

Effect of Spraying Fenugreek Seed Sprout Extract and Some Nutrients on Fruiting of Keitte Mango Trees Grown under Aswan Region Conditions

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ABSTRACT

During 2013 and 2014 seasons Keitte mango trees were subjected four times to foliar application of fenugreek seed sprout extract at 0.5 to 2.0% singly or in various combinations with N,P,K & Mg each at 0.5% and / or Zn, Fe & Mn each at 0.05%. The study focused on the impact of these treatments on growth, nutritional status of the trees, yield as well as physical and chemical characteristics of the fruits.

Spraying fenugreek seed sprout extract at 0.5 to 2% either alone or in combination with macro and/ or micronutrients was very effective in enhancing growth traits, tree nutritional status, yield and fruit quality rather than non- application. The promotion was associated with increasing concentrations of fenugreek seed sprout extract Using fenugreek seed sprout extract was superior than using all nutrients alone in this respect. Combined application of fenugreek seed sprout as well as macro and micronutrients was materially favorable than using each one alone in improving fruiting of such mango cv.

The best results with regard to growth, tree nutritional status, yield and fruit quality of Keitte mango trees grown under Aswan region conditions were obtained due to using a mixture of fenugreek seed sprout extract at 1% besides N,P,K&Mg each at 0.5% and Zn, Fe & Mn each at 0.05% four times.

Key words: Fenugreek seed sprout, nutrients, Keitte mango tree, fruiting and fruit quality.

INTRODUCTION

Poor yield of Keitte mango trees grown under Aswan environmental conditions is considered serious problem facing mango growers under such region. Deficiency of macro and micro nutrients causes a great disturbance in the physiology of mango trees (Hulme, 1971).

Macro and micro nutrients are responsible for enhancing the biosynthesis of plant pigments, DNA, RNA, amino acids, vitamins, antioxidants, sugars and most compounds related to plant metabolism, cell division, cell wall development, and enzymes. They are responsible in the biosynthesis of plant hormones like IAA, GA₃, cytokinins, ABA and ethylene. Flowering, fruit setting, fruit development, fruit dropping, fruit ripening and fruit quality were governed by the availability of nutrients (Mengel and Kirkby, 1987).

Previous studies showed that using complete program of fertilization to different fruit crops containing all nutrients had essential role in increasing yield and improving fruit quality (Rossetto *et al.*, 2000; Hegab, 2000; Hassan- Al-Sayda, 2004; Hamad, 2004; Hegab, *et al.*, 2005; Mahfouz, 2007; El-Khayyat *et al.*, 2007; El- Sayed - Esraa, 2007; Mahmoud *et al.*, 2007; Hamad, 2008; El- Sayed- Esraa, 2010; Harahash and Abdel-

Nasser, 2010; Ahmed *et al.*, 2013; Mohamed and Mohamed, 2013 and Gamal, 2013).

Recent studies clarified the beneficial effects of using extracts of crops seed sprouts such as fenugreek, wheat and barley for alleviating the adverse effects of unsuitable environmental conditions and all stresses around trees on fruiting as well as different drawbacks facing production of fruit crops. Sprouting of seeds may alter the content and composition of proteins, fats and amino acids and enhance the biosynthesis of essential amino acids like glutamic acid, tryptophan and arginine, vitamins B & C and most essential macro and micro nutrients and makes them high available to fruit crops (Cazuola *et al.*, 2004 and Cairney, 2005). Biommeron (2007) emphasized the beneficial effects of crop seed sprout extract on growth and fruiting of horticultural crops.

The results of Abdallah *et al.* (2000); Abdallah (2008); Mohamed (2008); Anwar *et al.* (2009); Darwish (2009); Al- Shereif *et al.* (2013); El- Sayed - Faten (2014) and El- Khawaga and Mansour (2014) emphasized the great benefits of using extracts of crops seed sprout extract on growth and fruiting of horticultural crops.

This study was carried out for examining the impact of using fenugreek seed sprout extracts and some macro and micro nutrients on growth and

fruiting of Keitte mango trees grown under Wady El Nokra region conditions, Aswan governorate.

MATERIALS AND METHODS

This investigation was carried out during 2013 and 2014 seasons on Keitte mango cv. trees onto seeding rootstocks, grown in sandy loam soil in a private orchard situated at Wady El- Nokra region, Kom Ombo district, Aswan governorate Egypt. The selected trees were 10- years old, healthy, nearly uniform in vigour, planted at 5x5 meters apart and received the same cultural practices. Surface irrigation system was used. Soil analysis was done according to the procedures outlined by Wilde *et al.* (1985) and the data are shown in Table(1).

Table 1: Analysis of the tested soil

Constituents	Values
Sand %	75.0
Silt %	10.0
Clay %	15.0
Texture	Sandy loam
CaCO ₃ %	1.95
pH (1 : 2.5 extract)	7.7
Organic matter	0.25
Total N %	0.09
P (Olson, ppm)	2.0
K(ammonium acetate , ppm)	205
EDTA extractable nutrients (ppm):	
Zn	0.9
Fe	1.1
Mn	0.7

This study included the following ten treatments:

- 1-Control (sprayed with water).
- 2-Spraying fenugreek seed sprout extract at 0.5%.
- 3-Spraying fenugreek seed sprout extract at 1.0 %.
- 4-Spraying fenugreek seed sprout extract at 2.0%.
- 5-Spraying N,P,K&Mg each at 0.5%.
- 6-Spraying Zn,Fe&Mn at 0.05%.
- 7-Spraying all nutrients N,P,K,Mg,Zn,Fe&Mn) at the previous concentrations.
- 8-Spraying fenugreek seed sprout extract at 0.5% + all nutrients.
- 9-Spraying fenugreek seed sprout extract at 1.0 % + all nutrients.
- 10-Spraying fenugreek seed sprout extract at 2.0 % + all nutrients.

Each treatment was replicated three times, one tree per each. Fenugreek seed sprout extract was prepared by sowing the seeds in dark place, then sprouts were harvested after 3-4 days from seed sowing. Sprouts were homogenated with distilled water at 1: 10 using an electric blender for five minutes, then filtered and kept under 4°C in refrigerator till use (Table 2).

Table 2: Chemical composition of fenugreek sprout.

Constituent	Values (mg/ 100 g F.W.)
Asparatic acid	2.2
Arginine	2.1
Alanine	2.9
Isoleucin	2.1
Cysteine	1.9
Cystine	1.8
Glutamic acid	2.0
Methionene	6.0
Lysine	5.1
Vitamin A	1.0
Vitamin B1	0.32
Vitamin B2	0.30
Vitamin B6	1.00
Vitamin C	2.00
Ca	220
P	341
K	469
Mg	371
Fe	242
Phytic acid	0.9
Niacin	1.4

Fenugreek seed sprout extract and all nutrients were sprayed four times at the first week of Feb. Mar., Apr. and May during both season Analysis of this extract was carried out using the proccdures methods that outlined by A.O. AC. (2000) N, P, K, Mg, Zn, Fe and Mn were applied in the sources of urea at 0.5%, orthophosphoric acid at 0.5%, potassium sulphate at 0.5%, magnesium sulphate at 0.5% as well as chelated Zn, Fe & Mn each at 0.05%, respectively. Triton B as a wetting agent was added to all spraying solutions at 0.05%, and spraying was done till runoff. Randomized complete block design (RCBD) was followed.

During both seasons, the following parameters were measured, spring shoot length (cm.), leaf area (cm²) (Ahmed and Morsy, 1999), chlorophyll a & b and total chlorophylls as mg / 100 g F.W. (Von – Wettstein, 1957); percentages of N, P, K and Mg (Wilde *et al.*, 1985), Fruit retention %, yield / tree (kg.), fruit weight (g.), percentages of seeds, peels and pulp; edible to non edible portions, T.S.S. %, total acidity, total and reducing sugars %, vitamin C content mg/ 100 ml juice and total fibres (A.O.A.C., 2000).

Statistical analysis was done using new L.S.D. test at 5% to differentiate among the ten treatment means (Mead *et al.*, 1993).

RESULTS AND DISCUSSION

1- Shoot length and leaf area:

It is clear from the data in Table(3) that treating Keitte mango trees with fenugreek seed sprout

extract at 0.5 to 2.0% and/ or macro and micronutrients significantly enhanced the main shoot length and leaf area rather than the control treatment. The stimulation was significantly associated with increasing fenugreek seed sprout extract concentrations from 0.5 to 2%. Using fenugreek seed extract at 0.5 to 1% was significantly favourable than using macro and/ or micronutrients in this respect. Combined applications of these materials were significantly superior than using each material alone in this respect. Increasing concentrations of fenugreek seed sprout extract from 1.0 to 2.0 failed significantly to stimulate such two growth characters. The maximum values were recorded on the trees that supplied with fenugreek seed sprout at 2% plus using all nutrients. The control trees produced the lowest values. These results were true during both seasons.

2- Leaf chemical composition:

It is clear from the data in Tables (3 & 4) that supplying the trees with fenugreek seed sprout extract and/ or micro and macronutrients significantly was followed by enhancing total chlorophylls as well as percentages of N, P, K & Mg in the leaves relative to the control treatment. The stimulation was significantly in proportional to the increase in concentrations of fenugreek seed sprout extract from 0.5 to 1% without significant promotion between the two higher concentrations. Using fenugreek seed sprout extract along with micro and macronutrients was significantly followed by enhancing total chlorophylls and leaf content of N, P, K & Mg rather than using fenugreek seed sprout extract alone. The maximum N (2.34 & 2.50 %), P (0.45 & 0.47%), K (1.92 & 1.99 %) and Mg (0.85 & 0.89%) were present in the leaves taken from the trees that received four sprays of a mixture containing fenugreek seed sprout extract at 2% plus all nutrients. In such treatment, values of total chlorophylls reached 18 and 18.3 mg/ 100 g F.W., during both seasons, respectively. The minimum values were recorded on untreated trees. Similar results were revealed during both seasons.

3- Percentage of fruit retention and yield per tree

Data in Table (4) clearly show that percentage of fruit retention and yield per tree were significantly improved in response to spraying the trees four times with fenugreek seed sprout and/ or macro and micronutrients relative to the check treatment. The promotion was significantly associated with increasing concentrations of fenugreek seed sprout, extract. Using fenugreek seed sprout extract was significantly accompanied with enhancing fruit retention % and yield per tree comparing to using macro and / or micronutrients. Combined applications had significant beneficial effects on fruit retention and yield comparing with using each material alone. From economical points

of view using fenugreek seed sprout at 1% (since no significant promotion was observed among 1.0 and 2.0%) besides all nutrients gave the best results with regard to fruit retention and yield / tree. Under such promised treatment, yield per tree reached 35.0 and 36.3kg/tree during both seasons, respectively. The control trees produced 22.0 and 21.5 kg/ tree during the same seasons, respectively. The percentage of increase in the yield due to application of the promised treatment over the control treatment reached 59.1 and 58.8 % during both seasons, respectively. These results were true during both seasons.

4-Physical and chemical characteristics of the fruits:

It is evident from the data in Tables (4 & 5 & 6) that treating Keitte mango trees four times with fenugreek seed sprout extract at 0.5 to 2.0% and/ or macro and micronutrients was significantly very effective in improving fruit quality in terms of increasing fruit weight, pulp%, edible to non edible portions, T.S.S. %, total and reducing sugars% and vitamin C content and decreasing percentages of seed and peel weights, total acidity % and total fibres rather than the check treatment. Using fenugreek seed sprout was significantly preferable than using macro and / or micro nutrients in improving fruit quality. The promotion on fruit quality was significantly related to the increase in concentrations of fenugreek seed sprout extract from 0.5 to 0.1%. Increasing concentrations from 1.0 to 2.0% failed to show significant promotion on quality parameters. Combined application of fenugreek seed sprout plus macro and micronutrients was significantly superior than using each alone in this respect. Fruit quality was not affected with increasing concentrations of fenugreek seed sprout extract from 1 to 2%. Therefore, the recommended concentration from economical point of view was 1%. The best results with regard to fruit quality were obtained with spraying fenugreek seed sprout extract at 1% besides using all nutrients. These results were true during both seasons.

The beneficial effects of sprout extract of fenugreek seed extract on fruiting of Keitte mango trees might be attributed to the higher content of sprouts from essential amino acids namely asparatic acid, arginine, alanine, isoleucine, cysteine, systeme, glutamic acid, methionene and lysine, vitamins such as vitamins A, B, & B₂, B₆ & C and various minerals such as Ca, P, K, Mg, and Fe, consequently. These components are responsible for enhancing cell division, enzymes and all organic foods (Mengel and Kirkby, 1987; Casuola *et al.* 2004; Biommeron, 2007).

Macro and micro nutrients are responsible for enhancing the biosynthesis of plant pigments, DNA, RNA, amino acids, vitamins, antioxidants,

Table 3: Effect of spraying fenugreek seed sprout extract and some macro and micronutrients on spring shoot length, leaf area, total chlorophylls and percentages of N and P in the leaves of Keitte mango trees during 2013 and 2014 seasons.

Treatment	Spring shoot length (cm.)		Leaf area (cm ²)		Total chlorophylls (mg/100 g F.W.)		Leaf N %		Leaf P %	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Control	40.0	41.3	74.1	73.3	13.2	13.0	1.71	1.81	0.18	0.20
Fenugreek seed sprout extract at 0.5 %	45.5	45.7	80.1	81.0	15.4	15.7	2.06	2.14	0.31	0.34
Fenugreek seed sprout extract at 1 %	47.3	48.0	81.3	82.2	15.9	16.2	2.13	2.22	0.36	0.37
Fenugreek seed sprout extract at 2 %	47.4	48.9	81.4	82.3	16.0	16.3	2.14	2.23	0.37	0.38
N,P,K&Mg at 0.5 %	42.7	44.2	77.2	78.1	14.3	14.7	1.91	1.96	0.25	0.27
Zn,Fe&Mn at 0.05 %	41.6	43.0	76.0	76.9	13.8	14.1	1.81	1.88	0.22	0.23
All nutrients	44.0	45.4	78.4	79.3	14.8	15.1	1.98	2.05	0.28	0.31
Fenugreek seed sprout extract at 0.5 % + all nutrients	45.9	50.5	82.9	83.8	16.4	16.8	2.25	2.40	0.41	0.42
Fenugreek seed sprout extract at 1 % + all nutrients	50.7	52.5	85.0	87.0	17.9	18.2	2.33	2.49	0.44	0.46
Fenugreek seed sprout extract at 2 % + all nutrients	51.0	52.6	82.0	87.1	18.0	18.3	2.34	2.50	0.45	0.47
New L.S.D. at 5%	1.0	1.1	0.9	1.1	0.4	0.3	0.06	0.07	0.03	0.03

Table 4: Effect of spraying fenugreek seed sprout extract and some macro and micronutrients on the percentages of K and Mg in the leaves and fruit retention %, yield / tree and average fruit weight of Keitte mango trees during 2013 and 2014 seasons.

Treatment	Leaf K %		Leaf Mg %		Fruit retention %		Yield/ tree (kg.)		Average of Fruit weight (g.)	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Control	1.41	1.44	0.50	0.47	0.88	0.90	22.0	21.5	342.5	352.0
Fenugreek seed sprout extract at 0.5 %	1.67	1.72	0.71	0.75	1.12	1.13	28.5	29.4	415.0	425.0
Fenugreek seed sprout extract at 1 %	1.74	1.80	0.75	0.79	1.18	1.19	30.0	31.0	431.0	441.3
Fenugreek seed sprout extract at 2 %	1.75	1.81	0.76	0.80	1.19	1.20	30.3	31.3	433.0	443.0
N,P,K&Mg at 0.5 %	1.55	1.61	0.61	0.65	1.00	1.00	25.5	26.5	375.0	385.0
Zn,Fe&Mn at 0.05 %	1.47	1.53	0.55	0.59	0.94	0.95	23.3	23.4	360.0	371.0
All nutrients	1.60	1.66	0.64	0.68	1.06	1.07	27.0	28.0	390.0	400.0
Fenugreek seed sprout extract at 0.5 % + all nutrients	1.81	1.87	0.80	0.84	1.25	1.25	33.0	34.1	461.0	471.0
Fenugreek seed sprout extract at 1 % + all nutrients	1.91	1.98	0.84	0.88	1.31	1.31	35.0	36.3	482.0	492.3
Fenugreek seed sprout extract at 2 % + all nutrients	1.92	1.99	0.85	0.89	1.32	1.32	35.3	36.6	483.0	494.0
New L.S.D. at 5%	0.05	0.05	0.03	0.03	0.05	0.04	1.0	1.0	12.0	12.2

Table 5: Effect of spraying fenugreek seed sprout extract and some macro and micronutrients on some physical and chemical characteristics of the fruits of Keitte mango trees during 2013 and 2014 seasons.

Treatment	Seed weight %		Peel weight %		Pulp %		Edible / non edible portions		T.S.S. %	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Control	14.1	14.0	18.9	19.0	67.0	67.0	2.03	2.03	9.0	9.2
Fenugreek seed sprout extract at 0.5 %	11.9	11.7	16.0	15.3	72.1	73.0	2.58	2.70	10.5	10.8
Fenugreek seed sprout extract at 1 %	10.3	10.1	15.4	14.7	74.3	75.2	2.89	3.03	11.0	11.4
Fenugreek seed sprout extract at 2 %	10.2	10.0	15.3	14.7	74.5	75.3	2.91	3.05	11.1	11.5
N,P,K&Mg at 0.5 %	13.0	12.8	17.6	17.0	69.4	70.2	2.27	2.36	9.7	10.1
Zn,Fe&Mn at 0.05 %	13.5	13.3	18.3	17.7	68.2	69.0	2.14	2.23	9.4	9.9
All nutrients	12.5	12.3	17.0	16.3	70.5	71.4	2.39	2.50	10.1	10.5
Fenugreek seed sprout extract at 0.5 % + all nutrients	9.1	8.9	14.0	13.3	76.9	77.8	3.33	3.50	11.5	11.9
Fenugreek seed sprout extract at 1% + all nutrients	8.0	8.0	13.0	12.4	79.0	79.6	3.76	3.90	12.1	12.6
Fenugreek seed sprout extract at 2% + all nutrients	7.7	7.5	12.9	12.2	79.4	80.3	3.85	4.08	12.2	12.07
New L.S.D. at 5%	0.4	0.4	0.4	0.4	1.0	1.0	0.14	0.18	0.3	0.3

Table 6: Effect of spraying fenugreek seed sprout extract and some macro and micronutrients on some chemical characteristics of the fruits of Keitte mango trees during 2013 and 2014 seasons.

Treatment	Total acidity %		Total sugars %		Reducing sugars %		Vitamin C (mg / 100 ml/ juice)		Total fibres %	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Control	0.992	0.997	7.1	7.0	2.9	3.0	41.5	40.7	1.00	1.07
Fenugreek seed sprout extract at 0.5 %	0.871	0.866	8.1	8.2	3.8	3.9	47.1	47.4	0.77	0.72
Fenugreek seed sprout extract at 1 %	0.850	0.845	8.5	8.6	4.3	4.1	48.9	49.2	0.70	0.69
Fenugreek seed sprout extract at 2 %	0.847	0.842	8.6	8.7	4.4	4.1	49.0	49.3	0.69	0.68
N,P,K&Mg at 0.5 %	0.930	0.925	7.7	7.8	3.3	3.3	44.1	44.3	0.89	0.90
Zn,Fe&Mn at 0.05 %	0.961	0.955	7.4	7.5	3.1	3.1	43.0	43.0	0.94	0.95
All nutrients	0.900	0.895	7.9	8.0	3.6	3.6	45.8	46.0	0.84	0.83
Fenugreek seed sprout extract at 0.5 % + all nutrients	0.811	0.806	8.8	8.9	4.5	4.7	50.5	51.5	0.60	0.57
Fenugreek seed sprout extract at 1% + all nutrients	0.771	0.765	8.9	9.1	4.7	4.9	52.0	53.0	0.51	0.49
Fenugreek seed sprout extract at 2% + all nutrients	0.769	0.764	9.0	9.2	4.7	5.0	52.3	53.3	0.50	0.48
New L.S.D. at 5%	0.020	0.025	0.2	0.2	0.2	0.2	1.0	1.0	0.05	0.06

sugars and most compounds related to plant metabolism, cell division, cell wall development, and enzymes. They are responsible in the biosynthesis of plant hormones like IAA, GA₃, cytokinins, ABA and ethylene. Flowering, fruit setting, fruit development, fruit dropping, fruit ripening and fruit quality were governed by the availability of nutrients (Mengel and Kirkby, 1987).

The results of Abdallah *et al.* (2000); Abdallah (2008); Mohamed (2008); Anwar *et al.* (2009); Darwish (2009); Al- Shereif *et al.* (2013); El- Sayed – Faten (2014) and El- Khawaga and Mansour (2014) emphasized the great benefits of using extracts of crops seed sprout on growth and fruiting of horticultural crops.

CONCLUSION

Four sprays of a mixture containing fenugreek seed sprout extract at 1% plus N,P,K&Mg at 0.5% and Zn,Fe & Mn at 0.05% was responsible for improving yield and fruit quality of Keitte mango trees grown under Aswan region conditions.

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المخلص العربي

تأثير رش مستخلص نبت بذور الحلبة وبعض العناصر الغذائية على الاثمار فى اشجار المانجو الكيت النامية تحت ظروف منطقة اسوان

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خلال موسمى الدراسة ٢٠١٣، ٢٠١٤ تم رش اشجار المانجو الكيت أربعة مرات بمستخلص نبت بذور الحلبة بتركيز ما بين ٠,٥ الى ٢% منفردا أو مع رش عناصر النيتروجين والفوسفور والبوتاسيوم والماغنسيوم بتركيز ٠,٥% والحديد والزنك والمنجنيز بتركيز ٠,٠٥% وقد ركزت الدراسة على بيان تأثير هذه المعاملات على النمو والحالة الغذائية للاشجار وكمية المحصول بالاضافة الى الخصائص الطبيعية والكيميائية للثمار.

كان رش مستخلص نبت بذور الحلبة ما بين ٠,٥ الى ٢% منفردا او مع العناصر الكبرى والصغرى فعالا جدا فى تحسين صفات النمو والحالة الغذائية للشجرة وكمية المحصول وخصائص الثمار وذلك بالمقارنة بعدم استخدام هذه المواد وكان التحسن متوافقا مع زيادة التركيز المستخدم من مستخلص نبت بذور الحلبة وقد تفوق استخدام هذا المستخلص على استخدام جميع العناصر وحدها فى هذا الصدد وكان استخدام مستخلص نبت بذور الحلبه جنبا الى جنب مع جميع العناصر الكبرى والصغرى مفضلا عن استخدام هذه المواد منفردة فى تحسين الاثمار فى هذا الصنف.

وأمكن الحصول على أفضل النتائج بخصوص النمو والحالة الغذائية للشجرة وكمية المحصول وخصائص جوده ثمار اشجار المانجو الكيت النامية تحت ظروف منطقة أسوان عند استخدام مخلوط مستخلص نبت بذور الحلبة مع عناصر النيتروجين والفوسفور والبوتاسيوم بتركيز ٠,٥ والزنك والحديد والمنجنيز بتركيز ٠,٠٥% أربعة مرات.

الكلمات الدالة: نبت بذور الحلبة- العناصر الغذائية- اشجار المانجو الكيت- الاثمار - خصائص الجودة.