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ATTEMPTS FOR REDUCING NITRITE POLLUTION IN RUBY SEEDLESS GRAPES BY USING SOME ORGANIC MANURES ENRICHED WITH EM

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ABSTRACT: *During 2010 and 2011 seasons, four organic manures namely F.Y.M; poultry manure; filter mud and compost either alone or enriched with EM were tested as a trial for replacing inorganic N partially and at the same improving the yield quantitively and qualitatively of Ruby seedless grapes.*

Application of inorganic N at 75 to 100 % of the suitable N beside any organic manure at 25 % with or without EM at 25 ml/ vine was favourable than using inorganic N alone in improving main shoot length, leaf area, percentages of N, P and K, yield, cluster weight, berry weight and total soluble solids % and reducing shot berries %, total acidity % and nitrite in the grapes. In descending order, using compost, filter mud, poultry manure and F.Y.M was very effective in enhancing the yield quantitively and qualitatively. Enriched these organic manures with EM surpassed the application of these organic manures alone in this connection.

For reducing nitrite pollution and improving production of Ruby seedless grapevines, it is advise to use the suitable N as 75% inorganic plus 25% compost enriched with EM at 10 ml/ vine/ year.

Key words : *Grapes, effective microorganisms, compost, poultry manure, filter mud*

INTRODUCTION

A principal goal of nature farming is producing healthy fruits without the use of chemical fertilizers, synthetic auxins and pesticides and without causing adverse effects on the natural environmental. Means of achieving this target are through the use of organic manures and Effective microorganisms (EM).

EM is beneficial in enhancing biological activity due to its higher own from microorganisms. It is responsible in suppresses of plant pathogens and diseases, conservation of energy in plants, solubilization of minerals in the soil and promotion of photosynthetic efficiency and biological N fixation (Higa and Wididana, 1991; El- Haddad *et al*., 1993; Myint, 1999 and Kannaiyan, 2002).

Using organic manures is responsible for stimulating soil fertility and biological activity, formation of natural hormones, antibiotics and B vitamins and developments of roots (Dahama, 1999).

Previous studies emphasized the different benefits of using the suitable N through inorganic, organic and bioforms on growth yield and fruit quality of various fruit crops (Kabeel *et al*., 2005; Barakat *et al*., 2007; El- Sehrawy, 2008; Seleem- Basma and Telep, 2008; Mohamed and Ahmed, 2008; Abada, 2009; Ahmed and Ibrahiem-Asmaa, 2009; Gad El- Kareem, 2009; Refaai, 2011; Uwakiem, 2011; Abd El- Aziz, 2011; Ahmed *et al*., 2011a and 2011b and Ibrahiem, 2012).

This target of this investigation was examining the possibility of reducing nitrite in the grapes of Ruby seedless grapevines by using inorganic N along with different organic manures enriched or not with EM. Selecting the best organic manures with or without EM applied with inorganic N is considered another merit.

MATERIALS AND METHODS

This study was carried out during 2010 and 2011 seasons on 60 uniform in vigour 12- years old Ruby seedless grapevines grown in a private vineyard located at West Matay, Minia Governorate where the soil is sandy. Soil analysis was done according to the procedures that outlined in Chapman and Pratt (1965) and the data are given in Table (1). The vines are planted at 2 × 3 meters apart and trained according to double cordon system with three wires, the first wire was on 80 cm height above the soil and the second and third ones were on 120 and 160 cm height above the soil. Vine load was 84 eyes/ vine (24 fruiting spurs x three eyes plus six replacement spurs x two eyes). Surface irrigation system was followed. The selected vines (60 vines) received the same horticultural practices that already applied in the vineyard except those dealing with the application of all sources of N. At blooming stage number of flower clusters was adjusted to 35 cluster in all the selected vines.

The present experiment consisted from the following ten treatments:-

1- Application of the suitable N (80 g/ vine/ year) (according to Mohamed and Ahmed (2008) completely via inorganic N form only (240 g ammonium nitrate / vine/ year).
2- Application of the suitable N through 75 % inorganic N form alone (180 g ammonium nitrate / vine/ year).
3- Application of the suitable N through 75 % inorganic N form + 25 % compost (1.143 kg / vine/ year).
4- Application of the suitable N through 75 % inorganic N form + 25 % filter mud (1.0 kg / vine/ year).
5- Application of the suitable N through 75 % inorganic N form + 25 % farmyard manure (8.0 kg / vine/ year).
6- Application of the suitable N through 75 % inorganic N form + 25 % poultry manure (0.8 kg / vine/ year).
7- Application of the suitable N through 75 % inorganic N form + 25 % compost (1.143 kg / vine/ year) enriched with 10 ml EM/ vine/ year.
8- Application of the suitable N through 75 % inorganic N form + 25 % filter mud (1.0 kg / vine/ year) enriched with 10 ml EM/ vine/ year.
9- Application of the suitable N through 75 % inorganic N form + 25 % farmyard manure (8.0 kg / vine/ year) enriched with 10 ml EM/ vine/ year.
10- Application of the suitable N through 75 % inorganic N form + 25 % poultry manure (0.8 kg / vine/ year) enriched with 10 ml EM/ vine/ year.

Each treatment was replicated three times, two vines per each. Nitrogen source was ammonium nitrate (33.5 % N) and it was applied at these unequal batches 40 % at growth start (1^{st} week of April), 30 % just after berry setting (2^{nd} week of June) and 30 % at one month later (2^{nd} week of July). The four organic manures namely compost (1.75 % N), Filter mud (2.0 % N), Farmyard manure (0.25 % N) and poultry manure (2.5 % N) at 25 % of the suitable N and applied either alone or each enriched with 10 ml EM/ vine/ year. They were added once after winter pruning in holes 25 cm apart from the trunk of each vine. Effective microorganisms (EM) were added once at growth start at fixed rate (10 ml/ vine/ year). A complete randomized block design was adopted.

Table (1): Analysis of the tested soil:

characters	Values
Sand %	: 75.0
Silt %	: 11.0
Clay %	: 14.0
Texture%	: Sandy
E.C (1:2.5, ppm)	: 640
pH (1:2.5)	: 7.56
O.M. %	: 0.60
$CaCO_3$ %	: 3.2
Total N %	: 0.03
Available P (ppm, Olsen)	: 2.2
Available K (ppm, ammonium acetate)	: 70
Available Mg (ppm)	: 5.0

The following parameters were measured during each season.

1- Main shoot length (cm.) at the last week of July.
2- Leaf area (cm^2) was estimated on the twenty leaves from those leaves opposite to the first clusters on the shoots at the last week of July. Leaf area was calculated according to the equation reported by Ahmed and Morsy (1999).
3- In the same previous leaves (Summer, 1985) petioles were washed several times with distilled water and dried at 70 ̊ C till constant and ground using an electric mill and digested using H_2O_2 and then percentages of N, P and K were determined according to the standard methods that outlined by Chapman and Pratt (1965) and the results were calculated on dry weight basis.
4- At harvesting time (mid. of Sept.), yield expressed in weight (kg.) and cluster weight (g.) were recorded.
5- Shot berries % by dividing total number of shot berries by total number of berries/ cluster and the product was multiplied by 100.
6- Berry weight (g.).
7- Total soluble solids %.
8- Total acidity % (as g tartaric acid/ 100 ml juice) (A.O.A.C., 1995).
9- Nitrite content as ppm in the juice was determined according to the procedure that outlined in (A.O.A.C., 1995).

All the obtained data were tabulated and statistically analyzed according to Mead *et al*., (1993) and the averages were compared using new L.S.D test at 5 %.

RESULTS AND DISCUSSION

1) Main shoot length and leaf area:-

Data in Table (2) clearly show that application of the suitable N through inorganic at 75 % + any of the four organic manures (compost, filter mud, F.Y.M and poultry manure) at 25 % with or without EM at 10 ml/ vine/ year significantly stimulated the main shoot length and leaf area comparing with using N completely via inorganic form at 75 to 100 %. The promotive effect on such two growth characters was attributed to using F.Y.M, poultry manure, filter mud and compost, in ascending order. Application of EM along with each organic manure was preferable than using each organic manures alone in enhancing such two growth traits. Significant differences on such two growth aspects were observed among all N management treatments. The maximum values were observed on the vines that received N as 75% inorganic N form plus 25 % compost enriched with EM at 10 ml/ vine/ year. The lowest values were recorded on the vines that fertilized with N completely via inorganic N at 100 %. These results were true during both the two experimental seasons.

The positive action of organic manures and EM on stimulating growth characters might be attributed to their essential role in enhancing soil fertility, secreting natural hormones and antibiotics and amending the vines with their requirements from different nutrients, amino acids, organic acids, B-vitamins and other antioxidants (Dahama, 1999 and Kannaiyan, 2002).

These results are in agreement with those obtained by Kabeel *et al*., (2005); Mohamed and Ahmed (2008); Uwakiem (2011) and Ibrahiem (2012).

2) Percentages of N, P and K in the leaves:-

It is clear from the data in Tables (2& 3) that supplying the vines with N as 75 % inorganic N plus any organic manures enriched or not with EM significantly was accompanied with enhancing percentages of N, P and K in the leaves rather than application of N at 75 to 100 % inorganic alone. Application of F.Y.M, poultry manure, filter mud and compost in ascending order was significantly very effective in enhancing these nutrients. An outstanding promotive effect on these nutrients was observed when these organic manures were enriched with EM comparing with using organic manures only. Fertilizing the vines with N through

75% inorganic plus 25 % compost enriched with EM at 10 ml/ vine/ year gave the highest percentages. The minimum values of N was presented in the leaves of the vines that received N completely via inorganic form at 75 %. The minimum values of both P and K were detected on the vines that fertilized with N as 100 % inorganic. Similar results were announced during 2010 and 2011 seasons.

These results might be attributed to the essential role of organic manures and EM in lowering soil pH and salinity as well as enhancing biological activity of the soil, fixation of N, soil fertility and organic matter (Higa and Wididana, 1991 and Myint, 1999).

These results are in approval with those obtained by Barakat *et al*., (2007); El-Sehrawy (2008); Abada (2009) and Ahmed *et al*., (2011a) and (2011b).

Table (2): Effect of inorganic N as well as some organic manures enriched with EM on the main shoot length (cm.), leaf area (cm^2) as well as percentages of N and P in the leaves of Ruby seedless grapevines during 2010 and 2011 seasons.

Treatment	Shoot length (cm.)		Leaf area (cm^2)	
	2010	2011	2010	2011
100 % inorganic N	91.4	92.1	125.2	124.0
75 % inorganic N	90.0	90.6	122.5	122.0
75 % inorganic N + 25 % compost	101.0	101.7	133.9	133.0
75 % inorganic N + 25 % Filter mud	98.0	98.6	132.0	131.3
75 % inorganic N + 25 % F.Y.M 200	93.1	94.0	128.0	127.3
75 % inorganic N + 25% Poultry manure	95.9	97.6	130.0	129.3
75 % inorganic N + 25 % compost enriched with EM	110.0	110.7	148.0	147.3
75 % inorganic N+ 25% Filter mud enriched with EM	107.9	108.6	145.9	145.0
75 % inorganic N+ 25% F.Y.M enriched with EM	104.0	104.7	141.9	141.0
75 % inorganic N+ 25% Poultry manure enriched with EM	106.0	106.8	144.0	143.7
New L.S.D at 5 %	1.2	1.3	1.1	1.2
Character	Leaf N %		Leaf P %	
100 % inorganic N	1.71	1.76	0.16	0.18
75 % inorganic N	1.64	1.70	0.19	0.21
75 % inorganic N + 25 % compost	1.97	2.02	0.31	0.33
75 % inorganic N + 25 % Filter mud	1.90	1.95	0.28	0.30
75 % inorganic N + 25 % F.Y.M 200	1.76	1.82	0.22	0.25
75 % inorganic N + 25% Poultry manure	1.83	1.88	0.25	0.28
75 % inorganic N + 25 % compost enriched with EM	2.20	2.25	0.44	0.47
75 % inorganic N+ 25% Filter mud enriched with EM	2.16	2.21	0.40	0.44
75 % inorganic N+ 25% F.Y.M enriched with EM	2.02	2.07	0.34	0.37
75 % inorganic N+ 25% Poultry manure enriched with EM	2.09	2.15	0.37	0.41
New L.S.D at 5 %	0.05	0.05	0.02	0.02

Table (3): Effect of inorganic N as well as some organic manures enriched with EM on the percentage of K in the leaves, yield/ vine (kg.), average cluster weight (g.) and percentage of shot berries of Ruby seedless grapevines during 2010 and 2011 seasons.

Treatment	Leaf K %		Yield/ vine (kg.)	
	2010	2011	2010	2011
100 % inorganic N	1.41	1.50	13.5	13.2
75 % inorganic N	1.51	1.60	13.0	12.7
75 % inorganic N + 25 % compost	1.82	1.91	15.2	15.0
75 % inorganic N + 25 % Filter mud	1.75	1.84	14.8	14.5
75 % inorganic N + 25 % F.Y.M 200	1.59	1.68	13.9	13.7
75 % inorganic N + 25% Poultry manure	1.69	1.78	14.4	14.1
75 % inorganic N + 25 % compost enriched with EM	2.11	2.20	16.9	16.7
75 % inorganic N+ 25% Filter mud enriched with EM	2.06	2.14	16.5	16.2
75 % inorganic N+ 25% F.Y.M enriched with EM	1.91	1.99	15.6	15.4
75 % inorganic N+ 25% Poultry manure enriched with EM	2.00	2.08	16.1	15.8
New L.S.D at 5 %	0.05	0.06	0.8	0.9
Character	Av. cluster weight (g.)		Shot berries %	
100 % inorganic N	385.0	378.0	10.9	10.0
75 % inorganic N	371.0	364.0	9.0	8.7
75 % inorganic N + 25 % compost	435.0	428.0	5.0	4.7
75 % inorganic N + 25 % Filter mud	422.0	415.0	6.0	5.7
75 % inorganic N + 25 % F.Y.M 200	396.5	390.0	8.0	7.7
75 % inorganic N + 25% Poultry manure	410.0	403.0	7.2	6.9
75 % inorganic N + 25 % compost enriched with EM	483.0	476.0	2.9	2.6
75 % inorganic N+ 25% Filter mud enriched with EM	471.0	464.0	3.4	3.0
75 % inorganic N+ 25% F.Y.M enriched with EM	446.9	440.0	4.5	4.2
75 % inorganic N+ 25% Poultry manure enriched with EM	459.0	452.0	4.0	3.7
New L.S.D at 5 %	11.0	11.0	0.5	0.4

3) Yield and cluster weight:-

As shown in Table (3), yield and cluster weight of Ruby seedless grapevines significantly were improved with using inorganic N as 75 % out of the suitable N + any organic manure each at 25 % with or without EM at 10 ml/ vine/ year comparing with using N via inorganic form at 100 %. A significant promotion on the yield and cluster weight was observed with using compost, filter mud, poultry manure and F.Y.M, in descending order. A supreme promotion was obtained when EM was mixed with any organic amendments without EM. The best results with regard to yield were obtained with supplying the vines with the suitable N through 75 % inorganic plus 25 % compost enriched with EM at 10 ml/ vine/ year. Under such promised treatment, yield reached 16.9 and 16.7 kg comparing to 13.0 and 12.7 kg produced by the vines that received N completely via inorganic form at 75 %. The percentage of increase on the yield in response to application of the previous promised treatment reached 30 % and 31.5 % in relative to the vines that received the suitable N completely via inorganic form at 75.0 % during both seasons, respectively. Similar trend was noticed during 2010 and 2011 season.

The benefits of organic manures and EM on growth and vine nutritional status could result in improving the yield.

These results are in the same line with those obtained by Ahmed and Ebrahiem-Asmaa (2009); Refaai (2011); Uwakiem (2011) and Ibrahiem (2012).

4) Percentage of shot berries:-

Data in Table (3) show that percentage of shot berries was significantly reduced with using all sources of N namely inorganic, organic and biofertilizers comparing with using organic N alone. A supreme effect on shot berries % was recorded when each organic manure was enriched with EM. The lowest values were recorded when vines were fertilized with N as 75 % inorganic plus 25 % compost enriched with EM at 10 ml/ vine/ year. The vines that fertilized with N completely via inorganic form at 75 to 100% gave the highest values. Similar results were obtained during both seasons.

The beneficial effects of using organic and EM or adjusting the uptake of N through all stages of growth as well as their positive action on the biosynthesis of natural hormones and other antioxidants could explain the present results.

These results are in agreement with those obtained by Seleem- Basma and Telep (2008); Mohamed and Ahmed (2008) and Abada (2009).

5) Some physical and chemical characteristics of the grapes:-

It is evident from the data in Table (4) that amending the vines with N through 75 % inorganic plus 25 % any organic manures enriched or not with EM at 10 ml/ vine/ year significantly improved berry weight and total soluble solids % and reduced total acidity % and nitrite in the grapes comparing with non-application of these manures. The promotion on quality of the grapes was associated with using compost, filter mud, poultry manure and F.Y.M, in descending order. Quality of the grapes was significantly improved particularly when EM was mixed with each organic manure. The best results with regard to quality of the grapes were obtained with supplying the vines with N as 75 % inorganic + 25 % compost enriched with EM at 10 ml/ vine/ year. The lowest nitrite content in the grapes was obtained in the same previous treatment. The vines that received N completely via inorganic form at 100 % had the highest nitrite content in the grapes. Similar results were announced during both seasons.

The beneficial of organic manures and EM on the biosynthesis of plant pigments and sugars could explain the present results. The great control of N uptake by the vines with application of N through all sources surely reflected on reducing nitrite in the grapes.

These results are in harmony with those obtained by Refaai (2011); Uwakiem (2011); Abd El- Aziz (2011a) and (2011b) and Ibrahiem (2012).

As a conclusion, it is beneficial for promoting the yield of Ruby seedless grapevines quantitively and qualitatively and reducing nitrite in the grapes by using the suitable N (80 g/ vine/ year) through 1.80 g ammonium nitrate, 1.1143 kg compost enriched with EM at 10 ml/ vine/ year.

Table (4): Effect of inorganic N as well as some organic manures enriched with EM on some physical and chemical characteristics of the grapes of Ruby seedless grapevines during 2010 and 2011 seasons.

Treatment	Av. berry weight (g.)		T.S.S %	
	2010	2011	2010	2011
100 % inorganic N	2.16	2.19	17.6	17.2
75 % inorganic N	2.11	2.15	17.9	17.5
75 % inorganic N + 25 % compost	2.35	2.39	19.2	19.3
75 % inorganic N + 25 % Filter mud	2.30	2.34	19.0	19.2
75 % inorganic N + 25 % F.Y.M 200	2.21	2.25	18.3	18.5
75 % inorganic N + 25% Poultry manure	2.26	2.30	18.6	18.9
75 % inorganic N + 25 % compost enriched with EM	2.69	2.75	20.2	20.5
75 % inorganic N+ 25% Filter mud enriched with EM	2.52	2.58	19.9	20.1
75 % inorganic N+ 25% F.Y.M enriched with EM	2.41	2.47	19.5	19.7
75 % inorganic N+ 25% Poultry manure enriched with EM	2.46	2.53	19.7	19.9
New L.S.D at 5 %	0.04	0.03	0.2	0.2
Character	Total acidity %		Nitrite in the juice (ppm)	
100 % inorganic N	0.703	0.688	2.05	2.00
75 % inorganic N	0.680	0.665	1.95	1.90
75 % inorganic N + 25 % compost	0.570	0.555	1.05	1.00
75 % inorganic N + 25 % Filter mud	0.591	0.575	1.22	1.22
75 % inorganic N + 25 % F.Y.M 200	0.655	0.640	1.55	1.50
75 % inorganic N + 25% Poultry manure	0.620	0.605	1.30	1.26
75 % inorganic N + 25 % compost enriched with EM	0.450	0.435	0.31	0.28
75 % inorganic N+ 25% Filter mud enriched with EM	0.480	0.465	0.72	0.65
75 % inorganic N+ 25% F.Y.M enriched with EM	0.545	0.530	0.95	0.91
75 % inorganic N+ 25% Poultry manure enriched with EM	0.515	0.500	0.84	0.79
New L.S.D at 5 %	0.020	0.22	0.10	0.10

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"محاولات لتقليل التلوث النيتريتي في حبات العنب الروبي سيدلس عن طريق استخدام بعض الأسمدة العضوية المزودة بالكائنات الدقيقة الفعالة"

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الملخص العربي

خلال موسمي ٢٠١٠ ، ٢٠١١ تم اختبار أربعة أسمدة عضوية هي السماد البلدي، سماد زرق الدواجن وطينة المرشحات والكمبوست مع أو بدون الكائنات الدقيقة الفعالة كمحاولة لإحلال هذه الأسمدة العضوية جزئيا محل السماد النيتروجيني الكيماوي وفي نفس الوقت تحسين المحصول كما ونوعا للعنب الروبي سيدلس.

وكان استخدام التسميد النيتروجيني الغير عضوي بنسبة ٧٥ إلي ١٠٠ % جنبا إلي جنب مع أي سماد عضوي بنسبة ٢٥ % مع أو بدون الكائنات الدقيقة الفعالة فعالا في تحسين طول النمو الرئيسي ومساحة الورقة والنسبة المئوية لعناصر النيتروجين والفوسفور والبوتاسيوم في الورقة وكمية المحصول ووزن العنقود وفي تقليل النسبة المئوية للحبات الصغيرة والحموضة الكلية والنيتريت في الحبات وكان استخدام الكمبوست وطينة المرشحات وسماد زرق الدواجن والسماد البلدي مرتبا ترتيبا تنازليا فعالا جدا في تحسين المحصول كما ونوعا وكان تزويد الأسمدة العضوية بالكائنات الدقيقة الفعالة مفضلا عن استخدام الأسمدة العضوية فقط في هذا الصدد.

لتقليل التلوث النيتريتي وتحسين إنتاجية كرمات العنب الروبي سيدلس فإنه ينصح باستخدام الكمية المناسبة من النيتروجين علي أساس ٧٥ % سماد غير عضوي جنبا إلي جنب مع استخدام الكمبوست المزود بالكائنات الدقيقة الفعالة بمعدل ١٠ مل/ الكرمة/ السنة.