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THE EFFECT OF SOME SLOW RELEASE NITROGEN FERT3ILIZERS ON GROWTH, NUTRIENT STATUS AND FRUITING OF BALADY MANDARIN TREES UNDER SANDY SOIL

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Abstract: The effect of some slow release nitrogen i.e. urea-formaldehyde, phosphorus-coated urea and sulpher coated-urea and urea that fast release nitrogen at levels 500, 1000 and 1500 g/tree/year on growth, leaf NPK, yield and fruit quality of Balady mandarin trees grown in sandy soil during 2006 and 2007 seasons were studied. Urea was added at three times at mid February, May and August, while slow-release N fertilizers applied once at the start of spring growth.

Application of three slow-release N fertilizers once a year surpassed the application of the fast one in improving vegetative growth, nutritional status of trees, yield and fruit quality. However added any batches over 1000 g/tree gave a slight improvement in yield and other characters under this study. Moreover, using sulpher coated urea at 500 g/tree gave the satisfactory yield with best fruit quality. The effectiveness of the three slow release N fertilizers was arranged descendingly as follows, sulpher-coated urea, phosphorus-coated urea and urea-formaldehyde, respectively.

Generally, fertilizing Balady mandarin trees once with sulpher coated urea at 500-1000 g/trees/year was the best results on vegetative growth, yield and all physical and chemical characters of fruits. In addition saving nitrogen fertilization cost and reducing nitrate pollution.

Key words: Fertilization – Slow release fertilizers – growth - nutrient status fruiting – Balady mandarin.

Introduction

Citrus is the most important fruit crop in Egypt. It can grow under different environmental conditions and soil types. Mandarin ranks second crop after oranges in Egyptian citrus industry. Balady mandarin fruits are superior quality and considered as one of the most popular fruits in local markets owing to its nutritive value and it is easy to peel.

Fertilization is one of the important tools in increasing crop yield, especially nitrogen. Nitrogen is known to be one of the most major elements for plant nutrition and development science it plays an important role in a constituent of all proteins, nucleic acids and enzymes synthesis (Nijjar, 1985). The efficiency of nitrogen fertilizer under field conditions and surface irrigated rarely exceeds 50% and its usually ranged between 30 and 40% (Sahrawat, 1979). Losses of elements nutrients by leaching, volatilization, denitrification as well as mobility of movement elements and other ways was the most important problem. Thus optimizing nitrogen agent lossing can be solving this problem. The loss of nitrogen via leaching through drainage water may be reduced to some extent by using slow release forms of nitrogen. Slow release could be regulated the release of their own N as the plant needed. Consequently lead to an increase in vegetative growth and yield. Several controlled-release N fertilizers were studied for improve the efficiency of N used by plants (Scuderi *et al.*, 1993; Alva, 1992 and Wang and Alva, 1996). In addition, minimize loss of nutrients by leaching (Wang and Alva, 1996). On the other hand, reduced chemical reactions, biological immobilization in the soil and rapid denitrificaiton (Koo, 1988 and Mikkelsen *et al.*, 1994). The vegetative growth, yield and fruit quality can be improved by application of slow-release N fertilizers which release of their own at a longer period. At the same time, they are using once a year therebye, its preferable than using fast release N fertilizers and less pollution meanwhile improved growth, nutritional status, yield and fruit quality of fruit crops (Jackson and Davis, 1984; Maquireiro *et al.*, 1984; Yuda *et al.*, 1987; Ferguson *et al.*, 1988; Boman, 1993; Alva and Tucker, 1996; Hammam and Assy, 2000 and Wassal *et al.*, 2000).

The process of developing nitrogen management practices for Balady mandarin trees in sandy soil to increase nitrogen uptake efficiency and minimize No3 leaching below the rooting depth is therefore required.

So, the aim of this work was to study the effect of three controlled release N fertilizers urea formaldehyde, phosphorus coated urea and sulpher coated-urea compared to fast release (urea) on vegetative growth, nutritional status, yield and fruit quality of Balady mandarin trees grown in sandy soil, to find out the best one.

Materials and Methods

This investigation was carried out during two successive seasons of 2006 and 2007 on seventy two trees, 12 years old Balady mandarin trees (*Citrus reticulate* L.). They were budded on sour orange; grown in a private orchard situated at El-Marachda, Qena Governorate. The selected and uniform in vigour trees were planted at 5x5 m apart and irrigated via surface irrigation. The texture of the orchard soil is sandy, Table (1).

Table(1): Some physical and chemical properties of the investigated soil.

Sand %	Silt %	Clay %	Texture	pH (1:2.5 extract)	E.C. ds/m	O.M. %	Total N%	Available		$CaCO_3$ %
								P (ppm)	K (ppm)	
86.95	8.13	4.92	Sandy	8.2	0.7	0.9	0.06	3.3	133.0	1.94

The selected trees were divided into twelve treatments as follow:

1- Application of urea (46.5% N) at 500 g N/tree.

2- Application of urea at 1000 g N/tree.

3- Application of urea at 1500 g N/tree.

4- Application of urea-formaldehyde (38.37% N) at 500 g N/tree.

5- Application of urea-formaldehyde at 1000 g N/tree.

6- Application of urea-formaldehyde at 1500 g N/tree.

7- Application of phosphorus-coated urea (37.11% N) at 500 g N/tree

8- Application of phosphorus-coated urea at 1000 g N/tree

9- Application of phosphorus-coated urea at 1500 g N/tree

10-Application of sulphur-coated urea (41% N) at 500 g N/tree.

11-Application of sulphur-coated urea at 1000 g N/tree.

12-Application of sulphur-coated urea at 1500 g N/tree.

The treatment experiments were arranged in a complete randomized block design with three replicates, two trees each. The three slow release N fertilizers were added once at the start of spring growth under soil surface about 2-3 cm while the fast release N fertilizers (urea) was added at three equal batches at the mid February, May and August.

All trees received all horticulture practice except with those N fertilizers additive during two studied seasons were done as usual. Generally, the following measurements were determined.

A-Vegetative growth measurements:

Four main branches which nearly uniform in growth, diameter and foliage density and distribution around the periphery of each tree were chosen and labeled in February.

The following vegetative characters were studied in the autumn growth cycle:

1- Shoot length (cm)

2- Leaf number /shoot

3- Leaf area (cm^2), thirty full mature leaves/tree (from the 4^{th} to 5^{th} leaf from the labeled shoot base) were randomly taken and measured by leaf area meter (Model Ci 203 USA made)

B- Leaf mineral content:-

Samples of fifty mature leaves were selected at random from the non fruiting shoots of the spring at mid September to determined percentage of N, P and K according to Wilde *et al.* (1985) as follows: Sample of leaves were taken, water and distilled water washed and oven dried at 70°C till constant weight. Dried samples were pulverised separately and samples of 0.2 (g) e ach was digested with a mixture of sulfuric acid and hydrogen peroxide, to determine the following:

1- Total nitrogen percentage was measured by the micro-kjeldahl methods.

2- Phosphorus percentage was determined colorimetricaly.

3- Potassium percentage was determined using flame photometer.

C – Measurements of yield and its components:

1- Fruit retention

Ten distributed fruiting shoots, around trees were chosen and labeled before the beginning of treatments. The number of flowers per each one was counted. In pre-harvest, the fruits retention for each branches was recorded. Then fruit retention was calculated as:

$$\text{Fruit retention\%} = \frac{\text{Total number of fruits}}{\text{Total number of flowers}}$$

At harvesting time at the middle of December, number of fruit/tree was count and yield/tree was calculated.

D – Fruit quality:

Sample of 10 fruits were randomly taken from each tree to evaluate fruit quality. Fruit weight and chemical fruit quality such as of total soluble solids, total acidity (expressed as gm citric acid/100 ml juice), ascorbic acid (mg/100 ml juice) and sugar contents were estimated according to A.O.A.C. methods (1985).

The obtained data were statistically analyzed according to Mead *et al.* (1993) using L.S.D. test to define the significance of the differences among various treatment means.

Results and Discussion

Vegetative growth measurements:

It is clear from the data in Table (2) that the application of the slow release N fertilizers, urea formaldehyde (UF), phosphorus-coated urea (PCU) and sulpher coated urea (SCU) were more effective positively and significantly improved, shoot length, no. of leaves/shoot and leaf area of Balady mandarin trees compared to application of fast release N fertilizer (urea) in both seasons. The promotion on vegetative growth traits were associated with increasing the level of N applied from 500 till 1500 g/tree. Raising N levels from 1000 to 1500 g/tree from either fast or slow release fertilizers failed to show any measurable increase in these traits. Moreover, the maximum, shoot length, leave no. per shoot and leaf area was detected on the trees fertilized with SCU at any level. These results were true in both two studied seasons.

Table(2): Effect of some slow-release nitrogen fertilizers on some vegetative growth traits of Balady mandarin trees in 2006 and 2007 seasons.

N source and level (g/tree)	Shoot length (cm)		Leaves No./shoot		Leaf area $(cm)^2$	
	2006	2007	2006	2007	2006	2007
U at 500 g	25.10	29.20	21.60	24.20	6.80	7.60
U at 1000 g	27.30	31.40	23.10	26.50	8.00	8.40
U at 1500 g	28.10	32.50	24.10	27.30	8.30	8.60
UF at 500 g	34.40	37.30	28.10	32.20	9.40	9.80
UF at 1000 g	36.70	39.70	30.30	34.20	9.70	10.75
UF at 1500 g	37.20	40.10	31.20	35.10	9.80	10.90
PCU at 500 g	40.30	44.30	33.20	38.00	10.90	11.50
PCU at 1000 g	41.90	46.20	35.10	39.90	11.20	11.60
PCU at 1500 g	42.40	47.80	36.30	40.50	11.40	11.80
SCU at 500 g	45.60	51.00	40.20	44.10	12.50	12.60
SCU at 1000 g	46.90	53.10	41.90	46.30	12.70	12.80
SCU at 1500 g	47.40	53.60	42.60	47.10	12.90	13.00
L.S.D. 5%	1.12	2.00	1.63	1.51	1.01	1.04

U = Urea (46.5% N), Fast release N fertilizer.

UF = Urea-formaldehyde (38.37% N), Slow release N fertilizer.

PCU = Phosphorus-coated urea (37.11% N), Slow release N fertilizer.

SCU = Sulpher-coated urea (41% N), Slow release N fertilizer.

Generally, the improving effects of slow release N fertilizer UF, PCU and SCU on vegetative growth might be attributed to their effect on regulating the release of their own N according to the plants needed. Also, they gave the highest values of residual N in soil due to their low activity index, compared to fast release (urea) which gave the lowest values of available N left in the soil (Mikkelsen *et al.*, 1994). In addition, the role of nitrogen in plants, which increase growth and development of all living tissue, also, N considered to be an important constituent of chlorophyll, protoplasm, protein and nucleic acid, so that it resulted in an increase in cell number and cell size with an increase in growth (Said, 1998 and El-Naggar *et al.*, 2002). In addition, the substantially improved the vegetative growth traits due to sulpher coated urea may be attributed to acidification resulted from S oxidation that decreasing soil pH that enhanced the solubility of nutrients and increases the activity of microorganisms. These effects increase the nutrients availability uptake and translocation and increase the vegetative growth (Yousry *et al.*, 1984). Similar findings were obtained by Alva and Tucker (1996), Hegab *et al.* (1999), Hammam and Assy (2000) and Wassal *et al.* (2000).

Leaf mineral content:

Data illustrated in Table (3) obviously reveal that application of N via slow release fertilizers was significantly preferable in increasing leaf N, P and K percentages than application of it via fast release.

In general data indicated higher leaf content of N percentage was associated with increasing of N level applied and vise versa via each treatment. However, increasing the levels of UF, PCU and SCU were followed by a gradual increase in leaf N percentage. Meaningless influence was detected between using the highest two levels of each slow release treatments. The best results of leaf N percentage observed at 1500 g SCU, while fast release (urea) at the same level recorded the lowest value. The intermediate value were shown at PCU and UF respectively. All the slow release N fertilizers give the same content of P and K, in the leaves.

Moreover, using SCU at 500 g/tree significantly increased the growth and leaf N, P and K percentage compared with other slow release and fast fertilizers. This means that using sulphur coated urea at 500 g/tree was sufficient to improve vegetative growth and tree nutritional status as well as useful in saving N fertilization cost and reducing nitrate pollution.

The great reduction in the loss of N and the increase in uptake due to the application of slow release N fertilizers could explain the reason for their effect in improving the leaf content of N. The vice versa was obtained due the application of the fast fertilizers which was mainly attributed due to great leaching of N from soil via drainge water.

The current study confirmed early studies by Mquireiro *et al.* (1984), Marler *et al.* (1987), Wang and Alva (1996) and Hammam and Assy (2000) and Wassal *et al.* (2000).

Table(3): Effect of some slow-release nitrogen fertilizers on N, P and K percentage (dry weight basis) of Balady mandarin leaves in 2006 and 2007 seasons.

N source and level (g/tree)	Leaf-N %		Leaf-P %		Leaf-K %	
	2006	2007	2006	2007	2006	2007
U at 500 g	2.10	2.20	0.13	0.14	1.03	1.02
U at 1000 g	2.17	2.26	0.12	0.13	1.01	1.00
U at 1500 g	2.18	2.29	0.11	0.12	0.97	0.98
UF at 500 g	2.25	2.37	0.21	0.23	1.23	1.21
UF at 1000 g	2.32	2.43	0.21	0.23	1.24	1.21
UF at 1500 g	2.33	2.44	0.21	0.23	1.24	1.22
PCU at 500 g	2.41	2.50	0.21	0.23	1.23	1.23
PCU at 1000 g	2.48	2.56	0.21	0.23	1.24	1.23
PCU at 1500 g	2.49	2.57	0.20	0.23	1.24	1.23
SCU at 500 g	2.60	2.65	0.20	0.23	1.23	1.23
SCU at 1000 g	2.68	2.71	0.20	0.23	1.23	1.23
SCU at 1500 g	2.69	2.73	0.20	0.23	1.24	1.24
L.S.D. 5%	0.06	0.05	0.02	0.02	0.08	0.07

Yield components

Table (4) presents Balady mandarin yield components as affected by application of some slow release fertilizes UF, PCU, SCU at level 500, 1000 and 1500 g/tree and fast release (urea). The treatments showed a significant differences among them in this respect. In general increasing nitrogen level via either fast or slow release fertilizers resulted increase yield components. However, the significant increases noticed between 500 g and 1000 g/tree while the results were non significant between the two higher level. Application of SCU was a considerable effect on increasing fruit retention % and fruit number and yield/tree at 1500 g/trees, it reached about 0.57 & 0.59%, 165.0 & 330.0 fruit/tree and 27.51 & 46.80 kg/tree at first and second seasons, respectively, compared to using urea at 500 g/tree which recorded the lowest values 0.27 & 0.32, 65 & 210 and 6.83 & 21.00 kg/tree during in both seasons, respectively. While, UF and PCU recorded the intermediate values. Moreover, the tree that fertilized with 500 g of sulpher-coated urea (SCU) recorded the highest values of fruit retention and fruit number and yield/tree compared to other slow release and fast fertilizers. Therefore, it could be concluded that such treatment was sufficient to get satisfactory increased the yield with good quality and very useful in saving N fertilization cost and reducing nitrate pollution.

Table(4): Effect of some slow-release nitrogen fertilizers on yield components of Balady mandarin trees in 2006 and 2007 seasons.

N source and level (g/tree)	Fruit retention %		Fruit no./tree		Yield/tree (kg)	
	2006	2007	2006	2007	2006	2007
U at 500 g	0.27	0.32	65.0	210.0	6.83	21.00
U at 1000 g	0.30	0.35	77.0	221.0	8.86	23.25
U at 1500 g	0.31	0.36	81.0	230.0	9.60	24.70
UF at 500 g	0.35	0.39	99.0	245.0	12.13	27.54
UF at 1000 g	0.38	0.42	115.0	255.0	14.80	30.00
UF at 1500 g	0.39	0.43	120.0	260.0	15.77	31.02
PCU at 500 g	0.42	0.47	128.0	270.0	17.79	33.48
PCU at 1000 g	0.45	0.50	136.0	279.0	19.82	35.71
PCU at 1500 g	0.46	0.51	140.0	283.0	20.62	36.85
SCU at 500 g	0.52	0.55	148.0	310.0	22.90	41.88
SCU at 1000 g	0.56	0.58	160.0	322.0	26.00	45.00
SCU at 1500 g	0.57	0.59	165.0	330.0	27.51	46.80
L.S.D. 5%	0.02	0.03	6.7	8.9	2.0	2.2

These findings emphasized that the slow release fertilizers regulate the release of their own N as the plants needed, as well as, decrease the losses N compared to fast release which speed losses of N from soil such effects the improve the vegetative growth, phytosynthesis and floral bud formation. So, slow-release fertilizers irregular N uptake by the trees and adjusted C/N ratio to favour of producing more flowers. Thus the aforementioned point were reflected in increasing fruit retention, fruit number per tree and yield/tree.

Also, it is obvious from Table (5) that the fruit weight was positively affected in response to application of slow release nitrogen fertilizers rather than using fast one. The promotion in fruit weight was associated with increasing the level of N applied from 500 till 1500 g/tree. The heaviest fruit were recorded on trees fertilized with 1500 g/tree sulpher coated urea. Moreover, raising N levels from 1000 to 1500 g/tree failed to show any significantly increase in fruit weight.

These findings could be related to the continuous release of N during growth stage of fruits due to the application of the slow release N fertilizers. In addition, N play an important role in stimulating cell division and cell elongation. In the same times enhancing biosynthesis of proteins and carbohydrates could be explain their action on increase the fruit weight. Similar results were reported by Ferguson *et al.* (1988), Boman (1993), Alva and Tuckar (1996), Wang and Alva (1996), Hegab *et al.* (1999) and Hammam and Assy (2000) and Wassal *et al.* (2000).

Effect of some slow release N fertilizers on fruit chemical characteristics:

Data in Tables (5&6) showed that the application of the three slow release N fertilizers were preferable in improving the fruit chemical quality in terms of increasing the total soluble solids and total sugars and in reducing the total acidity compared to via urea at the same levels. The best results with regards to chemical fruit quality were observed on UF, PCU and SCU in ascending order while urea showed the lowest values. Raising N levels from 500 to 1000 g/tree via urea significantly reduced total soluble solids and total sugar but increasing the total acidity. However, increasing the N level from 500 to 1500 g/tree via the three slow release N fertilizers failed to show any significantly action on chemical properties of the fruits. On the other hand, application of the three slow release N fertilizers had non significant results in reducing sugar and vitamin C content in fruit juice. From the previously mentioned findings, it is concluded that application of SCU at level 500 g/tree to Balady mandarin was the best results in obtaining a good chemical fruit quality in both seasons. These results are explained on the basis that slow release-N fertilizers was achieve a good balance between growth and fruiting through adjusting and controlling the release of N surely reflected on increasing the accumulating of the total carbohydrates and easily makes them available for inhancing ripening of fruits (Hammam and Assy, 2000). Similar results was obtained by Boman (1993) and Hegab *et al.* (1999).

Table(5): Effect of some slow-release (N fertilizer) on fruit weight, T.S.S.% and acidity % of Balady mandarin in 2006 and 2007 seasons.

N source and level (g/tree)	Fruit weight (g)		T.S.S. %		Acidity %	
	2006	2007	2006	2007	2006	2007
U at 500 g	105.0	100.0	12.30	12.60	0.99	0.98
U at 1000 g	115.0	105.2	12.10	12.30	1.01	1.02
U at 1500 g	118.0	107.3	11.70	12.00	1.15	1.10
UF at 500 g	122.5	112.4	12.80	13.00	1.07	1.06
UF at 1000 g	128.6	117.5	12.80	13.00	1.08	1.07
UF at 1500 g	131.3	119.3	12.80	13.00	1.09	1.08
PCU at 500 g	139.0	124.0	13.30	13.50	0.99	0.97
PCU at 1000 g	145.7	128.0	13.10	13.40	1.02	1.00
PCU at 1500 g	147.3	130.2	13.20	13.30	1.03	1.01
SCU at 500 g	154.6	135.1	13.60	13.90	0.92	0.90
SCU at 1000 g	162.3	139.7	13.50	13.70	0.92	0.91
SCU at 1500 g	166.7	141.8	13.50	13.70	0.92	0.91
L.S.D. 5%	3.1	3.3	0.39	0.28	0.02	0.03

Table(6): Effect of some slow-release nitrogen fertilizers on total sugar, reducing sugar % and vitamin C of Balady mandarin fruit juice in 2006 and 2007 seasons.

N source and level (g/tree)	Total sugars %		Reducing sugar %		Vitamin C (mg/100 ml juice)	
	2006	2007	2006	2007	2006	2007
U at 500 g	8.60	8.90	3.40	3.60	40.00	43.10
U at 1000 g	8.50	8.60	3.40	3.70	41.00	42.20
U at 1500 g	8.40	8.50	3.30	3.50	41.00	42.00
UF at 500 g	9.00	9.30	3.50	3.60	41.00	42.00
UF at 1000 g	9.00	9.10	3.50	3.60	42.00	42.00
UF at 1500 g	9.00	9.00	3.50	3.60	41.00	42.00
PCU at 500 g	9.80	9.80	3.30	3.70	39.50	42.80
PCU at 1000 g	9.80	9.80	3.20	3.60	40.00	43.00
PCU at 1500 g	9.80	9.70	3.30	3.60	41.00	42.80
SCU at 500 g	10.10	10.30	3.30	3.60	41.00	42.00
SCU at 1000 g	10.00	10.10	3.30	3.60	41.00	41.80
SCU at 1500 g	10.00	10.10	3.30	3.60	41.00	41.70
L.S.D. 5%	0.3	0.2	N.S.	N.S.	N.S.	N.S.

As a conclusion, fertilizing Balady mandarin trees grown in sandy loam soil with application of sulpher coated urea at level 500-1000 g/tree/year once gives the best results on yield and fruit quality compared to urea formaldehyde, phosphorus coated urea and the fast release (urea) N fertilizers under the same levels. In addition, it save nitrogen fertilization cost and reducing nitrate pollution.

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تأثير بعض الأسمدة النيتروجينية بطيئة التحلل على النمو وحالة العناصر الغذائية وإثمار أشجار اليوسفى البلدى تحت ظروف التربة الرملية

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أجريت هذه الدراسة فى موسمى 2006 ، 2007 على أشجار اليوسفى البلدى عمر 12 عام تحت ظروف التربة الرملية بمحافظة قنا لمقارنة ثلاثة أنواع من الأسمدة بطيئة التحلل وهى اليوريا فورمالدهيد ، اليوريا المغلفة بالفوسفور واليوريا المغلفة بالكبريت بالمقارنة مع الأسمدة السريعة التحلل (اليوريا) وذلك عند مستويات 500، 1000 ، 1500 جرام/ للشجرة/ سنة وتأثير ذلك على النمو الخضرى والحالة الغذائية للأوراق والمحصول حيث كانت إضافة الأسمدة السريعة تتم على 3 مرات منتصف فبراير، مايو ، أغسطس بينما الأسمدة البطيئة تضاف مرة واحدة فى بداية الربيع .

وقد أظهرت النتائج ما يلى :

- تفوقت الأسمدة البطيئة التحلل خلال مراحل الدراسة فى جميع الصفات السابقة مقارنة بالأسمدة السريعة التحلل .

- أظهرت الأسمدة البطيئة التحلل اختلافات معنوية فيما بينها وكانت الإستجابة أوضح ما يمكن فى حالة اليوريا المغلفة بالكبريت عن اليوريا المغلفة بالفوسفور أو اليوريا فورمالدهيد .

- أدت زيادة المعدلات المستخدمة فى التسميد من 500 – 1000 جم / شجرة إلى زيادة معنوية للنمو والحالة الغذائية للأشجار وكذلك المحصول ووزن الثمرة بينما لم تظهر زيادة معنوية نتيجة زيادة الجرعة إلى 1500 جم/شجرة/ سنة .

- أعطى استخدام 500 جم/شجرة/سنة من سماد اليوريا المغلفة بالكبريت محصول عال ذو صفات ثمرية جيدة مقارنة بالأسمدة الأخرى تحت أى مستويات .

من نتائج هذه الدراسة يمكن التوصية باستخدام الأسمدة البطيئة التحلل مرة واحدة عند بداية النمو وخصوصاً اليوريا المغلفة بالكبريت بمعدل 0.5 – 1 كجم / شجرة/سنة حيث يؤدى ذلك إلى تحسين النمو الخضرى والحالة الغذائية للأشجار مع إنتاج محصول عال ذو خصائص ثمرية جيدة.

وعليه يقترح تسميد أشجار اليوسفى البلدى باليوريا المغلفة بالكبريت بمعدل 0.5-1 كجم /شجرة / سنوياً مرة واحدة فى بداية النمو لتقليل فقد الآزوت وتحسين إنتاجية أشجار اليوسفى البلدى فضلاً عن تقليل تكاليف الأسمدة النيتروجينية وتقليل التلوث الناشئ عن زيادة النترات .