

INFLUENCE OF PACLOBUTRAZOL ON FLOWERING AND FRUITING OF ZEBDA MANGO CULTIVAR

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Abstract: The residual effect of paclobutrazol (PBZ) was investigated on mango Zebda cv. during "On" and "Off" years; 2004 and 2005; after application on October 2003 and 2004.

The result showed that PBZ application at 15 and /or 20 g/tree as a soil drench induced suppressed vegetative growth, early flowering and yield, controlled alternate bearing, increased fruit weight and yield as well as enhanced fruit quality in both "On"

and "Off" years during 2004 and 2005 seasons. In addition the same treatments suppressed vegetative growth, increased No. panicles per tree, No. hermaphrodite flowers/panicle, No. fruits per panicle and No. fruits per tree compared with untreated trees (control) on "Off " year during the two seasons of study. On the other hand, application of PBZ had no effect in seed weight %, pulp/seed ratio, acidity % and V.C. (mg/100g pulp) during "On" and "Off" years.

Key words: paclobutrazol, flowering, fruiting, mango.

Introduction

Many investigations were conducted to overcome the alternate bearing of some mango cultivars by several growth regulators. Paclobutrazol (PBZ) is involved in this respect. Thus, PBZ applied to the mango cultivar "Alphonso" as a soil drench induced regular cropping (Burondkar and Gunjate, 2000). Also, Yeshitela and Robbertse (2004) reported that treated "Tommy Atkins" trees by PBZ at rates of 5.50 and 8.25 g/tree as a soil drench increased number of panicles, percentages of hermaphrodite flowers, yield and fruit quality compared to the control. In addition,

Ferrari and Sargent 1996 found that PBZ reduced vegetative growth significantly, induced early and profuse flowering, increased the number and fruit weight of "Haden" mango cultivar. In addition, Singh and Dhillon 1992 found that PBZ applied of mango cultivar "Dashehari" as a foliar spray or as a soil drench at 10-60 g/tree during the first week of October enhanced yield and fruit quality compared to untreated trees.

The present study aimed to investigate the effect of PBZ on vegetative growth, flowering and fruiting of Zebda mango; such cultivar is known as a strong

alternate bearer; during the "On" and "Off" years to regulate the alternate bearing, enhanced yield and improved fruit quality.

Material and Methods

This study was conducted during two successive seasons of 2004 and 2005 seasons on Zebda mango cv. (*Mangifera indica*, L.) planted at a private orchard in sahel- salem district belongs to Assiut governorate. Fifteen healthy tree with uniform vigor and state of " On" year, as well as 15 tree state of "Off" year ; according to recent observations; were selected for this study .The same 15 tree in state of "On" year during 2004 season became in state of "Off" year in 2005 season ,similarly the same 15 tree in state of "off" year during 2004 season became in state of "On" year in 2005 season. All selected trees were 20 years old, budded on seedling rootstocks and planted as a square system at 6 m. apart in a loamy sand soil and subjected to the same orchard management. The experiment was arranged as a complete randomized design including five paclobutrazol (PBZ) treatments of three trees (replicate) state of " On" and " Off " year. Paclobutrazol was applied as a soil drench at 0, 5, 10, 15 and 20 g per tree during the first week of October 2003 and 2004 to study the residual effect on vegetative flushes,

flowering and fruiting of Zebda mango cultivar during 2004 and 2005 seasons as follows:

1- Vegetative flushes

Eight limbs on each tree representing the tree aspects (North, South, East and West) were chosen to study the number of flushes starting from Spring, Summer and Autumn. This was determined by labelling the new vegetative shoots.

2 – Flowering:

2-1- Blooming date: The beginning of blooming was recorded when about 5-10% of the terminal buds reached the burst stage (Shawky *et al.*, 1978).

2-2- Total number of panicles per tree was counted.

2.3- Total number of hermaphrodite flowers: Five panicles from each replicate were randomly chosen at full bloom time and the number of perfect flowers were counted.

3- Fruiting:

3-1 Yield:

Yield kg/ tree was estimated as number of fruits x average fruit weight at harvest.

To study the fruit quality, 10 fruits at uniform stage of maturity were picked at random from all directions of each tree (replicate) just before harvest of each season. All fruit samples were tested for :

3-2 physical and chemical characteristics as follows:

3-2-1 The physical properties included:

- a) Fruit weight (g)
- b) Seed weight (g)
- c) Pulp/seed ratio.

3-2-2 The chemical properties included:

- a) Total soluble solids percentage (TSS%) was estimated by using the hand refractometer.
- b) Total acidity was determined by direct titration of 0.1 N NaOH using phenolphthalein as an indicator and expressed as citric acid/100 g fruit pulp, according to A.O.A.C., 1985.
- c) Ascorbic acid content as mg vitamin C / 100 g fruit pulp was evaluated using of 2,6-dichlorophenol indophenol as outlined in A.O.A.C., 1985.

This experiment was designed as a complete randomized (CR). The analysis of variance (ANOVA) was conducted according to Snedecor and Cochran, 1980. The differences were compared using LSD at 5 % .

Results and Discussion

1-Effect of PBZ on vegetative flushes :

Data presented in Table (1) indicated percentages of vegetative flushes produced during spring, summer and autumn during " On" and " Off" years; 2004 and 2005 seasons; after application on October

2003 and 2004. The lowest percentage of vegetative flushes was found when PBZ was used at 15 and / or 20g /tree compared to the other treatments (0,5 and 10g PBZ / tree) during "On" and "Off" years of 2004 and 2005 seasons. These results were in agreement with those reported by Ferrari and Sergent 1996, Burondkar and Gunjate 2000 and Yeshitela and Robbertse 2004. They reported that PBZ suppressed vegetative growth.

2- Effect of PBZ on flowering:

Data presented in Table (2) and Fig. (1) show that PBZ application at 15 and / or 20 g/tree, as a soil drench induced early flowering (17-19 days earlier than the control) during "On" and "Off" years of 2004 and 2005 seasons. In addition, such treatments enhanced number of panicles per tree and number of hermaphrodite flowers per panicle in "Off" year during 2004 and 2005 seasons. On the other hand , application of PBZ during "On" year had no effect on No. panicles/tree and No. hermaphrodite flowers / panicle during 2004 and 2005 seasons. Such findings are in accordance with those reported by Kurian and layer (1989), Ferrari and Sergent (1996), Barraza et al.2000, Burondkar and Gunjate 2000, Phavaphutanon 2000, Cardenas and Rojas 2003, Blaikie et al. 2004 and Yeshitela and Robbertse 2004. They reported that PBZ suppressed vegetative growth, assimilated carbohydrates would induce profuse and early flowering.

Table(1): Vegetative flushes (%) during "On" and "Off" years;2004 and 2005; of Zebda mango cultivar as affected by PBZ application during October 2003 and 2004.

Character Treatment	" On" year			" Off" year		
	Spring	Summer	Autumn	Spring	Summer	Autumn
First season (2004)						
Control	9.42	43.15	1.25	11.83	71.60	1.92
5 g PBZ/tree	9.60	40.20	1.25	11.50	65.00	1.50
10 g PBZ/tree	8.84	40.00	1.00	9.90	56.12	0.80
15 g PBZ/tree	7.80	35.60	0.75	6.75	49.82	0.80
20 g PBZ/tree	7.44	36.10	0.75	6.62	48.88	0.50
L.S.D. 0.05	1.68	3.18	0.30	1.88	4.12	0.30
Second season (2005)						
Control	8.80	40.60	1.25	11.74	74.10	1.00
5 g PBZ/tree	8.00	39.80	1.00	11.50	73.00	1.00
10 g PBZ/tree	6.88	36.80	1.00	9.66	60.50	0.00
15 g PBZ/tree	6.50	32.20	0.80	7.00	52.40	0.80
20 g PBZ/tree	6.00	31.70	0.00	6.88	50.80	0.00
L.S.D. 0.05	1.76	2.50	0.18	1.80	4.92	0.21

Table(2): Date of flowering, No. panicles/tree and No. hermaphrodite flowers/panicle during "On" and "Off" years;2004 and 2005; of Zebda mango cultivar as affected by PBZ application during October 2003and 2004.

Character Treatment	Date of flowering		No. panicles/tree		No. hermaphrodite flowers/panicle	
	"On" year	"Off" year	"On" year	"Off" year	"On" year	"Off" year
First season (2004)						
Control	1/3	1/3	256.80	50.60	317.20	215.20
5 g PBZ/tree	1/3	1/3	253.20	57.80	325.70	227.30
10 g PBZ/tree	1/3	25/2	260.00	106.50	320.40	232.50
15 g PBZ/tree	10/2	12/2	265.50	221.00	336.50	267.00
20 g PBZ/tree	10/2	12/2	257.61	218.60	329.20	265.60
L.S.D. 0.05	-	-	NS	19.3	NS	18.1
Second season (2005)						
Control	3/3	1/3	254.30	57.00	325.00	209.00
5 g PBZ/tree	3/3	1/3	260.80	61.20	319.20	217.40
10 g PBZ/tree	27/2	27/2	258.10	112.00	321.60	246.7
15 g PBZ/tree	12/2	10/2	270.70	237.20	332.80	290.20
20 g PBZ/tree	12/2	10/2	253.90	229.40	326.50	285.60
L.S.D. 0.05	-	-	NS	18.9	NS	16.6

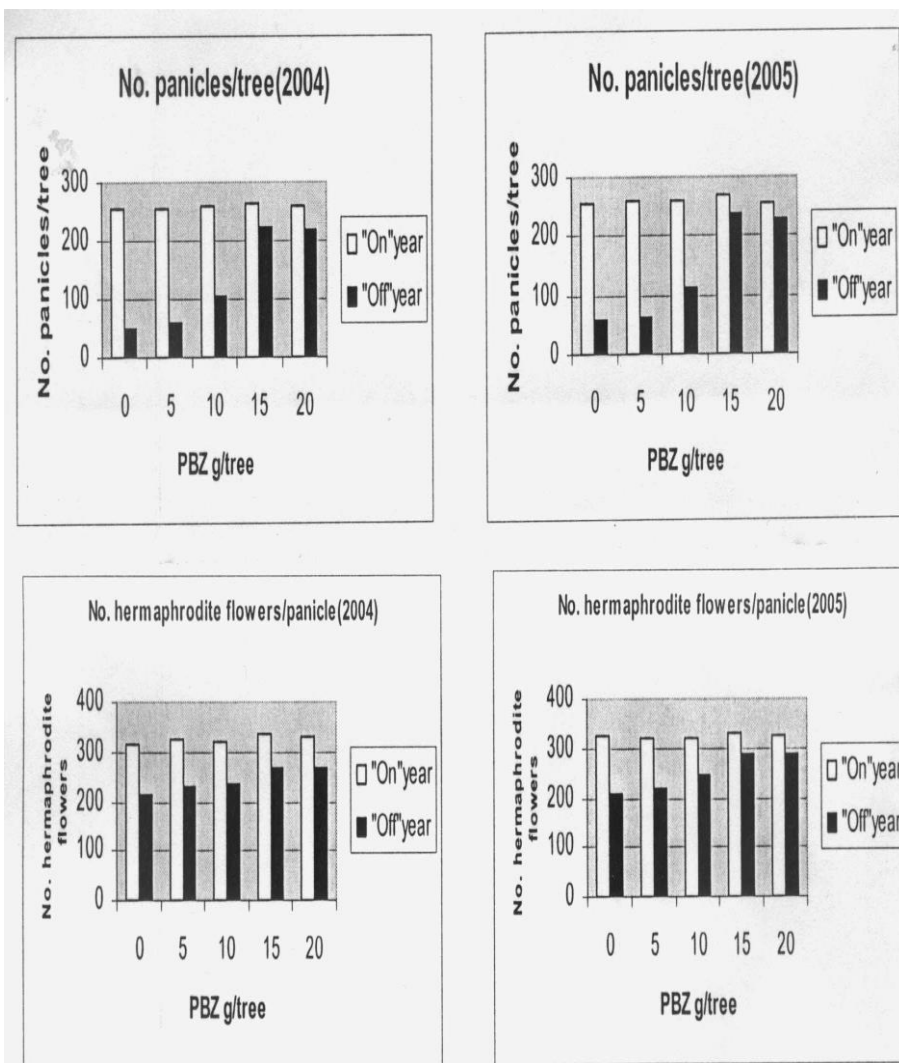


Fig (1). No. panicles / tree and No. hermaphrodite flowers/panicle during "On" and "Off" years;2004 and 2005; of Zebda mango cultivar as affected by PBZ application during October 2003 and 2004.

3 - Effect of PBZ on fruiting:

Data presented in Tables (3 & 4) and Figs. (2 & 3) show that Zebda trees treated by PBZ (15 or 20 g/tree) induced early cropping (about two weeks earlier than control), increased fruit weight & yield and enhanced TSS content of Zebda mango cultivar during "On" and "Off" years of 2004 and 2005 seasons. Moreover, application of PBZ at 15 and / or 20 g / tree increased the number of fruits per panicle and number of fruits per tree during the two seasons of study.

These results are in agreement with those found by Singh and Dhillon 1992 ,Ferrari and Sergent

(1996), Ram (1999) and Burondkar and Gunjate (2000) who found that PBZ induced early & regular cropping , increased yield and enhanced fruit quality. On the other hand, application of PBZ during "On" and "Off" years had no effect on seed weight %, pulp/seed ratio, acidity % and V.C. (mg/100 g pulp) during the two seasons of study.

It could be concluded from the results that application of PBZ at 15 and /or 20 g/tree as a soil drench during the first week of October induced early and regular cropping, increased fruit weight & yield and enhanced fruit quality of Zebda mango cultivar.

Table (3): Date of harvesting, No. fruits per panicle, No. fruits per tree and fruit yield (Kg/ tree) during "On" and "Off" years;2004 and 2005; of Zebda mango cultivar as affected by PBZ application during October 2003 and 2004.

Character Treatments	Date of harvesting		No. fruits/ panicle		No. fruits/ tree		Fruit yield (kg/tree)	
	On	Off	On	Off	On	Off	On	Off
First season (2004)								
Control	9/8	9/8	2.08	0.70	467.60	33.00	190.43	13.32
5 g PBZ/tree	9/8	9/8	2.05	0.73	459.40	40.20	187.90	16.29
10 g PBZ/tree	3/8	3/8	2.10	1.02	464.00	98.90	197.71	41.61
15 g PBZ/tree	25/7	25/7	2.17	1.87	466.00	342.80	208.00	148.50
20 g PBZ/tree	25/7	25/7	2.12	1.82	462.20	333.50	205.08	146.11
L.S.D. 0.05	-	-	NS	0.17	NS	20.93	9.03	5.97
Second season (2005)								
Control	12/8	12/8	1.98	0.65	440.70	29.80	175.71	11.93
5 g PBZ/tree	12/8	12/8	2.10	0.70	438.20	38.60	173.77	15.54
10 g PBZ/tree	7/8	7/8	2.07	1.10	435.00	107.80	182.62	45.96
15 g PBZ/tree	27/7	27/7	2.10	1.90	430.80	350.20	193.95	155.77
20 g PBZ/tree	27/7	27/7	2.06	1.87	432.50	346.40	192.99	152.52
L.S.D. 0.05	-	-	NS	0.16	NS	18.90	9.92	6.33

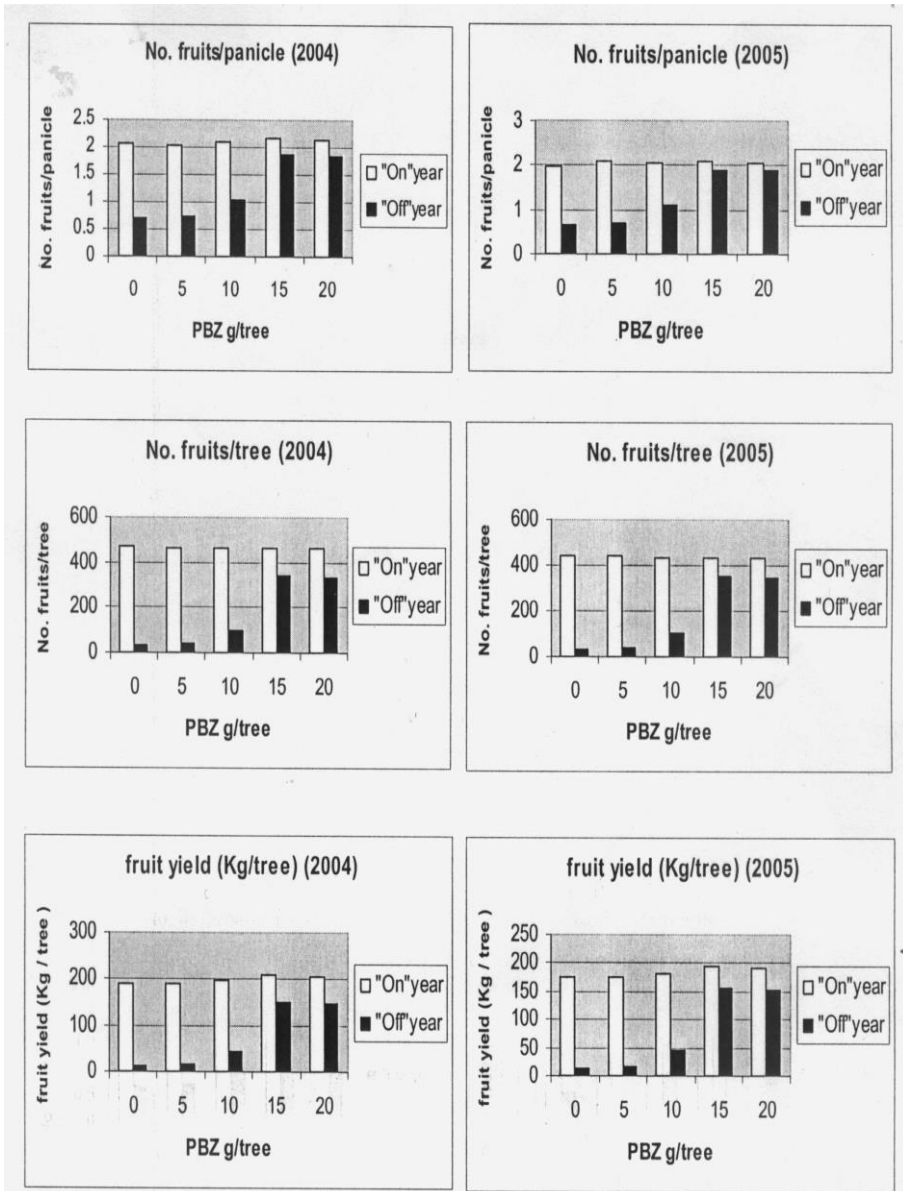


Fig (2). No. fruit per panicle, No . fruit per tree and fruit yield (Kg/ tree) during "On" and "Off" years;2004 and 2005; of Zebda mango cultivar as affected by PBZ application during October 2003 and 2004.

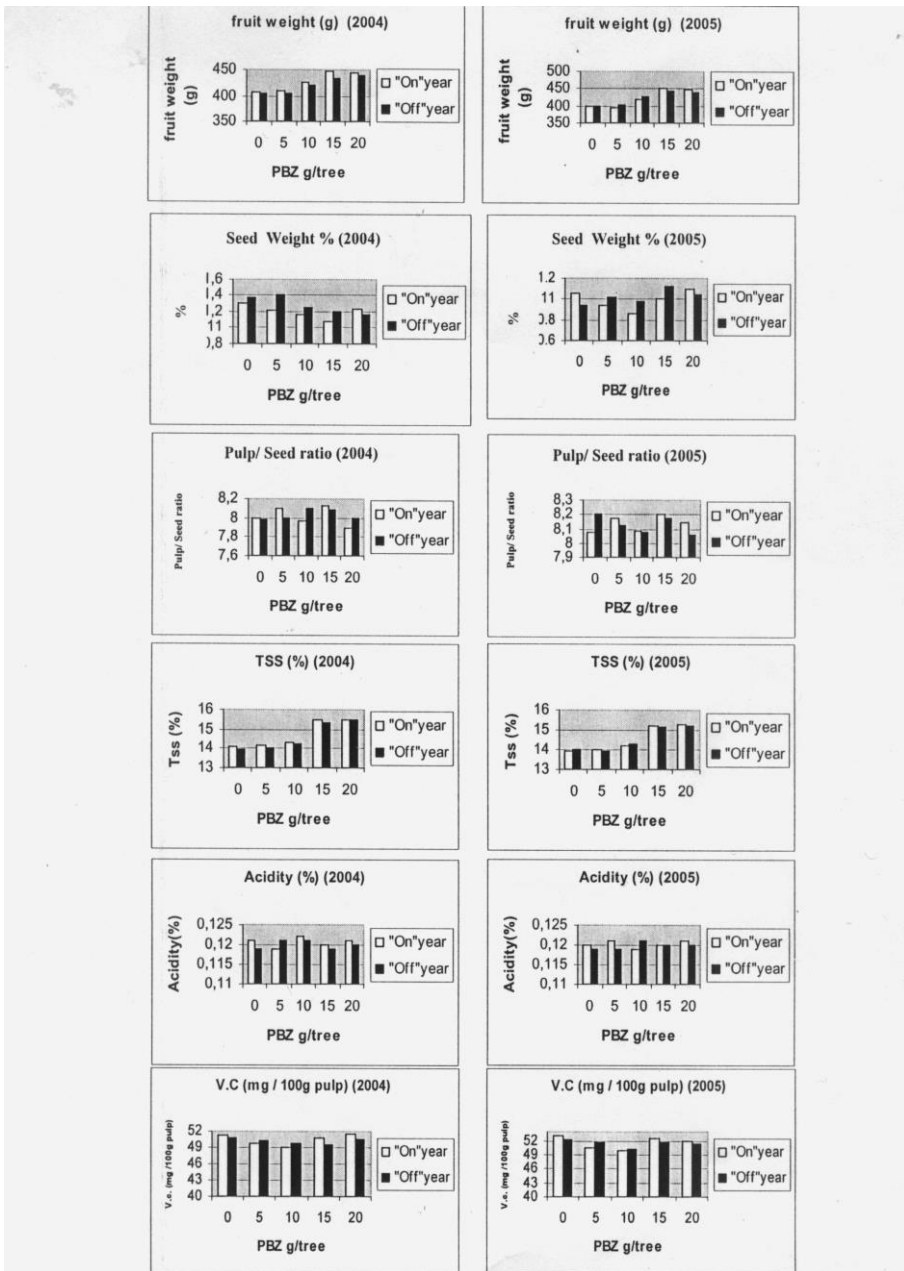


Fig (3) . Fruit physical and chemical properties during "On" and "Off" years;2004 and 2005; of Zebda mango cultivar as affected by PBZ application during October 2003and 2004.

References

- Association of Official Agricultural Chemists. 1985. Official Methods of Analysis. A.O.A.C.12th Ed. Published by A.O.A.C. Washington, D.C., U.S.A.
- Barraza, M.H; S.S. Garcia and V.V Valdivia. 2000. Delayed inflorescence bud initiation, a clue for the lack of response of the " Tommy Atkins" mango to promoters of flowering. Acta Horticulturae 509:174-183.
- Blaikie, S.J.;V.J.Kulkarni and W.J. Muller.2004. Effects of morphactin and pacloburazol flowering treatments on shoot and root phenolgy in mango cv. Kensington pride. Scientia Horticulture 101(1/2) 51-68 (c.f. Hort. Abst. 74 (8) : 6690).
- Burondkar, M.M. and R.T. Gunjate. 2000. Control of vegetative growth and inductive of regular and early cropping in "Alphonso" mango with paclobutrazol. Acta Horticulturae 509: 198-205.
- Cardenas, K.;E.Rojas. 2003. Effect of paclobutrazol and nitrates of potassium and calcium on the development of mango' Tommy Atkins'. Bioagro 15 (2) : 83-90 (C.F.Hort. Abst. 74 (7) : 5858).
- Ferrari, F. and A. Sergent. 1996. Promocion de la Floracion y Fructificacion en mango (*Mangifera indica* L.) cv. Haden, con Paclobutrazol. Rev. Fac. Agron. (Maracay) 22: 9-17.
- Kurian, R.M and C.P.A. layer. 1989. Chemical regulation of tree size in mango (*Mangifera indica*L.) cv. Alphonso. II. Effects of growth retardants on flowering and fruit set. J. Hort. Sci. 68 (3) : 355- 360.
- Phavaphutanon, L.; K.Krisanapook; A.Pichakum and K. Jutamanee. 2000. changes of total non-structural carbohydrate within shoots of " Nam Dok Mai" mango aafter paclobutrazol application. Acta Horticulturae 509:218-229.
- Shawky, I.; Z. Zidan; A. El-Tomi and D.I. Dahshan. 1978. Effect of GA₃ sprays on time of blooming and flowering malformation in Taimour mango. Egypt. J. Hort., 5: 123-132.
- Singh, Z. and B. Dhillon. 1992. Effect of paclobutrazol on floral malformation, yield and quality of mango (*Mangifera indica*). Acta Horticulturae 296: 51-54.
- Snedecor, G.W. and W.G. Cochran. 1980. Statistical Methods. Oxford and J.B.H. Publishing Com. 6th Edition.
- Ram, S. 1999. Paclobutrazol residues in the fruits of mango cultivars. J. Appl. Hort. 1(1):27-28.
- Yeshitela, T. and P.J. Robbertse. 2004. Paclobutrazol suppressed vegetative growth and improved yield as well as fruit quality of "Tommy Atkins" mango (*Mangifera indica* L.) in Ethiopia. New Zealand Journal of Crop and Horticultural Science 32: 281-293.

تأثير الباكلوبترازول على أزهار وإثمار صنف المانجو الزبدة

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أجريت هذه الدراسة على أشجار المانجو الزبدة المنزرعة ببستان خاص بمنطقة ساحل سليم بمحافظة أسيوط حيث تم معاملة أشجار في سنة الحمل الغزير وأخرى في سنة الحمل الخفيف بالباكلوبترازول بتركيز صفر ، 5 ، 10 ، 15 ، 20 جم / شجرة وذلك بإضافته حول جذع الشجرة خلال الأسبوع الأول من شهر أكتوبر 2003 ، 2004 وذلك لدراسة التأثير المتبقي له خلال موسمي 2004 ، 2005 على التوالي . وقد أظهرت النتائج أن معاملة أشجار المانجو الزبدة في سنة الحمل الخفيف أو الغزير بـ الباكلوبترازول بمعدل 15 أو 20 جرام / شجرة أدى إلى تقليل النوات الخضرية ، التبكير في التزهير و المحصول ، زيادة متوسط وزن الثمرة والمحصول وزيادة نسبة المواد الصلبة الذائبة للثمار مقارنة بأشجار المعاملة القياسية خلال موسمي الدراسة.

كذلك أدت المعاملتان السابقتان إلى زيادة عدد شماريخ الزهرية لكل شجرة ، عدد الأزهار الخنثي في الشمراخ ، عدد الثمار المتبقية على الشمراخ وعدد الثمار بكل شجرة مقارنة بأشجار المعاملة القياسية التي في سنة الحمل الخفيف وذلك خلال موسمي الدراسة . ولكن لم يكن للمعاملة بالباكلوبترازول تأثير سواء في أشجار الحمل الغزير أو الخفيف على نسبة وزن البذرة ، نسبة وزن اللب / البذرة ، الحموضة وفيتامين ج في كلا الموسمين .