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EFFECT OF ORGANIC NITROGEN FERTILIZATION ON GROWTH, NUTRIENT STATUS AND FRUITING OF ROUMI RED GRAPEVINES

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Abstract: The effect of organic manures on growth, nutrient status and fruiting of Roumi Red grapevines was studied during 2004 and 2005 seasons. The study was carried out at the experimental orchard of Qena Agriculture Faculty, South Valley University, Egypt. Two organic manures namely, filter mud cake and chicken manure were used either alone or combined with an inorganic source of nitrogen (N). Organic manures were applied at 0.0, 50, 75 and 100% of the recommended dose of the inorganic N fertilization (80g/vine/year).

It is evident from the obtained results that applying organic N either alone or in combination with the inorganic form was very effective in improving growth, yield, leaf nutrient composition and berry quality of vines, compared to the complete application of N as an inorganic form. The increment was associated with increasing the amount of each organic manure. Organic N fertilization alone was superior to inorganic one in this respect.

The obtained results also showed that applying 75 or 100% of the N requirements for Roumi Red grapevines in an organic form was very useful in improving yield and fruit quality. In addition , it decreases the environment at pollution problems.

Key words: organic nitrogen, growth, nutrient status, fruiting , grapevines.

Introduction:

Grape (*Vitis vinifera* L.) is considered as one of the most popular and favourite fruit crops in the world. In Egypt, it ranks the second, after the citrus. Moreover, Roumi Red grapevine cv. is considered one of the most important seeded grape varieties grown in Egypt. It is the dominant cultivars in Upper Egypt. One of the important tools in increasing crop yield is fertilization, especially the nitrogen one.

In the recent years, the use of organic fertilizers in place of mineral fertilizers has become potentially attractive because of the harm effect and high cost of mineral fertilizers. In sandy and sandy loam soils, the organic fertilization is a good source of nutrients. It also increases number and activity of microorganisms in the soil and helps to prevent breakdown of soil structure leaving good structure in the soil associated with greater water holding capacity (Nijjar, 1985; Miller *et al.,* 1990; Darwish *et al.*, 1995; Abdel-Nasser and Harhash,2000). In addition, it was thought fruitful to depress the accursed pollution in our Egyption environment due to the exaggeration in the application of chemicals and mineral fertilizers. Besides, the production of a safe and nutritive food that is good for health should be the agronomist goal. Fertilizing various grapevine cultivars with organic manures along with the inorganic N source was accompanied by improving growth, leaf mineral content, yield and berry quality than using N as an inorganic source only (Bhangoo *et al.,* 1988; El-Sayed, 1994; Ahmed *et al.*, 1996; El-Morsy, 1997; Akyuz *et al.*, 1997; Ragab and Mohamed, 1999; Kore and Guteryuz, 1999; Vercesi, 2000; Ahmed *et al.,* 2000; Harhash and Abdel-Nasser 2000; Haseli, 2001; Abdel Ghafar-Gehan, 2002; Kassem and Marzouk, 2002; Ahmed *et al.*, 2003; Mohamed and Gobara,2004).

The present work aims to evaluate two organic fertilizers as a source of nitrogen alone or in combination with an inorganic nitrogen source to select the best source and amount of organic N needed for improving growth, nutrient status, yield and berries quality of Roumi Red grapevines grown on sandy loam soil .

Materials and Methods

The present study was carried out during two successive seasons i.e. 2004 and 2005 at the experimental orchard of Qena Agriculture Faculty, South Valley University, Egypt. The soil was loamy sand, on forty two, 6- years old head trained Roumi Red grapevines. The vines were healthy with no visual nutrient deficiency and planted at 2.0 x 2.0m^2 apart and pruned in the Mid of January in both seasons leaving a vine load of 70 buds/vine (15 fruiting spurs x 4 buds plus 5 replacement spurs x 2 buds).

Physical and chemical properties of the soil used in this study before and after N treatments and were determined according to Wilde *et al.,* (1985) and are shown in Table (1)

Table(1): Some physical and chemical properties of the experimente soil used before and after treatments.

Soil property	Before treatment	After treatment		
		Inorganic(control)	F.M.C.*	CH.M.**
Sand (%)	77.2	76.8	71.5	73.0
Silt (%)	18.8	17.5	21.0	19.0
Clay (%)	4.0	5.7	7.5	8.0
Texture grade	Sandy loam	Sandy loam	Sandy loam	Sandy loam
PH(1:2.5)	8.08	8.10	7.88	7.91
Ca Co_3 (%)	7.47	7.45	6.32	6.50
Organic matter (%)	0.97	1.01	1.93	1.76
Total nitrogen (%)	0.19	0.21	0.32	0.34
Available P(ppm)	2.7	2.73	5.65	4.39
Soluble cations (mg/100g)				
Na	1.01	1.06	0.68	0.73
K	0.74	0.73	1.46	1.97
DTPA-Extractable Fe(ppm)	7.50	7.50	12.80	18.92
Mn(ppm)	5.20	5.30	8.14	6.93
Zn(ppm)	1.70	1.63	2.38	2.16

*F.M.C = filter mud cake. **Ch.M = Chicken manure.

The experiment involved seven treatments representing various (organic and inorganic) and levels of nitrogen. Each treatment had under the same recommended N level of 80 g N/ vine/year, as shown in (Table 2)

Table(2): The amount of nitrogen in organic and inorganic sources used in the studied treatments.

Tr.	Organic fertilizers		Inorganic fertilizer (M)	The amount of N/ (g/vine)		Total N(g/vine)
	Type	Amount(kg/vine)	Amount/ (g/vine)	Organic fertilizer	inorganic fertilizer	
1	I (control)	0.0	240.0	0.0	240.0	80.0
2	½ I +½ F .M.C	2.110	120.0	40.0	40.0	80.0
3	¼ I +3/4 F.M.C	3.160	60.0	60.0	20.0	80.0
4	F.M.C.	4.220	0.0	80.0	0.0	80.0
5	½ I +½ ch.M	1.60	120.0	40.0	40.0	80.0
6	¼ I +3/4 Ch.M	2.40	60.0	60.0	20.0	80.0
7	Ch.M	3.200	0.0	80	0.0	80.0

The experiment was arranged in a randomized complete block design with three replications consisting of two vines per each replication.

Filter mud cake (F.M.C. 1.9% N) and chicken manure (Ch. M. 2.5% N) as organic fertilizers were added in both seasons after the end of pruning (2^{nd} week of January).

The chemical analysis of the two studied organic nitrogen fertilizers are shown in Table (3).Ammonium nitrate (33.5% N) as an inorganic (I) source was added at three equal doses in the first week of April, May and June. All other agricultural and horticultural practices were carried out as usual.

Table(3): Chemical analysis of the used organic fertilizers

Character	Chicken manure (Ch.M.)	Filter mud cake (F.M.C.)	Character	Chicken manure (Ch.M.)	Filter mud cake (F.M.C.)
Organic matter(%)	34.34	68.70	Total K(%)	1.90	0.18
pH value	7.56	6.51	Fe (ppm)	3310	1154
Total N(%)	2.50	1.90	Zn(ppm)	654	211
Total P(%)	0.39	1.11	Mn(ppm)	190	323

Five current season's shoots per vine were tagged for growth measurements at growth cessation of each season. Vegetative parameters, such as shoot length, thickness and lateral branches, were annually recorded at the end of July. Samples of twenty leaves apposite to the basal clusters were taken, the average leaf area (cm^2) was estimated by weighing 40 sections of 1 cm^2 (2 sections of 1 cm^2 from each leaf) and then, the average area was calculated (leaves weight x 4 / sections weight).

The petioles of those leaves were separated, tap water-washed, distilled water rinsed, air-dried, oven-dried at 65^0C for 48 hrs, up to a constant weight then ground and digested using sulphuric acid and hydrogen peroxide. Nitrogen, P, K, Zn, Fe and Mn contents of leaves on dry weight basis were determined according to Wilde *et al.* (1985).

Berry set percentage was estimated by caging five clusters per vine in perforated paper bags before bloom start. At the end of berry set, bags were removed and berry set percentage was calculated by dividing the number of flowers set by the total number of flowers per cluster and multiplied by 100. The weight of pruning wood was calculated immediately after pruning and was expressed as Kg/vine.

The harvesting date was determined when the total soluble solids / total acidity ratio reached 30:1 in the control treatment (received N completely as an inorganic source). Yield was expressed as weight (Kg) and number of clusters per vine was calculated. Five clusters were randomly taken from each vine to determine the cluster weight, berry weight and length. In additions, chemical berry quality in terms of total soluble solids%, reducing sugar content and total acidity% (expressed as g tartaric acid per 100 ml juice) were determined according to A.O.A.C. (1985). Statistical analysis of the obtained data was carried out according to Gomez and Gomez (1984) and Snedecor and Cochran (1990) using the least significant difference (L.S.D.) for detecting the significant differences among the studied treatments.

Results and Discussion

1- Effect of organic manure on some growth parameters:

Table (4) shows the effect of organic fertilization of filter mud cake (F.M.C.) and chicken manure (Ch.M.) on some growth parameters during 2004 and 2005 seasons. Generally, amending the vines with N in both organic and inorganic sources as well as organic source only significantly stimulated the shoot length, shoot thickness and number of laterals / shoot as well as leaf area and pruning wood weight compared with using the inorganic nitrogen source only. Increasing both F.M.C. or Ch.M. levels were followed by a gradual increment in these traits. Supplying the vines with F.M.C. was superior than Ch.M. in improving such growth parameters except for the leaf area which had the maximum values with the use of the chicken manure.

The maximum values of shoot length, shoot thickness, number of laterals branches/shoot and pruning wood were obtained on vines received 4.22 Kg, of F.M.C./vine. However, the application of all N amounts as ammonium nitrate the minimum values of these traits. The stimulating effect on growth parameters was proportional to the increase in the amount of organic manure and to the decrease in the amount of mineral N. This study confirms the benefits of using all N requirements as an organic form or replacing ¾ of N requirements by organic form.

Such findings might be attributed to the organic matter that acts as a complexing agent resulting in reducing in nutrient loss by leaching. In addition, organic manures have great benefits in increasing the availability of nutrients and water as well as release continuous amounts of N and other nutrients at various growth stages of plants. Moreover, organic manure improves physical and chemical properties of the soil (Table1) and in turn good root and vine growth was obtained (Nijjar, 1985; Miller *et al.,* 1990; Ahmed,2001).

These results are in agreements with those obtained by Ahmed *et al.,* (1996), Ragab and Mohamed (1999), Abdel-Ghafar-Gehan(2002), Ahmed et al., (2003) and Mohamed and Gobara (2004), who reported positive vegetative growth responses of various grapevine cultivars to the annual application of organic fertilizers.

2- Effect of organic manure on leaf nutrient composition :

It is clear from the data in Table (5) that application of all N amounts as an organic source as well as using both organic and inorganic sources were significantly effective in increasing N, P, K, Zn, Fe and Mn levels in the leaves compared to applying all N as an inorganic source.

There was a gradual increment in these nutrients with increasing F.M.C. from 2.11 to 4.22 Kg/vine and P.Ch.M. from 1.60 to 3.20 Kg/vine. Moreover, insignificant differences in those nutrient contents were observed between either using both sources or using the two higher level of each one. Application of all N amounts of organic manure without applying inorganic N amounts as F.M.C. was favourable to increase N, P and Mn in leaves compared to using Ch.M. The other nutrients, namely K, Zn and Fe, tended to increase with using Ch.M. There is no significant differences in these nutrients between F.M.C. and Ch.M when each one as applied without an inorganic N. Fertilizing the vines by all amounts of N in an organic form gave the highest contents of these nutrients in the leaves. However, the lowest values were obtained when the vines received all amounts of N in an inorganic form. These results were true in both seasons.

Organic manures may increase the soil acidity, reduce the loss of nutrients with drainage water and enhance the availability of nutrients in the soil (Nijjar, 1985; El-Gharably, 2002). In addition, they can provide most nutrients to vines along the whole growth season .

Organic manures are considered important sources of macro and micro nutrients. They contains considerable amounts of N, P, K, Fe, Mn and Zn (Table 3). These results agreed with those of Bhangoo *et al.,* (1988), Kore and Guleryuz (1999), Abdel- Nasser and Harhash (2000), Ahmed et al., (2000), Abdel-Ghafar-Gehan(2002), Kassem and Marzouk (2002), Ahmed et al., (2003) and Mohamed and Gobara (2004). They concluded that nutrient supply can be improved by applying organic manure.

The obtained results proved that the application of organic manures or replacing ¾ of N requirements for Roumi Red vines by organic manure

was very useful in saving N fertilization cost and reducing nitrate pollution.

3- Effect of organic manure on yield components :

It can be seen from the data in Table (6) that using all amounts of N in an organic form or in both organic and inorganic forms resulted in positive effects on berry set percentage, yield expressed in weight and number of clusters per vine and cluster weight compared to using all amounts of N in an inorganic form. Number of clusters did not alter in the first season as a result of treatments. However, in the second season the maximum number of cluster was obtained from the vines received all amounts of F.M.C. However, The minimum number occurred on the vines that were supplied with the inorganic N only.

Also, amending vines with organic manure was responsible for producing the highest values of berry set, cluster weight and yield. The increment in the berry set percentage, cluster weight and yield was associated with the increase in the amount of each organic source. Significant differences in berry set and yield as well as cluster number and weight were observed among most levels of F.M.C. and Ch.M. except between both treatments that used organic manures only. The complete application of N in an organic form was preferable than using all amounts of N in an inorganic form. The best results with these traits were obtained from the vines that recived all amounts of N as F.M.C. The minimum values, occurred from the vines that were supplied by the inorganic N only. These results were true in both seasons.

The improving effect of organic manures on berry set percentage and number of clusters/vine could be attributed to their vital role in lowering soil pH and salinity. Improving vine growth and nutritional status can enhance percentage more productive buds (Nijjar,1985). In addition, the increase in berry set was surely reflected in an increase in the cluster weight. The pronounced increase in yield could be due to organic manure effects in increasing number of clusters/vine and in turn increasing berry set percentage induced by increasing cluster weight. The improving effect of organic fertilizers on yield components were supported by the results of Bhangoo *et al.*, (1988), El-Morsy (1997), Ragab and Mohamed (1999), Crespam *et al.*, (2000) Kassem and Marzouk (2002), Ahmed *et al.*, (2003) and Mohamed and Gobara (2004) found positive yield responses to the annual application of organic manures.

4- Effect of organic manure on the quality of berries

It is clear from the data in Table (7) that application of organic manures either alone or in combinatin with an

inorganic source of N were significantly effective in improving quality of Roumi Red berries in terms of increasing weight and length of berry, total soluble solids%, reducing sugars% and decreasing the total acidity% compared to using the inorganic N alone. The observed improving effect on the quality of the berries was associated with increasing the applied level of organic manure and with decreasing the amount of inorganic N. Application of each organic manure alone was very potent in improving quality than using the inorganic N source alone. Unfavourable effects on fruit quality were detected due to treating the vines with inorganic N alone. Significant differences in quality were detected among most levels of organic manures except between using both organic manures alone. The best results were obtained by using the filter mud cake at a level of 4.22 kg/vine followed by the chicken manure at level of 3.20 kg/vine.

The effect of organic manures on enhancing the availability of nutrient, accelerating the biosynthesis of organic and enhancing cell enlargement could explain the present results regarding berry weight and length. In addition, the advancing effect on ripening due to organics manure effects could explain their effect on the chemical quality.

The obtained results are in harmony with those reported by Bhangoo(1988), Ahmed *et al.* (1996), Akyuz *et al.* (1997), Harhash and abdel-Naser (2000) Abdel-Ghafar-Gehan (2002), Kassem and Marzouk (2002) Ahmed *et al.* (2003) and Mohamed and Gobara (2004).

In account of the previously mentioned results, it can be stated that application of all N requirements in an organic form or replacing ¾ of N requirements for grapevines by organic manures enhanced growth and nutritional status of vines as well as produced an economical yield and berries with good quality. In addition, it minimized the production costs and the environment pollution which could be occurred by the excess of chemical fertilizers.

References

Abd EL-Nasser, G. and M.M. Harhash (2000): Effect of organic manures in combination with elemental sulphur on soil physical and chemical characteristics, yield fruit quality, leaf water contents and nutritional stutus of Flame seedless grapevines 1- Soil physical and chemical characteristics. J. Agric. Mansura Univ. 25(6): 3541-3555 Egypt.

Abdel-Ghafar-Gehan, E.(2002): Effect of some organic nitrogen fertilizers on growth and productivity of Red Roomy grapevines (*Vitis vnifera* L) M.Sc.

Thesis, Fac. Of Aric. Minia Univ., Egypt.

Ahmed, A.M., H.A. El-Sayed and M.M. Shoeib (2003): Effect of bio and organic source of N as a partial substitute for chemical fertilizer on bud behaviour growth and fruiting of Flame seedless grapevines. Minia J. Agric. Res, Develop, Vol 23, pp259-246 Egypt.

Ahmed, F.F., A.H. Abd El-Aal and A. Ali-Mervet (2000) : A comparative study for using farmyard manure and filter mud on Flame seedless grapevines growing in sandy soils. 2nd sci. conf. Of Agric. Sci. Assiut, pp277-291 Egypt.

Ahmed, F.F., M.A. Ragab, and A.E.M. Mansour (1996) : A comparative study on the effects of farmyard manure and filter mud for Red Roomy grapevines (*Vitis vnifera* L) 1st Egypt -Hung. Hort. conf. Vol.2 :232-238.

Ahmed, M.M. (2001): Response of some fruit trees grown on the desert soils of Wadi El-Assiuti to fertilization using certain sugar industry by - products Ph.D. Thesis, Fac. of Aric. Assiut Univ., Egypt.

Akyus, M., S. Kara, A. Altindili, O. Calkan and E. Ilter (1997): Effect of various organic fertilizers on quality and ripening of Round seedless grape. Ege Universitesi ziraato Fakaltesi-Dergisi 34:1-2, 17-23.c Farming and Growing . The Crowood Press. New York .

A.O.A.C.Association of Official Agricultural Chemists (1985): Official Methods of Analysis A.O.A.C. Benjamin Franklin Station, Washington D.C.M.S.App.440-512.

Bhangoo, M.S., K.S. Day, V.R. Sundanagunta and V.E. Petrucci (1988) : Application of poultry manure influences Thompson seedless grape production and soil properties. Hort., Sci. 23(61): 1010-1012.

Crespan, G., C. Zenarola, G. Colygnii, F. Bregant, M. Bevedeth, S. Tagliavini, C.Kubiskin and M. Montanari (2000): Fertilizing grapes.vignevini 24(4):87-92

Darwish, O.H., N. Persaud and P.C. Martens (1995) : Effect of long term application of animal manure on physical properties of three soils. Plant and soil 175:289-295.

El-Gharably, A.G. (2002) : Response of corn and wheat to fertilization with mixture of certain sugar industry wastes. M.Sc. Thesis, Fac. of Aric. Assiut Univ., Egypt.

El-Morsy, F.M. (1997): Response of Banaty grapevines to application of the organic fertilizers filter mud and sludges. Annals of Agric. Sci. Vol. 35(1):477-488.

El-Sayed, M.A. (1994): The benefits of some organic nitrogen fertilizers on Red Roomy grapevines (*Vitis vnifera* L) Minia Agric. Res.& Dev. Vol. 16 No.3: 1295-1306 Egypt.

Gomez, K.A. and A.A. Gomez (1984) : Statistical procedures for Agriculture Research. John Wiley and Sons-New York, USA. Pp.680.

Harhash, M.M. and G. Abdel- Nasser (2000) : Effect of organic manures in combination with elemental sulphur on soil physical and chemical characteristics, yield , fruit quality , leaf water contents and nutritional status of Flame seedless grapevines. ll. Yield, fruit quality , leaf water contents and nutritional status. J.Agric. Mansoura Univ. 25(5) 2819-2837.

Haseli, A.(2001): Organic viticultures in Switzerland. Obst und Weinbau 136:6, 138-140.

Kassam, H.A. and H..A.Marzouk (2002) : Effect of organic and /or mineral Nitrogen fertilization on the nutritional status, yield and fruit quality of Flame seedless grapevines grown in calcareous soil J.Adv. Agric .Res.7(1):117-128.

Kore, C. and M. Guleryuz (1999) : Effect of some organic biostimulants on quality of table grapes Dorddrecht, Netherlands Academic Publishers (215-218), Turkey.

Miller , R. W., R.L. Donahue and J.U. Miller (1990): Soils an introduction to Soil and Plant Growth. 6th Ed. Prentice Hall Inter, London pp.181-224.

Mohamed , G.A. and A.A. Gobara (2004) : Response of Red Roomy grapevines to application of farmyard and poulty chicken manures. Minia J. Agric. Res. Develop. 24(1) : 123-138 Egypt.

Nijjar, G.S.(1985): Nutrition of fruit Trees. Mrs Usha Raji Kumar, Kalyani publishers New Delhi, India 10-50.

Ragab, M.A. and G.A. Mohamed (1999) : Effect of some organic and mineral nitrogen fertilization treatments on Flame seedless grapevines. Minia J. Agric. Res, Develop, Vol 19, pp 27-34 Egypt.

Snedecor, G.W. and W.G. Cochram (1990): Statistical Methods. 7th ed, Iowa State Univ. Press Amer., U.S.A. PP:507.

Vercesi, A (2000): Soil and foliar applied organic fertilizers in Viticulture informatore agrario 56(6): 83-89 Italy.

Wilde, S.A., R.B. Corey, J.G. Lyer and K. voigt, (1985): Soil and plant Analysis for tree culture. Mohan primlani & Oxford & IBH, Publishing Co., New Delhi, pp.1-142.

تاثير التسميد النيتروجينى العضوى على النمو و حالة العناصر الغذائية و الإثمار في العنب الرومى الأحمر

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أجريت هذه الدراسة في مزرعة كلية الزراعة بقنا – جامعة جنوب الوادى - مصر على شجيرات العنب الرومى فى موسمى 2005/2004ويهدف هذا البحث إلى دراسة تاثير أستخدام التسميد العضوى للنيتروجين (طينة المرشحات و زرق الدواجن) على النمو و الحالة الغذائية للشجيرات و المحصول و جودة الحبات. و قد تم إحلال السماد العضوى بنسبة (صفر ،50، 75، 100%) من الجرعة الموصى بها من النيتروجين الغير عضوى (80جم /شجرة).

و قد أوضحت النتائج :

- أن أستخدام السماد العضوى (طينة المرشحات و زرق الدواجن) أما بمفردها أو بالإشتراك مع الصورة المعدنية أدى إلى زيادة معنوية في معدل النمو و محتوى الاوراق من العناصر الغذائية.

- أدت زيادة النمو و تحسين الحالة الغذائية للشجيرات إلى زيادة وزن العنقود و المحصول مع تحسين واضح في خصائص جودة الحبات.

- أرتبطت الزيادة في النمو و الحالة الغذائية و المحصول و تحسين جودة الثمار بزيادة الجرعة المستخدمة من أى من السمادين العضويين و لقد تفوق أستخدام التسميد النيتروجينى العضوى بمفرده على التسميد المعدنى في هذا الصدد.

- أظهرت النتائج أن أحلال 75 أو 100% من كمية الإحتياج النيتروجينى لشجيرات العنب الرومى الأحمر بالأسمدة العضوية يؤدى إلى زيادة المحصول و خصائص جودة الحبات و تقليل تلوث البيئة.