Research Article

Influence of De-blossoming and GA_3 Application on Fruit Drop and Growth of Winter Guava

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Abstract | Influence of deblossoming and GA_3 application on fruit drop and growth of winter guava was carried out in Horticulture Farm at The University of Agriculture Peshawar, Pakistan during 2016. RCB Design was used for this experiment with three replications i.e. factor A was Deblossoming Time (Control, May, June, July, August and September) and factor B was GA_3 application (0, 10, 20, 30, 40 and 50 ppm). Results demonstrated that minimum fruit drop (5.95%), fruit density (0.80gcm^{-3}) with maximum number of new shoots (55.7), number of new flowers (225.3), fruit weight (197.5g), and fruit volume (245.5cm^3) were recorded in plants deblossomed in September treated with 50 ppm of GA_3. While maximum fruit density (1.13gcm^{-3}) was recorded in the month of July fruits treated with 10 ppm of GA_3. While maximum fruit drop (11.69%), titratable acidity (0.59%), with minimum number of new shoots (16.3), number of new flowers (65.3), fruit weight (53.3g), and fruit volume (48.1cm^3) were recorded in plants which were not deblossomed and sprayed with distilled water. It is concluded from the current study that Deblossoming time and GA_3 application might be significantly reduced the fruit drop and enhanced the growth of guava tree.

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Introduction

Guava (*Psidium guajava L.*) was originated in tropical regions of America, which belongs to family Myrtaceae. In Pakistan guava is known as the leading fruit crop and ranked third in this region after the higher production of citrus and mango fruits. In Pakistan, production area of guava is 62.3 thousand hectare, producing 512.3 thousand tons with an average yield of 8.223 tons ha^{-1}. Punjab is the largest province in Pakistan, therefore, Punjab is a major shareholder in production of guava (Anon, 2010). Guava is a healthy fruit, rich in Vitamins A, B1 (Thiamin), B2 (Riboflavin) and Vitamin C. Several minerals such as Phosphorus, Calcium and Potassium are essential for human body (Yadava, 1994). On the other hand, Red-fleshed guava has been considered the best source of carotene. Furthermore guava is consumed as a fresh fruit (Dhaliwal and Singla, 2002) or preserves as juice and used in dairy or bakery items (Jagtiani et al.,1988). In addition, Guava has praised for its medicinal value (Morton, 1987; Joseph and Priya, 2011) especially it helps in reduction level of cholesterol while it help in increasing the high-density lipid (Singh et al., 1992). The regulation of flowering by optimizing thinning intensity and GA_3 concentrations may not only help in switching fruit production toward the winter months but could also improve the yield, fruit size and quality of guava (Singh et al., 2001; Tahir and Kamran, 2002). Flower thinning can be made either by hand or by application of NAA at 50 ppm. Flower thinning improve the performance of tree and it's potential in producing profuse flowering in summer (June-July) and fruiting (Singh et al., 2002).

Materials and Methods

An experiment "influence of de-blossoming and GA_3 application on fruit tendency of winter guava" was conducted in horticulture farm at Agriculture University Peshawar Pakistan during 2016. For deblossoming, branches in the three trees on all four sides, *viz.,* North, South, East and West of the tree were tagged for counting number of new flowers and fruit sets. The control fruit trees were allowed to develop flower and fruit from 1st week of April onward .The rest of the treatments were de-blossomed regularly and allowed to flower after May, June, July , August and September only. The controls as well as the de-blossomed plants were sprayed with GA_3 at 0, 10 20 30, 40, and 50 ppm with specified concentration after de-blossoming operation. Thus the experiment was comprised of de-blossoming time (Factor 'A' i.e. Control, May, June, July, August and September) and GA_3 concentrations (Factor 'B' i.e. 0,10,20,30,40 and 50 ppm).

Parameters

The following parameters were studied during the experiment.

Fruit drop (%)

From the selected tree at least four branches spread to east, west, north and south was chosen. Counting was started after fruit setting up to fruit maturity. The fruit drop was obtained as percentage of fruit set.

Number of new shoot

In order to record the number of new shoots, proper counting of new shoots were done at the end of growing season in the month of September.

Number of new flowers

Number of new flowers were counted at the end of September.

Fruit weight (g)

Fruit weight was determined on digital weight balance of all the treatments.

Fruit volume (cm3)

Fruit volume was determined by water displacement method. Fruits were dipped in a beaker which was filled with water and readings were noted.

Fruit Density (g cm-3)

Fruit density was measured by weighting the fruit sample, then fruit sample was placed in a beaker which was filled with water. The following principle was used for fruit density:

$$Fruit\ Density = \frac{fruit\ weight\ (g)}{H2O\ displaced\ (cm3)}$$

Data Analysis

Data were recorded on the statistix 8.1 software and the means were computed with the help of LSD test (Steel et al., 1997).

Results and Discussion

Fruit drop (%)

Data pertaining fruit drop (%) are presented in table-1 showed that deblossoming time, gibberellic acid concentrations and its interaction significantly affected the fruit drop (%). Maximum fruit drop (11.69%) in plants which were not deblossomed and sprayed with distilled water, while minimum fruit drop (5.95%) was recorded at 50 ppm of GA_3 in the month of September.

The results demonstrated that deblossoming time and GA_3 application significantly affected the percent fruit drop. Results are in line with the findings of Agusti (2000), who concluded that the reduction in fruit drop by applying GA_3 treatments might be due to an increase in initial growth of ovaries and reduce the peak of abscission. The results are also in line with Kundu and Mitra (1997), who stated that GA_3 increased the fruit size and yield. Related observations was recorded by Davies and Zalman (2006), who described that in citrus, gibberellic acid application suggestively minimized the pre-harvest fruit drop.

Number of new shoot

Data pertaining number of new shoots are presented in table-1, showed that deblossoming time, gibberellic acid concentrations and its interaction significantly affected the number of new shoots. Maximum number of new shoots (55.70) was found at 40 ppm of GA_3 in plants deblossomed in the month of September, while minimum number of new shoots (16.30) was recorded in plants which were not de-blossomed and sprayed with distilled water.

According to Kriedemann et al. (2014), flower removal could cause increased shoot growth due to maintaining resources available for vegetative growth.

Table 1: *Fruit Drop (%), Number of New Shoots and Number of New flowers as affected by Deblossoming time GA_3 concentrations*

Factor A	Deblossoming Time	Fruit Drop (%)	No. of new Shoots	No. of new Flowers
	Control	11.96a	29.4 f	117.6 f
	May	10.74b	34.6 e	138.4 e
	June	9.62 c	37.9 d	151.6 d
	July	8.70 d	41.7 c	166.7 c
	August	7.70 e	46.2 b	184.9 b
	September	6.61 f	50.0 a	200.0 a
Factor B	**GA_3 Conc.**			
	0	9.78 a	27.8 f	111.1 e
	10	9.60 b	35.1 e	140.2 d
	20	9.19 c	40.6 d	162.4 c
	30	9.04 d	43.7 c	174.7 c
	40	8.83 d	45.5 b	182.0 b
	50	8.62 f	47.2 a	188.7 a
LSD Values at 0.05% level		0.12	2.78	4.54
Deblossoming Time*GA_3 Conc.				
Significance		*Fig: 1	*Fig: 2	* Fig: 3

Table 2: *Fruit Weight (g), Fruit Volume (cm^3) and Fruit Density (gcm^{-3})*

Factor A	Deblossoming Time	Fruit Weight(g)	Fruit volume (cm^3)	Fruit Density (gcm^{-3})
	Control	64.0 f	58.3 f	1.09 a
	May	74.2 e	83.4 e	0.88 d
	June	122.5 d	114.2 d	1.07 b
	July	143.3 c	131.2 c	1.09 a
	August	162.7 b	172.4 b	0.94 c
	September	184.5 a	222.2 a	0.83 e
Factor B	GA_3 Conc.			
	0	111.8 f	116.1. f	0.98 c
	10	116.9e	119.6 e	0.997 a
	20	121.6 d	126.2 d	0.987abc
	30	127.2 c	133.1 c	0.983 bc
	40	134.0 b	140.1 b	0.991ab
	50	139.5 a	146.7 a	0.986bc
LSD Values at 0.05% level		1.28	0.53	0.01
Deblossoming Time*GA_3 Conc.				
Significance		*Fig: 4	*Fig: 5	* Fig: 6

Nanda and Purohit (1965) reported that the augmentation of growth by GA_3 might be possibly due to deployment of reserve starch, and due to higher distribution by GA_3, large amounts of food material were available to the plant in shortened period of time which caused a progressive change in the growth processes. Boyers et al. (2003) also reported that GA_3 treatment increased the vegetative growth i.e. number of shoots and shoot length.

Number of new flowers

Data pertaining number of new flowers are presented in Table 1 revealed that deblossoming time, gibberellic acid concentrations and its interaction significantly influenced the number of new flowers.

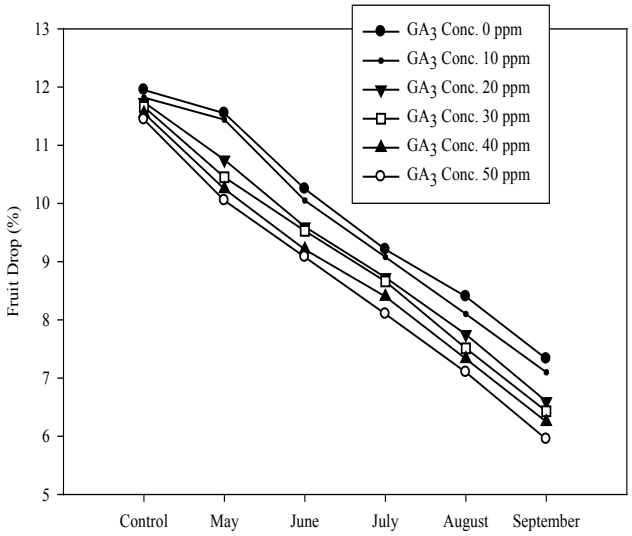

Figure 1: *Deblossoming time.*

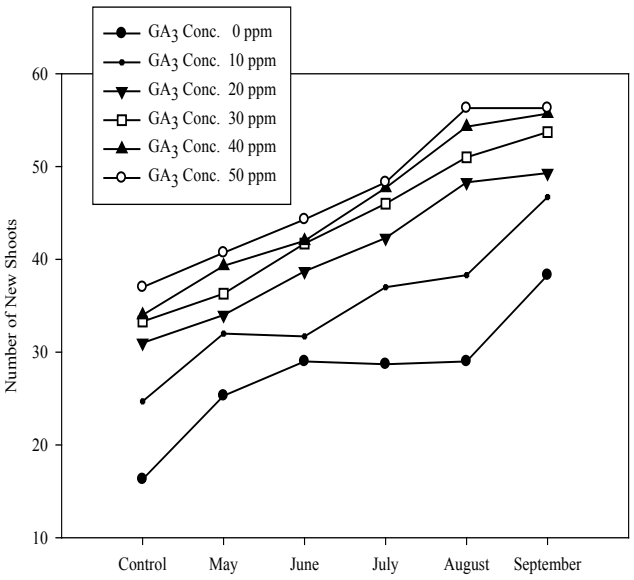

Figure 2: *Deblossoming time.*

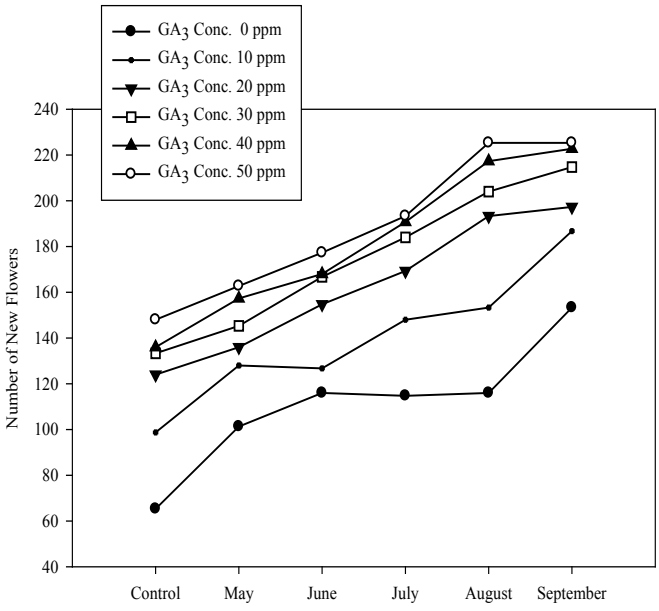

Figure 3: *Deblossoming time.*

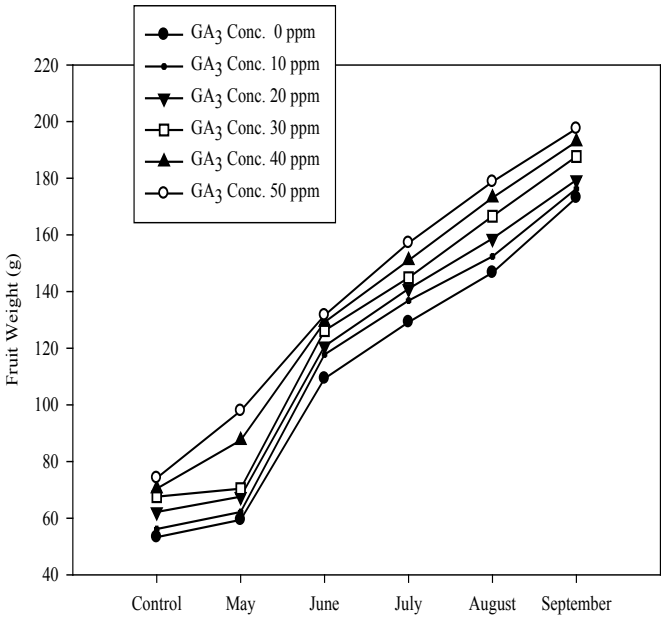

Figure 4: *Deblossoming time.*

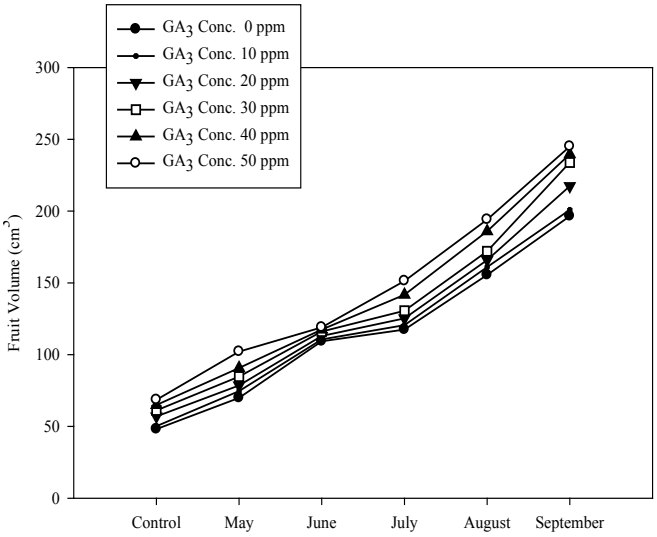

Figure 5: *Deblossoming time.*

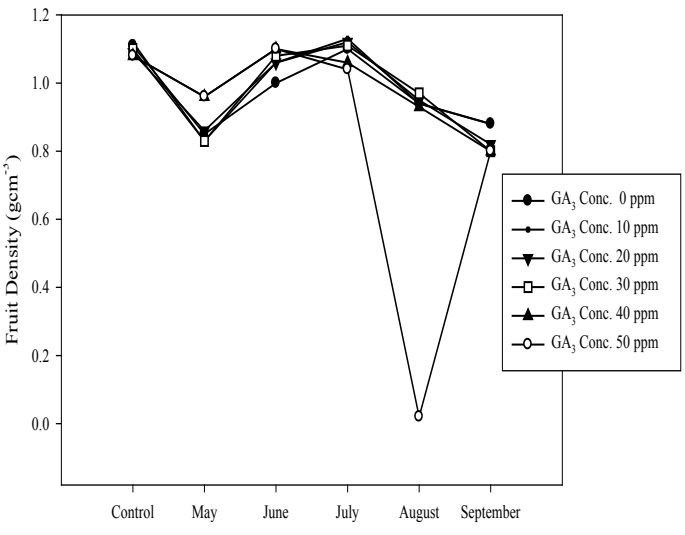

Figure 6: *Deblossoming time.*

Highest number of new flowers (225.30) was observed at 50 ppm of GA_3 in plants deblossomed in the month of September, followed by August (225.30). While minimum number of new flowers (65.30) was recorded in plants sprayed with distilled water and were not deblossomed.

Gibberellic acids are responsible for many plant growth processes and encourage a number of necessary properties i.e. flowering uniformity and increased flower number (Khassawneh et al., 2006). The results are also described by Voyiatzis and Paroussi (2002), who suggested that Gibberellic Acid application enhanced manufacturing of higher quantity of new flowers with fast elongation of peduncle, prominent to complete development of flower buds having all useful reproductive parts, which enhanced fruit set extremely in strawberry.

Fruit weight (g)

Data recorded for fruit weight are presented in Table 2 represent that monthly time duration, gibberellic acid levels and their interaction significantly affected fruit weight. The highest fruit weight (197.5g) of guava fruit was recorded in plants deblossomed in September and treated with 50 ppm of gibberellic acid. The lowest fruit weight (53.3g) was observed in fruits treated with zero ppm gibberellic acid which were not de-blossomed.

Maximum fruit weight might be due to higher accumulation of sugars molecules in pulp tissues of fruit (Hussein, 2006). Due to deblossoming levels and GA_3 application, the penetration of light inside the canopy was free which increased the photosynthesis rate and more reserves of carbohydrates and sugars were collected by the tree that was utilized by the fruit during their growth and development which helped them to attained maximum fruit weight (Hojo et al., 2007). Similarly, flower thinning in plum were also found significant and improved the mean fruit weight (Hamilton-Ilha et al., 1999).

Fruit volume (cm^3)

Data representing fruit volume are given below in Table 2 represented that monthly deblossoming time, gibberellic acid application and interaction between them was found significant. Data showed that maximum fruit volume ($245.50cm^3$) were observed in September plants sprayed with 50 ppm of gibberellic acid, while minimum fruit volume ($48.10cm^3$) were recorded at zero ppm of gibberellic acid application in un-deblossomed plants.

In winter season, maximum fruit volume might be due to maximum fruit size and more accumulation of carbohydrates. The increased in fruit volume occurred might be due to more duration available for fruit growth and development in winter season instead of summer crop (Njoroge, 2008). The results are also in an agreement with Sarkar and Ghosh (2005) who reported that foliar application of GA_3 had an important role in increasing the fruit volume and fruit weight because GA_3 increased the length of meristem cells which lead to increase the fruit volume and fruit size in mango.

Fruit density (gcm^{-3})

Data representing fruit density are given below in Table 2 represented that monthly time duration of deblossoming, gibberellic acid application and its interaction significantly affected fruit density. Maximum fruit density (1.13 gcm^{-3}) was showed in July with 10 ppm and minimum fruit density (0.80 gcm^{-3}) were recorded at 50 ppm of gibberellic acid application in September.

Sarkar and Ghosh, (2005) reported that foliar application of GA_3 had an important role in increasing the fruit volume and fruit weight because GA_3 increased the length of meristem cells which led to increase the fruit volume and fruit size in mango. In winter season, the increase in fruit volume might be due to increase in fruit size and more accumulation of carbohydrates. The increase in fruit volume occurred might be due to more duration available for fruit growth and development in winter season instead of summer crop (Njoroge, 2008).

Conclusions

It is concluded from the current study that Deblossoming time and GA3 application might be reduced the fruit drop, increase the number of new flowers, fruit weight (g), fruit volume (cm3) and fruit density (gcm-3).

Author's Contributions

Sadia collected data and wrote the artilce. AR supervised her. SHAS did statistical analysis. ZA wrote discussion, IU compiled references and FB wrote introduction. IZ helped in paper writing.

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