control.

The lower acidity might be due to early ripening of fruits caused by deblossoming and defoliation treatment, where acid might have been used during respiration or fastly converted into sugars.

These results are similar with the findings of Dubey *et al.* (2002), Tahir and Hamid (2002), Agnihotri *et al.* (2013) in guava who found that application of deblossoming the titratable acidity of guava fruit was decreased.

Table 13. Influence of deblossoming and defoliation on acidity (%)

Treatment		Acidity (%)	Percent decreased over control (%)
T_1	100% deblossoming + 100 % defoliation	0.39 (0.62)	9.30
T_2	50% deblossoming + 50 % defoliation	0.41 (0.64)	4.65
T_3	100% deblossoming + No defoliation	0.34 (0.58)	20.93
T_4	50% deblossoming + No defoliation	0.35 (0.59)	18.60
T_5	Control	0.43 (0.65)	-
'F' test		**Sig.**	
SE (m)±		**0.01**	
CD at 5 %		**0.03**	

Figures in parentheses are square root transformed values

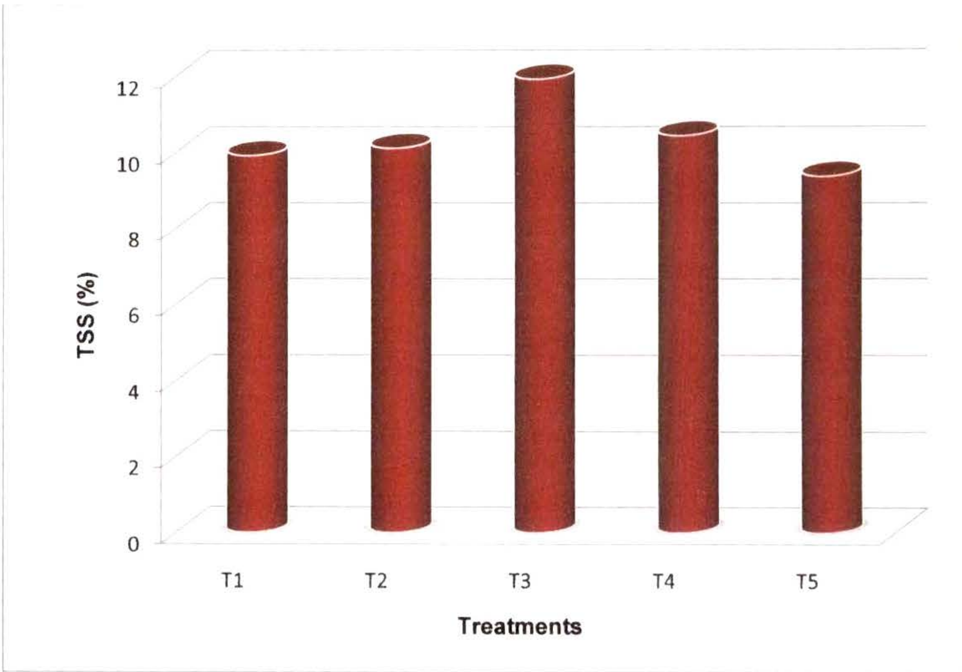


Fig. 14 Influence of deblossoming and defoliation on TSS

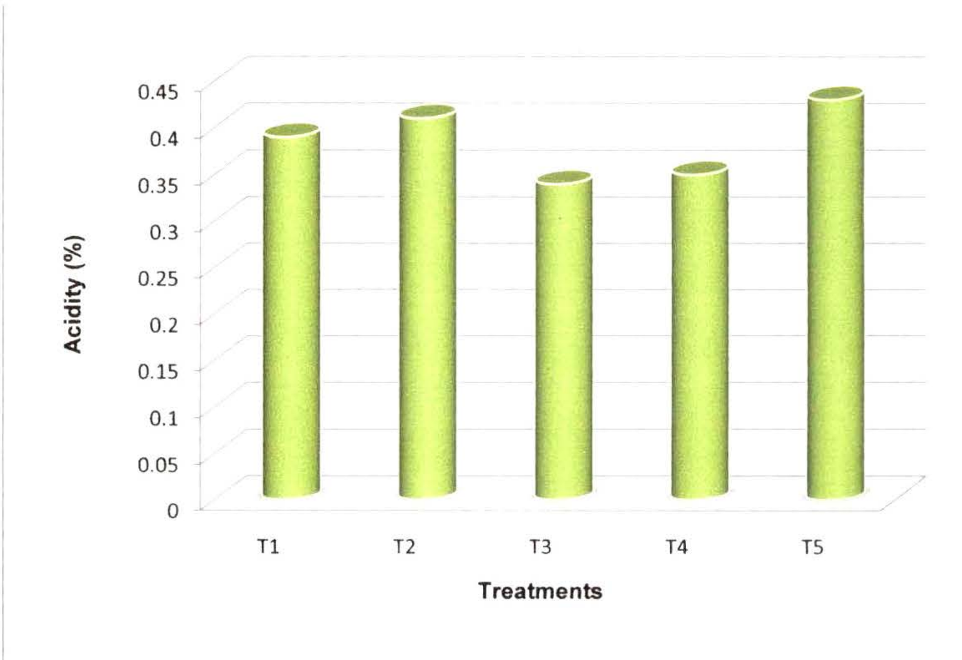


Fig. 15 Influence of deblossoming and defoliation on acidity

4.4.3 Influence of deblossoming and defoliation on ascorbic acid (mg/100g)

Data recorded on ascorbic acid content of guava fruit under various deblossoming and defoliation treatments were recorded and presented in Table 14 and illustrated in Fig.16 The data from Table 14 indicated that, the effect of deblossoming and defoliation on ascorbic acid content was found to be significant.

The data presented in Table 14 revealed that there was increase in ascorbic acid content with deblossoming and defoliation treatment. However maximum ascorbic acid (214.62mg/100g) recorded in treatment T_3 (100% deblossoming + No defoliation) followed by T_4 (209.5 mg/100g) which was found at par with T_2 (208.37mg/100g) and T_1 (206.87 mg/100g) whereas minimum ascorbic acid content (202.37 mg/100g) was recorded in control treatment T_5.The treatment T_3 (100% deblossoming + No defoliation) shows 6.05% increased in ascorbic acid content over control followed by treatment T_4 (50% deblossoming + No defoliation) which shows 3.52 percent increased in ascorbic acid content over control treatment.

Defoliation and deblossoming might be play an active role in the production of auxin in plant species as the production of auxin increases ascorbic acid content in fruits. These results are conformity with findings of Tahir and Hamid (2002) who found that deblossoming in guava improved the level of ascorbic acid content. Similar results were also obtained by Sahay and Kumar (2004), Agnihotri *et al.* (2013) who observed that deblossoming of summer season flowering resulted in maximum ascorbic acid content in winter crop of guava as compared to other treatments.

Table 14. Influence of deblossoming and defoliation on ascorbic acid (mg/100g)

Treatment		Ascorbic acid (mg/100 g)	Percent increased over control (%)
T_1	100% deblossoming + 100 % defoliation	206.87	2.22
T_2	50% deblossoming + 50 % defoliation	208.87	3.21
T_3	100% deblossoming + No defoliation	214.62	6.05
T_4	50% deblossoming + No defoliation	209.5	3.52
T_5	Control	202.37	-
'F' test		**Sig.**	
SE (m)±		**1.06**	
CD at 5 %		**3.27**	

4.4.4 Influence of deblossoming and defoliation on total sugars (%)

Data recorded on total sugars content of guava fruit under various treatments were recorded and presented in Table 15 and illustrated in Fig17. The data from Table 15 indicated that, the effect of deblossoming and defoliation on total sugar content was found to be significant.

The data presented in Table 15 revealed that there was increase in total sugar content. However maximum total sugar (8.01%) recorded in treatment T_3(100% deblossoming+ No defoliation) followed by T_4(7.3%) which was found at par with T_1(6.97) and T_2 (7.22) whereas minimum total sugar (6.74%) recorded in control treatment T_5. Treatment T_3 (100% deblossoming+ No defoliation) shows 18.84% increased in total sugars over control followed by treatment T_4 (50%

deblossoming + No defoliation) which shows 8.30% increased in total sugars over control.

During fruit maturation the sugar accumulation and transformation was regulated by the activities of enzymes which might be involved in the sucrose metabolism in the fruits. due to quick metabolic transformation of starch into soluble sugars and early ripening in response to deblossoming and defoliation treatment the total sugar content of the fruit increases as compare to control. These results are also in line with the findings of Mitra *et al.* (1982), Dwivedi *et al.* (1990), Tahir and Hamid (2002), Basu *et al.* (2007), Haji *et al.* (2012) who found that with deblossoming rainy crop improved the fruit quality of guava with improved sugar content.

Table 15. Influence of deblossoming and defoliation on total sugars (%)

Treatment		Total Sugars (%)	Percent increased over control (%)
T_1	100% deblossoming + 100 % defoliation	6.97 (2.64)	3.41
T_2	50% deblossoming + 50 % defoliation	7.22 (2.68)	7.12
T_3	100% deblossoming + No defoliation	8.01 (2.83)	18.84
T_4	50% deblossoming + No defoliation	7.30 (2.70)	8.30
T_5	Control	6.74 (2.59)	-
'F' test		**Sig.**	
SE (m)±		**0.16**	
CD at 5 %		**0.49**	

Figures in parentheses are square root transformed value.

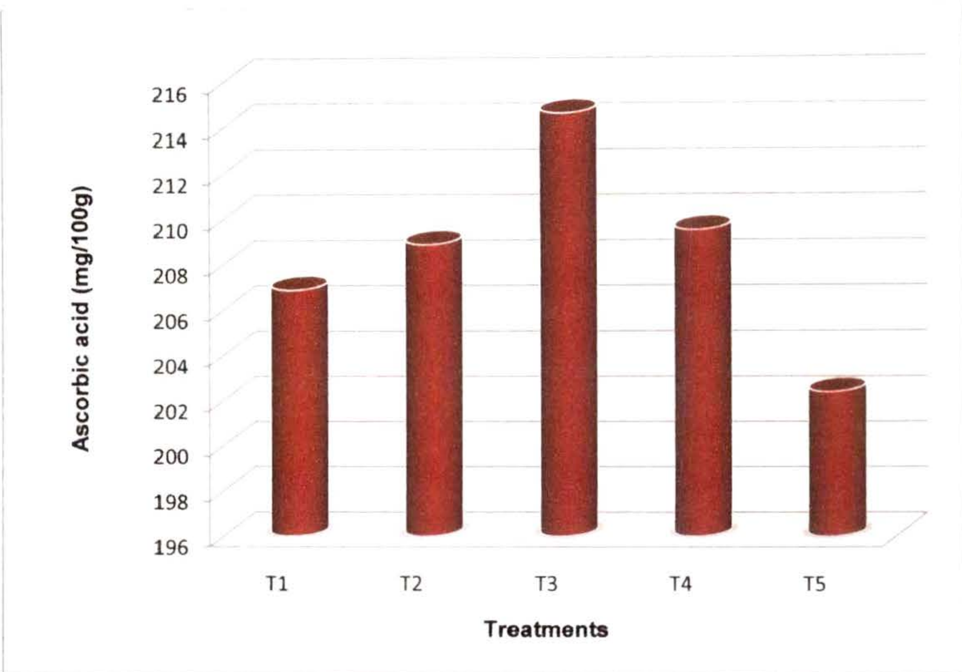


Fig. 16 Influence of deblossoming and defoliation on ascorbic acid

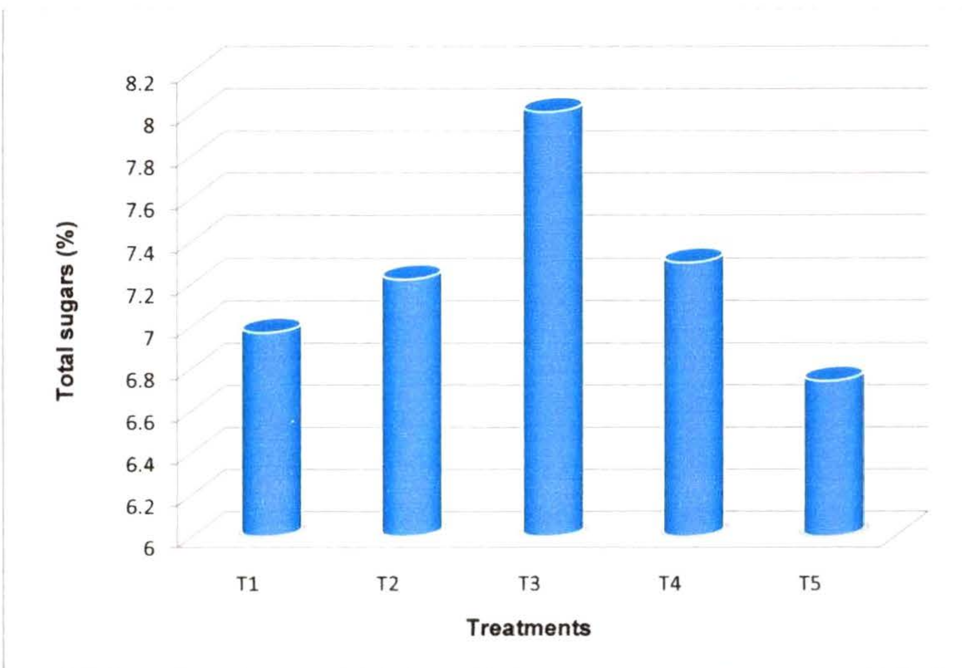


Fig. 17 Influence of deblossoming and defoliation on total sugars

4.4.5 Influence of deblossoming and defoliation on pectin content (%)

The data regarding the pectin content of guava fruit under various treatments were recorded and presented in Table 16 and illustrated in Fig. 18, the data from Table 18 clearly indicated that, the effect effect of deblossoming and defoliation on pectin content was found to be significant.

The data presented in Table 16 revealed that there was maximum pectin content (0.85%) recorded in treatment T_3 (100% deblossoming + No defoliation) followed by treatment T_4 (0.78%) which was found at par with treatment T_1 (0.75) whereas minimum pectin content (0.71%) recorded in control treatment T_5. The treatment T_3 (100% deblossoming + No defoliation) shows 19.71% increased in pectin content over control followed by treatment T_4 (50% deblossoming + No defoliation) which shows 9.85% increased in pectin content over control treatment.

Table 16. Influence of deblossoming and defoliation on pectin content (%)

Treatment		Pectin content (%)	Percent increased over control (%)
T_1	100% deblossoming + 100 % defoliation	0.75 (0.86)	5.63
T_2	50% deblossoming + 50 % defoliation	0.73 (0.85)	2.81
T_3	100% deblossoming + No defoliation	0.85 (0.92)	19.71
T_4	50% deblossoming + No defoliation	0.78 (0.88)	9.85
T_5	Control	0.71 (0.84)	-
'F' test		**Sig.**	
SE (m)±		**0.01**	
CD at 5 %		**0.04**	

Figures in parentheses are square root transformed value.

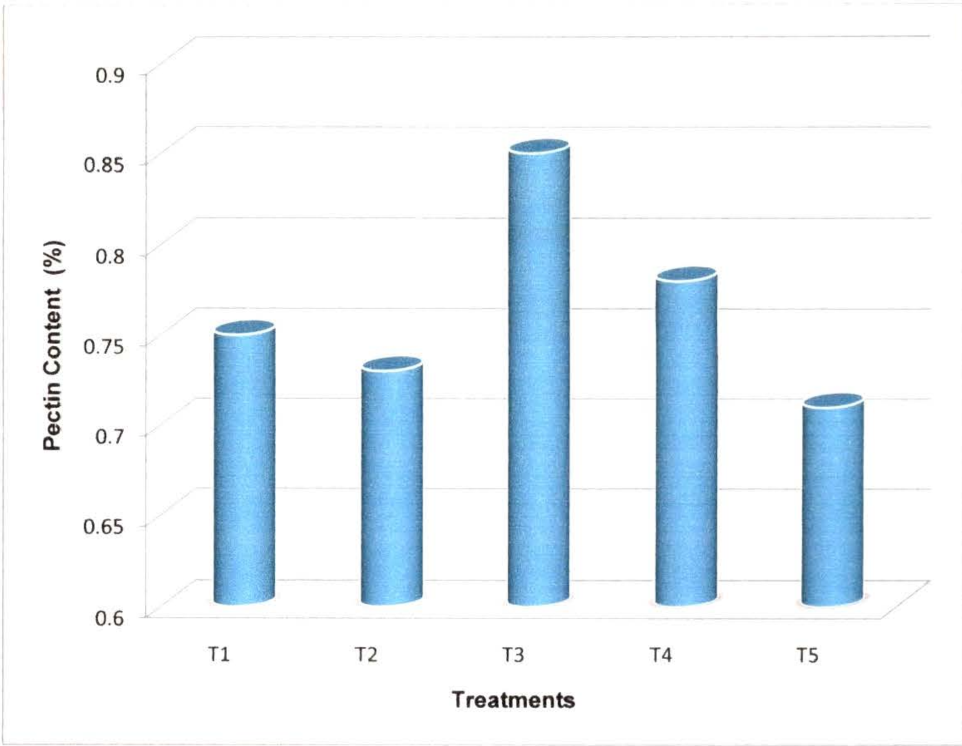


Fig. 18 Influence of deblossoming and defoliation on pectin content

This increase in pectin content in winter season might be due to more temperature and humidity during rainy season. (Mohammed *et al.* 2006).These findings are similar with the findings of Sahay and Singh (2001), Dubey *et al.* 2002, Mohammed *et al.* (2006), and Agnihotri(*et al.* 2013) who observed that deblossoming of summer season flowering with different crop regulating treatments increases pectin content of winter season.

4.5 Economics of Treatments

The data from Table 17 showed that highest net monitory return obtained from treatment T_3 (284560 Rs/ha) with high benefit cost ratio (3.12) followed by T_4 (257060 Rs/ha) with benefit cost ratio 2.95 and T_2 (219160 Rs/ha) with benefit cost ratio 2.40.

Table 17. Economics of treatments (Benefit Cost Ratio)

Particulars	T_1 (100% deblossoming + 100% defoliation)	T_2 (50% deblossoming + 50% defoliation)	T_3 (100% deblossoming + No defoliation)	T_4 (50% deblossoming + No defoliation)	T5 Control
Establishment cost	400	400	400	400	400
Harrowing (Tractor)	3000	3000	3000	3000	3000
N	1820	1820	1820	1820	1820
P	3352	3352	3352	3352	3352
K	2668	2668	2668	2668	2668
FYM	32000	32000	32000	32000	32000
Deblossoming	8000	4000	8000	4000	0
Defoliation	8000	4000	0	0	0
Weeding	3000	2800	3000	3000	3000
Harvesting	3000	3000	3000	3000	3000
Cost A	65240	57040	57040	53040	49040
Cost B	70240	61040	61040	57040	53040
Cost C (Total Cost)	100240	91040	91040	87040	83040
Yield kg/ha	10170	10340	12520	11470	8470
Gross return Rs/ha @30 Rs/kg	305100	310200	375600	344100	228690
Net monetory returns Rs/ha	204860	219160	284560	257060	145650
B: C ratio	**2.04**	**2.40**	**3.12**	**2.95**	**1.75**

Labour cost: Male 180 Rs/Day and Female 120 Rs/Day

CHAPTER V

SUMMARY AND CONCLUSIONS

The present investigation entitled "Influence of deblossoming and defoliation on vegetative and reproductive growth of guava" was conducted at Main Garden guava orchard, Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the year 2014-15 with the following objectives.

1) To study the effect of deblossoming and defoliation on vegetative and reproductive growth of guava.

2) To find out suitable deblossoming and defoliation treatment for better vegetative growth, reproductive growth and fruit yield of guava.

The guava tree has ability to flower throughout the year with three different flowering seasons that is in the month of January-February, June-July and in the month of October-November. The fruits of January-February flowering becomes ready in June-July called as rainy season crop. The fruits of June-July flowering becomes ready in Octomber-November called as winter season crop. The crop produced of guava during rainy season is inferior, insipid in taste, small in size, poor in quality and also attacked by many pest and diseases. On the other hand winter season crop is superior in quality free from diseases and pest and get high return. So there is need to regulate and prolong rainy season crop to winter, to get higher yield and better quality fruits from winter season the present investigation was carried out.

The experiment was laid out in Randomized Block Design with five treatments *viz.*,T_1-100% deblossoming (January-February) + 100% defoliation (Last week of April), T_2-50% deblossoming (January-February) + 50% defoliation (Last week of April), T_3-100% deblossoming (January-February) + No defoliation, T_4-50% deblossoming(January-February)+ No defoliation and T_5-Control which were replicated four times to study the influence of deblossoming and defoliation on plant growth parameters in respect of plant height, mean plant spread, days to emergence of vegetative flush after defoliation and leaf area was recorded. Flowering parameters like number of flowers per plant, number of deblossomed flowers per plant, days required for initiation of flowering, days required from flowering to harvesting were recorded. The yield attributing characters *viz.*, fruit set percent, fruit weight, fruit size in respect of length and diameter, fruit volume and number of fruits per tree were recorded. For studying the fruit quality, the chemical parameters of fruits *viz.*, total soluble solids, acidity, ascorbic acid content, total sugars and pectin content were recorded.

The plant growth parameters in respect of plant height and mean plant spread was found maximum in the plants treated with treatment T_3 (100% deblossoming + No defoliation). The leaf area was found maximum in treatment T_1 (T_1 (100% deblossoming+ 100% defoliation)and minimum in treatment T_3(100% deblossoming + No defoliation) and days taken to emergence of vegetative flush was minimum in treatment T_1 (100% deblossoming+ 100% defoliation) and maximum in treatment T_3 (100% deblossoming + No defoliation).

The flowering parameters like days required for initiation of flowering and days required from flowering to harvesting was recorded minimum in treatment T_3 which was treated with 100% deblossoming+ No defoliation

Similarly, yield contributing character on the basis of the highest fruit set, fruit weight and number of fruits per tree was recorded significantly maximum in treatment T_3 (100% deblossoming+ No defoliation).

Significantly superior fruit quality in respect of bigger fruit size (length and diameter of fruit), fruit volume with maximum total soluble solids, ascorbic acid content, total sugars and pectin content was recorded in treatment T_3 (100% deblossoming+ No defoliation).

Conclusions

On the basis of findings reported in present investigation, the response of deblossoming and defoliation on vegetative growth, flowering parameters, yield and yield attributing characters and fruit quality of guava was found to be promising.

The response of deblossoming and defoliation on the plant growth in terms of plant height, mean plant spread, days to emergence of vegetative flush and leaf area showed significant variations.

The flowering parameters *viz,* days required for initiation of flowering and days required from flowering to harvesting was minimum in treatment T_3 (100% deblossoming+ No defoliation).

The yield attributing characters viz., fruit set, fruit weight, fruit size (length and diameter), fruit volume, number of fruits per tree was observed in treatment T_3 (100% deblossoming+ No defoliation).

The fruit quality in respect of total soluble solids, ascorbic acid, total sugars and pectin content was observed higher in treatment T_3 (100% deblossoming+ No defoliation) .

Highest net monitory returns obtained from the treatment T_3 (100% deblossoming+ No defoliation) with high benefit cost ratio 3.12.

In conclusions, the defoliation and deblossoming significantly affected the vegetative and reproductive growth of guava cv. 'L-49'. Defoliation had less impact on the vegetative and reproductive growth of guava, while deblossoming can be effectively used to encourage the winter season crop.

The conclusions are based on the findings of one-year experimentation. However, further studies are required to standardize best level of deblossoming of rainy season crop for consistency in guava productivity.

CHAPTER VI

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APPENDIX I

Weekly weather Data for the Year 2013 recorded at Agro met. Observatory, Dr. PDKV, Akola																				
		Actual				2014									Normal			1971-2010		
Weeks	Dates	T MAX (°C)		T MIN (°C)		BSH (hrs)		WS (km/hr)		RH I (%)		RH II (%)		Evap (mm)		RF (mm)		CRF (mm)	Rainy Days	
		N	A	N	A	N	A	N	A	N	A	N	A	N	A	N	A		N	A
1	1-7 Jan	28.8	29.0	11.0	13.0	8.2	4.8	4.4	1.0	71	80	31	31	4.2	4.4	2.8	0.0	0.0	0.2	0.0
2	8-14	29.3	28.5	11.7	13.9	8.3	4.6	4.4	2.3	71	80	30	34	4.4	3.7	3.3	0.0	0.0	0.2	0.0
3	15-21	30.0	29.2	12.0	15.8	8.6	3.4	4.5	2.0	68	76	28	33	4.9	4.7	0.7	0.4	0.4	0.1	0.0
4	22-28	30.6	28.9	12.0	14.5	8.8	3.3	4.6	1.9	65	81	26	31	5.2	4.2	0.9	0.0	0.4	0.1	0.0
5	29-4 Feb	31.0	30.0	12.6	11.0	8.8	8.4	4.9	1.7	62	59	25	16	5.5	5.2	3.0	0.0	0.4	0.2	0.0
6	5-11	31.4	31.9	12.7	14.0	8.8	7.6	5.0	1.7	59	60	23	20	5.9	5.3	3.7	0.0	0.4	0.3	0.0
7	12-18	32.7	29.4	14.4	12.7	9.0	7.4	5.4	2.3	55	64	22	24	6.6	6.7	0.1	0.0	0.4	0.0	0.0
8	19-25	33.4	31.7	14.5	16.2	9.1	5.9	5.7	2.0	54	64	21	29	7.3	6.2	2.5	2.0	2.4	0.2	0.0
9	26-4 Mar	35.0	30.2	15.7	15.3	9.5	7.5	6.1	2.8	50	76	18	25	8.2	5.7	4.1	34.7	37.1	0.3	3.0
10	5-11	35.9	28.9	17.3	16.5	9.2	6.0	6.1	3.1	46	83	20	29	8.8	4.4	5.2	8.6	45.7	0.3	2.0
11	12-18	37.0	35.3	18.1	18.9	9.1	8.7	6.3	2.2	45	70	18	16	9.2	6.5	2.4	7.9	53.6	0.3	1.0
12	19-25	38.4	37.8	19.3	20.0	9.2	8.7	6.4	2.8	39	43	15	11	10.4	9.7	0.6	0.0	53.6	0.1	0.0
13	26-1 Apr	39.0	39.8	20.4	23.7	9.2	8.0	6.9	2.8	37	35	15	11	11.2	9.5	2.2	0.0	53.6	0.2	0.0
14	2-8 Apr	40.0	39.9	21.7	22.2	9.4	8.0	7.3	3.1	37	30	14	9	11.7	10.2	1.0	0.0	53.6	0.1	0.0
15	9-15	40.8	39.3	23.1	21.8	9.5	7.5	8.4	3.5	35	38	14	10	12.9	10.6	0.4	0.0	53.6	0.1	0.0
16	16-22	41.6	40.4	24.1	23.8	9.7	8.2	8.6	3.5	36	52	14	22	13.9	10.7	0.5	4.2	57.8	0.1	1.0
17	23-29	42.3	41.5	25.4	24.2	9.8	8.7	9.0	3.8	37	38	15	11	14.7	12.7	0.5	0.0	57.8	0.1	0.0
18	30- 6 May	42.6	42.6	26.6	25.5	9.4	8.3	10.5	3.2	39	38	15	11	15.5	11.7	0.8	6.4	64.2	0.1	1.0
19	7-13	42.6	39.3	27.1	25.8	9.7	6.6	12.2	6.4	42	56	17	21	16.2	10.8	1.3	0.8	65.0	0.1	0.0
20	14-20	42.5	41.2	27.7	26.5	9.4	7.5	14.2	5.1	47	46	19	21	16.8	11.7	2.8	0.0	65.0	0.4	0.0
21	21-27	42.1	43.3	27.8	27.2	9.5	7.2	15.1	6.7	50	47	20	16	16.9	13.1	3.8	3.2	68.2	0.4	0.0
22	28-3 Jun	41.7	43.6	27.8	28.3	9.4	8.3	15.2	7.1	53	48	23	21	16.2	11.8	6.3	4.5	72.7	0.4	1.0
23	4-10	40.2	43.0	26.9	29.6	8.4	6.5	15.2	10.9	62	49	30	26	14.0	16.6	16.8	0.0	72.7	1.0	0.0
24	11-17	38.0	39.3	25.7	25.3	7.1	8.5	13.4	10.4	69	66	40	28	11.1	13.2	43.6	22.5	95.2	1.7	2.0
25	18-24	35.5	37.2	25.0	26.8	5.8	4.7	14.2	14.6	74	63	48	31	9.2	14.3	43.5	1.5	96.7	2.0	0.0
26	25-1Jul	33.8	38.2	24.3	26.8	4.8	5.2	12.8	15.0	80	61	55	31	7.4	14.3	43.4	1.7	98.4	2.2	0.0
27	2-8	33.2	36.4	24.0	26.3	4.8	4.1	12.0	12.5	81	74	58	44	6.5	11.9	39.4	1.4	99.8	2.2	0.0
28	9-15	32.3	35.1	23.8	24.7	3.8	2.8	11.2	10.0	83	84	60	51	5.5	6.8	42.8	48.6	148.4	2.5	1.0
29	16-22	31.9	30.7	23.6	23.9	4.0	1.5	10.4	8.8	84	88	63	70	5.2	3.8	52.8	45.8	194.2	2.4	6.0
30	23-29	31.3	28.2	23.3	22.6	4.0	1.2	10.8	11.4	86	90	64	68	4.8	4.7	43.4	194.2	388.4	2.6	3.0
31	30-5 Aug	30.9	31.6	23.3	24.2	3.5	3.2	10.6	7.6	86	89	67	66	4.6	6.0	49.6	16.4	404.8	2.4	1.0
32	6-12	29.9	32.2	23.0	23.6	3.2	5.9	10.9	11.9	88	87	70	48	4.1	8.3	61.0	13.7	418.5	2.8	2.0
33	13-19	30.4	33.6	23.0	23.6	4.0	6.9	12.4	9.5	87	89	67	46	4.5	7.1	35.9	6.9	425.4	2.0	2.0
34	20-26	30.4	33.8	22.8	23.6	4.1	5.6	11.9	1.9	87	92	67	57	4.3	4.1	42.5	28.9	454.3	1.9	4.0
35	27-2 Sep	30.5	29.1	22.7	22.4	4.2	2.1	9.3	4.1	87	94	66	81	4.6	5.0	42.4	73.6	527.9	2.1	5.0
36	3-9	31.0	28.8	22.5	22.7	5.3	3.3	8.6	8.7	87	93	62	65	5.3	7.0	33.6	109.2	637.1	1.5	3.0
37	10-16	32.1	30.3	22.4	22.6	6.6	4.2	8.0	7.3	85	88	57	65	5.1	5.7	22.0	0.7	637.8	1.1	0.0
38	17-23	32.9	32.5	22.4	23.1	6.8	6.0	6.4	6.4	84	90	55	56	5.2	5.2	23.7	0.5	638.3	1.4	0.0
39	24-30	33.5	34.5	22.1	20.7	7.3	8.5	5.1	1.0	84	81	50	37	5.0	4.2	24.4	2.0	640.3	1.4	0.0
40	1-7 Oct	33.7	36.5	21.2	21.1	7.6	7.4	4.8	1.4	82	73	47	29	5.4	5.2	23.4	0.0	640.3	1.1	0.0
41	8-14	34.0	36.8	19.8	20.9	8.1	5.6	4.5	1.7	78	66	40	26	5.3	5.4	13.1	0.0	640.3	0.7	0.0
42	15-21	33.7	34.5	18.3	21.8	8.2	5.6	4.6	1.4	76	76	37	37	5.3	5.6	6.1	0.0	640.3	0.4	0.0
43	22-28	33.1	31.9	16.8	18.0	8.3	4.3	4.4	1.1	74	77	34	37	5.3	4.0	7.6	0.0	640.3	0.4	0.0
44	29-4 Nov	32.7	33.8	16.0	15.9	8.4	7.9	4.1	1.3	73	68	32	21	5.3	4.7	2.3	0.0	640.3	0.2	0.0
45	5-11	32.3	33.5	15.2	16.6	8.4	6.5	3.9	1.4	71	69	32	28	5.1	5.2	3.0	0.0	640.3	0.2	0.0
46	12-18	31.6	30.0	14.6	20.4	8.3	3.2	3.9	2.2	73	87	32	46	4.8	3.5	5.3	20.1	660.4	0.2	2.0
47	19-25	31.0	31.7	13.3	12.9	8.4	7.4	3.7	0.9	72	72	30	16	4.6	4.2	7.7	0.0	660.4	0.3	0.0
48	26-2 Dec	30.5	32.2	12.8	12.4	8.4	7.2	3.6	0.6	71	75	32	15	4.4	3.6	5.5	0.0	660.4	0.3	0.0
49	3-9	30.0	30.8	11.9	10.9	8.4	8.3	3.8	0.9	71	73	30	18	4.3	4.4	1.0	0.0	660.4	0.1	0.0
50	10-16	29.6	29.5	10.9	14.4	8.4	4.7	3.6	1.5	71	74	28	33	4.2	4.6	0.8	0.9	661.3	0.1	0.0
51	17-23	29.5	26.4	10.8	6.9	8.5	8.3	3.8	1.6	70	71	29	16	4.1	5.0	0.9	0.0	661.3	0.1	0.0
52	24-31	29.1	28.6	11.1	8.3	8.3	8.6	4.5	1.5	71	69	30	16	4.2	5.2	2.6	0.0	661.3	0.2	0.0
											TOTAL RFJanuary to Dec						661.3			40
											Total RFJune to Dec						593.1			32

APPENDIX-II

ALL INDIA AREA, PRODUCTION AND PRODUCTIVITY OF GUAVA

Year	Area (in '000 ha)	% of Total Fruit Area	Production (in '000 MT)	% of Total Fruit Production	Productivity (in MT/ha)
1991-92	94.0	3.3	1095.1	3.8	11.7
2001-02	154.6	3.9	1715.5	4.0	11.1
2002-03	154.6	4.1	1793.0	4.0	11.6
2003-04	166.4	3.6	1830.7	4.0	11.0
2004-05	161.0	3.2	1682.8	3.4	10.5
2005-06	166.5	3.1	1736.6	3.1	10.4
2006-07	176.0	3.2	1831.0	3.1	10.4
2007-08	179.0	3.1	1981.0	3.0	11.1
2008-09	204.0	3.3	2270.0	3.3	11.1
2009-10	219.7	3.5	2571.5	3.6	11.7
2010-11	205.0	3.2	2462.0	3.3	12.0
2011-12	219.9	3.3	2510.4	3.3	11.4
2012-13	235.6	3.4	3198.3	3.9	13.6
2013-14	268.2	3.7	3667.9	4.1	13.7

Source: Indian Horticulture Database, NHB (2013)

APPENDIX-III

STATEWISE AREA, PRODUCTION & PRODUCTIVITY OF GUAVA

(Area in '000 ha, Production in '000 MT and Productivity = MT/ha, A = Area, Pr = Production, Pv = Productivity)

State	2011-12			2012-13			2013-14		
	A	Pr	Pv	A	Pr	Pv	A	Pr	Pv
Madhya Pradesh	165	255.3	15.5	21.3	801.0	37.6	22.4	841.1	37.6
Uttar Pradesh	14.4	251.5	17.5	15.3	291.4	19.0	45.0	605.0	13.4
Bihar	29.5	245.2	8.3	29.7	259.5	8.7	30.0	373.7	12.5
Maharashtra	37.0	322.0	8.7	39.0	305.0	7.8	40.0	324.0	8.1
West Bengal	14.1	179.8	12.8	14.2	184.0	13.0	14.4	186.0	13.0
Punjab	7.9	173.8	22.0	8.1	177.6	22.0	8.2	180.8	22.0
Chhattisgarh	15.6	121.3	7.8	17.1	140.9	8.2	19.3	162.8	8.4
Karnataka	7.1	135.1	19.0	6.8	134.9	19.8	6.4	143.4	22.3
Gujrat	10.5	158.3	14.9	10.6	158.1	14.9	10.8	140.8	13.0
Haryana	9.7	87.1	9.0	10.4	107.6	10.4	10.7	125.0	11.7
Andhra Pradesh	8.9	134.0	15.1	12.3	184.5	15.0	6.9	104.1	15.0
Odisha	14.3	103.4	7.2	14.2	103.7	7.3	14.2	103.6	7.3
Telangana	-	-	-	-	-	-	6.0	90.0	15.0
Assam	5.0	99.3	19.9	5.3	105.8	20.1	4.2	83.8	20.0
Others	29.5	246.4	8.4	31.3	244.4	7.8	29.8	203.7	6.8
Total	219.9	2510.4	11.4	235.6	3198.3	13.6	268.2	3667.9	13.7

Source: Indian Horticulture Database, NHB (2013)

ANNEXURE I

The data regarding flowering parameters viz. number of flower present on plant during summer season and number of deblossomed flower per plant were presented below.

1) Number of flowers per plant

The data regarding number of flower present on plant during summer season at the time of deblossoming were counted and recorded per treatment. The data regarding number of flowers per plant in rainy season are presented below.

2) Number of deblossomed flowers per plant

The data regarding number of deblosssomed flowers per plant were recorded during summer season. In treatment T_1 (100% deblossoming + 100 % defoliation) and treatment T_3 (100% deblossoming + No defoliation) all flowers present on plant during summer season were removed. In treatment T_2 (50% deblossoming + 50% defoliation) and treatment T_4 (50% deblossoming + No defoliation) out of the total flowers present 50% flowers were removed. The data regarding number of deblossomed flower per plant are given below.

Table.1 Flowering parameters of rainy season recorded at the time of deblossoming

Treatment		Number of flowers per plant (Rainy crop)	Number of deblossomed flowers per plant
T_1	100% deblossoming+ 100 % defoliation	149	149
T_2	50% deblossoming + 50 % defoliation	161.5	80.75
T_3	100% deblossoming + No defoliation	157.75	157.75
T_4	50 % deblossoming + No defoliation	160	80
T_5	Control	157	0
'F' test		**NS**	**Sig.**
SE (m)±		**4.90**	**3.25**
CD at 5 %		**15.11**	**10.01**