

Effect of Naphthalene Acetic Acid (NAA) Spray on Yield and Fruit Characteristics of Zaghoul Date Palm

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ABSTRACT

The experiment was carried out through 2005 and 2006 seasons on "Zaghoul" date palm of about 50 years old grown in loamy soil at El-Kanater Horticulture Research Station, Kalubia Governorate, Egypt.

The effect of NAA at (20, 30, 40 and 50 ppm) were sprayed on bunches, within two weeks after pollination time, in each season.

Results indicated that NAA spray at different concentrations tended to decrease bunch weight than the control due to reducing fruit number/bunch as a result of fruit drop.

Fruit and flesh weights, fruit dimensions, total soluble solids, sugar content were significantly higher under all treatments. While the acidity content and tannins in fruits were significantly lower in comparison with control. From the present study it is concluded that spraying NAA at 40 or 50 ppm on "Zaghoul" date bunches after two weeks from pollination time was a beneficial treatment to ensure fruit thinning and improve fruit quality under such conditions.

Key words: Thinning, NAA, date palm, fruit quality, yield.

INTRODUCTION

Zaghoul date palm is the most important cultivar of soft dates in Egypt. The fruit is consumed fresh at Khalal stage (red color).

Flower or fruit thinning is a critical cultural practice in the date palm production chain that affects fruit development, quality and yield and regulates tree yearly bearing. Fruit thinning of dates was found to insure adequate flowering the following year, to insure larger size and improve fruit quality and to lighten insure bunch and make it less compact and easier to handle (Bakr *et al.*, 2007 and Hussien *et al.*, 1979). Several methods were used to thin date palm namely: bunch thinning, bunch strands thinning, and individual fruit removal Abou-Rawash and Moustafa (2007), Ali Dinar *et al.*, (2002), Al-Obeed *et al.*, (2003), Bakr *et al.*, (2007) and Moustafa *et al.*, (1993).

Recent investigations have shown that many advances could be achieved in improving yield and fruit quality by the use of certain plant growth regulators for thinning date palm fruits and NAA was reported to be an

effective thinner for date palm fruits. (Abou Rawash and Moustafa, 2007; Ali Dinar *et al.*, 2002; Aljuburi *et al.*, 2003; Al-Obeed, 2003; Al-Saikhan, 2008; Bakr *et al.*, 2007; Hussien *et al.*, 1986; Moustafa *et al.*, 1993; and Tavakkoli *et al.*, 2006 on some date palm cultivars.

This investigation was carried out to study the effect of post-pollination application of NAA on fruit characteristics and yield per bunch of Zaghoul date cultivar.

MATERIALS AND METHODS

This study was carried out in 2005 and 2006 seasons on Zaghoul date palm trees of about 50 years old grown in loamy soil at El-Kanater Al-Khairia Research station, Kalubia Governorate, Egypt. All palm trees were uniform in size and vigor and subjected to the same cultural practices. Pollen grains from the same male palm were used for pollination in both seasons. Only ten similar bunches were left on each female palm. Each bunch contained the same number of strands on every individual palm tree.

Five treatments of NAA were applied to comparable bunches on the same palm within 2 weeks after pollination.

The Naphthalene Acetic Acid (NAA) was sprayed at concentrations of 20, 30, 40 and 50 ppm using two bunches for each and two bunches on each palm was sprayed with distilled water and served as a control. The treatments were replicated on four palm trees, Triton B (0.1%) was used as wetting agent in all spraying solution and spraying was done in morning with a hand sprayer.

All fruit bunches were harvested (at Khalal stage) on mid of September and bunch weight of each treatment was recorded. Thirty fruits were taken at random from each replicate for the determination of fruit and flesh weights, dimensions of fruit, total soluble solids by hand refractometer as described by A.O.A.C (1995), acidity as a malic acid as described by A.O.A.C (1995), dry matter content, tannins content using the method of Winton and Winton (1958) and sugar contents using method of Forse, (1938) and Smith *et al.*, (1956). The obtained data were statistically analysis according to Snedecor and Cochran (1980).

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RESULTS AND DISCUSSION

Fruit drop percentage:

It can be noticed (Table 1 and 2) that NAA significantly increased the percentage of abscised fruits and this effect was dependent on its concentration. Fruit drop percentage was 33.80, 37.37, 38.12, 40.53 and 31.58 when bunches were treated with 20, 30, 40, 50 ppm and control, respectively in 2005 season. The corresponding values for 2006 season were 25.75, 27.32, 30.35, 34.42 and 23.48, respectively. In this respect, NAA treatment at 20 ppm, was similar statistically to control bunches in both seasons. Similar trend was obtained by El-Hammady *et al.*, (1983) and Khalifa *et al.*, (1984) on different date palm cultivars.

Yield per bunch:

NAA treatments significantly decreased the average weight of bunches than the control. The lowest bunch weight was obtained at concentrations of 40 and 50 ppm than bunches treated with 20 ppm and control in both seasons of study. This result might be due to the thinning effect of NAA on date fruits. Several studies have demonstrated that less date fruits in proper managed trees have always better chances to increase size, weight and other fruit quality variables (El-Hammady *et al.*, 1983). This is mainly due to abundance of photosynthesis to remaining fruits (Ali-Dinar *et al.*, 2002). NAA was reported to be an effective thinner for date palm fruits (El-Kassas, 1986). These results were identical to those of Tavakkoli *et al.* (2006) on Shahani date cultivar, because developing fruits normally act as stone sink to tree nutrient sources.

Fruit weight:

Fruit weight was significantly increased by NAA at 40 and 50 ppm treatments than control in both two seasons. While, NAA at 20 ppm did not induce any significant difference as compared to untreated bunches in both seasons. The fruit weight increment by NAA treatments was induced as a result of diminishes the fruit set percentage. Similar results were found by Aljuburi *et al.* (2007); Bakr *et al.*, (2007); Al-Obeed *et al.*, (2003); El-Kassas, (1986), they all reported that NAA was found to be adequate date fruit thinner.

Flesh weight:

NAA at 40 and 50 ppm treatments significantly increased the flesh weight than control during both seasons. On the other hand, NAA at 20 ppm did not induce any significant differences compared to untreated bunches in both seasons. Mean date fresh fruit weight, flesh percent increased with thinning treatments, Al-Saikhan (2008). Similar results were reported by (Abo-Rowash and Moustafa *et al.*, 2007; Bakr *et al.*, 2007; El-Kassas, 1986; Moustafa *et al.*, 1993).

Fruit dimensions:

The fruit length and width were increased by NAA treatments at 30, 40 and 50 ppm than the untreated fruits in both seasons and the differences were significant in most treases. These results were in line with those obtained by (Abd El-Ghaffar and Ceif El-Rahman, 1986; Aljuburi *et al.*, 2007; Al-Obeed *et al.*, 2003; Bakr, *et al.*, 2007 and El-Kassas, 1986).

Dry matter content:

Dry matter content of fruits treated with NAA at 50 ppm was significantly lower as compared with fruits treated with 20, 30 ppm and control in the first season. On the other hand, no significant differences were obtained during the second season by the studied treatments.

Total Soluble Solids:

NAA treatments had significantly effect on T.S.S. percentage of date fruits (Table 1 and 2). Significant higher of T.S.S. content was observed in fruit treated with NAA at 40 and 50 ppm than the untreated fruits in both seasons. On the other hand, T.S.S. content has nearly similar trends in fruits treated with NAA at 20, 30 ppm and untreated fruits (control) in both seasons. These results were in agreement with results obtained by Abo-Rawash and Moustafa (2007) and Al-Obeed *et al.*, (2007) on different date palm cultivars.

Total Sugars:

Total sugars content significantly increased in fruits treated with NAA at 40 and 50 ppm than the control in both seasons. While, total sugars content in fruits treated with NAA at 20 and 30 ppm were statistically similar compared with untreated fruits in both season. Similar results were reported by Abd El-Ghaffar and Ceif El-Rahman, (1986); El-Kassas, (1986) and Khalifa *et al.*, (1984) on different date palm cultivars.

Reducing Sugars:

In both seasons, NAA at 40 and 50 ppm significantly increased the reducing sugars content when compared with the untreated control. No significant pronounce effects when the fruits treated with NAA at 20 and 30 ppm compared with the untreated fruits in both seasons. Similar findings were reported by (Abd El-Ghaffar and Ceif El-Rahman, 1986; and Khalifa *et al.*, 1984). Increases of sugar contents in treatments of thinning may be attributed to an internal adjustment mechanism that makes the remaining fruits capable to efficiently use assimilates and improve their chemical and physical qualities in reduced competitive environments (Ali-Dinar *et al.*, 2002 and Hammam *et al.*, 2002).

Table 1. Effect of NAA with different concentration on yield and fruit quality on Zaghloul date palm cultivar during 2005 season

| Characteristics | NAA Concentration (ppm) | | | | | L.S.D. _{0.05} |
|---------------------------|-------------------------|-------|-------|-------|-------|------------------------|
| | Control | 20 | 30 | 40 | 50 | |
| Fruit drop percentage (%) | 31.58 | 33.80 | 37.37 | 38.12 | 40.53 | 4.15 |
| Bunch weight (Kg) | 18.17 | 17.38 | 16.75 | 16.13 | 15.55 | 2.09 |
| Fruit weight (gm) | 21.59 | 23.42 | 24.76 | 25.39 | 26.15 | 1.90 |
| Flesh weight (gm) | 19.41 | 20.98 | 22.71 | 23.13 | 23.85 | 2.05 |
| Fruit length (cm) | 5.61 | 5.75 | 5.78 | 5.82 | 5.99 | 0.18 |
| Fruit diameter (cm) | 2.64 | 2.78 | 2.84 | 2.83 | 2.92 | 0.21 |
| Dry matter content (%) | 30.10 | 29.78 | 29.27 | 29.83 | 28.20 | 1.30 |
| T.S.S. (%) | 19.90 | 20.57 | 21.57 | 23.00 | 23.74 | 3.02 |
| Total sugar (%)* | 23.77 | 25.52 | 26.15 | 29.67 | 31.42 | 5.30 |
| Reducing sugar (%)* | 13.39 | 15.35 | 16.95 | 19.90 | 21.21 | 4.07 |
| Titrateable acidity | 0.120 | 0.118 | 0.113 | 0.111 | 0.109 | 0.009 |
| Tannins (%) | 0.107 | 0.102 | 0.094 | 0.083 | 0.079 | 0.016 |

*On fresh weight base

Table 2. Effect of NAA with different concentration on yield and fruit quality on Zaghloul date palm cultivar during 2006 season

| Characteristics | NAA Concentration (ppm) | | | | | L.S.D. _{0.05} |
|---------------------------|-------------------------|-------|-------|-------|-------|------------------------|
| | Control | 20 | 30 | 40 | 50 | |
| Fruit drop percentage (%) | 23.48 | 25.75 | 27.32 | 30.35 | 34.42 | 3.77 |
| Bunch weight (Kg) | 21.30 | 20.48 | 19.92 | 18.77 | 18.55 | 2.05 |
| Fruit weight (gm) | 19.41 | 20.43 | 22.93 | 24.15 | 24.92 | 3.27 |
| Flesh weight (gm) | 17.30 | 18.27 | 20.81 | 22.00 | 22.75 | 3.11 |
| Fruit length (cm) | 5.44 | 5.60 | 5.69 | 5.76 | 5.86 | 0.20 |
| Fruit diameter (cm) | 2.54 | 2.68 | 2.73 | 2.75 | 2.85 | 0.17 |
| Dry matter content (%) | 26.33 | 26.28 | 26.07 | 25.51 | 25.77 | N.S |
| T.S.S. (%) | 18.67 | 19.80 | 20.34 | 22.00 | 22.34 | 2.57 |
| Total sugar (%)* | 21.52 | 23.82 | 23.76 | 24.72 | 26.82 | 3.18 |
| Reducing sugar (%)* | 11.39 | 12.87 | 12.85 | 14.74 | 16.00 | 2.99 |
| Titrateable acidity | 0.130 | 0.127 | 0.122 | 0.119 | 0.117 | 0.010 |
| Tannins (%) | 0.109 | 0.107 | 0.101 | 0.097 | 0.092 | 0.009 |

*On fresh weight base

Titrateable acidity:

NAA treatments had significantly effect on acidity content of date fruits. Significant lower of acidity content was observed in fruit treated with NAA at 40 and 50 ppm than the untreated fruits in both seasons. On the other hand, the acidity content was similar statistically in fruits treated with NAA at 20 and 30 ppm as well as untreated fruits in both seasons (Tables 1 and 2). Similar results were reported by (Abd El-Ghaffar and Cief El-Rahman, 1986).

Tannins content:

Naphthalene acetic acid treatment significantly affected the tannins content of treated fruits (Table 1 and 2). The data showed that significant reduction in tannins content was observed at 40 and 50 ppm NAA treatments than the control in both seasons. Tannins content in fruits treated with NAA at 20 and 30 ppm were similar statistically compared with untreated fruits. These results are in agreement with those of El-Hammady *et*

al., (1983) and Khalifa *et al.*, (1984) on different date palm cultivars.

CONCLUSION

It can be generally concluded that NAA treatments at 40 and 50 ppm were significantly superior to the other treatments in increasing fruit and flesh weights, fruit dimensions, T.S.S., total sugars and reducing sugars, while it decreased dry matter, acidity and tannins content in fruits. This may be due to the pronounced thinning effects of NAA treatments on reducing yield than the untreated treatment (control).

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الملخص العربي

تأثير الرش بالنفثالين حمض الخليك على المحصول وخصائص ثمار البلح الزغلول

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وزن السباطه في كلا الموسمين، ونتيجته لذلك زاد وزن الثمار واللحم وأبعاد الثمره معنويا مقارنة بعدم الرش في كلا الموسمين.

3 أظهرت النتائج زيادة معنويه في نسبة المواد الصلبة الذائبه ومحتوى الثمار من السكريات الكلبيه والمختزله والتي زادت بوضوح عند معاملة NAA بتركيز 40، 50 جزء في المليون مقارنة بعدم الرش (المقارنه) في كلا الموسمين.

4 أنخفض محتوى الثمار من التانينات والحموضه بمعاملة NAA بتركيز 40، 50 جزء في المليون عن معاملة المقارنه في كلا الموسمين.

من هذه النتائج إتضح أن الفائده قد عادت من أستعمال NAA نتيجة تأثيره على خف الثمار وتحسين جودة الثمارحيث يمكن أستبدال الحف اليدوى بالحف الكيماوى بمنظمات النمو NAA بتركيز 40، 50 جزء في المليون.

تم دراسة تأثير الحف الكيماوى للـNAA بتركيزات صفر ، 20، 30، 40، 50 جزء في المليون على محصول وخصائص ثمار البلح الزغلول خلال موسمي 2005، 2006 بمزرعة محطة بحوث البساتين بالقناطر الخيريّه بمحافظة القليوبيه - مصر.

أشتملت التجريه على خمسة معاملات للرش، أجرى الرش بعد التلقيح بأسبوعين وقد رشت سباطات معاملة المقارنه بالماء وكانت أهم النتائج التي تم الحصول عليها هي:

1 وجد أن الرش بـNAA أحدث زياده في نسبة تساقط الثمار، وكانت هذه الزياده عند الرش بتركيزات 30، 40، 50 جزء في المليون على الترتيب بالمقارنه بمعامله المقارنه.

2 قل وزن السباطه متأثره بمعاملات الرش مقارنه بمعاملة المقارنه. وقد كان الرش بتركيز 40، 50 جزء في المليون مسئولاً عن نقص