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A COMPARATIVE STUDY ON THE EFFECT OF FAST AND SLOW-RELEASE NITROGEN FERTILIZERS ON NUTRITIONAL STATUS, YIELD AND FRUIT QUALITY OF LE-CONTE PEAR TREES UNDER RAFAH CONDITION.

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ABSTRACT

This experiment was carried out for two successive seasons (1998 and 1999) on mature le – conte pear trees treated with two sources of bentonite coated urea as a slow release nitrogen fertilizer at 150 gm N/ tree/ year as
(BCU **1**) with thin coated (4%) or(BCU 2)
with thick coated (12%) , both added at one dose in March or at two equal doses in March and May. These treatments were compared with urea at 300gm N/tree/year
(the previously recommended dose) as fast release N fertilizer added at one dose in March or at two equal doses in March and May or at three equal doses in March, April and May.

Nitrogen and potassium in the leaves were significantly increased by slow release fertilizer treatments in both seasons.

The highest yield either as number or weight of fruits per tree, average fruit weight and volume were obtained by fertilizing trees with BCU**2** at 150 gm N/ tree applied at one dose in March.

Total soluble solids and total soluble solids / acid ratio were significantly affected by different treatments, while the other fruit characteristics were not affected in both seasons.

The use of (BCU**2**) at 150gm N/tree/year at one dose may be recommended for Le-conte pear trees grown in circumstances of Rafah orchard or similar to it.

INTRODUCTION

The use of controlled – release sources of N fertilizer, provide a continuous supply of N, consequently increase the N-use efficiency, reduce the N losses and reduce luxury consumption of nutrients (Koo, 1986 and 1988). Morever , the use of such fertilizers led to reduce rates and number of applications during the growing season (Jackson and Davies, 1984 ; Koo,1988 and Zekri and Koo, 1991).

The efficiency of nitrogenous fertilizers can be increased through the use of slow-release nitrogen sources, which potentially reduce N leaching (Cox,1993) and improve the efficiency of plant recovery (Khalaf and Koo,1983) .

These fertilizers have clear advantages compared with conventional ones in a great variety of Horticultural crops (Sharma 1979; Csizinszky,1994).

The main advantages of slow-release fertilizers are regular and continuous supply of nutrients , lower application frequency to soils and decrease of losses bleaching, denitrification and immobilization.

Bentonite coated urea (BCU) is one of the slow release nitrogen fertilizers which contains (35%N) .

The aim of this study is to compare the effect of application numbers of fast and slow release nitrogen fertilizers on nutritional status,yield and fruit quality of le-conte pear trees under Rafah conditions .

MATERIALS AND METHODS

. This experiment was carried out throughout 1998 and 1999 seasons on le-conte pear trees. The trees were 20- years -old planted at 5x5m apart, budded on *Pyrus communis* rootstock and grown in sandy soil located at Rafah destrict, Northern Sinai Governorate.

This soil had the following characteristics:

Ph 8.3,E.C. 0. 12 Dsm^{-1} ,Ca CO3 1.65%, sand 80.52%, silt 12.68% and clay 6.8%, organic matter 0.32% , total nitrogen 0.015%.

Twenty one trees as uniform as possible were selected for this study.

The trees received the same cultural practices.

Complete randomized block design was adapted.

Bentonite coated urea at 150 gm.N/tree was used in this investigation in order to determine the optimum number of applications in Rafah sandy soil (one or two equal doses) compared with urea at one, two or three equal doses.

The tested treatments are presented in Table (1) as follows : -

Table (1) Treatments tested in the present experiment .

Treatments *	**Source of nitrogen**
150 gm N / tree year as BCU 1(one dose in March)	- Bentonite coated urea (35%N)with thin coating material (4% BCU1)
150 gm N / tree / year as BCU1 (two equal doses in March and May)	- Bentonite coated urea (35%N)with thick coating material(12% BCU2)
150 gm N / tree / year as BCU2 (one does in March)	- Urea
150 gm N / tree as BCU2 (two equal doses in March and May)	
300 gm N / tree /year as Urea (one dose in March)	
300 gm N / tree / year as Urea (two equal doses in March and May)	
300 gm N / tree / year as Urea (three equal doses in March , April and May)	

- **Each treatment was replicated three times, one tree per each.**

Bentonite coated urea and urea fertilizers are applied 15cm under the soil surface.

The following determinations were carried out

Leaf mineral contents

Samples of 20 mid terminal leaves/tree were collected in early June. Leaves were cleaned, weighed, oven dried at 70ºc until constant weight and finally grounded.

Nitrogen, phosphorus and potassium were determined on dry weight basis .

- Nitrogen content was determined by the micro kieldahl method as described by Pregl (1945).
- Posphorus was determined by the colorimetric method according toTroug and Meyer (1929).
- Potassium was measured by using flame-photometer according to the method described by Brown and Lilliland (1946).

Yield per tree

When the fruit reached maturity stage (mid July) yield was recorded as number of fruits and weight in kg/tree.

Fruit characteristics

1- Physical characteristics

A Sample of 20 fruits was taken from each tree at the harvest time to study the physical characteristics:

- Average fruit weight (gm) .
- Average fruit volume (ml)
- Specific grafity: $\frac{\text{Fruit weight (gm)}}{\text{Fruit volume (ml)}}$
- Average fruit length and diameter (cm) .
- Fruit shape index. $\frac{\text{Fruit length}}{\text{Fruit diameter}}$
- Firmness of fruits was determined by using penetrometer (pressure tester) in Ib / inch²

2- Chemical characteristics

- Total soluble solids of fruit juice (T.S.S %) was determined by using a hand refractometer.
- Total acidity %

The percentage of total acidity in fruit juice was determined as malic acid (according to A.O.A.C.,1970).

-Total soluble solids/ acid ratio was calculated

Statistical analysis

All data were subjected to analysis of variance according to the procedure reported by Snedecor and Cochran (1974).

Treatment means were compared by the least significant difference test (LSD) at 5% level of probability in the two seasons of study.

RESULTS AND DISCUSSION

Leaf mineral contents

It is evident from the data presented in Table (2) that there was a significant increase in nitrogen and potassium percentages in leaves of pear trees treated with bentonite coated urea (BCU1 and BCU2) applied at one dose or at two equal doses compared with urea treatments in both seasons of the study.

The highest percentages of nitrogen and potassium were obtained by BCU2 applied at one dose in the two seasons, since it was 1.79% and 2.63% for Nitrogen, 1.69% and 1.85% for potassium in the first and second seasons, respectively. The least N values in the leaves were obtained by urea treatment 300gm at one dose in both seasons, since it was 1.30% and1.52% in both seasons, respectively. As for potassium the least values were recorded in the treatment of 300 gm urea at three equal doses.

Concerning phosphorus percentage, it was not significantly affected by different treatments in the two seasons of the study. The values ranged between 0.17-0.22% and 0.15-0.22% in the first and second seasons respectively .

Similar results were obtained by Balo *et al*. (1988), Ferguson *et al*. (1998), and Mansour (1998).

Table (2) Effect of fast and slow – release nitrogen fertilizers on N,P and K contents in leaves of Le- conte pear in 1998 and 1999 seasons.

Treatments	Nitrogen %		Phosphorus %		Potassium %	
	1998	1999	1998	1999	1998	1999
BCUı(150gm N) at One dose	1.58	2.48	0.17	0.15	1.60	1.69
BCUı(150gm N) at Two equal doses	1.58	2.45	0.19	0.22	1.63	1.72
BCU2 (150 gm N) at One dose	1.79	2.63	0.21	0.20	1.69	1.85
BCU2 (150 gm N) at Two equal doses	1.75	2.63	0.22	0.21	1.68	1.80
Urea (300gm N) at One dose	1.30	1.52	0.18	0.19	1.38	1.42
Urea (300gm N) at Two equal doses	1.32	1.54	0.17	0.18	1.36	1.40
Urea (300gm N) at Three equal doses	1.34	1.59	0.18	0.19	1.36	1.38
LSD 5%	0.05	0.09	NS	NS	0.04	0.05

Yield / tree

Data presented in Table (3) showed that bentonite coated urea treatments significantly increased number of fruits/tree in both seasons comparing with urea treatments . However , BCU2 and BCU1 both of them at one dose gave the highest values (450 & 421 fruits) in the first and second seasons respectively , while urea at one dose gave lowest values (398-376 fruits) in both seasons respectively .

As for yield (kg /tree) it is obvious from the data presented in Table (3) that yield of pear fruits as kg/ tree was significantly increased by BCU1, BCU2 treatments compared with urea treatments in the two seasons of the study.

Generally, yield/ tree was not significantly affected by the number of doses in both BCU1, BCU2 in the two seasons of study. The highest yield was obtained by BCU2 at one dose (36.5kg and 42.6kg) in the first and

second season, respectively and BCU2 at two equal doses (36.1kg) in the first season and (42.9kg) in the second season of the study.

The least yield was produced by urea treatments since, the values ranged between 31.2 –31.4kg / tree in the first season and 33.5 – 33.9kg / tree in the second one.

The average yield of the two seasons took the same trend of each season, since it was 39.6 and 39.5kg for BCU2 at one dose and two equal doses, 36.8 and 36.4 kg / tree. For BCU1 at one dose and two equal doses, respectively.

All urea treatments produced low yield / tree comparing with slow release treatments since it ranged between 32.4-32.6 kg/tree .

Table (3) Effect of fast and slow release nitrogen fertilizers on number of fruits/ tree and yield/ tree of Le -conte pear in 1998 and 1999 seasons.

Treatments	Number of fruits/ tree		Average of two seasons	Yield/ tree Kg.		Average of two seasons
	1998	1999		1998	1999	
BCU1(150gm N)at One dose	435	421	428	34.8	38.7	36.8
BCU1(150gm N) at Two equal doses	440	418	429	34.5	38.2	36.4
BCU2 (150 gm N) at One dose	450	388	419	36.5	42.6	39.6
BCU2 (150 gm N) at Two equal doses	446	390	418	36.1	42.9	39.5
Urea (300gm N) at One dose	398	376	387	31.4	33.5	32.5
Urea (300gm N) at Two equal doses	405	397	401	31.2	33.6	32.4
Urea (300gm N) at Three equal doses	410	386	398	31.2	33.9	32.6
LSD 5%	10	8	12	0.9	0.6	1.9

These results are in agreement with Shelton, (1976), Allen (1984) and Mansour (1998).

Fruit characteristics

Results in Table (4) show that bentonite coated urea as slow- release fertilizer was superior to urea as a fast release fertilizer. However , weight and volume of fruits from trees treated with bentonite coated urea at 150gm N/tree/year either at one or two doses attained the highest fruit weight and volume in both seasons comparing with those obtained from trees treated with urea. The values ranged between (76.0 – 81.0) , (88.0 –110.0 gm) for the two seasons respectively as weight , and (78.0-84.0 ml) , (90.0-112.0 ml.) for both seasons respectively as volume .

These results are in agreement with those obtained by Boman (1993) and Mansour (1998).

Specific grafity, fruit length, diameter, shape index and firmness were not significantly affected by different treatments in both studied seasons. These results are in agreement with those obtained by Gabara, 1998.

As shown in Table (5) the results revealed that the application of bentonite coated urea at one dose or two equal doses resulted in the highest total soluble solids values ranged between (13.2-13.4%) and (13-13.2%) in the

first and second seasons, respectively. While urea treatments attended (12.6-12.8%) and (12.5-12.7%) in the first and second seasons respectively.

As for acidity %, it is obvious from data in Table (5) that no significant differences were observed among different treatments. The values ranged between (0.45-0.50%) and (0.42 –0.49%) in the first and second seasons respectively.

TSS /acid ratio was significantly affected by different treatments in the two seasons of the study.

TSS /acid ratio ranged between 26.7%-29.0% in the first season and 25.5% - 30.9% in the second season.

Table (5) Effect of fast and slow release nitrogen fertilizers on fruit characteristics of Le- conte pear in 1998 and 1999 seasons

Treatments	Total soluble solids(Tss)%		Acidity %		TSS / acid ratio	
	1998	1999	1998	1999	1998	1999
BCUı(150gm N)at One dose	13.4	13.0	0.50	0.45	26.8	28.9
BCUı(150gm N) at Two equal doses	13.4	13.2	0.48	0.46	27.9	28.7
BCU2 (150 gm N) at One dose	13.4	13.0	0.49	0.44	27.3	29.5
BCU2 (150 gm N) at Two equal doses	13.2	13.0	0.48	0.42	27.5	30.9
Urea (300gm N) at One dose	12.6	12.5	0.45	0.49	28.0	25.5
Urea (300gm N) at Two equal doses	12.8	12.6	0.48	0.46	26.7	27.4
Urea (300gm N) at Three equal doses	12.8	12.7	0.47	0.44	29.0	28.9
LSD 5%	0.4	0.3	NS	NS	0.4	0.5

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دراسة مقارنة على تأثير التسميد بالأسمدة النيتروجينية السريعة والبطيئة التحلل على الحالة المعدنية ، والمحصول وجودة ثمار أشجار الكمثرى الليكونت تحت ظروف رفح

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أجريت هذه التجربة على أشجار الكمثرى المثمرة صنف ليكونت والنامية بمزرعة رفح بمحافظة شمال سيناء في موسمي 1998، 1999وقد تم تسميد الأشجار بمصدرين من الأسمدة البطيئة التحلل هما سماد اليوريا مغلفة بالبنتونيت غلاف رقيق (4%) ، سماد اليوريا المغلفة بالبنتونيت غلاف سميك (12%) بمعدل 150 جم نتروجين/الشجرة سنويا أضيفت على دفعة واحدة فى (مارس) أو على دفعتين متساويتين (مارس ومايو) مقارنة باليوريا العادية بمعدل 300 جم نيتروجين / الشجرة سنويا (وهو المعدل الموصى به) أضيفت على دفعة واحدة (مارس) أو على دفعتين متساويتين (مارس ومايو)او على ثلاث دفعات متساوية (مارس وأبريل ومايو) .

وقد أشارت النتائج المتحصل عليها أن التسميد بالأسمدة البطيئة التحلل كان فعالا فى تحسين الحالة الغذائية للأشجار والمحصول (عدد ووزن) ووزن الثمرة وحجم الثمرة والمواد الصلبة الذائبة ونسبة المواد الصلبة الذائبة/الحموضة وذلك بالتسميد باليوريا المغلفة بالبنتونيت غلاف سميك (12 %) بمعدل 150 جم نتروجين/الشجرة سنويا أضيفت على دفعة واحدة في مارس 0 بينما صفات الثمار الأخرى لم تتأثر خلال موسمي الدراسة.

لذا فانه يوصى باستخدام اليوريا المغلفة بغلاف سميك (12 %) بمعدل 150 جم نتروجين / الشجرة سنويا على دفعة واحدة لاشجار الكمثرى الليكونت النامية تحت ظروف مزرعة رفح أو أي ظروف مشابه لها.

Table (4): Effect of fast and slow-release nitrogen fertilizers on fruit physical characteristics of le-conte pear in 1998 and 1999 seasons.

Treatments	Fruit weight (gm)		Fruit volume (ml)		Specific gravity		Fruit length (cm)		Fruit width (cm)		Shape index (L/D ratio)		Firmness (lb/inch ²)	
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
BCUı(150gm N)at One dose	79.9	92.0	81.0	98.0	0.96	0.96	6.5	6.6	4.9	5.2	1.33	1.27	17.5	15.6
BCUı(150gm N) at Two equal doses	78.4	91.5	81.0	94.0	0.96	0.97	6.3	6.7	4.8	5.2	1.31	1.29	17.4	15.4
BCU2 (150 gm N) at One dose	81.0	110.0	84.5	112.0	0.96	0.98	6.6	6.9	5.0	5.4	1.32	1.26	17.3	15.0
BCU2 (150 gm N) at Two equal doses	80.0	110.0	83.1	112.0	0.96	0.98	6.6	6.8	5.0	5.4	1.32	1.28	17.5	15.0
Urea (300gm N) at One dose	78.8	89.2	79.6	90.0	0.99	0.99	6.2	6.6	4.6	5.2	1.35	1.27	17.3	15.3
Urea (300gm N) at Two equal doses	77.0	88.6	78.6	90.0	0.98	0.98	6.2	6.6	4.6	5.2	1.35	1.27	17.4	15.2
Urea (300gm N) at Three equal doses	76.0	88.0	78.0	90.0	0.97	0.98	6.2	6.5	4.7	5.2	1.32	1.25	17.3	15.0
LSD 5%	3.2	2.2	8.0	6.3	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS