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Reducing Mineral Nitrogen Partially Using Different Sources of Organic and Bio-Fertilization and Its Effect on Fruiting In Keitte Mango Trees under Sandy Soil Conditions

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Abstract: This study was carried out during 2018, 2019 and 2020 seasons, a private mango orchard located at Kom Ombo district, Aswan Governorate, Egypt. An attempt to reduce mineral nitrogen fertilizers partially in Keitte mango trees orchards under sandy soil conditions by application of organic (filter mud and chicken manure) and biofertilizer (Minia Azotene) Mineral, Organic and biofertilizers were applied at various proportions. Obtained results indicated that supplying Keitte mango trees with N inorganic source 70% and organic and biofertilizers at 30% was very effective in improving all growth characters, percentages of initials fruit setting and fruit retention and yield/ tree compared with using N completely in inorganic from and 40% inorganic plus 60% organic and biofertilization. A gradual increase in leaf chemical composition as well as physical and chemical fruits reducing the percentages of inorganic N from 100 to 40% and at the same time increasing the percentages of organic and biofertilizers from 30% to 60% caused a gradual increase in the fruits quality increasing in fruit weight, total soluble solids, total sugars and vitamin C and decreasing percentage seed weight, fruit peel and total acidity. The used of organic fertilization source of chicken manure was better than the filter mud. However , to improve Keitte mango trees yield quantitively and qualitatively it is advisable to supply the trees with the suitable N (1000 g / tree / year) as 40% inorganic (ammonium nitrate) + 20% organic (filter mud)+ 20% organic (chicken manure) + 20% biofertilization (Minia Azotene) for producing organic fruits.
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1. Introduction

Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae considered as one of the most important fruits of the tropical fruit and subtropical countries of the world' mango grows a under a wide range of climatic and soil conditions. In Egypt, mango ranks the second after citrus. Whereas its total area of fruitful orchards reached approximately 265509 f. producing about 1091535 tons of fruits (**Egyptian ministry of Agriculture , 2019**). However, lower yield with poor quality is one of the main problems facing mango growers in the new reclaimed tands particularly under sandy soil conditions namely poor fruit set, high fruit drop, irregular bearing, low productivity and malformation disease (**Sayed *et al.*, 2009**).

Adding organic fertilizers enriched with various biofertilizers not only increase the organic matter in the soil but also enhance the availability of most nutrients via lowering soil pH. Organic and biofertilizers play an important role in fixing the atmospheric N nitrogen. Under such system the application of any chemicals is avoided and excluded for preventing all sorts of pollution.

Previous studies showed the enriching organic materials with microorganisms was favourable than using each organic or bio- fertilizers alone. Application of inorganic Nitrogen aside of organic and bio- fertilizers had an announced effect ion promoting growth nutritional status of the trees and productivity of the trees. (**Mahmoud- Sara, 2008; Morsi, 2009; Ibrahiem- Zenib, 2010; Roshdy, 2010; Ahmed – Samah, 2011; Mahfouz, 2011; Ahmed *et al.*, 2011; Mohamed 2011; Roshdy *et al.*, 2011; Abdelaal *et al.*, 2012 ; Ibrahiem , 2012; Refaai *et al.*, 2012 Ahmed, *et al.*, 2015 and Ibrahiem, *et al.*, 2018**).

The objective of this study was to select the best proportion of inorganic, organic and biofertilized of nitrogen that results in improving growth characters, yield and quantitively and qualitatively and reducing

nitrite pollution of Keitte mango trees grown under sandy soil.

2. Materials and Methods

This study was carried out during 2018, 2019 and 2020 seasons on uniform in vigour twenty one. 11- years of Keitte mango trees onto seedling rootstocks. The trees are grown in a private mango orchard located at Kom Ombo district, Aswan Governorate.

The selected trees are planted at 4x2 meters apart (525 tree/ fed.) in a sandy soil under drip irrigation system were carefully selected as being healthy, disease free and uniform as possible in their vigour and size to study the effect of inorganic , organic and bio- fertilization in trees.

The results of the orchard soil analysis (according to **Black *et al.*, 1965**) are shown in table (1). The selected trees received all horticultural practices that applied in the orchard except those dealing with nitrogen fertilization.

Table (1): Analysis of the tested soil

Constituent	Value	Constituent	Value
Sand %	82.0	EC (1:2.5 extract ppm) mmhos cm 25°C	956
Silt %	10.0	$CaCO_3$ %	4.8
Clay %	8.0	O.M. %	0.9
Texture grade	Sandy	Total N%	0.04
pH (1:2.5 extract)	7.96	Available P (ppm)	1.6
		Available K (ppm)	120

The experiment included the following seven treatment from inorganic (ammonium nitrate 33.5 % N), organic (filter mud, 2% N and chicken manure 2.5 % N) and biofertilization (Minia Azotene)

1- Application of the suitable N (1000g / tree/ Year) as 100% inorganic source (2985.0 g ammonium nitrate / tree/ year).
2- Application of the suitable N as 70% in organic source (2090.0 g ammonium nitrate / tree / year + 15% organic source (7.5 kg/ filter mud/ tree/ year + 15% bio (150 g. Minia Azotene / tree/ year) .
3- Application of the suitable N as 70% inorganic source (2090.0 g ammonium nitrate / tree / year + 15% organic source (6.0 kg. chicken manure / tree/ year + 15% bio (150 g. Minia Azotene / tree/ year) .
4- Application of the suitable N as 70% inorganic source (2090.0 g ammonium nitrate / tree / year) + 10% organic source (5.0 kg/ filter mud/ tree/ year) + 10% organic source (4.0 kg chicken manure/tree/year+ 10% bio (100 ml Minia Azotene / tree/ year).
5- Application of the suitable N as 40% inorganic source (1195.0 g ammonium nitrate / tree/ year) + 30% organic source (15.0 kg filter mud/ tree/ year) + 30% bio (300 g Minia Azotene / tree).
6- Application of the suitable N as 40% inorganic source (1195.0 g ammonium nitrate / tree / year) + 30% organic source (12.0 kg chicken manure/ tree/ year) + 30% bio (300 g Minia Azotene / tree/ year).
7- Application of the suitable N as 40% inorganic source (1195.0 g ammonium nitrate / tree / year) + 20% organic source (10.0 kg filter mud/ tree / year) + 20 % organic source (8.0 kg chicken manure) / tree / year) + 20% bio (200 g Minia Azotene / tree/ year).

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

Inorganic, organic and biofertilization of nitrogen were added in the forms of ammonium nitrate (33.5 % N), filter mud (2.0 % N) (Table 2), chicken manure (2.5 % N) (Table 3) and Minia Azotene, respectively, ammonium nitrate as inorganic N source was divided into three equal batches and applied at the first week of March, first week of May and first week of July each season. Filter mud and chicken manure were added once at the last week of Jan. each season. Minia Azotene nitrogen bio- fertilizer was applied once on the middle of Feb. each season.

Treatments were arranged in randomized complete block design with three replications for each treatment, one tree for each.

Table (2): Analysis of the tested filter mud

Parameter	Values
Organic matter %	22.2
Organic carbon %	29.1
pH (1: 10)	8.8
EC (ds/m)	5.4
C/N ratio	14.6
Total N%	2.0
Total P%	0.02
Total K%	0.1
Total Fe ppm	400
Total Zn ppm	80
Total Mn ppm	70

Table (3): Analysis of the tested chicken manure

Parameter	Values	Parameter	Values
Organic matter %	58.16	Total N %	2.5
Organic carbon %	27.6	Total P %	0.09
pH (1: 10)	10.18	Total K %	0.6
EC (ds/ m)	15.2	Total Fe (ppm)	430
C/N ratio	11.18	Total Zn (ppm)	95
		Total Mn (ppm)	100

During 2018, 2019 and 2020 seasons the following parameters were measured:

1- Some vegetative growth characters namely shoot length (cm), number of leaves/ shoot and leaf area $(cm)^2$ (**Ahmed and Morsy, 1999**) in the Spring growth cycle.
2- Plant pigments namely chlorophylls A, B, total chlorophylls and total carotenoids (mg/ 1.0 g F.W.) (**Von-Wettstein, 1957**).
3- Percentages of N, P and K in the leaves from non fruiting shoots of spring growth cycle (**Summer, 1985; Chapman and Pratt, 1965 and Wilde *et al.*, 1985**).
4- Percentages of initial fruit setting and fruit retention.
5- Yield per tree expressed in number of fruits/ tree and fruit weight (kg.).
6- Some physical and chemical characteristics of the fruits namely fruit weight (g.), length and width (cm) of fruit, fruit peels % seeds %, pulp %, T.S.S. %, total acidity (as g citric acid / 100 ml juice, total and reducing sugars (**Lane and Eynon 1965**), vitamin C content (mg/ 100 ml juice) and total fibre % (**A.O.A.C., 2000**).

The proper statistical analysis was done and the treatment means were compared using new L.S.D. at 5% (**Mead *et al.*, 1993**).

3. Results

1-Growth characters:

Data in Table (4) clearly show that supplying Keitte mango trees with N as 70% inorganic N and 30% organic (filter mud or chicken manure) and biofertilization significantly was very effective in stimulating the four growth characters namely length shoot , number of leaves per shoot, thickness shoot and leaf area in spring growth cycle. Comparing with using nitrogen completely via inorganic N or when N was used as 40% inorganic N and 60 % organic and biofertilization. The best organic manure in this respect was chicken manure followed by filter mud. Using nitrogen as 70% inorganic N plus 30% organic and biofertilization significantly was superior than using inorganic fertilization alone in enhancing these growth characters.

A significant reduction on these growth characters was observed when N was added via 40% inorganic N plus 60% any organic manures and biofertilization. The minimum values were recorded

on the trees that received nitrogen as 40% inorganic (ammonium nitrate) + 30 % organic (filter mud) +30 % biofertilization (Minia Azotene).

Supplying the tree with nitrogen as 70% inorganic (ammonium nitrate) + 10% filter mud + 10% chicken manure + 10% Minia Azotene gave the maximum values. These results were true during 2018, 2019 and 2020 seasons.

2-Plant pigments as well as N, P, K and Mg in the leaves:

It is clear from the data in Tables (5, 6) that chlorophylls a, b, total chlorophylls, total carotenoids , N, P, K, and Mg in the leaves were significantly enhanced in response to application of the suitable nitrogen via 70% inorganic + 30% any organic manure and bio fertilization comparing with using nitrogen completely via inorganic N or when N was added via 40% inorganic + 60% organic and biofertilization. The promotion was gradually associated with reducing percentages of inorganic nitrogen from 100 % to 40% and increasing organic manures from 0.0 % to 60% . Using chicken manure better than filter mud.

The maximum values of leaf pigments N, P, K and Mg in the leaves were recorded on the trees that received nitrogen as 40% inorganic (ammonium nitrate) + 20% filter mud + 20% chicken manure + 20% Minia Azotene . While the lowest values were recorded on the trees that fertilized with N as 100% inorganic. These results were true during 2018, 2019 and 2020 seasons.

3-Percentages of fruit setting and yield / tree:

It is obvious from the data in table (7) that fertilizing the trees with nitrogen as 70% inorganic + 30% any organic manures and biofertilization significantly improved the percentages of initial fruit setting and fruit retention, number of fruits per tree and yield / tree rather than using nitrogen as 100% inorganic N as well as when nitrogen was added via inorganic N at 40% regardless organic and biofertilization.

The best organic manures in this respect was chicken manure and filter mud, in descending order. A significant reduction on fruit setting % and yield was observed when N was added in inorganic nitrogen form at 40% and 60% organic and biofertilization. The maxim um yield (23.2, 24.2 , 25.2) during three seasons respectively was observed when the trees received nitrogen as 70% inorganic nitrogen + 10% filter mud+ 10% chicken manure + 10% Minia Azotene. The yield of the trees that fertilized with nitrogen as 100% inorganic nitrogen was (17.6, 18.5, 19.1) during three seasons respectively. The percentages of increase on the yield due to application of the previous promised treatment over the check treatment reached 31.8%, 30.8 % and 31.9% during 2018, 2019 and 2020 seasons respectively. These results were true during three seasons.

4-Physical and chemical characters of the fruits:

It was clear from the data in Tables (8, 9) that amending the trees with suitable nitrogen as 40 to 70% inorganic N + 30 to 60% any organic manure (filter mud and chicken manure) and biofertilization (Minia Azotene) significantly was very effective in improving fruit quality in terms of increasing fruit weight, pulp %, T.S.S. %, total sugars % and vitamin C content and decreasing percentages of seeds and fruit peel weight and total acidity comparing to using nitrogen as 100% inorganic. The best organic manure in this connection was chicken manure followed by filter mud in this respect. Treating Keitte mango trees with nitrogen as 40% inorganic nitrogen plus 20% filter mud + 20 % chicken manure + 20% Minia Azotene gave the best results with regard to fruit quality.

4. Discussion

The promoting effect of different organic manure namely filter mud and chicken manure (when applied at the Optimum rate of the suitable nitrogen on growth characters, leaf pigments, nutrients, yield and fruit quality of Keitte mango trees might be attributed to the positive action of these organic manures in enhancing soil organic matter N fixation microbial activity, water holding capacity, soil aggregation and aeration, nutrient transport, vitamin B, natural hormones and antibiotics as well as reducing soil pH, pathogens, salinity leaching processes and soil erosion consequently enhancing soil fertility and the availability of most elements and tree nutritional status (**Gorammagar *et al.*, 2000; Obreza and Ozoresm, 2000; Wang *et al.*, 2000 and Venzon *et al.*, 2001**).

The results of (**Mahmoud, 2012; Mohamed *et al.*, 2012; El- Khawaga and Meklad, 2013; Omar, 2015; and Ibrahiem *et al.*, 2018**). Bio- fertilizers are microbial inoculants that have an important role on biological, physical and chemical soil properties. There are a number of inoculants that can serve as useful components of integrated plant nutrient supply systems. Such inoculants may help in increasing crop productivity by increasing biological N fixation, availability or uptake of nutrient though solubilization or increasing absorption, stimulation of the plant growth through hormonal action antibiosis and by decomposition of organic residues (**Subba-Rao *et al.*, 1993 and Wu *et al.*, 2005**).

Table (4): Effect of different proportions of inorganic, organic and biofertilization of nitrogen on some growth characters of Keitte mango trees during 2018, 2019 and 2020 seasons.

Different inorganic , organic and biofertilization treatments	Spring shoot length (cm.)			Number of leaves/ shoot			Leaf area (cm)2			Shoot thickness (cm)		
	2018	2019	2020	2018	2019	2020	2018	2019	2020	2018	2019	2020
1-100% AN	46.2	45.8	46.8	43.0	43.0	43.5	80.0	81.0	81.6	0.59	0.60	0.62
2-70% AN + 15% FM + 15% MA	48.5	48.9	49.4	45.2	46.0	46.2	83.2	83.5	83.9	0.63	0.66	0.68
3-70% AN + 15% CM + 15% MA	49.6	49.8	50.1	46.5	47.3	47.8	84.5	85.2	86.1	0.64	0.66	0.69
4-70% AN + 10% FM + 10% CM + 10% MA	51.2	52.0	53.0	48.2	49.0	49.2	86.0	86.5	87.2	0.65	0.67	0.71
5-40% AN + 30% FM + 30% MA	40.1	40.2	41.5	41.0	40.6	40.3	77.6	78.4	79.1	0.49	0.50	0.51
6-40% AN + 30% CM + 30% MA	42.5	42.9	43.0	41.6	41.2	41.6	78.0	79.3	79.9	0.53	0.55	0.56
7-40% AN + 20% FM + 20% CM + 20% MA	43.0	44.0	44.5	42.0	43.0	44.1	79.0	80.2	81.0	0.57	0.58	0.61
New L.S.D. at 5%	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.2	0.04	0.03	0.03

AN= ammonium nitrate CM= chicken manure FM= filter mud MA = Minia Azotene

Table (5): Effect of different proportions of inorganic, organic and biofertilization of nitrogen on some plant pigment in the leaves of Keitte mango trees during 2018, 2019 and 2020 seasons.

Different inorganic , organic and biofertilization treatments	Chlorophyll a (mg/ 1.0 g F.W.)			Chlorophyll b (mg/ 1.0 g F.W.)			Total chlorophylls (mg/ 1.0 g F.W.)			Total carotenoids (mg/ 1.0 g F.W.)		
	2018	2019	2020	2018	2019	2020	2018	2019	2020	2018	2019	2020
1-100% AN	3.8	3.9	3.9	1.2	1.3	1.3	5.0	5.2	5.2	1.0	1.1	1.1
2-70% AN + 15% FM + 15% MA	4.2	4.3	4.4	1.5	1.6	1.7	5.7	5.9	6.1	1.2	1.3	1.3
3-70% AN + 15% CM + 15% MA	4.7	4.8	4.9	1.8	1.9	1.9	6.5	6.7	6.8	1.5	1.6	1.7
4-70% AN + 10% FM + 10% CM + 10% MA	5.0	5.2	5.3	2.2	2.3	2.5	7.2	7.5	7.8	1.7	1.9	1.9
5-40% AN + 30% FM + 30% MA	5.2	5.4	5.5	2.5	2.6	2.6	7.7	8.0	8.1	2.1	2.2	2.4
6-40% AN + 30% CM + 30% MA	5.5	5.6	5.8	2.7	2.7	2.7	8.2	8.3	8.5	2.3	2.4	2.6
7-40% AN + 20% FM + 20% CM + 20% MA	5.6	5.7	5.9	2.7	2.8	2.8	8.3	8.5	8.7	2.5	2.6	2.7
New L.S.D. at 5%	0.6	0.6	0.7	0.2	0.3	0.3	0.8	0.9	0.9	0.2	0.2	0.2

AN= ammonium nitrate CM= chicken manure FM= filter mud MA = Minia Azotene

Table (6): Effect of different proportions of inorganic, organic and biofertilization of nitrogen on some percentages of N, P, K, and Mg in the leaves of Keitte mango trees during 2018, 2019 and 2020 seasons.

Different inorganic , organic and biofertilization treatments	Leaf N %			Leaf P %			Leaf k %			Leaf Mg %		
	2018	2019	2020	2018	2019	2020	2018	2019	2020	2018	2019	2020
1-100% AN	1.50	1.55	1.56	0.11	0.16	0.20	1.30	1.30	1.31	0.49	0.52	0.55
2-70% AN + 15% FM + 15% MA	1.57	1.59	1.60	0.13	0.19	0.22	1.32	1.33	1.35	0.53	0.56	0.57
3-70% AN + 15% CM + 15% MA	1.70	1.73	1.77	0.15	0.21	0.24	1.36	1.38	1.39	0.56	0.57	0.59
4-70% AN + 10% FM + 10% CM + 10% MA	1.76	1.77	1.79	0.17	0.20	0.26	1.41	1.42	1.44	0.61	0.63	0.66
5-40% AN + 30% FM + 30% MA	1.81	1.85	1.88	0.21	0.24	0.28	1.45	1.47	1.48	0.64	0.66	0.69
6-40% AN + 30% CM + 30% MA	1.90	1.93	1.95	0.26	0.29	0.30	1.49	1.52	1.53	0.69	0.71	0.73
7-40% AN + 20% FM + 20% CM + 20% MA	1.94	1.97	1.99	0.29	0.30	0.31	1.56	1.58	1.60	0.73	0.76	0.78
New L.S.D. at 5%	0.05	0.06	0.06	0.01	0.01	0.02	0.05	0.05	0.06	0.02	0.03	0.03

AN= ammonium nitrate CM= chicken manure FM= filter mud MA = Minia Azotene

Table (7): Effect of different proportions of inorganic, organic and biofertilization of nitrogen on percentages of initial fruit setting, fruit retention , number of fruits/ tree and yield per tree (kg.) of Keitte mango trees during 2018, 2019 and 2020 seasons.

Different inorganic , organic and biofertilization treatments	Initial fruit setting %			Fruit retention %			Number of fruits / tree			Yield/ tree (kg.)		
	2018	2019	2020	2018	2019	2020	2018	2019	2020	2018	2019	2020
1-100% AN	13.0	13.3	13.8	0.95	0.96	0.98	49.0	50.0	51.0	17.6	18.5	19.1
2-70% AN + 15% FM + 15% MA	13.9	14.5	14.9	0.99	1.01	1.02	51.5	53.0	54.5	19.2	20.4	21.3
3-70% AN + 15% CM + 15% MA	14.8	15.6	16.2	1.04	1.06	1.09	55.2	56.0	57.0	21.4	22.4	23.4
4-70% AN + 10% FM + 10% CM + 10% MA	16.7	17.0	17.8	1.08	1.10	1.13	57.2	58.0	59.7	23.2	24.2	25.2
5-40% AN + 30% FM + 30% MA	12.1	12.2	12.3	0.89	0.91	0.91	44.5	45.0	45.5	12.2	19.0	19.3
6-40% AN + 30% CM + 30% MA	12.4	12.5	12.7	0.93	0.94	0.95	46.2	47.5	47.6	19.3	20.2	20.5
7-40% AN + 20% FM + 20% CM + 20% MA	12.8	13.1	13.5	0.94	0.96	0.97	48.0	48.2	48.8	20.4	21.0	21.9
New L.S.D. at 5%	0.02	0.03	0.03	0.03	0.03	0.03	1.2	1.3	1.4	1.6	1.5	1.5

AN= ammonium nitrate CM= chicken manure FM= filter mud MA = Minia Azotene

Table (8): Effect of different proportions of inorganic, organic and biofertilization of nitrogen on some physical characteristics of the fruits of Keitte mango trees during 2018, 2019 and 2020 seasons.

Different inorganic , organic and biofertilization treatments	Fruit weight (g.)			Seeds %			Fruit peel %			Pulp %		
	2018	2019	2020	2018	2019	2020	2018	2019	2020	2018	2019	2020
1-100% AN	360.0	370.0	375.0	12.5	12.3	12.2	18.1	18.0	17.8	69.4	69.7	70.0
2-70% AN + 15% FM + 15% MA	372.0	385.0	390.0	11.2	11.0	10.8	16.5	16.3	16.0	72.3	72.7	73.2
3-70% AN + 15% CM + 15% MA	388.0	400.0	410.0	10.5	10.3	10.0	15.8	15.5	15.3	73.7	74.2	74.7
4-70% AN + 10% FM + 10% CM + 10% MA	405.0	418.0	422.0	10.1	9.8	9.6	14.2	14.0	14.0	75.7	76.2	76.4
5-40% AN + 30% FM + 30% MA	410.0	422.0	425.0	9.7	9.5	9.3	13.0	12.8	12.6	77.3	77.7	78.1
6-40% AN + 30% CM + 30% MA	418.0	425.0	430.0	9.4	9.2	9.0	12.6	12.4	12.2	78.0	78.4	78.8
7-40% AN + 20% FM + 20% CM + 20% MA	425.0	435.0	450.0	8.8	8.6	8.5	12.0	11.9	11.7	79.2	79.5	79.8
New L.S.D. at 5%	9.8	10.1	10.6	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.9

AN= ammonium nitrate CM= chicken manure FM= filter mud MA = Minia Azotene

Table (9): Effect of different proportions of inorganic, organic and biofertilization of nitrogen on some chemical characteristics of the fruits of Keitte mango trees during 2018, 2019 and 2020 seasons.

Different inorganic , organic and biofertilization treatments	T.S.S. %			Total acidity %			Total sugars %			V.C. (mg/ 100 ml juice)		
	2018	2019	2020	2018	2019	2020	2018	2019	2020	2018	2019	2020
1-100% AN	9.2	9.4	9.6	1.380	1.370	1.355	7.05	7.15	7.28	40.2	41.0	41.3
2-70% AN + 15% FM + 15% MA	9.5	9.7	9.9	1.325	1.310	1.300	7.30	7.50	7.70	42.6	42.8	43.0
3-70% AN + 15% CM + 15% MA	9.8	9.9	10.1	1.285	1.270	1.260	7.60	7.66	7.82	43.2	43.4	43.5
4-70% AN + 10% FM + 10% CM + 10% MA	10.1	10.3	10.3	1.250	1.240	1.225	8.00	8.06	8.10	44.0	44.4	44.6
5-40% AN + 30% FM + 30% MA	10.6	10.8	11.0	1.180	1.150	1.120	8.22	8.36	8.50	45.6	46.0	46.2
6-40% AN + 30% CM + 30% MA	11.0	11.2	11.3	1.100	1.070	1.040	8.80	8.88	8.92	46.3	46.6	46.9
7-40% AN + 20% FM + 20% CM + 20% MA	11.2	11.4	11.7	0.990	0.970	0.950	9.08	9.19	9.26	47.2	47.7	48.0
New L.S.D. at 5%	0.2	0.2	0.3	0.022	0.022	0.021	0.04	0.05	0.06	0.6	0.7	0.7

AN= ammonium nitrate CM= chicken manure FM= filter mud MA = Minia Azotene

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