

Impact of Spraying Extracts of Fenugreek and Rocket Seed Sprouts on Fruiting of Keitte Mango Trees

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Abstract: During 2013 & 2014 seasons, Keitte mango trees treated four times with fenugreek seed sprout extract and/ or rocket seed sprout extract each at 0.5 to 4 %. The study focused on the effect of these seed sprout extract treatment, on growth, tree nutritional status, yield and fruit quality of such mango cv. Single and combined applications of fenugreek and rocket seed sprout extracts each at 0.5 to 4.0 % considerably enhanced all growth characters, nutritional status of the trees, yield as well as physical and chemical characteristics of the fruits compared to the check treatment spraying fenugreek seed sprout extract was materially Superior than using seed sprout extract of rocket in this respect. Combined application surpassed the use of each alone in this respect. The promotion was considerably related to the increase in fenugreek and rocket seed sprout concentrations from 0.5 to 4.0 % without material stimulation among the higher two concentrations namely 1.0 and 2.0%. Carrying our four sprays of a mixture of fenugreek and rocket seed sprouts at 1% gave the best results with regard to yield and fruit quality of Keitte mango trees grown under sandy soil condition.

[Mahmoud M.Refaai. **Impact of Spraying Extracts of Fenugreek and Rocket Seed Sprouts on Fruiting of Keitte Mango Trees.** *World Rural Observ* 2014;6(4):75-80]. ISSN: 1944-6543 (Print); ISSN: 1944-6551 (Online). <http://www.sciencepub.net/rural>. 12

Keywords: Fenugreek, rocket, Keitte mango.

1. Introduction

Many trials were made for overcoming poor of yield in Keitte mango trees grown under sandy soil. It is not surprising for using crops seed sprout extracts for amending fruit crops with their requirements from all organic and mineral nutrients from unconventional and undamaged sources. Extracts of crop seed sprouts characterized by higher own content of all essential amino acids, vitamins especially vitamins B & A & C, antioxidants, natural promoters, carbohydrates and most essential macro and micro nutrients at balanced rate (Camacho *et al.*,1992, Patil *et al.*,1997, and Cairney,1999 and 2005).

The results of Abdallah *et al.*, 2000; Crews and Peoples, 2004; Cazuola *et al.*, 2004; Biomerson, 2007, Abdallah, 2008; Darwish, 2009; Anwar *et al.*, 2009; Anderson and Cedergreen,2010;Al- Shereif *et al.*, 2013 and El- Sayed- Faten, 2014).

The main target of this study was examining the effect of extracts of fenugreek and rocket seed sprouts on overcoming the yield poor problems facing Keitte mango trees grown under sandy soil.

2. Material and Methods

This study was carried during 2013 and 2014 seasons on 39 uniform in vigour 10 – years old Keitte mango trees onto seeding rootstock and grown in sandy soil in a private orchard situated at West Samalout, Minia Governorate. The selected trees are planted at 5x5 meters apart. Surface irrigation system was followed. All the selected trees received the common horticultural practices that already applied in the

orchard. Table (1) show the analysis of the tested soil (Wilde *et al.*, 1985).

Table (1): Analysis of the tested soil

Constituent	Value
Sand %	80.9
Silt %	10.0
Clay %	9.1
Texture grade	Sandy
pH (1: 2.5extract)	7.95
EC (1: 2.5 extract ppm) mmhos/ cm ²⁵ C	960
CaCO ₃ %	5.1
O.M. %	0.8
Total N %	0.04
Available P (ppm)	1.3
Available K (ppm)	120

This study included the following thirteen treatments:

- 1- Control.
- 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 fenugreek seed sprout extract at 4.0 %.
- 6- Spraying rocket seed sprout extract at 0.5%.
- 7- Spraying rocket seed sprout extract at 1.0 %.

- 8- Spraying rocket seed sprout extract at 2.0 %.
- 9- Spraying rocket seed sprout extract at 4.0 %.
- 10- Spraying both at 0.5 %.
- 11- Spraying both at 1.0 %.
- 12- Spraying both at 2.0 %.
- 13- Spraying both at 4.0 %.

Each treatment was replicated three times, one tree per each. Both fenugreek and rocket seed sprouts extracts were sprayed four times at the first week of March, April, May and June. Rocket seeds were sown at a rate of 30 g seeds / m², then they harvested at fully

expanded green catyledonny leaves stage (after eleven days from sowing). Fenugreek seeds were sown in dark place using glass jar method (**Abdallah, 2008**), then sprouts were harvested after three days from seed soaking. Sprouts of rocket and fenugreek were homogenized 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) shows the chemical analysis of seed sprouts of fenugreek and rocket.

Table (2): Chemical analysis for fenugreek and rocket seed sprouts

Fenugreek (mg 100 g F.W.)		Rocket (mg/100 g F.W.)	
Constituent	Values	Constituent	Values
Asparatic acid	2.2	Cystine	4.1
Arginine	2.1	Cysteine	3.9
Alanine	2.9	Methionene	3.8
Isoleucin	2.1	Glutamic acid	3.5
Cysteine	1.9	Thiamine	0.16
Cystine	1.8	Riboflavine	0.15
Glutamic acid	2.0	Vitamin E	0.94
Methionene	6.0	Vitamin A	4.4
Lysine	5.1	Vitamin C	101
Vitamin A	1.0	K	496
Vitamin B1	0.32	P	1410
Vitamin B2	0.30	Mg	460
Vitamin B6	1.00	Fe	267
Vitamin C	2.00	Mn	16
Ca	220	Zn	255
P	341		
K	469		
Mg	371		
Fe	242		
Phytic acid	0.9		
Niacin	1.4		

Spraying was done using triton B as a wetting agent at 0.05%. Randomized complete block design (RCBD) was adopted.

During both seasons, the following parameters were measured, spring shoot length (cm.), number of leaves / shoot and leaf area(cm²) (**Ahmed and Morsy, 1999**), chlorophylls a & b, and total chlorophylls (mg/100 g F.W.) (**Von – Wettstein, 1957**), percentages of N, P,K,Mg, Ca and S in the leaves (**Wilde et al., 1985**), percentages of initial fruit setting and fruit retention, yield/ tree, fruit weight (g.) and dimensions (length& width in cm.), fruit firmness (pound/ inch²), percentages of fruit peel, seeds and pulp, edible to non edible portions, T.S.S. %, total acidity % (as g citric acid/100 ml juice) (**A.O.A.C., 2000**), total, reducing and non reducing sugars (**A.O.A.C.,2000**), vitamin C

(mg/100 ml juice) and total fibre percentage (**A.O.A.C., 2000**).

Statistical analysis was done using new L.S.D. at 5% according to **Mead et al. (1993)**.

3. Results

1- Effect of spraying fenugreek and rocket seed sprout extracts on some vegetative growth traits.

Data in Table (3) obviously reveal that spraying fenugreek seed sprout extract and/ or rocket seed sprout extract each at 0.5 to 4.0 % significantly stimulated all growth characters namely main shoot length, number of leaves / shoot and leaf area rather than the control treatment. The promotion was associated with increasing concentrations of fenugreek and rocket seed sprout extracts from 0.5 to 4%. Significant difference

son these growth characters were observed among all concentrations except between 2.0 and 4.0 %. Using fenugreek seed sprout extract at 0.5 to 4.0 % significantly was superior than using rocket seed sprout extract at the same concentrations on improving these growth characters. Combined application of fenugreek plus rocket seed sprout extracts significantly surpassed the application of each alone in this respect. The

maximum values were recorded on the trees that supplied with fenugreek and rocket seed sprout each at 4%. The lowest values were recorded on untreated trees. These results were true during both seasons.

2- Effect of spraying fenugreek and rocket seed sprout extracts on plant pigments and percentages of N, P, K, Mg, Ca and S in the leaves.

Table (3): Effect of different concentrations of fenugreek and rocket seed sprouts on some growth characters and plant pigment of Keitte mango trees during 2013 & 2014 seasons.

Fenugreek and rocket seed sprout extract treatments	Spring shoot length (cm.)		No., of leaves / shoot		Leaf area (cm ²)		Chlorophyll a (mg/ 100 g F.W.)		Chlorophyll b (mg/ 100 g F.W.)		Total chlorophylls (mg/ 100 g F.W.)	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Control	39.0	39.7	33.0	32.0	74.5	75.2	11.1	12.0	3.1	3.2	14.2	15.2
Fenugreek at 0.5%	44.3	45.0	38.0	37.0	80.9	81.6	15.7	16.6	5.1	5.2	20.8	21.8
Fenugreek at 1.0 %	45.7	46.4	39.0	38.0	81.9	82.6	16.39	17.8	5.6	5.7	22.5	23.5
Fenugreek at 2.0 %	48.0	48.8	39.0	39.0	83.3	84.0	17.9	18.9	6.0	6.1	23.9	25.0
Fenugreek at 4.0 %	48.3	49.0	39.0	39.0	83.5	84.2	18.0	18.9	6.1	6.2	24.1	25.0
Rocket at 0.5 %	40.3	41.0	35.0	36.0	75.7	76.5	11.9	12.9	3.5	3.5	15.4	16.4
Rocket at 1.0 %	41.4	42.1	36.0	37.0	77.0	77.9	12.9	13.8	3.9	4.0	16.8	17.8
Rocket at 2.0 %	42.5	43.2	37.1	38.0	78.9	79.6	14.0	14.9	4.5	4.6	18.5	19.5
Rocket at 4.0 %	42.6	43.3	37.2	38.3	79.0	79.7	14.3	15.2	4.6	4.7	18.9	19.9
Both at 0.5 %	49.5	50.2	40.9	41.9	86.9	87.6	19.9	20.9	6.7	6.8	26.6	27.7
Both at 1.0 %	51.7	52.4	42.3	43.4	88.3	89.0	20.9	21.9	7.2	7.3	28.1	29.2
Both at 2.0 %	52.9	53.6	44.0	45.0	90.0	91.0	21.9	22.9	7.7	7.9	29.6	30.8
Both at 4.0 %	53.0	53.7	44.1	45.3	90.3	91.4	22.0	23.0	7.8	8.0	29.8	31.0
New L.S.D. at 5%	1.0	0.9	1.0	1.0	1.0	0.9	0.7	0.8	0.4	0.3	0.4	0.4

Table (4): Effect of different concentrations of fenugreek and rocket seed sprouts on percentages of N, P, K, Mg, Ca and S in the leaves of Keitte mango trees during 2013 & 2014 seasons.

Fenugreek and rocket seed sprout extract treatments	Leaf N %		Leaf P %		Leaf K %		Leaf Mg %		Leaf Ca %		Leaf S %	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Control	1.71	1.78	0.12	0.11	1.29	1.30	0.59	0.57	2.19	2.20	0.61	0.95
Fenugreek at 0.5%	2.09	2.16	0.22	0.23	1.61	1.58	0.76	0.73	2.64	2.63	0.83	0.84
Fenugreek at 1.0 %	2.16	2.23	0.25	0.26	1.76	1.64	0.80	0.77	2.75	2.74	0.90	0.91
Fenugreek at 2.0 %	2.27	2.34	0.26	0.27	1.74	1.71	0.85	0.82	2.84	2.84	0.95	0.96
Fenugreek at 4.0 %	2.28	2.35	0.26	0.28	1.75	1.72	0.86	0.83	2.85	2.85	0.96	0.97
Rocket at 0.5 %	1.81	1.88	0.14	0.15	1.36	1.33	0.63	0.60	2.29	2.30	0.66	0.67
Rocket at 1.0 %	1.91	1.98	0.16	0.17	1.42	1.39	0.67	0.64	2.39	2.40	0.71	0.72
Rocket at 2.0 %	2.01	2.08	0.18	0.19	1.50	1.47	0.71	0.68	2.50	2.51	0.76	0.77
Rocket at 4.0 %	2.02	2.09	0.19	0.20	1.51	1.48	0.72	0.69	2.51	2.52	0.77	0.78
Both at 0.5 %	2.39	2.46	0.30	0.31	1.81	1.78	0.90	0.86	2.94	3.04	1.01	1.03
Both at 1.0 %	2.51	2.58	0.33	0.34	1.87	1.84	0.93	0.90	3.03	3.14	1.06	1.08
Both at 2.0 %	2.62	2.70	0.36	0.37	1.93	1.90	0.97	0.94	3.14	3.25	1.11	1.12
Both at 4.0 %	2.63	2.71	0.37	0.38	1.94	1.91	0.97	0.95	3.15	3.26	1.12	1.13
New L.S.D. at 5%	0.06	0.07	0.02	0.02	0.05	0.03	0.03	0.03	0.08	0.07	0.03	0.03

It is noticed from the data in Tables(3 & 4) that single and combined applications of fenugreek and rocket seed sprout extract each at 0.5 to 4.0 % had an announced and significant stimulation on chlorophyll a & b, total chlorophylls and percentages of N, P,K,Mg, Ca and S in the leaves relative to the control treatment. There was a gradual promotion on these plant pigments and essential nutrients with increasing concentrations

of both fenugreek and rocket seed sprout extracts from 0.5 to 4.0 %. Increasing concentrations from 2.0 to 4.0 of each crop seed sprout extract failed to show significant promotion on these parameters. Using fenugreek seed sprout extract significantly was superior than application of rocket seed sprout extract. Combined application of fenugreek and rocket seed sprout extracts significantly enhanced all aspects when

compared with using each alone. The maximum values were recorded on the trees that received four sprayed of a mixture containing fenugreek and rocket seed sprout extract each at 4%. The untreated trees produced the minimum values. Similar results were declared during both seasons.

3- Effect of spraying fenugreek and rocket seed sprout extracts on the percentages of initial fruit setting and fruit retention and yield per tree.

Data in Table (5) clearly exhibit that percentages of initial fruit setting and fruit retention as well as yield of Keitte mango trees were significantly improved in response to spraying fenugreek and / or rocket seed sprout extracts each at 0.5 to 4.0 % over the control treatment. There was a gradual promotion on these characters with increasing concentrations of each material from 0.5 to 4.0%. Using fenugreek seed sprout extract at 0.5 to 4.0 % was significantly preferable than using rocket seed sprout extract in improving initial fruit setting, fruit retention and yield per tree. The best results were obtained due to using both materials together when compared with using any one alone. The maximum yield from economical point of view (34.5 & 35.5 kg/ tree) was presented on the trees supplied with both fenugreek and rocket seed sprout extract each at 2.0 % (since no significant promotion was observed among 2.0 and 4.0%). The untreated trees produced 21.0 and 20.7 kg during both seasons, respectively. The percentage of increase on the yield due to using the previous promised treatment over the check treatment

reached 64.3 and 71.5 % during 2013 & 2014 seasons, respectively.

4- Effect of spraying fenugreek and rocket seed sprout extracts on both physical and chemical characteristics of the fruits

Data listed in Tables (5 & 6 & 7) obviously reveal that single and combined applications of fenugreek and rocket seed sprout extracts each at 0.5 to 4% caused a significant promotion on fruit quality in terms of increasing fruit weight and dimensions (length & width), fruit firmness, pulp %, edible to non- edible portions, T.S.S. %, total and reducing sugars and vitamin C and decreasing percentages of seeds, peels, total acidity and total fibre relative to the control treatment. The promotion was associated with increasing concentrations. Significant differences on the fruit quality were observed among all concentrations except between using 2.0 and 4.0 %. Using fenugreek seed sprout extract was significantly preferable in improving fruit quality than using rocket seed sprout extract. Combined application of such two material significantly improved fruit quality over the application of each material alone in this respect. The present treatments had no significant effect on non-reducing sugars. The best results from economical point of view were obtained with treating Keitte mango trees four times with fenugreek and rocket seed sprout extracts each at 2.0 %. Untreated trees gave unfavourable effects on fruit quality. These results were true during both seasons.

Table (5): Effect of different concentrations of fenugreek and rocket seed sprouts on the percentage of initial fruit setting and fruit retention, yield per tree and some fruit physical characters, of Keitte mango trees during 2013 & 2014 seasons.

Fenugreek and rocket seed sprout extract treatments	Initial fruit setting %		Fruit retention %		Yield/ tree		Fruit weight (g.)		Fruit length cm		Fruit width (cm)	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Control	13.3	14.0	0.90	0.89	21.0	20.7	341.0	350.0	10.1	9.8	7.6	7.3
Fenugreek at 0.5%	15.6	16.3	1.14	1.17	26.6	27.0	413.0	422.0	11.9	11.6	9.0	8.7
Fenugreek at 1.0 %	16.2	16.9	1.21	1.24	27.7	28.1	435.0	444.0	11.7	11.4	9.1	8.8
Fenugreek at 2.0 %	17.0	17.7	1.30	1.33	28.9	29.3	456.0	466.0	12.0	11.7	9.1	8.9
Fenugreek at 4.0 %	17.1	17.8	1.31	1.34	29.0	29.4	457.0	467.0	12.1	11.8	9.2	8.9
Rocket at 0.5 %	13.7	14.4	0.95	0.98	22.7	23.1	357.0	367.0	10.4	10.3	7.9	7.6
Rocket at 1.0 %	14.2	14.9	1.00	1.03	23.8	24.2	371.0	381.0	10.7	10.8	8.2	7.9
Rocket at 2.0 %	15.0	15.7	1.06	1.10	25.0	25.2	391.0	399.0	11.0	11.0	8.5	8.3
Rocket at 4.0 %	15.1	15.8	1.07	1.11	25.1	25.6	393.0	400.0	11.1	11.1	8.6	8.3
Both at 0.5 %	18.0	18.7	1.28	1.32	30.9	31.5	477.0	489.0	12.5	12.6	9.2	8.9
Both at 1.0 %	18.5	19.5	1.33	1.37	33.0	33.7	499.0	511.0	12.8	12.9	9.4	9.2
Both at 2.0 %	19.0	19.7	1.40	1.41	34.5	35.5	520.0	551.0	13.1	13.1	9.5	9.3
Both at 4.0 %	19.2	19.8	1.41	1.42	34.7	35.6	525.0	553.0	13.2	13.2	9.6	9.4
New L.S.D. at 5%	0.3	0.3	0.05	0.04	1.0	1.1	11.5	11.3	0.3	0.3	0.3	0.3

Table (6): Effect of different concentrations of fenugreek and rocket seed sprouts on some physical and chemical characteristics of the fruits of Keitte mango trees during 2013 & 2014 seasons.

Fenugreek and rocket seed sprout extract treatments	Fruit firmness (pound/inch ²)		Seeds %		Fruit peel %		Pulp %		Edible/non-edible portion		T.S.S.%	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Control	35.0	34.9	13.1	12.9	18.0	17.3	68.9	69.8	2.22	2.31	8.8	8.7
Fenugreek at 0.5%	36.3	36.2	10.2	10.0	14.1	13.4	75.7	76.6	3.12	3.15	9.8	9.9
Fenugreek at 1.0 %	36.7	36.6	9.5	9.3	13.1	12.4	77.4	78.3	3.42	3.61	10.1	10.2
Fenugreek at 2.0 %	37.0	36.9	9.0	8.8	12.2	11.5	78.8	79.7	3.72	3.93	10.3	10.3
Fenugreek at 4.0 %	37.1	37.0	8.8	8.6	12.1	11.4	79.1	80.0	3.78	4.00	10.4	10.5
Rocket at 0.5 %	35.4	35.3	12.6	12.4	17.3	16.7	70.1	70.9	2.34	2.44	9.0	9.1
Rocket at 1.0 %	35.8	35.7	12.1	11.9	16.3	15.6	71.6	72.5	2.52	2.64	9.2	9.3
Rocket at 2.0 %	35.9	36.0	11.6	11.4	15.2	14.3	73.2	74.1	2.73	2.86	9.4	9.5
Rocket at 4.0 %	36.0	35.9	11.5	11.3	15.0	14.3	73.5	74.4	2.77	2.91	9.5	9.6
Both at 0.5 %	37.4	37.3	7.3	7.1	10.0	9.3	82.7	83.6	4.78	5.10	10.7	10.8
Both at 1.0 %	37.8	37.7	6.5	6.3	9.0	8.3	84.5	85.4	5.45	5.85	11.1	11.0
Both at 2.0 %	37.9	37.8	6.0	5.9	8.0	7.3	86.0	86.8	6.14	6.58	11.5	11.4
Both at 4.0 %	38.0	37.9	5.9	5.8	7.8	7.2	86.3	87.0	6.29	6.69	11.6	11.5
New L.S.D. at 5%	0.4	0.4	0.4	0.4	0.7	0.6	0.9	1.0	0.16	0.14	0.2	0.2

Table (7): Effect of different concentrations of fenugreek and rocket seed sprouts on some chemical characteristics of fruits of Keitte mango trees during 2013 & 2014 seasons.

Fenugreek and rocket seed sprout extract treatments	Total acidity %		Total sugars%		Reducing sugars %		Non-reducing sugars %		V.C. (mg/100ml/ juice)		Total fibre %	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Control	1.500	1.570	7.55	7.51	2.92	2.93	4.63	4.58	39.8	40.6	1.11	1.15
Fenugreek at 0.5%	0.935	0.942	7.95	7.88	3.20	3.21	4.75	4.67	44.4	44.5	0.81	0.80
Fenugreek at 1.0 %	0.915	0.922	8.11	8.04	3.27	3.28	4.84	4.76	45.9	46.1	0.76	0.75
Fenugreek at 2.0 %	0.880	0.888	8.23	8.15	3.35	3.36	4.88	4.79	47.0	47.2	0.70	0.69
Fenugreek at 4.0 %	0.877	0.885	8.24	8.16	3.36	3.37	4.88	4.79	47.3	47.5	0.69	0.68
Rocket at 0.5 %	1.300	1.370	7.57	7.50	2.98	2.99	4.59	4.51	40.9	41.1	1.02	1.00
Rocket at 1.0 %	1.100	1.180	7.69	7.62	3.05	3.06	4.64	4.56	41.9	42.1	0.95	0.94
Rocket at 2.0 %	0.980	0.990	7.82	7.75	3.11	3.12	4.71	4.63	43.0	43.2	0.90	0.89
Rocket at 4.0 %	0.960	0.967	7.83	7.77	3.12	3.13	4.71	4.64	43.1	43.2	0.89	0.88
Both at 0.5 %	0.855	0.865	8.36	8.27	3.45	3.46	4.91	4.81	49.0	49.2	0.60	0.55
Both at 1.0 %	0.831	0.840	8.49	8.40	3.50	3.55	4.99	4.85	49.9	50.1	0.55	0.49
Both at 2.0 %	0.803	0.810	8.62	8.55	3.56	3.61	5.06	4.94	50.9	51.1	0.48	0.40
Both at 4.0 %	0.801	0.808	8.63	8.57	3.57	3.62	5.06	4.95	51.0	51.2	0.47	0.39
New L.S.D. at 5%	0.018	0.019	0.11	0.12	0.05	0.05	NS	NS	0.9	0.9	0.05	0.05

4. Discussion

The previous positive action of fenugreek and rocket seed sprout extracts on growth and fruiting of Keitte mango trees was mainly attributed to their higher own content from essential amino acids, antioxidants, vitamins A & C & B and essential nutrients (Camacho *et al.*, 1992; Patil *et al.*, 1997; Cariney, 1999 and 2005 and Anwar *et al.*, 2009). Similar results were announced by Darwish (2009);

Anderson and Cedergreen (2010); Al- Shereif *et al.*, (2013) and El- Sayed – Faten (2013).

Conclusion

For promoting yield and fruit quality of keitte mango trees, it is advised to spray the trees four times with fenugreek and rocket seed sprout extracts each at 2.0%.

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11/23/2014