J. Agric. Sci. Mansoura Univ., 32 (6): 4669 - 4681, 2007

EFFECT OF PACLOBUTRAZOL AND POTASSIUM NITRATE ON LEAVES NUTRIONAL STATUS OF EWAIS AND SIDIK MANGO TREES

1- CARBOHYDRATES AND NITROGEN

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ABSTRACT

Paclobutrazol and potassium nitrate were applied for two seasons (2002 and 2003) on Ewais and Sidik mango cultivars to evaluate their effect on leaves content of nitrogen, carbohydrates and C/N ratio. Trees were sprayed with potassium nitrate in October at 1, 2 and 4 % in the two seasons , meanwhile pacloputrazol was used only in the first season as a soil drench at 2.5, 5 and 7.5 g per tree. The treatments were carried out on "on year" trees in the first season. KNO3 and PBZ increased leaves carbohydrates content of both Ewais and Sidik mango cultivars and there was a direct relationship between the used concentrations and this content. Using PBZ at 7.5 g per tree and KNO3 at 4% significantly increase carbohydrates content in the leaves for both tested cultivars. Regardless of treatments the leaves total carbohydrates content increased significantly during Nov. and Dec. as it reached their maximum level, then it decreased sharply from Jan. to Feb. and increased again in Mar.

Increasing KNO3 and PBZ concentration increased leaves nitrogen content. The application of PBZ at 7.5 g per tree and KNO3 at 4% significantly increased this content compared to the control. The highest leaves nitrogen content was recorded in Nov. with PBZ at 7.5 g per tree and KNO3 at 4%, then gradually decreased and attained the lowest level in Jan. and Feb., afterwards an increase occurred during March.

C/N ratio was significantly increased with the application of KNO3 and PBZ at all tested concentrations, except low levels of PBZ on Sidik cv. at the second season. There was a direct relationship between the used concentration and this ratio.

Keywords: Mango (*Mangifera indica* L.)- Paclobutrazol- Potassium nitrate- Carbohydrates - Nitrogen - C/N ratio.

INTRODUCTION

Mango (*Mangifera indica* L.) is considered one of the most important fruit crops in the world. It belongs to the family Anacardiaceae.

Although many cultivars are grown in Egypt, productivity of mango trees is considered low due to many reasons such as low fruit set, high percentage of fruit drop, and irregular bearing. Moreover, irregular bearing was observed in young trees of Ewais and Sidik cvs under desert conditions. Using chemical substances as reported by many researchers might be of importance in increasing reproductive growth, regulate flowering and fruiting of some mango cultivars. For instance, application of paclobutrazol was reported to enhance mango flowering, increase the yield and improve fruit quality [Kurian and Tyer, 1993 on Alphonso cv.; Winston,1993 on Kensington cv. and Tongumpai et al., 1997a on Nam Dok Mai cv.] Also, certain reports suggested that KNO3 may, directly or indirectly, function as growth regulator in certain circumstances. KNO3 sprays to mango trees before flowering have

been reported to advance and increase the intensity of flowering (Bondad and Linsangan, 1979). Many investigators used KNO3 to induce flowering, fruit set, retention and yield of mango, Sharma et al (1990) on Langra cv.; Oosthuyse (1993 and 1996) on Tommy Atkins, Kent and Heidi cvs. and Khattab *et a*l. (2000) on Alphonso cv.

This work was conducted to investigate the effects of paclobutrazol and potassium nitrate on carbohydrates, nitrogen and C/N ratio in leaves of Ewais and Sidik mango trees.

MATERIALS AND METHODS

This study was conducted throughout 2001/2002 and 2002/2003 seasons on Ewais and Sidik mango trees grown in a private orchard located at Elwadi El-Faregh Cairo/Alexandria desert road, Giza governorate, Egypt. Trees were about 5 years old planted in a sandy soil at 5x5 m a part, grafted on seedling rootstocks, under drip irrigation system. Chosen trees were uniform in growth vigor and received the same horticultural practices. The experiment was conducted on the same selected trees during two consecutive seasons. Selected trees were in the on-year at the first season and were off-year in second season. The completely randomized block design was used where each treatment was replicated three times, each comprising one tree.

Trees were treated at the first week of October 2001and 2002 (pre-floral bud induction as determined by, Zidan *et al.,* 1975) with potassium nitrate (KNO3) at 1, 2 and 4% as a foliar spray and Paclobutrazol (PBZ, Cultar) at 2.5, 5 and 7.5 g per tree as a soil drench in 20 liter of water. Paclobutrazole was added to the trees once at the first week of October 2001 as a soil drench, its effect was studied during the two seasons of study.

Nine leaves were taken from the upper, middle and lower parts of one year old shoots at monthly intervals from November to March for determination of total carbohydrates according to Duboise *et al.* (1956) and nitrogen according to Ranganna (1979), then C/N ratio was calculated.

Data were tabulated and statistically analyzed according to Snedecor and Cochran (1980). Duncan multiple range tests were used to differentiate means at 5% level (Duncan, 1955).

RESULTS AND DISCUSSION

4.1. Effect of PBZ and KNO3 on total carbohydrates in the leaves of Ewais and Sidik mangos:

Data in tables (1,2,3 and 4) show the effect of PBZ and KNO3 treatments on leaves carbohydrates content of Ewais and Sidik mango cultivars, in the two seasons of study. It is clear that adding PBZ to the soil significantly increased carbohydrates content in the leaves compared to the control. A direct relationship was found between PBZ concentration and carbohydrates content in the leaves, as the highest values were recorded with PBZ at 7.5 followed by 5 then 2.5 g per tree with significant differences.

Moreover these differences were significant compared to the control in both seasons.

Concerning the effect of KNO3 on carbohydrates content in the leaves of the two cultivars under study, results indicate that KNO3 significantly increased this content compared to the control in both seasons of study. Increasing KNO3 concentration significantly increased leaves total carbohydrates content. Interaction between PBZ or KNO3 concentrations and leaves carbohydrates content cleared that the highest carbohydrates content was recorded in Nov., then it decreased throughout the month's preceded flower bud burst and the period of flower bud initiation and differentiation. This content increased as flowering time was expecting (March). Regardless tested treatments the Leaves total carbohydrates content were higher in Nov. and Mar. than in Dec., Jan. or Feb. This was noticed for the first season, meanwhile in the second season it increased significantly from Nov. to Dec. reached the maximum level in Dec., then decreased sharply from Jan. to Feb. and increased again in Mar. Generally, the accumulation of carbohydrate in the leaves during November helped in inducing flower bud initiation and differentiation for both cultivars.

From the above mentioned results it could be concluded that both PBZ and KNO3 treatments increased carbohydrates content in the leaves of Ewais and Sidik mango cultivars for both seasons. This carbohydrates increment could promote flowering and then leading to overcome the alternate bearing. These results are in harmony with the findings of Khattab *et al*. (2006) that application of PBZ and KNO3 increased the percentage of flowered shoots in the same mango cultivars. Moreover, Villiers (1998) reported that, when the mango tree carries more fruit than its bearing potential allows the carbohydrate reserves in almost all the other plant tissues in the tree are totally exhausted. This may result in the tree, after harvest, being unable to build up sufficient reserves for a good fruit yield in the subsequent year.

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Table (1): Effect of paclobutrazol and potassium nitrate on total carbohydrates (D.W %) in leaves of Ewais mango cv. (first season).

Treatments	Conc.	Date of sampling					Mean	Mean
		Nov.	Dec.	Jan.	Feb.	Mar.		
PBZ (g / tree)	2.5	19.13 d	15.76 k-m	14.41 op	13.98 pq	15 no	15.65 E	17.14 **B**
	5	19.81 ef	16.18 ijk	14.58 op	15.60 l-n	15.8 k-m	16.39 D	
	7.5	26.69 b	16.68 g-i	15.15 m-o	21.36 c	17.15 gh	19.40 B	
KNO3 (%)	1	21.99 c	15.86 j-m	13.28 qr	11.76 s	16.59 h-j	15.89 DE	17.88 **A**
	2	26.69 b	15.91 j-l	13.35 qr	16.49 n-k	16.73 j-i	17.83 C	
	4	30.22 a	17.4 fg	16.68 g-j	16.74 g-i	18.58 de	19.92 A	
Control		18.85 de	14.66 op	12.72 r	11.42 s	14.82 o	14.49 F	14.49 **C**
Mean		21.91 *A*	14.63 *D*	14.31 *E*	15.33 *C*	16.38 *B*		

Values followed by the same letter(s) are not significantly different at 5% level

Table (2): Effect of paclobutrazol and potassium nitrate on total carbohydrates (D.W %) in leaves of Sidik mango cv. (first season).

Treatments	Conc.	Date of sampling					Mean	Mean
		Nov.	Dec.	Jan.	Feb.	Mar.		
PBZ (g / tree)	2.5	19.17 c-e	19.19 c-e	13.95 l-n	12.22 no	15.61 i-l	16.02 D	17.09 **B**
	5	20.42 c	20.73 c	14.64 k-m	13.11 m-o	16.86 g-j	17.15 C	
	7.5	21.88 c	20.68 c	14.74 k-m	16.4 g-k	16.92 f-j	18.12 B	
KNO3 (%)	1	29 a	16.84 g-j	16.46 g-k	11.4 o	16.74 g-ij	18.08 B	19.02 **A**
	2	29.52 a	17.28 e-i	16.51 g-k	12.51 no	18.26 d-g	18.81 A	
	4	30 a	19.95 cd	17 e-h	15.32 i-l	18.69 d-g	20.19 A	
Control		15.75 h-l	16.82 g-j	13.8 l-n	11.65 o	15 j-m	14.6 E	14.6 **C**
Mean		23.67 *A*	18.78 *B*	15.30 *D*	13.23 *E*	16.86 *C*		

Values followed by the same letter(s) are not significantly different at 5% level

Table (3): Effect of paclobutrazol and potassium nitrate on total carbohydrates (D.W %) in leaves of Ewais mango cv. (second season).

Treatments	Conc.	Date of sampling					Mean	Mean
		Nov.	Dec.	Jan.	Feb.	Mar.		
PBZ (g / tree)	2.5	15.52 o-r	17.15 J-n	14.43 r	12.76 st	14.21 rs	14.81 D	16.95 **B**
	5	16.99 k-o	18.21 g-k	18.52 f-j	15.93 n-q	16 n-q	17.13 C	
	7.5	18.63 f-i	22.15 bc	19.09 e-h	17.15 j-n	17.6ijkl	18.92 B	
KNO3 (%)	1	17.77 h-l	18.16 g-k	16.07 m-q	15.34 p-r	18.51 f-j	17.17 C	19.23 **A**
	2	18.17 g-k	24.05 a	16.49 l-p	17.52 i-m	19.80 def	19.20 B	
	4	19.41 efg	26.79 a	20.34de	19.21 e-h	20.93 cd	21.33 A	
Control		16.31 l-p	17.57 i-l	15.06 p-r	12.46 t	14.75 qr	15.23 D	15.23 **C**
Mean		17.54 *B*	20.58 *A*	17.14 *C*	15.76 *D*	17.40 *C*		

Values followed by the same letter(s) are not significantly different at 5% level

Table (4): Effect of paclobutrazol and potassium nitrate on total carbohydrates (D.W %) in leaves of Sidik mango cv. (second season).

Treatments	Conc.	Date of sampling					Mean	Mean
		Nov.	Dec.	Jan.	Feb.	Mar.		
PBZ (g/tree)	2.5	13.99 q	14.99 o	12.81 t	13.15 s	13.58 r	13.70 F	15.51 **B**
	5	14.66 p	15.6 m	13.80 q	15.23 n	15.49 m	14.95 E	
	7.5	18.12 l	21.07 c	16.32 k	15.53 m	18.48 h	17.90 C	
KNO3 (%)	1	15.95 l	16.33 k	15.65 l	16.56 j	19.18 f	16.73 D	19.14 **A**
	2	19.52 e	18.47 g	18.78 g	18.24 i	20.60 d	19.14B	
	4	21.52 b	23.11 a	21.07 c	21.34 b	20.77 d	21.56 A	
Control		12.94 t	13.57 r	12.25 u	15.68 m	20.60 d	15 E	15 **C**
Mean		16.67 *B*	17.59 *A*	15.81 *D*	16.53 *C*	16.67 *B*		

Values followed by the same letter(s) are not significantly different at 5% level

This low carbohydrate reserve level can then lead to the perpetuation of the on-off bearing cycle with the tree bearing very few or no fruit one year and then a multitude of small fruit the next year. Although the starch reserve available in the plant is not the only factor determining on/off- years, it plays a major role in many plant processes. In several cases, low carbohydrate levels actually influences these factors which cause alternate bearing. Moreover, Phavaphutanon et al (2000) showed that, total non structural carbohydrates (TNC) decreased significantly during leaf flushing and flower emergence as vegetative growth was inhibited by PBZ. Also PBZ induced off-season flowering, while the control, non-treated trees still grew vegetatively producing another 2-3 flushes. Changes in shoot TNC were correlated with leaf flushing and flowering. Shoot TNC tended to accumulate faster prior to off-season flowering; they also noticed a significant decrease in TNC in 1 year old stem sections which correlated with leaf flushing. Moreover, Yeshitela *et al*. (2004), reported that Tommy Atkins mango trees which treated with PBZ at 2.75, 5.5, 8.25 g per tree contained higher total non-structural carbohydrate in their shoots before flowering than the control trees.

4.2. Effect of PBZ and KNO3 on total nitrogen in leaves of Ewais and Sidik mangos:

Data presented in tables (5, 6,7 and 8) indicate that the application of PBZ at 7.5 g per tree significantly increased Ewais leaves content of nitrogen compared to the control only in the second season. Meanwhile, PBZ at the lowest concentrations (2.5 or 5 g per tree) did not significantly affect leaves nitrogen contents. The interaction between PBZ concentration and dates indicate that the highest leaves nitrogen content was recorded in Nov. with PBZ at all tested levels.

Table (5): Effect of PBZ and KNO3 on nitrogen (%) in leaves of Ewais mango cv. (first season).

Treatments	Conc.	Date of sampling					Mean	Mean
		Nov.	Dec.	Jan.	Feb.	Mar.		
PBZ (g/tree)	2.5	1.20 e-k	1.08 m-o	1.04 O	1.11 j-o	1.15 h-n	1.11 D	1.14 **B**
	5	1.23 d-i	1.11 j-o	1.06 no	1.15 h-n	1.20 e-k	1.15 CD	
	7.5	1.29 c-f	1.14 i-o	1.07 no	1.19 f-l	1.22 d-i	1.18 C	
KNO3 (%)	1	1.46 b	1.23 d-i	1.20 e-k	1.18 g-m	1.26 c-g	1.26 B	1.29 **A**
	2	1.52 ab	1.25 c-h	1.20 e-k	1.20 e-k	1.32 cd	1.29 B	
	4	1.61 a	1.30 c-e	1.26 c-g	1.22 d-i	1.35 c	1.34 A	
Control		1.21 e-j	1.14 i-o	1.09 l-o	1.10 k-o	1.21 e-j	1.15 CD	1.15 **B**
Mean		1.36 *A*	1.17 *C*	1.13 *D*	1.16 *C*	1.24 *B*		

Values followed by the same letter(s) are not significantly different at 5% level.

Table (6): Effect of PBZ and KNO3 on nitrogen (%) in leaves of Ewais mango cv. (second season).

Treatments	Conc.	Date of sampling					Mean	Mean
		Nov.	Dec.	Jan.	Feb.	Mar.		
PBZ (g/tree)	2.5	1.12 a-e	0.98 g-j	0.90 j-l	0.81 l	0.95 h-k	0.95 E	1.01 **B**
	5	1.18 a-c	1.02 e-i	0.99 f-j	0.86 kl	1.06 d-h	1.02 CD	
	7.5	1.20 ab	1.13 a-e	1.02 e-i	0.97 g-k	1.12 a-e	1.08 B	
KNO3 (%)	1	1.13 a-e	1.08 c-g	1.00 f-j	0.92 i-l	1.02 e-i	1.03 CD	1.07 **A**
	2	1.15 a-d	1.10 b-f	1.00 f-j	0.98 g-j	1.05 d-h	1.05 BC	
	4	1.22 a	1.16 a-d	1.12 a-e	1.10 b-f	1.10 b-f	1.14 A	
Control		1.06 d-h	1.02 e-i	0.95 h-k	0.92 i-l	1.00 f-j	0.99 DE	0.99 **C**
Mean		1.15 *A*	1.07 *B*	0.99 *C*	0.93 *D*	1.04 *B*		

Values followed by the same letter(s) are not significantly different at 5% level.

Table (7): Effect of PBZ and KNO3 on nitrogen (%) in leaves of Sidik mango cv. (first season).

Treatments	Conc.	Date of sampling					Mean	Mean
		Nov.	Dec.	Jan.	Feb.	Mar.		
PBZ (g/tree)	2.5	1.24 a-d	1.20 b-f	1.09 f-i	0.96 j	1.06 g-j	1.11 B	1.12 **A**
	5	1.29 ab	1.21 b-f	1.10 e-i	0.98 ij	1.09 f-i	1.13 AB	
	7.5	1.35 a	1.21 b-f	1.08 a-c	1.01 h-j	1.09 f-i	1.14 AB	
KNO3 (%)	1	1.18 b-g	1.20 b-f	1.12 d-h	1.09 f-i	1.10 e-i	1.13 AB	1.15 **A**
	2	1.20 b-f	1.20 b-f	1.14 c-g	1.10 e-i	1.16 c-g	1.16 AB	
	4	1.22 b-e	1.18 b-g	1.12 d-h	1.16 c-g	1.18 b-g	1.17 A	
Control		1.18 b-g	1.15 c-g	1.15 c-g	1.10 e-i	1.16 c-g	1.14 AB	1.14 **A**
Mean		1.23 *A*	1.19 *AB*	1.11 *BC*	1.05 *D*	1.12 *C*		

Values followed by the same letter(s) are not significantly different at 5% level.

Table (8): Effect of PBZ and KNO3 on nitrogen (%) in leaves of Sidik mango cv. (second season).

Treatments	Conc.	Date of sampling					Mean	Mean
		Nov.	Dec.	Jan.	Feb.	Mar.		
PBZ (g/tree)	2.5	1.03 d-g	0.98 g-j	0.95 g-k	0.92 i-k	0.96 g-k	0.96 C	1.00 **A**
	5	1.09 c-f	1.02 e-g	0.96 g-k	0.95 g-k	0.98 g-j	1.00 BC	
	7.5	1.18 ab	1.10 b-e	0.99 g-i	0.95 g-k	1.02 e-g	1.04 A	
KNO3 (%)	1	0.96 g-k	0.92 i-k	0.89 k	0.88 k	0.93 h-k	0.91 D	0.99 **A**
	2	1.16 a-c	1.03 d-g	1.00 g-i	0.95 g-k	0.99 g-i	1.02 AB	
	4	1.21 a	1.11 b-d	1.02 e-g	0.96 g-k	0.99 g-i	1.05 A	
Control		1.00 g-i	0.98 g-j	0.95 g-k	0.90 jk	1.01 f-h	0.96 C	0.96 **B**
Mean		1.09 *A*	1.02 *B*	0.96 *C*	0.93 *D*	0.98 *BC*		

Values followed by the same letter(s) are not significantly different at 5% level.

Regarding Sidik cultivar PBZ treatment at 7.5g/tree significantly increased leaves nitrogen content compared to the control only in the second season. A direct relationship was found between PBZ concentration and nitrogen content in the leaves, as the highest values were recorded with PBZ at 7.5 followed by 5 then 2.5 g per tree. Differences were significant for the highest concentration only in the second season. This may cleared the extended action of PBZ the next year of application. Meanwhile, the lower concentration of PBZ (2.5 or 5 g per tree) had similar results as the control in the two seasons. Concerning the interaction between PBZ concentration and dates it was noticed that the highest nitrogen content was recorded in Nov. with PBZ at all tested levels, meanwhile, the lowest values were recorded in Feb.

Concerning KNO3 treatments, results indicated that leaves nitrogen content of Sidik cultivar was significantly increased by KNO3 at 2 and 4% only in the second season. Regarding Ewais cultivar, data indicated that KNO3 significantly increased leaves nitrogen content in both seasons. A direct relationship was found between KNO3 concentration and this content. All KNO3 concentrations had significant effect except 1% level at the second season.

Generally the highest leaves nitrogen content was recorded in Nov. with KNO3 treatments, then gradually decreased attaining the lower level in Jan. and Feb., afterward a significant and gradual increase occurred during March. This was clearly shown in both cultivars in the two seasons. The obtained results are generally in harmony with those reported by Avilan (1971), who stated that, in mango cv. Kent, the analyses of leaves showed the highest level of nitrogen before flowering fell during flowering and fruit formation and rose again during ripening. Moreover, Devi and Tyogi (1991)

in India, postulated that, in Langra mango cv. the leaf alcohol insoluble N, total N content, and nitrate redacts activity were higher on branches which had flowered, furthermore alcohol soluble N contents were higher on branches which had not flowered. Also Fierro and Ulloa (1991), mentioned that, in Keitt mango variety trees that had heavy crop in the previous season differ in nitrogen content from lightly cropped trees in a non resting environment. Nitrogen content was significantly lower and the regression curve showed one to two weeks delay accumulation of nitrogen. During the initial stage in the growth flush, (less than 8 cm), the nitrogen content decreased significantly with respect to the intermediate and late stages.

4.3. Effect of PBZ and KNO3 on C/N ratio in leaves of Ewais and Sidik mango cultivars:

Data in tables (9, 10, 11 and 12) show the effect of PBZ and KNO3 on C/N ratio in leaves of Ewais and Sidik cultivars. It is noticed that PBZ significantly increased this ratio in Ewais cv compared to the control. All PBZ concentrations significantly increased leaves C/N ratio and there was a direct relationship between the used concentration and this ratio. PBZ at 7.5 g per tree recorded the highest values in this regard. Concerning the interaction between PBZ concentration and date it is noticed that the highest ratio was detected in Nov. for the first season and in Dec. for the second one in all tested concentrations.

Concerning Sidik cultivar all PBZ concentrations significantly increased leaves C/N ratio in the first season. Meanwhile, in the second one the lowers concentrations of PBZ (5 and 2.5 g per tree) decreased this ratio compared to the control. A positive relationship was found between the used concentration of PBZ and C/N ratio, where the highest ratio was recorded with the highest concentration (7.5 g per tree) followed by 5 then 2.5 g per tree.

Regarding KNO3 treatments results cleared a significant increase in C/N ratio for Ewais trees which sprayed with KNO3. All KNO3 concentrations significantly increased leaves C/N ratio than the control except 1% level in the first season. The highest ratio was recorded with KNO3 at 4% followed by 2 then 1%. KNO3 recorded the highest C/N ratio in Nov. in the first season and Dec. in the second one.

Regarding Sidik cultivar the same trend was noticed in both seasons of study. All KNO3 treatments significantly increased C/N ratio in the leaves. The maximum ratio was recorded by 4% then 2% and 1% in descending order. The highest C/N ratio was recorded in Nov. in the first season and in Dec. in the second season

The obtained results indicated that both KNO3 and PBZ treatments increased C/N ratio in the leaves during the period of flower bud differentiation which subsequently help in increasing flowering. Pandey (1988) supported these results who indicate that higher level of carbohydrates and high C/N ratio at the time of flower bud differentiation were correlated with the fruit full condition in mango.

Table (9): Effect of PBZ and KNO3 on C/N ratio in leaves of Ewais mango cv. (first season).

Treatments	Conc.	Date of sampling					Mean	Mean
		Nov.	Dec.	Jan.	Feb.	Mar.		
PBZ (g/tree)	2.5	15.94 de	14.59 g	13.85 i-k	12.59 qr	13.04 n-p	14.00 D	14.83 **A**
	5	16.10 d	14.57 gh	13.75 i-l	13.56 k-m	13.16 m-o	14.22 C	
	7.5	20.68 a	14.63 g	14.15 hi	17.94 c	14.05 ij	16.29 A	
KNO3 (%)	1	15.06 f	12.89 o-q	11.06 t	9.96 u	13.16 m-o	12.42 F	13.51 **B**
	2	17.55 c	12.72 pq	11.12 t	13.74 i-l	12.67 pq	13.56 E	
	4	18.77 b	13.38 l-n	13.23 m-o	13.72 j-l	13.76 i-l	14.57 B	
Control		15.57 e	12.85 o-q	11.66 s	10.38 u	12.24 r	12.54 F	12.54 **C**
Mean		17.09 *A*	13.66 *B*	12.69 *C*	13.12 *D*	13.15 *D*		

Values followed by the same letter(s) are not significantly different at 5% level.

Table (10): Effect of PBZ and KNO3 on C/N ratio in leaves of Ewais mango cv. (second season).

Treatments	Conc.	Date of sampling					Mean	Mean
		Nov.	Dec.	Jan.	Feb.	Mar.		
PBZ (g/tree)	2.5	13.85 {	17.50 k	16.03 pq	15.75 st	14.95 x	15.61 G	16.65 **B**
	5	14.39 z	17.85 i	18.70 f	18.52 g	15.09 w	16.91 D	
	7.5	15.52 u	19.60 c	18.71 f	17.68 j	15.71 t	17.44 C	
KNO3 (%)	1	15.72 st	16.81 m	16.07 p	16.67 n	18.14 h	16.68 E	17.85 **A**
	2	15.80 rst	21.68 b	16.49 o	17.87 i	18.85 e	18.17 B	
	4	15.90 qr	23.09 a	18.16 h	17.46 k	19.02 d	18.72 A	
Control		15.38 v	17.22 l	15.85 rs	13.54]	14.75 y	15.34 H	15.34 **C**
Mean		15.22 *E*	19.13 *A*	17.14 *B*	16.78 *C*	16.64 *C*		

Values followed by the same letter(s) are not significantly different at 5% level.

Table (11): Effect of PBZ and KNO3 on C/N ratio in leaves of Sidik mango cv. (first season).

Treatments	Conc.	Date of sampling					Mean	Mean
		Nov.	Dec.	Jan.	Feb.	Mar.		
PBZ (g/tree)	2.5	15.45 fg	15.99 c-e	12.79 n	12.72 n	14.72 h	14.33 E	15.02 **B**
	5	15.82 def	17.13 b	13.30 k-m	13.37 kl	15.46 fg	15.01 D	
	7.5	16.20 cd	17.09 b	13.64 jk	16.23 c	15.52 fg	15.73 C	
KNO3 (%)	1	24.57 a	14.03 ij	14.69 h	10.45 q	15.21 g	15.79 C	16.34 **A**
	2	24.60 a	14.40 hi	14.48 h	11.37 p	15.74 ef	16.11 B	
	4	24.59 a	16.90 b	15.17 g	13.20 lm	15.83 c-f	17.13 A	
Control		13.34 kl	14.62 h	12.00 o	10.59 q	12.93 mn	12.69 F	12.69 **C**
Mean		19.22 *A*	15.73 *B*	13.72 *D*	12.56 *E*	15.05 *C*		

Values followed by the same letter(s) are not significantly different at 5% level.

Table (12): Effect of PBZ and KNO3 on C/N ratio in leaves of Sidik mango cv. (second season).

Treatments	Conc.	Date of sampling					Mean	Mean
		Nov.	Dec.	Jan.	Feb.	Mar.		
PBZ (g/tree)	2.5	13.58 x	15.29 s	13.48 y	14.29 u	14.14 v	14.15 G	15.40 **C**
	5	13.44 y	15.29 s	14.37 t	16.03 q	15.80 r	14.98 F	
	7.5	15.35 s	19.15 f	16.48 o	16.34 p	18.11 h	17.08 D	
KNO3 (%)	1	16.61 n	17.75 j	17.58 k	18.81 g	20.62 d	18.27 C	19.15 **A**
	2	16.82 m	17.93 i	18.78 g	19.20 f	20.80 c	18.70 B	
	4	17.78 j	20.81 c	20.65 d	22.22 a	20.97 b	20.48 A	
Control		12.94 z	13.84 w	12.89 z	17.42 l	20.39 e	15.49 E	15.49 **B**
Mean		15.21 *E*	17.15 *C*	16.31 *D*	17.75 *B*	18.69 *A*		

Values followed by the same letter(s) are not significantly different at 5% level.

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تأثير الباكلوبترازول ونترات البوتاسيوم على الحالة الغذائية لأوراق أشجار المانجو عويس وصديق

١- الكربوهيدرات والنيتروجين

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تم معاملة أشجار المانجو صنفى عويس وصديق خلال موسمى الدراسة بكلا من نترات البوتاسيوم والباكلوبترازول لتقييم تأثيرهما على محتوى الأوراق من الكربوهيدرات والنيتروجين والنسبة بين الكربوهيدرات إلى النيتروجين. نترات البوتاسيوم استخدمت بتركيز ١ و ٢ و ٤% رشا على المجموع الخضرى فى شهر اكتوبر خلال الموسمين (٢٠٠١ و ٢٠٠٢) بينما تم إضافة الباكلوبترازول إلى التربة فى الاسبوع الأول من اكتوبر الموسم الأول فقط بمعدل ٢,٥ و ٥ و ٧,٥ جرام للشجرة.الأشجار المستخدمة كانت فى سنة الحمل الغزير فى الموسم الأول من الدراسة. أدت المعاملة بالباكلوبترازول ونترات البوتاسيوم إلى زيادة محتوى الأوراق من الكربوهيدرات ووجدت علاقة طردية بين التركيز المستخدم وهذا المحتوى. استخدام الباكلوبترازول بمعدل ٧,٥ جرام للشجرة ونترات البوتاسيوم بمعدل ٤% أدى إلى زيادة معنوية فى محتوى الأوراق من الكربوهيدرات لكلا الصنفين موضع الدراسة. زاد محتوى الأوراق من الكربوهيدرات خلال الفترة من نوفمبر و ديسمبر حيث وصل إلى أعلى مستوى ثم انخفض تدريجياً خلال يناير وفبراير وزاد مرة اخرى خلال مارس.

زيادة تركيز كلا من نترات البوتاسيوم والباكلوبترازول أدت الى حدوث زيادة معنوية فى محتوى الأوراق من النيتروجين. استخدام الباكلوبترازول بمعدل ٧,٥ جرام للشجرة ونترات البوتاسيوم بمعدل ٤% أدى إلى حدوث زيادة معنوية فى محتوى الأوراق من الكربوهيدرات مقارنة بالكنترول. أعلى محتوى للأوراق من النيتروجين سجل فى نوفمبر مع نترات البوتاسيوم بتركيز ٤% والباكلوبترازول بمعدل ٧,٥ جرام للشجرة. زاد محتوى الأوراق من النيتروجين فى نوفمبر ثم انخفض إلى أقل مستوى له فى يناير وفبراير ثم زاد مرة اخرى معنوياً خلال مارس. زادت نسبة الكربوهيدرات إلى النيتروجين نتيجة المعاملة بنترات البوتاسيوم أو الباكلوبترازول فى الموسمين فيما عدا صنف الصديق مع التركيزات المنخفضة من الباكلوبترازول فى الموسم الثانى. جميع تركيزات نترات البوتاسيوم أدت إلى حدوث زيادة معنوية فى نسبة الكربوهيدرات إلى النيتروجين ووجدت علاقة طردية بين التركيز المستخدم وهذه النسبة.