

## Reducing Inorganic N Fertilizer Partially In Hayany Date Palm Orchards By Using Animal And Chicken Manures

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**Abstract:** During 2011 and 2012, Hayany date palms grown under dandy soil were fertilized with the suitable N (1200 g N / palm/ year) through 25 to 100% inorganic N, 50% organic N plus 50% animal or chicken manures as well as via 100% animal or chicken manures. The target was adjusting the best ratio and source of organic N fertilizers applied with mineral N source that was responsible for reducing pollution and at the same time improving yield and quality of the fruits. Using the suitable N (1200 g N/ palm/ year) via 50% mineral N plus 50% animal or chicken manure remarkably improved percentages of initial fruit setting and fruit retention, yield, bunch weight and both physical and chemical characteristics of the fruits in relative to using N completely via inorganic form or using N as 100% animal or chicken manure. Using chicken manure organic source was superior in this respect than using animal manure source. A great decline on the yield per palm was observed with using N completely via animal or chicken manure (the neglect of using mineral N fertilization). A gradual promotion on fruit quality was observed with reducing inorganic N and increasing organic manures. Under sandy soil conditions, it is recommended to fertilize Hayany date palms with N (1200 g N/ palm/ year) through 50% inorganic (1.8 kg ammonium nitrate/ palm/ year) plus 50% chicken manure (24.0 kg/ palm/ year) for avoiding environment pollution and at the same time improving yield and fruit quality.

[Al-Wasfy, M.M.M. and Abd El- Rahman, M.M.A. **Reducing Inorganic N Fertilizer Partially In Hayany Date Palm Orchards By Using Animal And Chicken Manures.** *World Rural Observ* 2014;6(1):94-98]. ISSN: 1944-6543 (Print); ISSN: 1944-6551 (Online). <http://www.sciencepub.net/rural>. 17

**Key words:** Hayany date palms, mineral N, animal and chicken; manures, yield and fruit quality.

### 1. Introduction

Nowadays, most date palm orchards depends on producing organic fruits through avoiding the application of all chemical forms partially or completely. Organic fertilization is used as a substitute for mineral N fertilization. Application of organic manure has numerous merits such as reducing soil pH and increasing the availability of all nutrients, reducing soil salinity, as well as enhancing soil fertility, water retention, soil organic matter, biological activity of microflora, soil cation exchange, natural hormones and antibiotics (Nijjar, 1985).

Previous studies showed that application of the suitable N through inorganic and organic fertilization was preferable rather than using mineral N fertilization alone in enhancing growth, soil fertility and fruiting of all evergreen fruit crops particularly date palms, bananas, citrus and mangoes (Moustafa, 2002; Mohamed and Ragab, 2004; Roshdy, 2004; Gobara and Ahmed, 2004; Mansour *et al.* 2004; Shaarawy, 2005; El- Assar, 2005; Diab, 2006; Mouftah, 2007; El- Salhy, 2008; Sayed, 2008; Al-Wasfy and El- Khawaga, 2008; Shaalan- Nashwah, 2008; Abdo, 2008; Mahmoud-Sara, 2008; Shaheen *et al.*, 2009; Morsi, 2009; Ibrahim- Zenib, 2010; Saad *et al.* 2011; Mahfouz, 2011; Mahmoud, 2012; Ibrahim, 2012; Abdelaal *et al.* 2012 and Farag, 2013).

The objective of this study was examining the effect of replacing mineral N fertilizer partially by using two organic N fertilizers namely animal and chicken manures on fruit setting, yield and fruit quality of Hayany date palms grown under sandy soil.

### 2. Material and Methods

This study was carried out during 2011 and 2012 seasons in a private date palm orchard situated at the experimental form of Qena Fac. of Agric., South New Valley Univ. Egypt on fifteen 16-years old Hayany date palms. These palms produced through conventional propagation by off shoots. The selected palms are uniform in vigour, healthy, good physical conditions and free from insects, diseases and damage. They are planted at 10 x 10 meters apart (42 palms./ fed.). The texture of the soil is sandy loam. Analysis of the tested soil was done according to Wilde *et al.* (1985) and the data are shown in Table (1-a).

Hand pollination of the selected palms was achieved by inserting ten fresh male strands into the centre of one female spathe (according to Diab, 2006) using the same source of pollens obtained from one male Hayany date palm to avoid residues of metaxenia (according to Saad, 2008). Pollination was carried out throughout two days after female spathes cracking at the day time of afternoon (according to Omar, 2007). Number of bunches per palm was adjusted to nine

bunches by removing excess earliest, latest and small bunches and the leaf bunch ratio was maintained at 8 : 1 (according to **Sayed, 2002 and Diab, 2006**) All the selected Hayany date palms received the same and common horticultural practices that already applied in the orchard except those dealing with application of inorganic and organic N fertilization.

This investigation included the following five treatments:

- 1- Using the suitable N (1200 g N / palm/ year) through 100% inorganic N (3582 g ammonium nitrate / palm/ year).
- 2- Using the suitable N through 50% inorganic N (1791 g ammonium nitrate / palm/ year) plus 50% animal manure (1.6 %N) (37.5 kg/ palm/ year).
- 3- Using the suitable N through 50% inorganic N plus 50% chicken manure (2.5 % N) (24 kg/ palm/ year).
- 4- Using the suitable N through 100% animal manure (75 kg/ palm /year).
- 5- Using the suitable N through 100% chicken manure (48 kg/ palm year)

All the selected palms (15 palms) received N at the fixed rate namely 1200 g N / palm/ year according to **Al-wasfy and El Khawaga (2008)**. Inorganic N source was ammonium nitrate (33.5% N) and added at three equal batches at the first week or March, May and July during each season. Meanwhile, the two organic manures namely animal and chicken manures (Table 1-b) were added once at the first week of January in both seasons.

**Table (1-a) : Analysis of the tested data.**

Character	Values
Sand %	77.2
Silt %	18.2
Clay %	5.0
Texture grade	Sandy loam
pH (1 : 2.5)	8.08
CaCO <sub>3</sub> %	7.47
O.M. %	0.97
Total N %	0.19
Available P (ppm)	2.7
Available K (ppm) (ammonium acetate)	7.4
DTPA extractable Fe (ppm)	7.5
DTPA extractable Mn (ppm)	5.2
DTPA extractable Zn (ppm)	1.7

The experiment was arranged in a randomized complete block design (RCBD) with three replications, one palm per each.

Initial fruit setting % was determined in three labeled bunches six weeks after carrying out

pollination. Five strands were randomly marked on each bunch and then percentage of initial fruit setting was calculated by dividing number of fruits by number of total flowers and multiplying the product x 100. One week before harvesting, the number of fruits in the five marked strands was counted and the percentage of fruits retention was estimated by dividing number of fruits just before harvesting date by the number of total flowers and multiplying the product x 100.

**Table (1-b) : Analysis of animal and chicken manures**

Character	Animal manure	Chicken manure
O.M %	34.34	32.0
pH(1 : 2.5 extract)	7.56	7.05
Total N %	2.50	1.6
Total P %	0.39	0.41
Total K %	1.90	1.20
EDTA Fe (ppm)	3310	2110
EDTA Mn (ppm)	654	510
EDTA Zn (ppm)	190	171

At ripening when 3-4 fruits on each bunch were reached softening stage, yield expressed in weight (kg) was recorded. Bunch weight (kg.) was estimated by dividing yield by 9 (number of bunches/ palm). Fifty fruits from each bunch were randomly selected to determine the averages fruit weight (g.) and dimensions(length and width in cm.), average flesh weight, then the percentage of flesh weight was calculated, T.S.S.% using handy refractometer. Total and reducing sugars as well as total acidity % (as g malic acid /100 g pulp) were also determined according to **A.O.A.C. (1995)**.

Statistical analysis was done according to **Mead et al. (1993)** using new L.S.D. at 5% for comparing among different treatment means.

### 3. Results And Discussion

#### 1- Fruit setting, yield and bunch weight

Data in Table (2) clearly show that significant differences were observed on the percentages of initial fruiting setting and fruit retention, yield and bunch weight among the five inorganic and organic treatments. Application of the suitable N(1200 g N / palm/ year) through 50% in organic N plus 50% animal or chicken manures significantly was responsible for improving these parameter in relative to using N via 100% inorganic N or when the suitable N was added completely via animal or chicken manures. Using chicken manure either alone or in combined with inorganic N significantly was superior

in improving these parameter than using the other organic fertilizer namely animal manure. A significant decline on the percentages of initial fruit setting and fruit retention, yield and bunch weight was observed with using the suitable N via 100% organic sources (animal or chicken manures). Using the suitable N as 100% inorganic was significantly favourable than using N as 100% organic N in this respect. The

maximum values of initial fruit setting (85.5 and 87.5%), fruit retention (60.2 and 61.7%), yield per palm (245.7 and 252.0 kg) and bunch weight (27.3 and 28.0 kg) were observed on the palms that received the suitable N via 50% inorganic plus 50% chicken manure. Fertilization with N through 100 % animal manure produced the minimum values. These results were true during both seasons.

**Table (2): Effect of replacing inorganic N fertilizer partially by using animal and chicken manures on the percentages of initial fruit setting and fruit retention, yield / palm and bunch weight of Hayany date palms during 2011 and 2012 seasons.**

Characters Treatment	Initial fruit setting %		Fruit retention %		Yield / palm (kg.)		Bunch weight (kg.)	
	2011	2012	2011	2012	2011	2012	2011	2012
1-Using N as 100% inorganic N	52.2	54.0	36.7	37.8	194.4	200.7	21.6	22.3
2- Using N as 50 % inorganic N + 50 % animal manure.	69.5	71.3	49.3	50.3	215.1	220.5	23.9	24.5
3- Using N as 50 % inorganic N + 50 % chicken manure.	85.5	87.5	60.2	61.7	245.7	252.0	27.3	28.0
4- Using N as 100 % animal manure(1.6 % N).	25.6	27.6	18.3	19.6	126.9	133.2	14.1	14.8
5- Using N as 100 % animal manure(2.5 % N).	41.5	43.6	29.4	30.8	163.8	171.0	18.2	19.0
New L.S.D. at 5%	2.3	3.1	3.0	3.1	5.1	4.9	1.9	2.0

**Table (3): Effect of replacing inorganic N fertilizer partially by using animal and chicken manures on some physical characters of the fruits of Hayany date palms during 2011 and 2012 seasons.**

Characters Treatment	Fruit weight (g.)		Fruit length (cm.)		Fruit width (cm.)		Flesh weight %	
	2011	2012	2011	2012	2011	2012	2011	2012
1-Using N as 100% inorganic N	20.0	20.9	4.1	4.2	2.1	2.0	74.4	74.6
2- Using N as 50 % inorganic N + 50 % animal manure.	21.6	22.5	4.5	4.6	2.5	2.4	78.0	78.3
3- Using N as 50 % inorganic N + 50 % chicken manure.	22.9	23.8	4.9	5.0	2.8	2.7	81.0	81.4
4- Using N as 100 % animal manure(1.6 % N).	24.0	25.0	5.4	5.6	3.1	3.0	83.0	83.3
5- Using N as 100 % animal manure(2.5 % N).	25.3	26.4	5.9	6.2	3.4	3.3	86.0	86.4
New L.S.D. at 5%	0.6	0.7	0.3	0.4	0.3	0.3	2.0	1.9

**Table (4): Effect of replacing inorganic N fertilizer partially by using animal and chicken manures on some chemical characteristics of the fruits of Hayany date palms during 2011 and 2012 seasons.**

Characters Treatment	T.S.S. %		Total sugars %		Reducing sugars %		Total acidity %	
	2011	2012	2011	2012	2011	2012	2011	2012
1-Using N as 100% inorganic N	41.0	41.1	30.8	30.8	25.3	25.6	0.299	0.297
2- Using N as 50 % inorganic N + 50 % animal manure.	43.1	43.2	31.9	31.9	26.9	27.1	0.250	0.250
3- Using N as 50 % inorganic N + 50 % chicken manure.	45.6	45.7	32.3	33.7	28.0	28.5	0.218	0.210
4- Using N as 100 % animal manure(1.6 % N).	48.0	48.1	34.5	35.6	30.0	30.6	0.179	0.171
5- Using N as 100 % animal manure(2.5 % N).	49.9	50.5	36.0	37.1	31.9	32.3	0.141	0.131
New L.S.D. at 5%	1.9	2.0	1.0	1.0	0.8	0.7	0.031	0.033

## 2- Fruit quality:

It is obvious from the obtained data in Tables (3 & 4) that fruit quality was significantly varied according to the different inorganic and organic N treatments. Application of the suitable N through inorganic N at 50% besides organic fertilization with animal or chicken manures each at 50 % as well as application of the suitable completely through animal or chicken manures significantly improved fruit

quality in terms of increasing fruit weight and dimensions (length & width), flesh %, T.S.S. %, total and reducing sugars and decreasing total acidity % in relative to using N completely via inorganic N. The promotion on fruit quality was significantly associated with reducing percentages of inorganic N from 100 to 0.0% and at the same time increasing the percentages of organic N fertilizers from 0.00 to 100%. A significant promotion on fruit quality was observed

with using chicken manure either alone or when used with inorganic N in relative to using the other organic N namely animal manure. The heaviest fruits were received on the bunches harvested from palms received N completely via chicken manure. The best results with regard to fruit quality were obtained with using the suitable N via 100% chicken manure. Using inorganic N fertilization alone caused unfavourable effects on fruit quality from statistical point of view. The same trend was observed during both seasons.

#### 4. Discussion

The previous positive action of organic fertilizers on yield and fruit quality of Hayany date palms might be attributed to their benefits in reducing soil pH and salinity as well as enhancing the biosynthesis of natural hormones and antibiotics, N fixation, organic matter, water and nutrient uptake, biological activity and soil fertility. The great leaching of N via soil when applied through mineral N as well as the slow release of N applied via organic fertilizers could give another explanation for the present results (Nijjar, 1985). The higher own content from nutrients of chicken manure explained its preferability than animal manure in this respect.

These results are in harmony with those obtained by El- Sалhy (2008); Al- Wasfy and El- Khawaga (2008); Morsi (2009), Ibrahim- Zenib (2010) and Saad *et al.* (2011).

#### Conclusion:

The best results with regard to yield and fruit quality of Hayany date palms grown under sandy soil were obtained with fertilization of the palms with N (1200 g N/ palm/ year) through 50% inorganic N (1791 g ammonium nitrate, 33.5% N) plus 50% chicken manure (24 kg/ palm/ year).

#### References

1. Abdelaal; A.M.K.; Ahmed, F.F. and Hassan, K.M. (2012): Partial replacement of chemical N fertilizers in Balady mandarin orchard through application of extracts of yeast, seaweed and farmyard manure. *Minia J. of Agric. Res. & Develop.* Vol. (32): No. pp. 129- 148.
2. Abdo, Z.A.A. (2008): Effect of some biofertilization treatments on growth and fruiting of Balady mandarin trees. Ph. D. Thesis Fac. of Agric. Minia. Univ. Egypt.
3. Al- Wasfy, M.M. and El- Khawaga, A.S. (2008): Effect of organic fertilization on growth, yield and fruit quality of Zaghoul date palms grown in sandy soil. *Assiut J. of Agric. Sci.* 39(1): 121-133.
4. AOAC, (1995): Official Methods of Analysis 14<sup>th</sup> Association of Official Agricultural Chemists, Washington, DC (USA).
5. Diab, Y.M. (2006): Effect of some cultural practices on yield and fruit quality of *Phoenix dactylifera* L. cv Sewy under New Valley conditions M. Sc. Thesis Fac. of Agric. Assiut Univ. Egypt.
6. El- Assar A.M. (2005): Response of Zaghoul date yield and fruit characteristics to various organic and inorganic fertilization types as well as fruit thinning models in a rich carbonate soil. *J. Agric. Sci. Mansoura Univ.* 30 (5): 2795-2814.
7. El- Sалhy, A.M. (2008): Effect of mineral and organic nitrogen fertilization on vegetative growth, yield and fruit characteristics of Sewy date palms. 3<sup>rd</sup> Inter. Conf. For Date Palms Agric., Sci. and Environ. Fac. Suez Canal Univ. 25-27 El- Arish.
8. Farag, M.H.A. (2013): Reducing the amount of chemical fertilization partially by using organic and biofertilization in Balady mandarin orchards. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
9. Gobara, A.A. and Ahmed, F.F. (2004): Response of Zaghoul date palms to application of some biofertilizers 2<sup>nd</sup> Inter. Conf. on date Palm Suez Canal Univ. El- Arish 6-8 Oct. 2004.
10. Ibrahim, W.M.A. (2012): Behaviour of Taimour mango trees to inorganic and organic fertilization and application of EM. Ph. D. Thesis Fac. of Agric. Minia Univ. Egypt.
11. Ibrahim- Zenib, A. (2010): Fertilization of date palm Amhat cv. grown in new reclaimed land by organic and inorganic nitrogen sources. The sixth Inter. Conf. of Sustain Agric. And Develop. Fac. of Agric. Fayoum Univ. 27-29 Dec.
12. Mahfouz, M.S.M. (2011): Partial replacement of chemical fertilizers by some organic and biofertilizers in Williams banana plants under Minia region conditions. Ph. D. Thesis Fac. of Agric. Minia Univ. Egypt.
13. Mahmoud, Kh. M. H. (2012): Reducing N fertilizer in Balady mandarin orchard through application of extracts of yeast, seaweed and farmyard manure M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
14. Mahmoud- Sara, M.A. (2008): Response of Valencia orange trees to organic and biofertilization. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
15. Mansour, A.E.M.; Ahmed, F.F. and Ahmed, Y.H. (2004): Effect of bio and organic sources of N as a partial substitute for mineral fertilizer on fruiting of Sewy date palms. 2<sup>nd</sup> Inter. Conf. on Date Palm Fac. of Agric. El Arish, Suez Canal Univ.
16. Mead, R.; Curnow, R. N. and Harted, A. M. (1993): Statistical Methods in Agriculture and

- Experimental Biology. 2<sup>nd</sup> Ed. Chapman & Hall, London pp. 54 - 60.
17. Mohamed, M.A. and Ragab, M.A. (2004): Response of Sewy date palms to application of some organic fertilizers 2<sup>nd</sup> Inter. Conf. on date Palm, Suez Canal Univ. El- Arish 6-8 Oct.
  18. Morsi, M.E. (2009): Response of date palm Sewy cv. grown in new reclaimed land to organic and inorganic nitrogen sources. Fayoum J. Agric. Res. & Dev. Vol. 33 No. (1): 106-172.
  19. Mouftah, R.T. (2007): Physiological studies on biofertilization of mango trees cvs Taimour and Zebda. Ph. D Thesis Fac. of Agric., Minia Univ., Egypt.
  20. Moustafa, E.A.M. (2002): Effect of different nitrogen fertilizer distribution through the grown season on vegetative growth, yield and fruit quality of some banana cultivars. Assiut J. Agric. Sci. Egypt. 31(4): 231-245.
  21. Nijjar, G.S. (1985): Nutrition of Fruit Trees. Mrs Msha Raj Kumar for Kalyany Publishers, New Delhi pp. 10- 52.
  22. Omar, M.G. (2007): Effect of some pollination treatments on yield and fruit quality of Sewy date palms grown under El- Farafra Oasis conditions M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
  23. Roshdy, Kh. A. (2004): Effect of some organic nitrogen fertilizers on growth and fruiting of Williams banana. Ph. D. Thesis Fac. of Agric. Minia Univ. Egypt.
  24. Saad, H.H.A. (2008): Evaluation of some different date palm pollinators and its effects on fruit physical and chemical characteristics of Zaghoul and Samany date palm cultivars. 3<sup>rd</sup> Inter. Conf. on date Palm, El- Arish Egypt, 25- 27 April pp. 12.
  25. Saad, R.L.; Roshdy, Kh. A. and Abd El- Migeed-Nagwa, A. (2011): Response of Zaghoul date palms grown under new reclaimed lands to application of organic and biofertilizers. Alex Exch. J. Vol. 31 No. 2 pp. 121- 129.
  26. Shaalan- Nashwah, G.M. (2008): Response of Balady mandarin trees to application of some bio, organic, inorganic and slow release N fertilizers. Ph. D. Thesis Fac. of Agric. Minia Univ. Egypt.
  27. Sayed, E.F.A. (2002): The productive capacity of Sewy date palms grown under New Valley conditions in response to leaves /bunch ratio. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
  28. Sayed, E.F.A. (2008): Physiological studies on the behaviour of Saily date palms under some treatments. Ph. D. Thesis Fac. of Agric. Assiut Univ. Egypt.
  29. Shaarawy, A.M.A. (2005): Response of Balady lime trees to organic and biofertilizaton. Minia J. of Agric. Res. & Develop. Vol. 25(1): 1-18.
  30. Shaheen, M.A.; Eissa, M.M.A. and Mahmoud, S.M. (2009): Influence of organic and biofertilization on growth, yield and fruit quality of Williams banana. J. Agric., Sci. Mansoura Univ. 34 (7): 8013-8025.
  31. Wilde, S. A.; Corey, R. B.; Lyer, J. G. and Voiget, G. K. (1985): Soil and Plant Analysis for Tree Culture. Oxford and IBH publishing Co., New Delhi, pp. 96 – 106.

3/1/2014