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EFFECT OF SOME SLOW RELEASE N FERTILIZERS ON GROWTH AND FRUITING OF TWO MANGO CVS; FIGRI KELAN AND KEITT

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ABSTRACT

This study was conducted for comparing three slow release N fertilizers namely, sulphur-coated urea (SCU), phosphorus – coated urea (PCU) and Enciabene with the conventional fast release N fertilizer namely ammonium nitrate each at the recommended rate of N i.e., 1000 g N/tree/year for growth characters on the three growth flushes, percentages of leaf N, P and K in the Spring growth cycle, date of first bloom, number of panicles/tree, fruit retention %, yield as well as physical and chemical characters of fruits in two mango cvs Figri Kelan and Keitt during 2004 and 2005 seasons. Results showed that suppling the trees of both mango cvs with the three slow release N fertilizers were superior to the application of the fast one in improving shoot length, number of leaves / shoot and leaf area in the three growth cycles, percentages of leaf N, number of panicles / tree as well as physical and chemical properies of the fruits. The slow release N fertilizers slightly advanced first bloom date. Application of sulphur-coated urea (SCU), phosphorus-coated urea (PCU) and Enciabene (ENC) in a descending order, was very favorable in this connection. These results were true for both mango cvs. It is suggested to fertilize the trees of both mango cvs Figri Kelan and Keitt with N at 1000g/tree/year as sulphur-coated urea fertilizer (2.4 Kg/tree/year) for obtaining an economical yield with fairly good fruit quality.

Keywords: Mango trees, Fertilization, Slow release, Growth, Friuting

INTRODUCTION

Mango cvs Firgri Kelan and Keitt as prime mango growth under Upper Egypt conditions still need a lot of studies about the type and exact rate of N required to produce the maximum yield and to improve fruit quality. Recently, new techniques for fertiliztion of fruit trees grown under sandy soil were arisen. Out of those, the application of controlled release N fertilizers. They were developed mainly to reduce the number of applications per year, minimize the cost of production, improve the efficeny of N used by trees, reactions and the rapid

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denitrification **(Travis, 1971; Nijjar, 1985; Allen, 1986 and Alva, 1992)**. The control and continous providing of the trees with their requirements from N can be achieved by using controlled release N fertilizers which are responsible for releasing their own N at a longer peroid and at the critical date of fruit development.

Previous studies showed that using slow release N fertilizers was preferable than using the fast one in improving growth cirteria **(Jackson and Davies, 1984; Marler *et al* 1987; Yuda *et al* 1987; Ferguson *et al* 1988; Zekri and Koo, 1991; Alva *et al* 1993 and Alva and Tucker, 1996)**, nutritional status of the trees **(Maquireiro *et al* 1984; Koo 1986; Scuderi *et al* 1993 and Akl *et al* 2002)** and fruiting **(Koo, 1988; Boman, 1993; Ahmed *et al* 1997 and Akl *et al* 2002)**.

This study was conducted to compare three controlled release N fertilizers with the conventional fertilizer i.e ammonium nitrate on growth and fruiting of Firgri Kelan and Keitt mango trees grown in sandy soil .

MATERIAL AND METHODS

This investigation was carried out during 2004 and 2005 seasons on 24 trees rearly uniform in vigour of 15 years old Firgri Kelan and Keitt mango trees budded on the same rootstock (Balady mango) transplants in the Tropical fruit department Farm, Horticultural Research Institute at Kom-Ombo district, Aswan Governorate. The trees of each mango cv were planted in sandy loam soil at 7.0 x 7.0 meters apart.. Analysis of the tested soil according to **(Wilde *et al* 1985)** is shown in Table (1).

Table 1. Mechanical physical and chemical analysis of the tested orchard soil

Sand %	56.30
Silt %	29.20
Clay %	14.50
Texture	Sandy loam
pH	7.92
E.C. $(dsm)^{-1}$	0.95
O . M . %	1.80
Total Ca Co_3 %	2.33
Total N %	0.09
Avialable P (ppm)	11.0
Avialable K (ppm)	300.00

This experiment included the following four treatments for each mango cv.

1- Application of sulphur-coated urea (SCU, 41% N) at the recommended rate of N namely, 1000g/tree (2.4 kg/ tree).
2- Application of phosphorus–coated urea (PCU, 37.11% N) at the recommended rate of N (2.50 Kg / tree) .
3- Appication of Eciabene (ENC, 40% N) at the recommeneded rate of N (2.50 Kg/tree).
4- Application of ammonium nitrate (AN 33.33% N) at the recommended rate of N (3.0 Kg / tree).

Each treatment was replicated three times, one tree per each for both mango cvs.. The design of experiment was completely randomized blocks. The three slow release N fertilizers at the prementioned amounts were applied once in circular digs around each tree 50 cm apart from trunk and covered with soil.

The soluble N fertilizer; ammonium nitrate was added twice at Spring growth cycle start (1st week of March) and just after fruit setting (last week of April). The treated trees received the basal P and K fertilizers. Other hortiucultural practices were carried out as usual.

Shoot length (cm) number of leaves and leaf area $(cm)^{-2}$ according to **(Ahmed and Morsy, 1999)** were mearsued in the Spring, Summer and Autumn flushes in the two mango cvs.

Samples of twenty leaves from the 6 month old shoots from the Spring growth cycle (1st week of September) were selected to determine percentages of N , P and K (on dry weight basis) according to the methods outlined by **(Wilde *et al* 1985)** .

First bloom date was recorded. Number of panicles/tree was also counted. Percentage of fruit retention was calculated by dividing the number of retained fruits up to the date of harvest by the total number of fruit set at pea stage and multiplying the product by 100.

The yield of each tree was recorded (in Kg) at harvesting time in both mango cvs.. Samples of twenty fruits were taken from each replicate for measuring the following physical and chemical properties :

1. Average fruit weight (g) and dimensions (cm).
2. Total soluble solids% by handy refractometer.
3. Total and reducing sugars percentages using Lane and Eynon procedure **(A.O. A.C., 1985).**
4. Non-reducing sugars percentage.
5- Total acidity percentage (expressed as g tartaric acid/ 100 g pulp) by titration with 0.1 N Na OH using phenolphthalein as an indicator **(A.O. A.C., 1985).**
6. Ascorbic acid content (expressed as mg per 100g pulp) by the use of 2.6– dichlorphenolendophenol method **(A.O.A.C., 1985)**.

All the obtained data were tabulated and statistically analyzed according to **Mead *et al* (1993)** using New L.S.D test at 5% level for differentiating between various treatment means.

RESULTS AND DISCUSSION

1- Growth characters in the three growth flushes

It is clear from the data in Table (2) that varing the source of slow and fast release N fertilizers significantly affected the three growth parametrs namely shootlength, number of leaves/shoot and leaf area in both mango cvs.. Fertilizing the three slow release N fertilizers surpassed the application of the fast one in stimulating each growth character was attributed to using SCU, PCU and ENC, in a descending order. Supplying the trees with SCU and ammonium nitrate gave the maximum and minimum values, respectively. These findings were true in both seasons and in both mango cvs.

The effect of the slow release N fertilizers in improving the growth of the trees could be attributed to their effect on regulating the release of its own N as the plants needed. Also they gave the highest values of residual N due to their low activity index, while those soluble one gave the lowest values of available N left in the soil. In addition, the role of N as a constituent of amino acids and proteins as well as its important effect in encouraging cell division and the

development of meristemtic tissues **(Nijjar, 1985)** can give an explanation for the present effect of such slow release N fertilizers in activating the growth.

These results are in agreement with those obtained by **Jackson and Davies (1984); Marler *et al* (1987); Yuda *et al* (1987); Ferguson *et al* (1988); Zekri and Koo (1991) and Alva and Tucker (1996).**

2. Leaf content of N P and K

Data in Table (3) clearly show that the percantages of N, P and K in the leaves of mango cvs Firgri Kelan and Keitt were significantly varied according to the sources of slow and fast release N fertilizers. Percentages of N was maximized in the trees treated with the three slow release N fertilizers compared to using the fast release N fertilizer. However, treating the trees with ammonium nitrate was significantly accompanied with maximizing percentages of P and K rather than using the three slow release N fertilizers. Amending the trees with sulphur-coated urea (SCU), phosphorus–coated urea (PCU) and Ecniabene (ENC) in a descending order was accompanied with maximizing these nutrients.

The minimum values of N and the maximum values of both P and K were recorded in the trees fertilized with ammonium nitrate . Using sulphur-coated urea had the maximum values of these nutrients compared to the other slow release N fertilziers. These results were true in 2004 and 2005 seasons in both mango cvs.

The great reduction in N loss and the increase in plant uptake of N due to application of the slow release N fertilizers could expalain the reason of their effect in improving the leaf status of N. However, the observed reduction in the leaf content of both P and K due to application of these fertilizers could be attributed to the great consumption of these nutrients to face the increase in vegtative growth (dilution factor). The reduction in N uptake in response to the application of the fast release N fertilizer ammonium nitrate was mainly attributed to the great leaching of N from soil through drainge water, especially in sandy soils.

These finding are in accordance with those obtained by **Maquireiro *et al* (1984); Scuderi *et al* (1993) and Akl *et al* (2002).**

3. First bloom date

As shown in Table (4) using slow release N fertilizers clearly advanced first bloom date in comparsion with the use of Ammnonium nitrate.

Fertilizing with sulphur-coated urea achieved the earliest date of first bloom. The greatest delay on first bloom was observed on the trees fertilized with ammonium nitrate. These result confirmed the beneficial effect of slow release of N on advancing blooming stages in both mango cvs Firgri Kelan and Keitt. this is true in both 2004 and 2005 seasons.

4. No. of panicles/tree, fruit retention % and yield / tree

It is obvious from the data in Table (4) that the great and significant differences on number of panicles/tree, fruit retention % and yield/ tree were observed among the four sources of N. They were

significantly maximized in response to application of the three slow release N fertilizers compared to using the fast one. Supplying the trees of mango cvs Firgri Kelan and Keitt with SCU, PCU and ENC, in a descending order, succeeded in obtaining the highest values. The minimum values were detected on the trees fertilized with ammonium nitrate. The mango cv. Firgri Kelan produced 90 and 120 Kg under fertilization with SCU, while those fertilized with ammonium nitrate gave 70 and 89 Kg in both seasons respectively. In the mango cv, Keitt the trees fertilized with SCU produced 55 and 80 Kg in 2004 and 2005 seasons, respectively. Yield in such cv. that received ammonium nitrate reached 35 and 58 Kg in both seasons, respectively. These results were true in 2004 and 2005 seasons in mango cvs Firgri Kelan and Keitt.

The more avialbility of N for growth and fruiting in the slow release N fertilizers and the promoption on nutritional status of the trees could explain the improving effect of these slow release N fertilizers on the yield. Also, the great control of N uptake by the trees due to the application of slow release N fertilizers makes the ratio between carbohydrates and total nitrogen in favour of producing more flowers. These merits of the slow release N fertilizers result in a great promotion on fruit set , and consequently, the yield.

These result are in a ccordance with those obtained by **Koo, (1986); Koo, (1988); Boman, (1993); Scuderi *et al* (1993); Wassel *et al* (2000) and Akl *et al* (2002).**

5. Fruit Quality

Data in Table (5 & 6) clearly show that physical and chemical characters of mango cvs Firgri Kelan and Keitt were greatly varied according to sources of N. Application of the three slow realease N fertilizers; SCU, PCU and ENC was favourable in improving fruit quality in terms of increasing fruit weigth and dimension, total soluble solids totals sugars, reducing sugars non-reducing sugars and ascorbic acid and in reducing total acidity % than using ammonium nitrate. The promotion in quality of the fruit was associated with using SCU, PCU and ENC in a descending, order. Unfavourable effects on fruit quality were detected owing to using ammonium nitrate fertilizers. These results were true in 2004 and 2005 seasons in mango cvs Firgri Kelan and Keitt.

The continous release of N through all tree growth stages especially at fruit development stage due to the application of slow release N fertilizers could expalin their action on fruit weight. In addition, the important role of N in stimulating both cell division and cell elongation and the biosythesis of proteins and carbohydrates must be taken into our consideration. The effect of the slow realease N fertilizers on achieving a good balance between growth and fruiting through adjusting the release of N is surely reflected on accumulating total carbohydrates and making them available for enhancing the ripening of fruits.

The promoting effect of the slow release N fertilizers on fruit quailty was confirmed by the resultsd of **Ahmed *et al* (1997) and Hegab *et al* (1999).**

As a conclusion, fertilizing the trees of mango cvs Figri Kelan and Keitt with N at 1000 g/tree as sulphur-coated urea was beneficial in obtaining an economical yield and improving fruit quality.

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مجلة اتحاد الجامعات العربية للدراسات والبحوث الزراعية ، جامعة عين شمس ، القاهرة ،١٤(١) ، ٣٢١-٣٣٥ ، ٢٠٠٦

تأثير بعض الأسمدة النيتروجينية بطيئة التحلل على النمو و الإثمار في صنفي المانجو الفجري كلان و الكيت

[٢١]

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أجريت هذه التجربة لمقارنة تأثيرثلاثة أسمدة نيتروجينية بطيئة التحلل هي اليوريا المغطاة بالكبريت ، واليوريا المغطاة بالفوسفور والإنسيابين ، بالسماد سريع التحلل نترات الأمونيوم بمعدل ١٠٠٠ جرام نيتروجين للشجرة/سنة على صفات النمو الخضري في دورات النمو الثلاثة، والنسب المئوية للنيتروجين والفوسفور والبوتاسيوم في أوراق نموات الربيع، موعد الإزهار، عدد النورات الزهرية على الشجرة ، النسبة المئوية للثمار العاقدة ، كمية المحصول والخصائص الطبيعية والكيميائية للثمار في صنفي المانجو الفجري كلان والكيت وذلك خلال موسمي ٢٠٠٤ و ٢٠٠٥.

أشارت نتائج الدراسة إلى أن إمداد أشجار صنفي المانجو الفجري كلان والكيت بالأسمدة بطيئة التحلل الثلاثة قد تفوق على استخدام السماد سريع التحلل وهو نترات الأمونيوم في تحسين طول النمو الخضري ، عدد الأوراق على النمو الخضري ومساحة الورقة في دورات النمو الثلاثة، النسبة المئوية للنيتروجين فى الاوراق ، عدد النورات الزهرية على الشجرة ، النسبة المئوية للثمار العاقدة ، كمية المحصول والخصائص الطبيعية والكيميائية للثمار وكان هناك تبكير طفيف في موعد الإزهار عند استخدام الأسمدة بطيئة التحلل. وكان استخدام اليوريا المغطاة بالكبريت ، واليوريا المغطاة بالفوسفور والإنسيابين مرتبة ترتيباً تنازلياً فعالاً في هذا الصدد وكانت هذه النتائج متماثلة في كلا صنفي المانجو.

يقترح تسميد أشجار المانجو صنفي الفجري كلان والكيت بالنيتروجين بمعدل ١٠٠٠ جرام للشجرة في صورة سماد اليوريا المغطاة بالكبريت (٢,٤ كجم للشجرة) للحصول على محصول إقتصادي وثمار ذات جودة عالية.

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