Annals Agric. Sci., Ain Shams Univ., Cairo, 50(2), 551-562, 2005

PRELIMINARY STUDIES ON FERTILIZATION OF MANGO TREES UNDER U.A.E. CONDITIONS I- RESPONSE OF ALFONS MANGO TREES FOR ORGANIC FERTILIZATION "CHICKEN MANURE"

[37]

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ABSTRACT

This study was done to investigate the possibility to use chicken manure as organic fertilizer partially in supplying Alfons mango trees by nitrogen fertilization requirements through three consecutive seasons (2001, 2002 and 2003) at western farm of Dibba Al- Fujaira Fruit Research station, in eastern coast of United Arab Emirates (UAE) on 12 year old Alfons mango trees. The experiment contained five combinations between the two nitrogen fertilizer sources, organic (chicken manure) and inorganic (urea) at different ratios as follow (100 + 0%), (75 + 25%), (50+50%), (25 + 75 %) and (0 + 100 %). All these treatment had equal nitrogen amount (900 g actual nitrogen /tree /year).

The important results could be concluded as follow

1- Leaf dry mater percentage was not affected significantly by fertilization treatments through three seasons.
2- Leaf mineral content differences among treatments were decrease gradually from season to seasor till it become insignificant differences in the third season (except the increment of potassium which increase by increasing organic fertilizer percentage), may be this trend explain the beneficial of accumulative effect of organic fertilizer in this respect .
3- The differences among yield and fruit quality from season to season was increased from first to third season to become significant in the last season where the significant superiority of the two treatments of 50% & 25% organic nitrogen fertilizer source to increase yield weight and clear improvement of fruit qualities .

It could be recommended to use chicken manure as nitrogen source of 25% or 50% from annual addition under the condition of this study. It has economic benefit by using secondary product and from healthy view point to reduce or prevent mineral food human pollution and also environmentally to evasive of these wastes.

Keywords: Alfons, Mango, Organic, Fertilization, Chicken manure

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(Received April 17, 2004)
(Accepted September 3, 2005)

INTRODUCTION

Mango is one of the oldest fruits cultivated by man for his use. Mango consider one of tropical and sub tropical fruit crop. Eastern coast of United Arab Emirates (UAE) lei in sub-tropical region is the best climate needed for mango trees that is parallel to its original home climate. Mango consider the second important fruit crop after date palm in UAE.. The reduction of chemical fertilization and the use of natural products become recent trend in the world. Consequently, it is very important to study the response of Alfons mango trees for application of organic fertilization "chicken manure" application. **Gandhi (1955)** cleared that, 20 lb of FYM, 5 lb of bonemeal and 10 lb of wood ash should be applied for 1-year old mango plants which should be increased each year by one lb of FYM, 1 lb of bonemeal and 2lb of wood ash till 9- years old trees get 100 lb of FYM, 15 lb of bonemeal and 30 lb of wood ash. **Bose *et al* (1998)** recorded that, although the practice of manuring mango orchards existed in India long before the end of the nineteenth century, the habit of applying in regulated doses was not known. **Mansour and Ahmed (1998)** working on productivity of Hindi Bissinara mango as influenced with the application of filter mud and farmyard manure. They revealed that, the best results with regard to yield and fruit quality of Hindi Bissinara mangoes were obtained owing to using filter mud at rate of 300g N/tree and the rest amount (600 gN/tree) was added via any mineral N source. **Elkobbia (1999)** working on the response of Washington Navel orange to organic fertilizer "biohumas" and cattle manure application. She noticed that, the increasing of the organic fertilization doses caused an increase in the N, P, K content .Also significant increase in leaves Fe, Zn and Mn content, shoot length and yield was noticed by increasing the organic fertilization doses. **Raghupathi and Bhragava (1999)** recorded that, the optimal levels of leaf nutrients of Alfons mango trees as follows: N (0.77-1.65%) P (0.22-0.44%) K (0.77-1.73%) Ca (0.76-1.63%) S (0.35-1.31%) Fe (657-961ppm), Mn (13-408ppm), Zn (7.71-18.3ppm), Cu (14.3-17.8ppm). The plant Mg content was low in all orchards surveyed .A yield level from 5.4 to 7.4 t/h was possible for Alfons mango when soil nutrients were in the optimum range. **Vega and Molina (1999)** mentioned that, 66 kg N / h would be the best for high commercial fruit yields of Tommy Atkins cv. Mango trees. **Awad (2000)** reported about the effect of irradiated poultry manure on growth and leaf nutrient content of Flameseedless that, generally, tested treatments enhanced most growth parameters such as plant height, root length, number of leaves / plant, total chlorophyll content and dry matter (leaf and stem), moreover exceeded leaf nutrients content of N, P, K, Ca, Mg, Zn, and Fe . The soil applications of dry poultry manure either irradiated or unirradiated as well as soil application of water extract of irradiated dry poultry manure were the superior treatments in this respect .

MATERIAL AND METHODS

This study was carried out through three successive seasons (2001, 2002 and 2003) in western farm of Dibba Al- Fujaira Fruit Trees Research station, in eastern coast of UAE. Twelve year old Alfons mango trees budded on seedy root-

stock. The soil analyses are shown in Table (2) and bubbler irrigation system was used with well water (350 ppm salts). Planting distance was 7.5 × 7.5 meters apart. Sterilized pallet of chicken manure and urea (46% N) were used in this work. **Mansour and Ahmed (1998)** recommended 900 g actual amount of nitrogen / mango tree a year which was the basic amount for counting the manure quantity per tree. Five combinations between chicken manure (as organic source) and urea (as inorganic source) were carried out as follow:

1-100 % chicken manure (CM) 22.5 kg/ tree + 0 % urea (U) 0.00 kg/tree.
2 75 % CM 16.80 kg/tree + 25 % (U) 0.45 kg/tree.
3- 50 % CM 11.25 kg/tree + 50 % (U) 0.90 kg/tree.
4-25% CM 5.63 kg / tree + 75 % (U) 1.35 kg/tree.
5- 0 % CM 00.00 kg/tree + 100 % (U) 1.8 kg/tree.

The treatments were arranged in a randomized complete block design in a simple experiment with four replicates for each treatment and each replicate was represented by one tree. The organic and inorganic combination treatments were added from October to May in three equal doses. Chicken manure fertilizer analysis is shown in Table (1).

The first vegetative growth cycle begin in the first week of January under the experiment conditions, from these shoots sample of twenty leaves 4-6 months age were collected at random from each replicate. The leaves samples were washed several times with tap water then rinsed with distilled water, dried at 70°C in an electric oven, grounded in electric mill and digested according to **(Chapman and Pratt, 1961)**. Nitrogen analyses was determined by MicroKjeldahl according to **(A.O.A.C., 1990)**. Phosphorus was determined by the method of **(Truog and Meyer, 1929)**. Potassium was determined by the method of the flame photometer according to the method of **(Brown and Lilleland, 1946)**. Calcium and magnesium were determined by titration against versenate solution **(Chapman and Pratt, 1961)**. The yield and fruit quality were recorded at first and third seasons only because at second season strong wind caused lost in the yield in most replicates. The yield (kg/tree) and number of fruits per tree were recorded at fruit mature stage (Last week of June). Samples consisting of ten mature fruits were randomly taken from each replicate to determine, average fruit weight (g), fruit length (cm), fruit width (cm), fruit thickness (cm), total soluble solids percent, total acidity percent and vitamin C content (according to **A.O.A.C., 1985**). Data obtained throughout this study were statistically analyzed using the analysis of variance method as reported by **(Snedecor and Cochran, 1980)**, and the differences between means were differentiated by using Duncan's range test.

RESULTS AND DISCUSSION

1- Effect of organic and inorganic combinations on leaf dry matter percentage

Data presented in Table (3) showed an insignificant response of leaf dry matter percentage to different N fertilization treatments during 3 experimental seasons. But it could be noticed that highest values of leaf dry matter percentage were recorded by 4th; 3rd and 2nd treatments (25% organic fertilizer + 75% inorganic one);

Table 1. Analysis of chicken manure fertilizer used in the present study (Dry matter basis)

Organic matter	pH	N	P	K	Ca	Mg	Na	Moisture	C/N ratio	Intensity
90%	6.35	4%	4.8%	3.7%	10.3%	0.86%	0.45%	9.94%	10 /18.7	0.65g /L

Table 2. Chemical and mechanical soil analysis

Chemical analysis											
				Milliequivalent / liter							
S.P. %	$CaCo_3$	pH	ECe mmhos	Cations				Anions			(%)
				Ca++	Mg++	Na+	K+	CO_3	HCO_3	Cl-	
30.0	4.0	8.21	9.93	16	58	27.2	3.32	Nil	7.0	40.	3.52
ppm											
N		P		K		Ca		Mg			
27.4		19.10		173.2		369.2		717.7			
Mechanical soil analysis											
%								Texture			
Clay		Silt		Sand							
5.96		3.80		90.24				Sand			

Table 3. Effect of different organic and inorganic fertilization treatments on leaf dry matter percentage of Alfons mango trees through three seasons (2001, 2002 and 2003)

Treatments	First season 2001	Second season 2002	Third season 2003
1- O.F. 100% + I.F. 0%	42.27a	39.83a	38.92a
2- O.F. 75% + I.F. 25%	45.54a	40.42a	40.23a
3- O.F. 50% + I.F. 50%	46.09a	42.21a	39.00a
4- O.F. 25% + I.F. 75%	46.96a	38.65a	38.83a
5- O.F. 0% + I.F. 100%	44.24a	38.49a	39.63a

O.F. = organic fertilizer I.F. =inorganic fertilizer
Values having the same letter within the same column are not statically different at 5% level.

(equal proportions of organic and inorganic fertilizers) and (75% organic fertilizer + 25% inorganic fertilizers) during 1st; 2nd, 3rd seasons respectively. However obtained results explain that leaf dry matter percentage did not Follow firm trend in response to different combinations of organic and inorganic fertilizer, but it could be concluded that 3rd treatment organic and inorganic fertilizer at 50: 50% exceeded relatively other one as an average of 3 seasons was concerned.

2- Effect of organic and inorganic combinations on leaf mineral contents

Data presented in Table (4) showed leaf mineral nitrogen, phosphorus, potassium, calcium, magnesium, iron, zinc, and manganese content in 3 seasons study.

Nitrogen: leaf nitrogen percent was affected significantly in first season only, where it was increased significantly by fifth treatment (100% I.F.) as compared to first, second and third treatments. Meanwhile in the second and third seasons no significant differences were noticed among treatments in leaf nitrogen content. On the other hand, it could be generally concluded that leaf N content was relatively increased by both 4th and 5th treatments especially as an average of 1st and 3rd seasons was concerned.

Phosphorus: leaf phosphorus percent was significantly affected in first season, where first treatment (100% O.F.) had highest significant value compared to any other treatment. In second and third seasons differences in leaf P content among treatments were so slight to reach level of significance.

Table 4. Effect of different organic and inorganic fertilization treatments on leaf mineral content of Alfons mango trees through three seasons (2001, 2002 and 2003)

Treatments	Leaf mineral content %				
	N	P	K	Ca	Mg
	First season 2001				
1- O. F. 100% + I.F. 0%	1.01d	0.19a	0.72ab	1.40c	0.72a
2- O. F. 75% + I.F. 25%	1.04cd	0.15c	0.75a	1.58c	0.62a
3- O. F. 50% + I.F. 50%	1.10bc	0.17b	0.70b	1.58c	0.63a
4- O. F. 25% + I.F. 75%	1.16ab	0.15c	0.55d	1.81a	0.67a
5- O. F. 0% + I.F. 100%	1.22a	0.14c	0.65c	1.61b	0.77a
	Second season 2002				
1- O. F. 100% + I.F. 0%	1.18a	0.16a	0.82b	1.33a	0.51a
2- O. F. 75% + I.F. 25%	1.61a	0.18a	1.10a	1.12b	0.60a
3- O. F. 50% + I.F. 50%	1.26a	0.18a	0.82b	0.96b	0.56a
4- O. F. 25% + I.F. 75%	1.24a	0.18a	0.92ab	1.07b	0.69a
5- O. F. 0% + I.F. 100%	1.24a	0.17a	0.97ab	1.12b	0.69a
	Third season 2003				
1- O. F. 100% + I.F. 0%	1.01a	0.18a	1.17a	0.79b	0.46b
2- O. F. 75% + I.F. 25%	0.93a	0.16a	0.72c	0.98a	0.47b
3- O. F. 50% + I.F. 50%	0.86a	0.15a	1.04b	0.78b	0.48b
4- O. F. 25% + I.F. 75%	1.05a	0.18a	0.76c	0.82b	0.34c
5- O. F. 0% + I.F. 100%	1.04a	0.15a	1.07b	0.92a	0.66a

O.F.= organic fertilizer I.F. =inorganic fertilizer
Values having the same letter within the same column are not statically different at 5% level.

Potassium: leaf potassium percent showed higher significant value with second treatment (75% O.F. + 25% I.F.) compared to third ,fourth and fifth ones but it had insignificant difference compared to first treatment in first season . In second season the same treatment (second treatment) recorded higher significant value than that of first and third one but it lack significance compared to fourth and fifth treatments. In third season first treatment (100%O.F.) had highest significant value compared to any other treatment.

Calcium: leaf calcium percent was higher significant with fourth treatment in first season, and first treatment in second season compared to any other treatment but fifth treatment and second one in third season showed higher significant values compared with other treatments .

Magnesium: leaf magnesium percent showed insignificant differences among treatments in all studied seasons. But it could be noticed that fifth treatment (100% I.F.) showed highest value compared to other treatments in studied season.

Finally: it could be concluded that, the use of chicken manure at 22.5kg/tree a year may be enough to recover the need of Alfons mango tree of macro-nutrient. These results are in harmony with those found by **Mansour and Ahmed (1998).**

3- Effect of organic and inorganic combinations on yield and fruit quality of Alfons mango tree

Concerning field experiment as number of fruits per tree, Data presented in Table (5) showed that in first season, fourth treatment showed higher significant value compared with second one but it was not with others however difference was significant as compared to 2nd only. In third season, third treatment recorded higher significant value compared to any other treatment.

Regarding to yield/tree (Kg) fruit weight (g), Concerning the yield kg/tree third and fourth treatments recorded higher yield (kg/tree) during both seasons. However, differences were more pronounced in 3rd one and significant as compared to any of 3 other ones, while in 1st season the superiority of the aforesaid two treatments were less pronounced and didn't reach level of significance except with comparing to 1st treatment only.

As for fruit weight(g), no significant differences among treatments were recorded in first season, but in third season fourth and fifth treatments recorded higher significant fruit weight compared to others.

Regarding to fruit dimensions, Table (5) displays that the least of fruit length value was always in concomitant to the Alfons trees subjected to the second N fertilization treatment (75.0% O.F. + 25.0% I.F.) during 1st and 3rd experimental seasons. However the decrease was significant during 3rd season only, especially as compared to either, 1st; 4th or 5th treatments. As for the fruit width, it is quite clear that the same trend previously discussed with fruit length was also detected, but the variances were relatively pronounced with fruit width. Herein, the 4th and 5th treatments surpassed statistically the 2nd one during both seasons, as well as 1st and 3rd treatments resulted also in significant increase in fruit width over the 2nd treatment during 3rd season. Meanwhile, the fruit thickness followed

Table 5. Effect of different organic and inorganic fertilization treatments on the yield, fruit dimensions and fruit chemical properties of Alfons mango trees through first and third seasons (2001 and 2003)

Treatments	Yield		Fruit physical properties				Fruit chemical properties		
	First season 2001								
	No. of fruit /tree	Yield kg/ tree	Fruit weight /g	Length cm	Width cm	Thick-ness cm	T.S.S.	Acidity %	V.C.
1-O. F. 100% + I.F. 0%	273ab	78b	280a	8.7a	7.1bc	6.7ab	14.1b	1.18b	51d
2-O. F. 75% + I.F. 25%	240b	97ab	312a	8.2a	6.9c	6.6b	15.6a	1.38ab	63bc
3-O. F. 50% + I.F. 50%	297ab	108a	328a	8.6a	7.1bc	6.7b	15.4a	1.14b	56cd
4-O. F. 25% + I.F. 75%	311a	111a	327a	8.6a	7.3ab	6.7b	15.0ab	1.60a	95a
5-O. F. 0% + I.F. 100%	289ab	90ab	300a	8.6a	7.6a	7.2a	15.6a	1.20b	65b
	Third season 2003								
1-O. F. 100% + I.F. 0%	138bc	29c	211d	9.0a	7.7b	7.2ab	15.1a	0.97ab	53d
2-O. F. 75% + I.F. 25%	119d	31c	258c	8.2b	7.1c	6.9b	16.3a	1.13ab	76b
3-O. F. 50% + I.F. 50%	167a	48a	286b	8.7ab	7.7b	7.0ab	15.8a	0.51c	65c
4-O. F. 25% + I.F. 75%	149b	46a	313a	8.9a	7.7b	7.2ab	16.8a	1.17a	52d
5-O. F. 0% + I.F. 100%	124cd	41b	330a	9.2a	8.1a	7.4a	15.7a	0.93b	97a

O.F. = organic fertilizer I.F. =inorganic fertilizer
In the second season (2002) yield of most replicates were lost by the cause of strong wind
Values having the same letter within the same column are not statically different at 5% level

the same trend of fruit width which reflects the superiority of 5th fertilization treatments i.e., 100% of N applied in inorganic form.

Concerning the fruit chemical properties i.e., fruit juice total soluble solids (TSS%); total acidity and vitamin C contents as influenced by different N fertilization treatments, data obtained during both 2001 and 2003 seasons revealed that each chemical property followed its own trend of response.

Anyhow, the least fruit soluble TSS% was in closed relationship to the 1st N fertilization i.e. 14.1 and 15.1% during 1st and 3rd experimental seasons, respectively. However, the decrease was significant as compared to either 2nd or 5th treatments during 1st season only, while 2nd; 3rd or 5th treatments during 1st season only, while in the 3rd season it didn't reach level of significance. On the contrary, the highest TSS% was achieved by 2nd and 5th treatments during 1st season (16.6%), while in the 3rd season fruit of Alfons mango trees subjected to 2nd 4th treatments (75.0% O. F. + 25.0% inorganic form) and (25.0% O.F. + 75.0% inorganic form) were relatively the reached in their juice total soluble solids (16.3 and 16.8%).

As for the fruit juice total acidity percent, Table (5) displays that 3rd N fertilization treatment (N applied at equal ratio of organic and inorganic forms – 50:50%), resulted in inducing the poorest Alfons mango fruits with the acidity content (1.14 and 0.5% during 1st and 3rd seasons, respectively. Differences were more pronounced and significant in 3rd season as compared to the analogous values of 4 other treatments, while in 1st season it was significant as compared to 4th treatment (25.0% organic + 75.0% inorganic form) only. The reverse was true with fruits of 4th treatment (25.0% org. F. + 75.0 inorganic F.) which characterized by their relative higher acidity contents rather than other N fertilization treatments during both 1st and 3rd seasons.

Nevertheless, vitamin C content, didn't follow fruit juice trend of response to N fertilization treatments during both 1st and 3rd seasons. On the other hand, it could generally noticed that 5th treatment (100% inorganic form) induced fruits relatively richer in their vit. C content during 3rd season.

Depending upon the obtained results regarding the response of different growth, yield, fruit quality and nutritional status to the investigated N fertilization treatments (representing various ratios of organic/ chicken manure and inorganic / urea forms) which pointed out that variation between such treatments in most cases were too slight to be safety neglected. So it could be easy concluded that using chicken manure as a source of 25 or 50% of N fertilization program under similar environmental condition could be recommended practically for achieve the following economic and beneficial aims:

1- An active mean form the economic point of view for utilization by – product of one secondary product " chicken manure " to supply soil with the depleted nutrient elements.
2- Safety mean of fertilization by which a clean edible product could be gained from the nutritional and healthy standpoints of human – beings.
3- Keeping the environmental free form such waster.

These results are in harmony with those found by **Mansour and Ahmed (1998).**

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مجلة حوليات العلوم الزراعية ، كلية الزراعة ، جامعة عين شمس ، القاهرة ، م٥٠ ، ع(٢)، ٥٥١ - ٥٦٢ ، ٢٠٠٥

دراسات أولية على تسميد أشجار المانجو تحت ظروف الامارات العربية المتحدة

١- استجابة أشجار المانجو الفونس للتسميد العضوي "سماد الدواجن"

[٣٧]

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أجريت هذه الدراسة لاختبار إمكانية استخدام زرق الدواجن كسماد عضوي يمكن الاستفادة به جزئيا في إمداد أشجار المانجو باحتياجاتها من الأسمدة النيتروجينية بالمزرعة الغربية بمحطة أبحاث الفاكهة - دبا -الفجيرة -الساحل الشرقي لدولة الإمارات العربية المتحدة خلال ثلاثة مواسم متتالية (٢٠٠١ & ٢٠٠٢ & ٢٠٠٣) على أشجار مانجو الفونس مثمرة عمرها ١٢عام. وتضمنت التجربة خمسة معاملات سمادية تمثل خمسة تراكيب بين مصدري السماد النيتروجيني عضوي (سماد الدواجن) ومعدني (يوريا) بنسب متباينة هي (١٠٠% عضوي + صفر معدني) & (٧٥% عضوي +٢٥% معدني) & (٥٠% عضوي +٥٠% معدني) & (٢٥% عضوي+ ٧٥% معدني) & (صفر عضوي +١٠٠% معدني) بحيث تساوت هذه المعاملات في أن كل منها يمثل ٩٠٠ جم نيتروجين صافي / الشجرة / السنة.

وعن أهم النتائج المتحصل عليها يمكن إيجازها في الآتي

١- لم تتأثر نسبة المادة الجافة بالورقة معنويا بمعاملات التسميد خلال المواسم الثلاثة .

٢- تضاءلت الفروق في محتوى الورقة المعدني تدريجيا مع توالي مواسم التجربة لتصبح الفروق بين المعاملات غير معنوية في الموسم الثالث (باستثناء تزايد البوتاسيوم بزيادة نسبة السماد العضوي المضاف) ربما يفسر ذلك بالأثر التراكمي المفيد للسماد العضوي في هذا الصدد .

٣- تزايد معدل التباين في المحصول وصفات جودة الثمار مع توالي المواسم التجريبية من الأول إلى الثالث لتصبح الفروق معنوية في الموسم الأخير حيث تفوقتا معاملتي اضافة ٥٠& ٢٥% من النيتروجين في صورة عضوية (سماد

الـــدواجن) معنويـــا بالنســـبة لزيـــادة المحصول وزنا مع تحسينا ملموسا فـــي صفات الجودة .

وعليه يمكن التوصية باســـتخدام ســـماد الدواجن كمصدر نيتروجينـــي يمثـــل ٢٥% أو ٥٠% من الإضافة السنوية تحت ظروف هذه التجربة وما يمثله ذلك من بعض الفوائد الاقتصادية (لإعادة استخدام منتج ثانوي من تربية الدواجن) والصحية (تقليـــل أو منـــع التلوث المعدني في الغذاء الآدمي) والبيئـــة للتخلص من هذه المخلفات .

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أ.د محمد رضا بركـــات