

Effect of Gibberellic Acid and Male Bud Removal on Yield and Fruit Quality of Banana Plants

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Abstract: Grand nain banana bunches were sprayed twice (just after emergence of the last hand and one month later) with GA₃ at 100 and 200 ppm in presence or with removing male bud. Results indicated that removing male bud and spraying GA₃ had a positive effect on improving yield and fruit quality. However, removing male bud with spraying GA₃ at 200ppm twice after emergence of the last hand and one month later seems to be the promising treatment under this experiment conditions.

Key words: Grand nain banana, bunches, GA₃, male bud, yield, fruit quality

INTRODUCTION

Plant cells do not migrate during development as do animal cells, and organ shape is determined by the organized and regulated control of cell expansion together with cell division^[6]. The gibberellins are especially abundant in seeds and young shoots where they control stem elongation by stimulating both cell division and elongation^[7]. Experimentation with GA₃ sprayed on genetically dwarf plants stimulates elongation of the dwarf plants to normal heights. Normal-height plants sprayed with GA₃ become giants. Many investigators studied the effect of GA₃ sprays on banana bunches after emergence and found a great effect on bunch weight and fruit quality^[10,2,3,8,5]. On the other hand, removing male bud was more effective on improve fruit quality and increase bunch weight^[2].

The aim of this study is to investigate the effect of removing male bud of Grand nain banana with spraying GA₃ at 100 or 200ppm twice after bunch shooting.

MATERIALS AND METHODS

The present investigation was carried out during two successive seasons (2004/2005) and (2005/2006) on the second and third ratoon plants of Grand nain banana grown in a private farm located in Kafer Yaakoub village, Gharbia Governorate, Egypt. Plants were planted at 3.5 meters apart under loamy soil conditions and irrigated with flood system.

GA₃ was used at 100 and 200 ppm as spraying treatments twice on the emerged bunches (just after emergence of the last hand and one month later). The experiment included six treatments as follows:

- Control (spray water only) in presence of male bud.
- Control (spray water only) without male bud.
- Spraying GA₃ at 100 ppm in presence of male bud.
- Spraying GA₃ at 200 ppm in presence of male bud.
- Spraying GA₃ at 100 ppm without male bud.
- Spraying GA₃ at 200 ppm without male bud.

Each treatment included four plants and was replicated five times. The fertilization program and the other agricultural practices were the same for all plants under investigation.

At the harvest time (when the fingers reached full stage), bunches were harvested and the following determinations were measured for each plant:

- Average bunch weight in kg.
- Average finger weight in gm.
- Finger length in cm.
- Finger diameter in cm.
- Angulations percentage

Also, number of days from bunch shooting to maturation was calculated. The harvested bunches were artificially ripened and the following measurements were taken:

- Pulp weight in gm.
- Peel weight in gm.
- Pulp/peel ratio.
- Total soluble solids percentage in the pulp.
- Total acidity percentage (as malic acid) in the pulp.
- Total sugars percentage in the pulp.

The previous chemical determinations were done as the methods described in the A.O.A.C.^[1].

The data were subjected to analysis of variance and the method of Duncan was used to differentiate means^[4].

RESULTS AND DISCUSSION

Table (1) showed number of days for maturation, bunch and finger weight as affected by GA₃ sprays. Regarding number of days to maturation, it is observed that removing male bud shortened the period from bunch shooting to maturation compared with un-removing male bud. Also spraying GA₃ shortened this period than without spraying it. On the other hand, no differences were detected between the two concentrations of GA₃. In this respect, bunch weight was affected by different treatments. Generally, in the first season removing male bud at shooting significantly increased bunch weight comparing with un-removing them. In this respect, removing male bud gave the same results when GA₃ sprayed at 100ppm without the male bud. On the other hand, spraying GA₃ at 200ppm was more effective than spraying it at 100ppm, since spraying GA₃ at 200ppm increased bunch weight than the lower concentration (100ppm) and recorded the heaviest bunch specially with removing the male bud. As for finger weight, spraying GA₃ especially at 200ppm concentration with removing the male bud recorded the highest value of finger weight followed in decreasing order by GA₃ at 100ppm with removing the male bud then GA₃ at 200ppm in presence of male bud. This was true in both studies seasons.

Table (2) showed length, diameter and angulations percentage of the finger as affected by GA₃ sprays. Concerning length and diameter of the finger was shown in Table (2), it is observed that removing male bud had a positive effect on increasing both length and diameter of the finger either with spraying GA₃ at 100 or 200ppm. In this respect, removing male bud with spraying GA₃ at the high concentration followed by the low one recorded the higher values for length and diameter of the finger. As for angulations percentage, it is observed that either GA₃ or remove male bud

treatments had a positive effect on this parameter but spraying GA₃ treatments were more effective and the high concentration (200ppm) was superior and gave the highest value in both studied seasons.

Table (3) showed pulp and peel weight and pulp/peel ratio as affected by GA₃ sprays. As for pulp weight, it is observed that removing male bud improved pulp weight of the fingers comparing with un-removing male bud. This improvement reached the maximum with spraying GA₃ especially at the high concentration (200ppm). The previous results were noticed in both seasons. Concerning peel weight, it is clear those treatments included male bud removing increased this parameter than without removing it. However, spraying GA₃ had a little effect on peel weight either with or without removing male bud. Pulp/peel ratio was increased with GA₃ spray than without spray it and no differences were detected between the two concentrations. On the other hand, male bud had no effect on pulp/peel ratio.

Table (4) showed Total soluble solids, acidity and total sugars percentages as affected by GA₃ sprays. In this concern, total soluble solids content was increased with remove male bud and GA₃ spray. However, the higher values were obtained when the male bud was removed + spraying GA₃ at 200ppm. The results were detected in both studied seasons. Acidity percentage was slightly affected by treatments. In this respect, the highest value was recorded by the control (without removing male bud) and the lower values were obtained with removing male bud with either GA₃ at 100ppm or 200ppm in the first and second seasons respectively.

Total sugars content were increased by spraying GA₃ and the highest value was recorded by removing male bud + spray 200ppm of GA₃.

The previous results concerning GA₃ may due to its effect on both cell division and elongation. These results are in agree with those obtained by Tadros *et al.*^[10], Chattopadhyay and Jana^[2], Dinesh and Reddy^[3], Pradhan *et al.*^[8], Samra *et al.*^[9] and Hemeed,^[5] who found that spraying GA₃ and removing male bud were more effective than the control on improving yield as bunch weight and fruit quality of banana plants.

From the above mentioned results, it could be concluded that the removing male bud and spraying GA₃ had a positive effect on improving yield and fruit quality of Grand nain banana plants. However, removing male bud and spraying GA₃ at 200ppm twice after emergence of the last hand and one month later seems to be the promising treatment under this experiment conditions.

Table 1: Bunch and finger weights and number of days for maturation as affected by GA₃ spray.

Treatments	No. of days for maturation		Bunch wt. (kg)		Finger wt. (gm)	
	1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season
Cont. with male bud	135 a	135a	21.0e	23.5e	145d	162e
Cont. without male bud	125b	124b	24.0c	27.1c	142e	160f
GA ₃ 100ppm with male bud	124b	123b	22.8d	25.9d	146d	166d
GA ₃ 200ppm with male bud	120b	120b	23.5c	27.2c	149c	171c
GA ₃ 100ppm without male bud	112c	110c	27.0b	30.8b	154b	175b
GA ₃ 200ppm without male bud	110c	110c	29.3a	33.6a	161a	185a
Significance at 5% level	S	S	S	S	S	S

Means having the same letter(s) within a column are not significantly different at 5% level.

Table 2: Length, diameter and angulations percentage of the finger as affected by GA₃ spray.

Treatments	Finger length (cm)		Finger diameter (cm)		Angulations %	
	1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season
Cont. with male bud	15.6f	17.4d	3.0f	3.3e	9.4e	9.4e
Cont. without male bud	16.8d	18.9c	3.4e	3.8d	9.9d	9.9d
GA ₃ 100ppm with male bud	16.5e	18.8c	3.6d	4.1c	10.2c	10.3c
GA ₃ 200ppm with male bud	17.0c	18.9c	3.8c	4.3b	10.5b	10.7b
GA ₃ 100ppm without male bud	18.4b	20.9b	4.2b	4.7a	10.5b	10.7b
GA ₃ 200ppm without male bud	18.8a	21.6a	4.4a	4.8a	11.2a	11.3a
Significance at 5% level	S	S	S	S	S	S

Means having the same letter(s) within a column are not significantly different at 5% level.

Table 3: Pulp and peel weight and pulp/peel ratio as affected by GA₃ spray.

Treatments	Pulp wt. (gm)		Peel wt. (gm)		Pulp/peel ratio	
	1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season
Cont. with male bud	95.0e	106.0	50.0bc	55.7c	1.90c	1.97d
Cont. without male bud	110.0c	124.0c	59.0a	66.0a	1.90c	1.93d
GA ₃ 100ppm with male bud	106.0d	120.3d	50.0bc	57.0bc	2.10b	2.10c
GA ₃ 200ppm with male bud	109.0c	125.0c	49.0c	56.0c	2.20b	2.30b
GA ₃ 100ppm without male bud	124.0b	141.0b	51.0b	57.6b	2.40a	2.47a
GA ₃ 200ppm without male bud	129.0a	148.0a	51.0b	58.0b	2.50a	2.47a
Significance at 5% level	S	S	S	S	S	S

Means having the same letter(s) within a column are not significantly different at 5% level.

Table 4: Total soluble solids, acidity and total sugars percentages as affected by GA₃ spray.

Treatments	TSS%		Acidity%		Total sugars%	
	1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season
Cont. with male bud	16.5f	17.0e	0.36a	0.36a	14.40f	14.30f
Cont. without male bud	18.0e	18.2d	0.33ab	0.33ab	15.80e	15.90e
GA ₃ 100ppm with male bud	19.0d	19.1c	0.32ab	0.31ab	16.60d	16.70d
GA ₃ 200ppm with male bud	19.2c	19.1c	0.30ab	0.30ab	16.80c	16.87c
GA ₃ 100ppm without male bud	20.4b	20.4b	0.30ab	0.29b	18.00b	17.90b
GA ₃ 200ppm without male bud	20.8a	20.7a	0.29b	0.30ab	18.20a	18.30a
Significance at 5% level	S	S	S	S	S	S

Means having the same letter(s) within a column are not significantly different at 5% level.

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