*Minia J. of Agric. Res. & Develop.*
*Vol. (٣٠) No. ١ pp ٣١ -٥٠ ,*
**٢٠١٠**

FACULTY OF AGRICULTURE

# IMPROVING SOIL FERTILITY AND PRODUCTIVITY OF FLAME SEEDLESS GRAPEVINES GROWN UNDER SANDY SOIL BY APPLICATION OF HUMIC ACID

**H. M. Abd El- Hameed* and A. M. Ahmed.****
*Viticulture Dept. Hort. Res. Instit. And **Soil & Water and Environ. Res. Instit. ARC. Giza, Egypt.

**Received ١٥ Feb. ٢٠١٠ Accepted ١٥ March ٢٠١٠**

## ABSTRACT

**Flame seedless grapevines grown under sandy soil were fertilized with the suitable amount of N ( ٨٠ g / vine) through ٢٥ to ١٠٠٪ inorganic and / or humic acid at ٢.٥ to ٤٠ $cm^{٢}$/ vine as a trial for improving sandy soil fertility, vine nutritional status and productivity of the vines. The study also aimed to partially reduce the amount of inorganic N by using humic acid for decreasing pollution of the berries with nitrite and nitrate.**

**Results showed that reducing the amount of inorganic N from ١٠٠ to ٥٠ % of the suitable N and increasing the amount of humic acid from ٢.٥ to ٤٠ $cm^{٢}$/ vine were accompanied with improvement in soil fertility and growth , N, P and K content , yield, physical and chemical characters of the grapes. Reducing the amount of inorganic N from ٥٠ to ٢٥٪ of the suitable rate of N even with the application of humic acid had inferior effects on the studied parameters. Combined application of N in inorganic form and humic acid was favourable than using inorganic N alone in this respect.**

**The best results with regard to soil fertility, and Flame seedless grapevines nutritional status and productivity of grown under sandy soil were obtained with supplying the vines with ٨٠ g N/ vine as ٥٠٪ inorganic plus humic acid at ٢٠ cm٢/ vine. This treatment greatly reduced nitrite and nitrate contents in the juice of the berries.**

## INTRODUCTION

It was evidence in the last three decades that the reclamation and improvement of new lands in Egypt is an absolute must to face the ever increasing demands of the growing population. The majority of the new lands in Egypt was sandy saline soils. Poor structure and consequently low available water capacity are the main problems of the sandy saline soils. Other limitations are the low fertility and the higher salts contents (Nijjar, ١٩٨٥). The reclamation of these soils in Egypt was mainly by addition of natural amendments such as organic materials in different forms (Mengel,١٩٨٤).

Nitrogen fertilization is an important and limiting factor for growth, nutritional status and fruiting of grapevines. Considerable amounts of N applied to the soil are lost through leaching, accordingly additional amount of N has to be added in different N sources namely organic and humic acids. Several studies were carried out for finding the best N management that is responsible for improving fruiting of different grapevine cvs. However, the high cost of inorganic fertilizers is a major problem facing grape growers in addition to their roles on health problems and environmental pollution. Therefore, great attention was paid to fulfill the nutrient requirements of grapevines from organic sources. Using of organic fertilizers not only increase the organic matter in the soil but also enhance the available P, K and most micronutrients perhaps through their effects on lowering soil pH. Using organic fertilizers also improve water use efficiency, and avoid all forms of pollution that may result from conventional agricultural techniques (Nijjar, ١٩٨٥ and Miller *et al.*, ١٩٩٠).

Applications of organic fertilizers in vineyards is a production system that avoids or largely excludes the use of mineral N fertilizer.

Thus, produce uncontaminated fruits and juice. Organic fertilizers and humic acid had higher amounts of essential nutrients and growth regulators and also (Vercesi, ٢٠٠٠) beneficial in solving soil and water salinity and improving soil fertility physically and chemically (Nijjar, ١٩٨٥ and Miller *et al*, ١٩٩٠*)*.

The positive action of organic fertilizers on fruiting of fruit crops might be attributed to their positive action on improving the biological activity, water holding capacity of the soil, soil fertility, soil organic matter as well as their important roles in reducing soil erosion, (the deterioration of the soil structure) soil salinity and soil pH (Mengel and Kirkby, ١٩٨٢; Mengel, ١٩٨٤, Darwish, *et al.,* ١٩٩٥; Dahama , ١٩٩٩ and Vercesi, ٢٠٠٠).

Humic substances namely humic acid, fulvic acid and humin act as conditioners for the soil and as bio catalyst and improve soil structure, and increase root development. Also, addition of organic matter to organically deficient soils, increase root vitality, improve nutrient uptake, increase chlorophyll synthesis, better seed germination, increase fertilizer retention, stimulate beneficial microbial activity and produce healthier plants and improve yield. Humic acids, the fraction of humic substances that is not soluble in water under acidic conditions but is soluble at higher pH values, are dark brown to black in color. Fulvic acids, the fraction of humic substances that is soluble in water under all pH conditions, Fulvic acids are light yellow to yellow brown in color. Human, the fraction of humic substances that is not soluble in water at any pH value and in alkali are black in color. (Stevenson, ١٩٨٢, Gaffney *et al.,* ١٩٩٦ , Hayes and Wilson, ١٩٩٧, Davis and Ghabbour, ١٩٩٨ and Kabeel *et al*, ٢٠٠٨).

Humic acid and other organic fertilizers are essential in enhancing growth and fruiting of fruit crops growing under sandy soil (Ahmed *et al.,* ١٩٩٦ ; Kose and Guleryuz , ١٩٩٩ ; Ragab and Mohamed, ١٩٩٩; Ahmed, *et al.,* ٢٠٠٠; Ezz- Thanaa, ٢٠٠٠; Krajnc, ٢٠٠٠; Dobrie *et al.,* ٢٠٠١; Conradie, ٢٠٠١ ; Zachariakis *et al.,* ٢٠٠١; Kassem and Marzouk , ٢٠٠٢ ; Gobara *et al.,* ٢٠٠٢; Kamel, ٢٠٠٢ ;

Salama , ٢٠٠٢ ; Abd El- Ghafar- Gehan, ٢٠٠٢ ; Ahmed, *et al.*, ٢٠٠٣; Abd El- Hameed and Rabea , ٢٠٠٥ ; El- Shenawy and Stino ٢٠٠٢a and ٢٠٠٢b; Omar and Abd Elaal, ٢٠٠٥ ; Omar, ٢٠٠٥; El- Hamady, *et al.*, ٢٠٠٥; Saleh *et al.*, ٢٠٠٦; El- Khafagy, ٢٠٠٦; Abd El-aal *et al.*, ٢٠٠٧; Masoud, ٢٠٠٨; Abada , ٢٠٠٩ and Gad El- Kareem, ٢٠٠٩).

The objective of this study was to examine the effect of humic acid on the improvement of soil fertility and the productivity of Flame seedless grapevines grown under sandy soil.

## MATERIALS AND METHODS

This investigation was carried out during three consecutive seasons of ٢٠٠٧, ٢٠٠٨ and ٢٠٠٩ on ١١٧ ten-years Flame seedless grapevines. The selected vines were visually uniform in vigour, grown in sandy soil at ٢x ٣ m apart in a private vineyard located at Matay district, Minia Governorate. Irrigation was made by drip system. Short (spur) pruning method with Gable shape supporting system was followed. Pruning was made in the middle of Jan leaving ٧٢ eyes / vine ( on the basis of ١٥ fruiting spurs x four eyes + six replacement spares x two eyes) . Soil analysis before study start and at the end of each season was carried out according to the procedures of Page *et al.*, (١٩٨٢) and Wilde *et al.*, (١٩٨٥). The obtained data at the start of experiment are shown in Table (١) and at the end of each season are illustrated in Tables ٥ and ٦.

**Table ١: Soil analysis at the trial location:**

| Characters | Values |
|---|---|
| **Sand %** | ٨١.٥ |
| **Silt %** | ٩.٠ |
| **Clay %** | ٩.٥ |
| **Texture** | **Sandy** |
| **O.M. %** | ١.٥ |
| **pH ( ١: ٢.٥ suspension)** | ٧.٩٦ |

| | |
|---|---|
| **E.C. ( ١:٢.٥ extract) ( mmhos/١cm/٢٥$^{o}$C)** | **١.١١** |
| **$CaCO_{٣}$ %** | **١.٥٢** |
| **Total N %** | **٠.٠٨** |
| **Available K ( ammonium acetate ppm)** | **٥٠.٥** |
| **Available P ( Olsen method, ppm)** | **٣.٥** |

This experiment included the following thirteen treatments from inorganic N and humic acid applications:

١- Application of the suitable N ( ٨٠ g vine) completely via inorganic form (٣٨٨ g ammonium sulphate / vine)
٢- Application of ٧٥٪ of the suitable N via inorganic form (٢٩١g ammonium sulphate / vine)
٣- Application of ٧٥٪ of the suitable N via inorganic form (٢٩١g ammonium sulphate / vine) + ٢.٥ cm$^{٣}$ humic acid / vine.
٤- Application of ٧٥٪ of the suitable N via inorganic form (٢٩١g ammonium sulphate / vine) + ٥.٠ cm$^{٣}$ humic acid / vine.
٥- Application of ٧٥٪ of the suitable N via inorganic form (٢٩١g ammonium sulphate / vine) + ١٠ cm$^{٣}$ humic acid / vine.
٦- Application of ٥٠ % of the suitable N via inorganic form (١٩٤g ammonium sulphate / vine).
٧- Application of ٥٠ % of the suitable N via inorganic form (١٩٤g ammonium sulphate / vine) + ٥.٠ cm$^{٣}$ humic acid / vine.
٨- Application of ٥٠ % of the suitable N via inorganic form (١٩٤g ammonium sulphate / vine) + ١٠ cm humic acid / vine.
٩- Application of ٥٠ % of the suitable N via inorganic form (١٩٤g ammonium sulphate / vine) + ٢٠ cm$^{٣}$ humic acid / vine.
١٠- Application of ٢٥ % of the suitable N via inorganic form (٩٧g ammonium sulphate / vine).
١١- Application ٢٥٪ of the suitable N via inorganic form (٩٧g ammonium sulphate / vine) + ١٠ cm$^{٣}$ humic acid / vine.
١٢- Application of ٢٥٪ of eth suitable N via inorganic form (٩٧g ammonium sulphate / vine) + ٢٠ cm humic acid / vine.
١٣- Application of ٢٥ % of the suitable N via inorganic form(٩٧g ammonium sulphate / vine) + ٤٠ cm$^{٣}$ humic acid / vine.

Each treatment was replicated three times, three vines per each. Inorganic N namely ammonium sulphate (٢٠.٦ % N) was divided into three unequal batches and applied as ٤٠ % at growth start (٣$^{rd}$ week of Feb.), ٣٥% just after berry setting (٣$^{rd}$ week of Apr.) and ٢٥% at one month later (٣$^{rd}$ week of May). Humic acid was applied once at the last week of Jan. during the three seasons.

All selected vines received common horticultural practices that already applied in the vineyard except those of the application of inorganic, organic fertilization and humic acid.

The design of this investigation was complete randomized block with three replicates. Each replicate consisted from three vines.

Main shoot length (cm) was measured at the last week of May in both seasons in eight main shoots in all directions of the vines.

Leaf area ($cm^{٢}$) was estimated in the twenty leaves per vine from those leaves opposite to the first clusters on each shoot ( mid of May) and leaf area ($cm^{٢}$) was recorded according to the equation reported by Ahmed and Morsy (١٩٩٩).

The selected leaf petioles in the same previous leaves (Balo *et al.,* ١٩٨٨) were oven dried at ٧٠ $^{o}$C and digested with $H_{٢}SO_{٤}$ and $H_{٢}O_{٢}$ according to the methods of Chapman and Pratt (١٩٧٨). Nitrogen was determined colormetrically using spectrophotometer (Wilde *et al.,* ١٩٨٥). Phosphorus was determined colormetrically using spectrophotometer according to Piper (١٩٥٠). Potassium was determined using the Flame photometer according to Page *et al.,* (١٩٨٢) and Wilde *et al.,* (١٩٨٥).

Yield expressed in weight (kg.) and number of clusters per vine was recorded at harvesting date (mid. of June) when T.S.S. / acid in the berries of the check treatment reached at least ٢٤/١. Five clusters were taken from each vine for measuring average cluster weight (g.), average berry weight (g.), T.S.S. %, total sugars % and total acidity % (as g tartaric acid per ١٠٠ ml juice) (A.O.A.C., ١٩٩٥).

Nitrite and nitrate contents in the juice (ppm) were determined according to the procedures outlined by Ridnour- Lisa *et al.,* (٢٠٠٠).

Data were statistically analyzed according to Snedecor and Cochran (١٩٦٧). New L.S.D. test was used to determine the various differences between the various treatment means.

At the end of each season, analysis of the soil around each treated vines was carried out for determination of organic matter %, pH and E.C. (mmhos/١cm/ ٢٥ $^{o}$C) as well as soil content of N%, P (ppm) and K ( ppm) ( Chapman and Pratt, ١٩٧٨).

## RESULTS AND DISCUSSION

**The effect of humic acid on:**

**١- Main shoot length and leaf area.**

It is clear from the data in Table ٢ that fertilizing the vines with the suitable N via ٥٠ to ٧٥٪ inorganic N plus humic acid at ٢.٥ to ٢٠ $cm^٣$/ vine significantly stimulated main shoot length and leaf area compared with applying inorganic N at ٥٠ to ١٠٠٪ of the suitable N alone. The stimulation effect on growth characters was coincided with increasing humic acid levels from ٢.٥ to ٤٠ $cm^٣$ / vine and at the same time decreasing the amount of inorganic N from ١٠٠ to ٥٠٪. Using inorganic N at percentages lower than ٥٠٪ of the suitable N even with the application of humic acid significantly reduced the two growth characters. The maximum values were recorded on vines fertilized with the suitable N as ٥٠٪ inorganic plus ٢٠ $cm^٣$ humic acid/ vine, while, the minimum values were recorded on vines that fertilized with the suitable N as ٢٥٪ inorganic without using humic acid. These results were true during the three seasons. The results are in harmony with those obtained by El- Hamady *et al.*, (٢٠٠٥) and Abada (٢٠٠٩).

**٢- Leaf chemical composition.**

It is clear from the data in Tables ٢ and ٣ that using the suitable N through ٥٠ to ٧٥٪ inorganic N plus humic acid at ٢.٥ to ٢٠ $cm^٣$ / vine significantly enhanced percentages of N, P and K in the leaves compared with using inorganic N alone at ٢٥ to ١٠٠٪ of the suitable N. There was a gradual promotion on these nutrients with reducing inorganic N from ١٠٠ to ٥٠ % and at the same time increasing the amount of humic acid from ٢.٥ to ٢٠ $cm^٣$/ vine. A significant reduction on these nutrients was observed with using N as ٢٥٪ inorganic source. Fertilizing of the vines with N as ٥٠ % inorganic plus ٢٠ $cm^٣$ humic acid / vine had an obvious increase on these nutrients. The minimum values were recorded on the vines that received N as ٢٥٪ inorganic form alone. Similar trend was observed during the three seasons. These results are in agreement with those obtained by Kabeel *et al.*, (٢٠٠٨) and Abada (٢٠٠٩).

**Table ٢: Effect of humic acid application on the main shoot length (cm.), leaf area(cm$^{٢}$) and percentages of N and P in the leaves of Flame seedless grapevines during ٢٠٠٧, ٢٠٠٨ and ٢٠٠٩ seasons.**

| Humic acid treatment | Main shoot length (cm.) | | | Leaf area (cm$^{٢}$) | | |
|---|---|---|---|---|---|---|
| | ٢٠٠٧ | ٢٠٠٨ | ٢٠٠٩ | ٢٠٠٧ | ٢٠٠٨ | ٢٠٠٩ |
| ١٠٠ % inorganic | ١٣١.٠ | ١٣٢.٠ | ١٣٠.٠ | ١٠٣.٠ | ١٠٨.٠ | ١١٢.٠ |
| ٧٥ % inorganic N | ١٢٩.٥ | ١٣٠.٠ | ١٢٨.٠ | ١٠١.٨ | ١٠٥.٠ | ١١٠.٠ |
| ٧٥ % inorg. + ٢.٥ cm$^{٣}$ Humic | ١٣٣.٠ | ١٣٤.٠ | ١٣٢.٠ | ١٠٥.٣ | ١١٠.٠ | ١١٤.٠ |
| ٧٥ % inorg. + ٥.٠ cm$^{٣}$ Humic | ١٣٤.٥ | ١٣٦.٠ | ١٣٣.٩ | ١٠٨.٠ | ١١٢.٠ | ١١٦.٠ |
| ٧٥ % inorg. + ١٠ cm$^{٣}$ Humic | ١٣٦.٠ | ١٣٧.٩ | ١٣٦.٠ | ١١٠.٠ | ١١٣.٥ | ١١٨.٠ |
| ٥٠ % inorganic N | ١٢٧.٥ | ١٢٨.٠ | ١٢٦.٣ | ٩٨.٩ | ١٠٣.٥ | ١٠٨.٠ |
| ٥٠ % inorg. + ٥.٠ cm$^{٣}$ Humic | ١٣٧.٩ | ١٤٠.٠ | ١٣٨.٠ | ١١٢.٠ | ١١٥.٠ | ١٢٠.٠ |
| ٥٠ % inorg. + ١٠ cm$^{٣}$ Humic | ١٤٠.٠ | ١٤٢.٠ | ١٤٠.٠ | ١١٤.٩ | ١١٧.٥ | ١٢٢.٠ |
| ٥٠ % inorg. + ٢٠ cm$^{٣}$ Humic | ١٤٤.٠ | ١٤٣.٨ | ١٤٢.٢ | ١١٧.٠ | ١١٩.٠ | ١٢٥.٠ |
| ٢٥ % inorganic N | ١٢٠.٥ | ١٢٢.٠ | ١١٩.٥ | ٩١.٠ | ٩٦.٣ | ١٠١.٠ |
| ٢٥ % inorg. + ١٠ cm$^{٣}$ Humic | ١٢٢.٠ | ١٢٣.٥ | ١٢١.٥ | ٩٣.٣ | ٩٧.٥ | ١٠٣.٠ |
| ٢٥ % inorg. + ٢٠ cm$^{٣}$ Humic | ١٢٣.٩ | ١٢٥.٠ | ١٢٣.٥ | ٩٥.٠ | ٩٨.٥ | ١٠٥.٠ |
| ٢٥ % inorg. + ٤٠ cm$^{٣}$ Humic | ١٢٥.٩ | ١٢٧.٠ | ١٢٤.٥ | ٩٧.٠ | ١٠٠.٥ | ١٠٧.٠ |
| New L.S.D. at ٥ % | ١.٠ | ١.١ | ١.٠ | ١.٥ | ١.٠ | ١.٢ |
| | Leaf N % | | | Leaf P % | | |
| ١٠٠ % inorganic | ٢.١٠ | ٢.٢٥ | ٢.٢٠ | ٠.٣١ | ٠.٣٢ | ٠.٣١ |
| ٧٥ % inorganic N | ٢.٠١ | ٢.١٥ | ٢.١٠ | ٠.٢٩ | ٠.٢٩ | ٠.٢٨ |
| ٧٥ % inorg. + ٢.٥ cm$^{٣}$ Humic | ٢.٢٠ | ٢.٣٥ | ٢.٣١ | ٠.٣٣ | ٠.٣٥ | ٠.٣٣ |
| ٧٥ % inorg. + ٥.٠ cm$^{٣}$ Humic | ٢.٣١ | ٢.٤٥ | ٢.٤٠ | ٠.٣٦ | ٠.٣٨ | ٠.٣٥ |
| ٧٥ % inorg. + ١٠ cm$^{٣}$ Humic | ٢.٣٩ | ٢.٥٥ | ١.٤٩ | ٠.٣٨ | ٠.٤٠ | ٠.٣٨ |
| ٥٠ % inorganic N | ١.٩٤ | ٢.٠٥ | ٢.٠٢ | ٠.٢٧ | ٠.٢٦ | ٠.٢٦ |
| ٥٠ % inorg. + ٥.٠ cm$^{٣}$ Humic | ٢.٥٠ | ٢.٦٢ | ٢.٦٠ | ٠.٤٠ | ٠.٤٥ | ٠.٤١ |
| ٥٠ % inorg. + ١٠ cm$^{٣}$ Humic | ٢.٦١ | ٢.٧٠ | ٢.٧٠ | ٠.٤٢ | ٠.٤٨ | ٠.٤٢ |
| ٥٠ % inorg. + ٢٠ cm$^{٣}$ Humic | ٢.٦٧ | ٢.٨١ | ٢.٨١ | ٠.٤٤ | ٠.٥١ | ٠.٤٤ |
| ٢٥ % inorganic N | ١.٦٠ | ١.٦٩ | ١.٧٢ | ٠.١٨ | ٠.١٦ | ٠.١٦ |
| ٢٥ % inorg. + ١٠ cm$^{٣}$ Humic | ١.٦٩ | ١.٨٠ | ١.٨٠ | ٠.٢٠ | ٠.١٩ | ٠.١٨ |
| ٢٥ % inorg. + ٢٠ cm$^{٣}$ Humic | ١.٧٨ | ١.٨٧ | ١.٨٧ | ٠.٢٢ | ٠.٢١ | ٠.٢١ |
| ٢٥ % inorg. + ٤٠ cm$^{٣}$ Humic | ١.٨٦ | ١.٩٥ | ١.٩٤ | ٠.٢٥ | ٠.٢٣ | ٠.٢٤ |
| New L.S.D. at ٥ % | ٠.٠٦ | ٠.٠٦ | ٠.٠٦ | ٠.٠٢ | ٠.٠٢ | ٠.٠٢ |

**Table ٣: Effect of humic acid application on the percentage of K in the leaves, yield and cluster weight (g.) of Flame seedless grapevines during ٢٠٠٧, ٢٠٠٨ and ٢٠٠٩ seasons.**

| Humic acid treatment | Leaf K % | | | No. of clusters / vine | | |
|---|---|---|---|---|---|---|
| | ٢٠٠٧ | ٢٠٠٨ | ٢٠٠٩ | ٢٠٠٧ | ٢٠٠٨ | ٢٠٠٩ |
| ١٠٠ % inorganic | ١.٨٠ | ١.٩٠ | ٢.٠٠ | ٢٦.٠ | ٣٠.٠ | ٣٠.٠ |
| ٧٥ % inorganic N | ١.٧٢ | ١.٨٢ | ١.٩٢ | ٢٦.٠ | ٣٠.٠ | ٣٠.٠ |
| ٧٥ % inorg. + ٢.٥ cm$^{٣}$ Humic | ١.٨٧ | ١.٩٦ | ٢.٠٥ | ٢٧.٠ | ٣١.٠ | ٣١.٠ |
| ٧٥ % inorg. + ٥.٠ cm$^{٣}$ Humic | ١.٩٤ | ٢.٠٢ | ٢.١٠ | ٢٧.٠ | ٣٢.٠ | ٣٢.٠ |
| ٧٥ % inorg. + ١٠ cm$^{٣}$ Humic | ٢.٠٠ | ٢.١٠ | ٢.١٥ | ٢٧.٠ | ٣٢.٠ | ٣٢.٠ |
| ٥٠ % inorganic N | ١.٦٦ | ١.٧٥ | ١.٨٦ | ٢٦.٠ | ٢٩.٠ | ٣٠.٠ |
| ٥٠ % inorg. + ٥.٠ cm$^{٣}$ Humic | ٢.٠٦ | ٢.١٦ | ٢.٢٠ | ٢٧.٠ | ٣٣.٠ | ٣٢.٠ |
| ٥٠ % inorg. + ١٠ cm$^{٣}$ Humic | ٢.١٢ | ٢.٢٢ | ٢.٢٦ | ٢٧.٠ | ٣٣.٠ | ٣٣.٠ |
| ٥٠ % inorg. + ٢٠ cm$^{٣}$ Humic | ٢.١٨ | ٢.٣٠ | ٢.٣٢ | ٢٧.٠ | ٣٤.٠ | ٣٣.٠ |
| ٢٥ % inorganic N | ١.٤١ | ١.٥٢ | ١.٦٠ | ٢٥.٠ | ٢٨.٠ | ٢٨.٠ |
| ٢٥ % inorg. + ١٠ cm$^{٣}$ Humic | ١.٤٧ | ١.٥٧ | ١.٦٥ | ٢٥.٠ | ٢٨.٠ | ٢٩.٠ |
| ٢٥ % inorg. + ٢٠ cm$^{٣}$ Humic | ١.٥٢ | ١.٦٣ | ١.٧٠ | ٢٥.٠ | ٢٨.٠ | ٢٩.٠ |
| ٢٥ % inorg. + ٤٠ cm$^{٣}$ Humic | ١.٥٨ | ١.٦٩ | ١.٨٠ | ٢٥.٠ | ٢٩.٠ | ٢٩.٠ |
| New L.S.D. at ٥ % | ٠.٠٤ | ٠.٠٥ | ٠.٠٥ | NS | ١.٠ | ١.٠ |
| | Yield / vine (kg.) | | | Cluster weight (g.) | | |
| ١٠٠ % inorganic | ١٠.١ | ١٢.٠ | ١١.٧ | ٣٩٠.٠ | ٤٠٠.٠ | ٣٩١.٠ |
| ٧٥ % inorganic N | ٩.٩ | ١١.٧ | ١١.٤ | ٣٨١.٠ | ٣٩٠.٠ | ٣٨١.٠ |
| ٧٥ % inorg. + ٢.٥ cm$^{٣}$ Humic | ١٠.٨ | ١٢.٧ | ١٢.٤ | ٤٠٠.٠ | ٤١٠.٠ | ٤٠٠.٠ |
| ٧٥ % inorg. + ٥.٠ cm$^{٣}$ Humic | ١١.١ | ١٣.٤ | ١٣.١ | ٤١٠.٠ | ٤٢٠.٠ | ٤١٠.٠ |
| ٧٥ % inorg. + ١٠ cm$^{٣}$ Humic | ١١.٣ | ١٤.١ | ١٣.٤ | ٤٢٠.٠ | ٤٤٠.٠ | ٤٢٠.٠ |
| ٥٠ % inorganic N | ٩.٦ | ١١.٠ | ١١.٣ | ٣٧٠.٠ | ٣٨١.٠ | ٣٧٥.٠ |
| ٥٠ % inorg. + ٥.٠ cm$^{٣}$ Humic | ١١.٦ | ١٤.٥ | ١٣.٨ | ٤٣٠.٠ | ٤٤٠.٠ | ٤٣١.٠ |
| ٥٠ % inorg. + ١٠ cm$^{٣}$ Humic | ١١.٩ | ١٤.٩ | ١٤.٧ | ٤٤٠.٠ | ٤٥٠.٠ | ٤٤٥.٠ |
| ٥٠ % inorg. + ٢٠ cm$^{٣}$ Humic | ١٢.٤ | ١٦.٠ | ١٥.٥ | ٤٦٢.٠ | ٤٧٠.٠ | ٤٧١.٠ |
| ٢٥ % inorganic N | ٨.٣ | ٩.٣ | ٩.٢ | ٣٣١.٠ | ٣٣١.٠ | ٣٢٨.٠ |

| | | | | | | |
|---|---|---|---|---|---|---|
| **٢٥ % inorg. + ١٠ cm$^{٣}$ Humic** | ٨.٥ | ٩.٥ | ٩.٩ | ٣٤١.٠ | ٣٤٠.٠ | ٣٤٠.٠ |
| **٢٥ % inorg. + ٢٠ cm$^{٣}$ Humic** | ٩.٨ | ٩.٩ | ١٠.٤ | ٣٥٠.٠ | ٣٥٥.٠ | ٣٥٧.٠ |
| **٢٥ % inorg. + ٤٠ cm$^{٣}$ Humic** | ٩.٠ | ١٠.٥ | ١٠.٦ | ٣٦٠.٠ | ٣٦٢.٠ | ٣٦٦.٠ |
| **New L.S.D. at ٥ %** | | | | ١٥.٠ | ١٥.٢ | ١٦.٠ |

**٣- Yield and cluster weight:**

Data in Table ٣ clearly show that fertilizing the vines with the suitable N through ٥٠ to ٧٥٪ inorganic N plus humic acid at ٢.٥ to ٢٠ cm$^{٣}$/ vine significantly improved yield expressed in weight and number of clusters per vine and cluster weight compared with using inorganic N at ٢٥ to ١٠٠٪ of the suitable rate without using humic acid. The promotion on yield and cluster weight was associated with reducing the amount of inorganic N from ١٠٠ to ٥٠٪ and at the same time increasing the amount of humic acid from ٢.٥ to ٢٠ cm$^{٣}$ / vine. Using the suitable N as ٢٥٪ inorganic form even at the higher amount of humic acid significantly decreased the yield. The maximum yields during the three seasons ١٢.٤, ١٦.٠ and ١٥.٥ kg were recorded on vines received the suitable N as ٥٠٪ inorganic source plus ٢٠ cm$^{٣}$ humic acid/vine. The lowest yields of ٨.٣, ٩.٣ and ٩.٢ kg for the three seasons were obtained on vines received the suitable N as ٢٥٪ inorganic form alone (without humic acid). The studied treatments had no effect on the number of clusters per vine in the first season of study. These results are in agreement with those obtained by Kose and Guleryuz (١٩٩٩); Kabeel *et al.,* (٢٠٠٨) and Abada (٢٠٠٩).

**٤- Quality of the berries and juice content of nitrite and nitrate.**

Data in Tables ٤ and ٥ reveal that the physical and chemical characters of the berries and juice content of nitrite and nitrate were significantly affected by humic application.

Using the suitable N via ٥٠ to ٧٥٪ inorganic N plus humic acid at ٢.٥ to ٢٠ cm$^{٣}$/ vine significantly improved berries quality in terms of increasing berry weight, total soluble solids and total sugars content and reducing total acidity and juice content of both nitrite and nitrate rather than no application of humic acid with N. The promotion on berry weight and total sugars as well as the reduction on total acidity and nitrite and nitrate content was associated with reducing the amount of inorganic N and at the same time increasing the amount of humic acid. For enhancing fruit quality and reducing at the lower extent the juice content of nitrite and nitrate. It was advised to use the suitable N as ٥٠ % inorganic + ٢٠ $cm^{٣}$ humic acid per vine.

**Table ٤: Effect of humic acid application on some physical and chemical characters of the berries of Flame seedless grapevines during ٢٠٠٧, ٢٠٠٨ and ٢٠٠٩ seasons.**

| Humic acid treatment | Berry weight (g.) | | | T.S.S. % | | |
|---|---|---|---|---|---|---|
| | ٢٠٠٧ | ٢٠٠٨ | ٢٠٠٩ | ٢٠٠٧ | ٢٠٠٨ | ٢٠٠٩ |
| ١٠٠ % inorganic | ٢.١٨ | ٣.١٣ | ٣.١٠ | ١٨.٥ | ١٨.٨ | ١٨.٧ |
| ٧٥ % inorganic N | ٣.١٠ | ٣.٠٣ | ٣.٠٠ | ١٨.٥ | ١٨.٨ | ١٨.٧ |
| ٧٥ % inorg. + ٢.٥ cm$^{٣}$ Humic | ٣.٢٥ | ٣.٢٠ | ٣.١٦ | ١٩.٠ | ١٩.٤ | ١٩.٠ |
| ٧٥ % inorg. + ٥.٠ cm$^{٣}$ Humic | ٣.٣٢ | ٣.٣٠ | ٣.٢٢ | ١٩.٣ | ١٩.٨ | ١٩.٤ |
| ٧٥ % inorg. + ١٠ cm$^{٣}$ Humic | ٣.٤٠ | ٣.٣٧ | ٣.٣٠ | ١٩.٦ | ٢٠.٢ | ١٩.٨ |
| ٥٠ % inorganic N | ٣.٠٠ | ٢.٩٦ | ٢.٩٢ | ١٨.٥ | ١٨.٨ | ١٨.٦ |
| ٥٠ % inorg. + ٥.٠ cm$^{٣}$ Humic | ٣.٥٠ | ٣.٤٤ | ٣.٣٨ | ٢٠.٠ | ٢٠.٦ | ٢٠.٣ |
| ٥٠ % inorg. + ١٠ cm$^{٣}$ Humic | ٣.٥٦ | ٣.٥٠ | ٣.٤٥ | ٢٠.٤ | ٢١.٠ | ٢٠.٧ |
| ٥٠ % inorg. + ٢٠ cm$^{٣}$ Humic | ٣.٦٢ | ٣.٥٦ | ٣.٥٢ | ٢٠.٩ | ٢١.٤ | ٢١.٢ |
| ٢٥ % inorganic N | ٢.٧١ | ٢.٧١ | ٢.٦٨ | ١٧.٥ | ١٧.٦ | ١٧.٥ |
| ٢٥ % inorg. + ١٠ cm$^{٣}$ Humic | ٢.٨٠ | ٢.٧٧ | ٢.٧٤ | ١٧.٨ | ١٨.٠ | ١٧.٩ |
| ٢٥ % inorg. + ٢٠ cm$^{٣}$ Humic | ٢.٨٦ | ٢.٨٤ | ٢.٨٠ | ١٨.١ | ١٨.٤ | ١٨.٣ |
| ٢٥ % inorg. + ٤٠ cm$^{٣}$ Humic | ٢.٩٢ | ٢.٩٠ | ٢.٨٦ | ١٨.٥ | ١٨.٧ | ١٨.٦ |
| New L.S.D. at ٥ % | ٠.٠٦ | ٠.٠٥ | ٠.٠٥ | ٠.٣ | ٠.٣ | ٠.٣ |
| | Total acidity % | | | Total sugars % | | |
| ١٠٠ % inorganic | ٠.٦٥٠ | ٠.٦٤٠ | ٠.٦٤٢ | ١٦.٨ | ١٧.٠ | ١٧.٠ |
| ٧٥ % inorganic N | ٠.٦٥٠ | ٠.٦٤٠ | ٠.٦٤٢ | ١٦.٨ | ١٧.٠ | ١٧.٠ |
| ٧٥ % inorg. + ٢.٥ cm$^{٣}$ Humic | ٠.٦٣٠ | ٠.٦٢٠ | ٠.٦٢٠ | ١٧.٠ | ١٧.٣ | ١٧.٥ |
| ٧٥ % inorg. + ٥.٠ cm$^{٣}$ Humic | ٠.٦١٠ | ٠.٦٠٠ | ٠.٦٠٠ | ١٧.٣ | ١٧.٦ | ١٧.٧ |
| ٧٥ % inorg. + ١٠ cm$^{٣}$ Humic | ٠.٥٩٠ | ٠.٥٨٠ | ٠.٥٧١ | ١٧.٥ | ١٧.٩ | ١٧.٩ |
| ٥٠ % inorganic N | ٠.٦٥٠ | ٠.٦٤٠ | ٠.٦٤٢ | ١٦.٨ | ١٧.٠ | ١٧.٠ |
| ٥٠ % inorg. + ٥.٠ cm$^{٣}$ Humic | ٠.٥٧٠ | ٠.٥٦٠ | ٠.٥٥٠ | ١٧.٨ | ١٨.٢ | ١٨.١ |
| ٥٠ % inorg. + ١٠ cm$^{٣}$ Humic | ٠.٥٥٠ | ٠.٥٤١ | ٠.٥٣٠ | ١٨.١ | ١٨.٥ | ١٨.٣ |
| ٥٠ % inorg. + ٢٠ cm$^{٣}$ Humic | ٠.٥٣٠ | ٠.٥٢٠ | ٠.٥١٠ | ١٨.٣ | ١٨.٨ | ١٨.٥ |
| ٢٥ % inorganic N | ٠.٧٠٠ | ٠.٧٠١ | ٠.٧٠٤ | ١٦.٠ | ١٦.٠ | ١٦.٢ |
| ٢٥ % inorg. + ١٠ cm$^{٣}$ Humic | ٠.٦٨٥ | ٠.٦٨٠ | ٠.٦٨٢ | ١٦.٢ | ١٦.٣ | ١٦.٥ |
| ٢٥ % inorg. + ٢٠ cm$^{٣}$ Humic | ٠.٦٦٩ | ٠.٦٦٠ | ٠.٦٦٢ | ١٦.٥ | ١٦.٦ | ١٦.٨ |
| ٢٥ % inorg. + ٤٠ cm$^{٣}$ Humic | ٠.٦٥٠ | ٠.٦٤٠ | ٠.٦٤٢ | ١٦.٨ | ١٦.٩ | ١٧.٠ |
| New L.S.D. at ٥ % | ٠.٠١٤ | ٠.٠١٥ | ٠.٠١٥ | ٠.٢ | ٠.٢ | ٠.٢ |

**Table ٥: Effect of humic acid application on juice content of nitrite and nitrate (ppm) as well as soil organic matter and soil pH in Flame seedless vineyard during ٢٠٠٧, ٢٠٠٨ and ٢٠٠٩ seasons.**

| Humic acid treatment | Nitrite (ppm) | | | Nitrate( ppm) | | |
|---|---|---|---|---|---|---|
| | ٢٠٠٧ | ٢٠٠٨ | ٢٠٠٩ | ٢٠٠٧ | ٢٠٠٨ | ٢٠٠٩ |
| ١٠٠ % inorganic | ٢.٥٦ | ٢.٨٠ | ٢.٦٠ | ١٠.٢ | ١١.٠ | ١٢.٠ |
| ٧٥ % inorganic N | ٢.٤٨ | ٢.٧٠ | ٢.٥٠ | ٨.٢ | ١٠.٠ | ٩.٩ |
| ٧٥ % inorg. + ٢.٥ cm$^{٣}$ Humic | ٢.٤٠ | ٢.٥٥ | ٢.٤٠ | ٦.٠ | ٦.٦ | ٧.٠ |
| ٧٥ % inorg. + ٥.٠ cm$^{٣}$ Humic | ٢.٣٠ | ٢.٤٠ | ٢.٢٠ | ٥.١ | ٦.٠ | ٦.٢ |
| ٧٥ % inorg. + ١٠ cm$^{٣}$ Humic | ٢.٢٠ | ٢.٢٥ | ٢.٠٠ | ٤.٠ | ٥.٨ | ٥.٧ |
| ٥٠ % inorganic N | ٢.٠٠ | ٢.٠٥ | ١.٨٠ | ٣.٢ | ٤.٠ | ٤.٢ |
| ٥٠ % inorg. + ٥.٠ cm$^{٣}$ Humic | ١.٩٠ | ١.٨٠ | ١.٧٠ | ٢.٧ | ٣.٠ | ٣.٣ |
| ٥٠ % inorg. + ١٠ cm$^{٣}$ Humic | ١.٥٠ | ١.٦٠ | ١.٥٠ | ٢.٤ | ٢.٧ | ٣.٠ |
| ٥٠ % inorg. + ٢٠ cm$^{٣}$ Humic | ١.٤٠ | ١.٤٠ | ١.١٠ | ٢.٠ | ٢.٢ | ٢.٤ |
| ٢٥ % inorganic N | ١.٣٠ | ١.٢٠ | ١.٠٠ | ١.٦ | ١.٩ | ٢.٠ |
| ٢٥ % inorg. + ١٠ cm$^{٣}$ Humic | ١.١٦ | ١.٠٠ | ٠.٩٢ | ١.٤ | ١.٥ | ١.٨ |
| ٢٥ % inorg. + ٢٠ cm$^{٣}$ Humic | ٠.٩٠ | ٠.٨٢ | ٠.٧١ | ١.٢ | ١.٠ | ١.٥ |
| ٢٥ % inorg. + ٤٠ cm$^{٣}$ Humic | ٠.٧١ | ٠.٦٤ | ٠.٦٠ | ١.٠ | ١.٠ | ٠.٩ |
| New L.S.D. at ٥ % | ٠.٠٦ | ٠.٠٨ | ٠.٠٧ | ٠.٧ | ١.٠ | ١.١ |
| | O.M. % | | | Soil pH | | |
| ١٠٠ % inorganic | ١.٥٠ | ١.٥٢ | ١.٥٣ | ٧.٩٠ | ٧.٨٠ | ٧.٧١ |
| ٧٥ % inorganic N | ١.٥٠ | ١.٥٢ | ١.٥٤ | ٧.٩١ | ٧.٨١ | ٧.٧٣ |
| ٧٥ % inorg. + ٢.٥ cm$^{٣}$ Humic | ١.٦٠ | ١.٥٨ | ١.٦١ | ٧.٨٨ | ٧.٨٠ | ٧.٧٠ |
| ٧٥ % inorg. + ٥.٠ cm$^{٣}$ Humic | ١.٦٩ | ١.٦٤ | ١.٧٠ | ٧.٨٢ | ٧.٧٧ | ٧.٦٧ |
| ٧٥ % inorg. + ١٠ cm$^{٣}$ Humic | ١.٧٤ | ١.٧٠ | ١.٧٦ | ٧.٨٠ | ٧.٧٥ | ٧.٦٥ |
| ٥٠ % inorganic N | ١.٥٠ | ١.٥٢ | ١.٥٤ | ٧.٩١ | ٧.٨٠ | ٧.٧١ |
| ٥٠ % inorg. + ٥.٠ cm$^{٣}$ Humic | ١.٧٧ | ١.٧٦ | ١.٨٣ | ٧.٧٧ | ٧.٧٢ | ٧.٦٣ |
| ٥٠ % inorg. + ١٠ cm$^{٣}$ Humic | ١.٨١ | ١.٨٢ | ١.٩٠ | ٧.٧٧ | ٧.٧٠ | ٧.٦٠ |
| ٥٠ % inorg. + ٢٠ cm$^{٣}$ Humic | ١.٨٧ | ١.٨٧ | ١.٩٧ | ٧.٧٢ | ٧.٦٨ | ٧.٥٨ |
| ٢٥ % inorganic N | ١.٥٠ | ١.٥٢ | ١.٥٤ | ٧.٩١ | ٧.٨١ | ٧.٧٢ |
| ٢٥ % inorg. + ١٠ cm$^{٣}$ Humic | ١.٩٢ | ١.٩٢ | ١.٩٩ | ٧.٧١ | ٧.٦٦ | ٧.٥٥ |
| ٢٥ % inorg. + ٢٠ cm$^{٣}$ Humic | ١.٩٦ | ١.٩٧ | ١.٩٩ | ٧.٧٠ | ٧.٦٤ | ٧.٥٢ |
| ٢٥ % inorg. + ٤٠ cm$^{٣}$ Humic | ١.٩٨ | ١.٩٧ | ١.٩٩ | ٧.٧٠ | ٧.٦٢ | ٧.٥٠ |
| New L.S.D. at ٥ % | ٠.٠٤ | ٠.٠٥ | ٠.٠٦ | - | - | - |

These results were true during the three seasons. The results are in agreement with those obtained by Kose and Guleryuz (١٩٩٩); Kabeel *et al.,* (٢٠٠٨) and Abada (٢٠٠٩).

**٥- Soil fertility:**

It is clear from the data in Tables ٥ and ٦ that the application of humic acid beside inorganic N significantly improved soil fertility at the end of each season, in terms of increasing organic matter as well as soil content of N, P and K and in reducing electrical conductivity and soil pH. The promotion on soil fertility was associated with reducing the amount of inorganic N from ١٠٠ to ٢٥٪ and at the same time increasing the amount of humic acid from ٢.٥ to ٤٠ cm٣/ vine. Using ٤٠ cm٣ humic acid vine along with inorganic N at ٢٥٪ of the suitable N gave the best results with regard to soil fertility.

Fertilizing the vines with the suitable N through ١٠٠٪ inorganic without humic acid gave unfavourable effects on soil fertility. The results of soil analysis after the end of each season were the same. Mengel (١٩٨٤) and Nijjar (١٩٨٥) reported the beneficial effect of humic acid on soil fertility.

The positive effects of humic acid on growth, vine nutritional status and fruiting of Flame seedless grapevine might be attributed to its essential role in enhancing soil fertility in terms of increasing organic matter, microbial activity, water holding capacity and the availability of different nutrients as well as reducing soil pH and electrical conductivity (El-Shenawy and Stino ٢٠٠٥ a and b).

As a conclusion, fertilizing Flame seedless grapevines grown in sandy soil with the suitable N (٨٠ g /vine) through ٥٠٪ inorganic N plus humic acid at ٢٠ cm٣ /vine is recommended for improving both soil fertility and productivity of the vines.

**Table ٦: Effect of humic acid application on E.C.(mmhos/١cm/٢٥$^{o}$C), percentages of N, P and K in the soil in Flame seedless vineyard during ٢٠٠٧, ٢٠٠٨ and ٢٠٠٩ seasons.**

| Humic acid treatment | Soil E.C (mmhos/١cm/ ٢٥$^{o}$C) | | | Soil N % | | |
|---|---|---|---|---|---|---|
| | ٢٠٠٧ | ٢٠٠٨ | ٢٠٠٩ | ٢٠٠٧ | ٢٠٠٨ | ٢٠٠٩ |
| ١٠٠ % inorganic | ١.١٠ | ١.٠٨ | ١.٠٨ | ٠.٠٩ | ٠.١٠ | ٠.١٠ |
| ٧٥ % inorganic N | ١.١٠ | ١.٠٧ | ١.٠٧ | ٠.٠٩ | ٠.١٠ | ٠.١٠ |
| ٧٥ % inorg. + ٢.٥ cm$^{٣}$ Humic | ١.٠٧ | ١.٠٣ | ١.٠٣ | ٠.١١ | ٠.١٢ | ٠.١٢ |
| ٧٥ % inorg. + ٥.٠ cm$^{٣}$ Humic | ١.٠٤ | ٠.٩٩ | ١.٠٠ | ٠.١١ | ٠.١٤ | ٠.١٢ |
| ٧٥ % inorg. + ١٠ cm$^{٣}$ Humic | ١.٠١ | ٠.٩٦ | ١.٠٠ | ٠.١٢ | ٠.١٤ | ٠.١٢ |
| ٥٠ % inorganic N | ١.١٠ | ١.٠٧ | ١.٠٧ | ٠.٠٩ | ٠.١١ | ٠.١١ |
| ٥٠ % inorg. + ٥.٠ cm$^{٣}$ Humic | ٠.٩٩ | ٠.٩٢ | ٠.٩٦ | ٠.١٣ | ٠.١٤ | ٠.١٢ |
| ٥٠ % inorg. + ١٠ cm$^{٣}$ Humic | ٠.٩٧ | ٠.٩٠ | ٠.٩٣ | ٠.١٣ | ٠.١٤ | ٠.١٣ |
| ٥٠ % inorg. + ٢٠ cm$^{٣}$ Humic | ٠.٩٤ | ٠.٨٧ | ٠.٩٣ | ٠.١٣ | ٠.١٤ | ٠.١٤ |
| ٢٥ % inorganic N | ١.١٠ | ١.٠٧ | ١.٠٧ | ٠.٠٩ | ٠.١١ | ٠.١١ |
| ٢٥ % inorg. + ١٠ cm$^{٣}$ Humic | ٠.٩٢ | ٠.٨٦ | ٠.٩٠ | ٠.١٣ | ٠.١٤ | ٠.١٤ |
| ٢٥ % inorg. + ٢٠ cm$^{٣}$ Humic | ٠.٩٠ | ٠.٨٦ | ٠.٨٧ | ٠.١٣ | ٠.١٤ | ٠.١٤ |
| ٢٥ % inorg. + ٤٠ cm$^{٣}$ Humic | ٠.٩٠ | ٠.٨٦ | ٠.٨٧ | ٠.١٣ | ٠.١٤ | ٠.١٤ |
| New L.S.D. at ٥ % | ٠.٠٢ | ٠.٠٣ | ٠.٠٣ | ٠.٥ | ٠.٠٢ | ٠.٠٢ |
| | Soil P (ppm) | | | Soil K (ppm) | | |
| ١٠٠ % inorganic | ٣.٥٠ | ٣.٥٠ | ٣.٥١ | ٥١.٠ | ٥١.٢ | ٥١.٠ |
| ٧٥ % inorganic N | ٣.٥١ | ٣.٥١ | ٣.٥٢ | ٥١.٠ | ٥١.٥ | ٥١.٠ |
| ٧٥ % inorg. + ٢.٥ cm$^{٣}$ Humic | ٣.٩٥ | ٣.٩٥ | ٤.٠٠ | ٥١.٦ | ٥٢.٠ | ٥١.٤ |
| ٧٥ % inorg. + ٥.٠ cm$^{٣}$ Humic | ٣.٩٥ | ٣.٩٥ | ٤.١١ | ٥٢.٣ | ٥٢.٦ | ٥١.٨ |
| ٧٥ % inorg. + ١٠ cm$^{٣}$ Humic | ٣.٩٣ | ٣.٩٥ | ٤.١١ | ٥٣.٠ | ٥٣.٢ | ٥٢.٣ |
| ٥٠ % inorganic N | ٣.٥٠ | ٣.٥٠ | ٣.٥٢ | ٥١.٠ | ٥١.٥ | ٥١.٠ |
| ٥٠ % inorg. + ٥.٠ cm$^{٣}$ Humic | ٣.٩٣ | ٣.٩٦ | ٤.٢٠ | ٥٣.٦ | ٥٤.٠ | ٥٣.٠ |
| ٥٠ % inorg. + ١٠ cm$^{٣}$ Humic | ٣.٩٥ | ٣.٩٧ | ٤.٣٠ | ٥٤.٠ | ٥٤.٥ | ٥٣.٤ |
| ٥٠ % inorg. + ٢٠ cm$^{٣}$ Humic | ٣.٩٥ | ٣.٩٥ | ٤.٤٩ | ٥٤.٠ | ٥٥.١ | ٥٤.٠ |
| ٢٥ % inorganic N | ٣.٥٠ | ٣.٥٥ | ٣.٥٥ | ٥١.٢ | ٥١.٥ | ٥١.٠ |
| ٢٥ % inorg. + ١٠ cm$^{٣}$ Humic | ٣.٩٥ | ٣.٩٥ | ٤.٦٢ | ٥٤.٢ | ٥.٢ | ٥٤.٥ |
| ٢٥ % inorg. + ٢٠ cm$^{٣}$ Humic | ٣.٩٥ | ٣.٩٥ | ٤.٧١ | ٥٤.٢ | ٥٥.٣ | ٥٥.٠ |
| ٢٥ % inorg. + ٤٠ cm$^{٣}$ Humic | ٣.٩٦ | ٣.٩٥ | ٤.٨٠ | ٥٤.٠ | ٥٥.٩ | ٥٥.٧ |

| | | | | | | |
|---|---|---|---|---|---|---|
| New L.S.D. at ٥ % | ٠.١٤ | ٠.١٤ | ٠.٢٠ | ٠.٤ | ٠.٥ | ٠.٣ |

## REFERENCES

**Abada, M.A.M. (٢٠٠٩):** Reducing' the amount of inorganic N fertilizers in Superior grape vineyard by using organic and biofertilizers and humic acid. Egypt. J. Agric. Res., ٨٧ (١): ١٧-٣٤٤.

**Abd E١-aal, A.H.; Basma- Selim, M. and Ghada- Shaker, Sh.(٢٠٠٧):** Response of Superior grapevines to application of filter mud, compost El- Nile and green manure. J. Agric. Sci. Mansoura Univ. ٣٢ (١٢): ١٠٣٠٠-١٠٣٠٩.

**Abd El- Ghafar- Gehan, E. (٢٠٠٢):** Effect of some organic nitrogen fertilizers on growth and productivity of Red Roomy grapevines *(Vitis vinifera L.).* M. Sc Thesis, Fac. of Agric. Minia Univ.

**Abd El- Hameed, H.M. and Rabea, M. ( ٢٠٠٥):** Adjusting the best proportion of mineral, organic and biofertilizers for Superior grapevines. Minia ٣. Agric. Res. & Develop ٢٥(٥) : ٨٦٣-٨٨٢.

**Ahmed, A.M; EI-Sayed, H.A. and Shoeib, M. M. (٢٠٠٣):** 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. of Agric. Res. & Develop. ٢٣(٣): ٥٢٩-٥٤٦.

**Ahmed, F.F. and Morsy, M.H. (١٩٩٩):** A new method of measuring leaf area in different fruit species. Minia. J., Agric. Res. & Dev. ١٩:٩٩:١٠٥.

**Ahmed F.F., A. H. Abd El- Elaal and Ali- Mervet, A. (٢٠٠٠):** A comparative study for using farmyard manure and filter mud on Flame seedless grapevines in sandy soils. The ٢nd Scientific Conferences of Agricultural Sciences, Assiut, Oct, ٢٨ -٣٠ Vol. ١: ٢٧٧-٢٨٤.

**Ahmed F.F., Ragab, M.A. and Mansour, A.E.M. (١٩٩٦):** A comparative study on the effects of farmyard manure and filter mud for Red Roomy grapevines ( *Vits vinifera L.).* The first Egyptian Hungarian Hort. Conf. Kafr El- Shaikh, Egypt ١٥-١٧ Sept. ١٩٩٦, ١٠-٢٠.

**Association of Official Agricultural Chemists (١٩٩٥):** Official Methods of Analysis (A.O.A.C.) ١٤th Benjamin Franklin Station, Washington D.C. U.S.A. pp. ٤٩٠-٥١٠.

**Balo, E., G. Prileszky, Happ, L.; Kaholam, M. and Vego, L. (١٩٨٨):** Soil improvement, and the use of leaf analysis for forecasting nutrient requirements of grapes. Potash Rev. subject ٩, ٢nd suite, No.٦١.

**Chapman, H.D. and Pratt, P.F. (١٩٧٨):** Methods and Analysis of Soils, Plants and Water. Univ. Calif. Div. Agr. Sci., Berkely, P.٣٠٩.

**Conradie, W.J. (٢٠٠١):** Timing of nitrogen fertilization and effect of poultry manure on the performance of grapevine on yield and vegetative growth. South African J. of Enol. and Vitic. ٢٢(٢):٥٣- ٥٩.

**Dahama, A.K. (١٩٩٩):** Organic farming for sustainable Agriculture. Agro Botanic, Daryagun, New Delhi, India, p. ٢٥٨.

**Darwish, O.H.; Persaud, N. and Martens, P.C. (١٩٩٥):** Effect of long term application of animal manure on physical properties of three soils. Plant and Soil ١٧٦: ٢٨٩-٢٩٥.

**Davis, G. and Ghabbour, E.A. (١٩٩٨):** Humic substances, structure properties and uses. Royal Soc. of Chemistry, Cambridge pp. ١٠-١٥.

**Dobrie A., Lava, G.H.; Olimpia, F. and Rodica, D. (٢٠٠١):** The influence of chemical and organic fertilizers on the fertility and productivity of some table grape varieties. Cerceteri stiinnte Universtitatea de Stiinnte Agricola SiMedicina veterinary a Banatulur. Timisoara ٢٣-٢٨

**El- Hamady, A.M.; Abdo- Hamid, N.; Omer, A.H. and Farag, S.G. (٢٠٠٥):** Minimizing mineral fertilizers in grapevine farms to reduce chemical residuals in grapes. J. Envn. Sci. Vol. ١١(٤)): ٩٩-١٢٢.

**El- Khafagy H.A. (٢٠٠٦):** Effect of some organic and biofertilizer treatments on growth and productivity of Thompson seedless grapevines in reclaimed areas. M. Sc. Thesis Fac. of Agric., Minia Univ., Egypt.

**El- Shenawy, I.E. and Stino, R.G (٢٠٠٥a):** Evaluation of the conventional to organic and biofertilizers on "Crimson seedless grapevines" in comparison with chemical fertilizers "yield and fruit quality". Egypt. J. Appl. Set; ٢٠(١). Pp (١٩٢-٢١١).

**El- Shenawy, I.E. and Stino, R.G (٢٠٠٥b):** Evaluation of the conventional to organic and biofertilizers -on "Crimson seedless grapevines" comparison with chemical fertilizers "Vegetative growth and nutritional status". Egypt. J. Appl.Sci, ٢٠ (١). ٢١٢٢٢٥ pp.

**Ezz, Thanaa, M. (٢٠٠٠):** Response of Thompson seedless grapevines grown in calcareous soil to organic fertilizer " Bio treasure" and cattle manure application. Alex. Univ., (EGY), Fac. of Agric., ١٠ (١-٣): ٦٣١-٦٣٤.

**Gad El- Kareem, M.A. (٢٠٠٩):** Response of Swelling and Florida Prince peach trees to application of some res-breaking chemicals as well as organic and biofertilization under- Sohag conditions Ph. **D.** Thesis Fac. of Agric. Minia Univ. Egypt.

**Gaffney IS., Marley, N.A. and Clark, S.B.** (١٩٩٦): Humic and Fulvic acids isolation Structure and Environmental Role. Amer. Chemical Soc. Symposium Series pp. ٦٥.

**Gobara A.A., Ahmed, F.F.; Ragab, M.A. and Kamel, M.Kh. (٢٠٠٢):** Effect of Insiabine and Agrolig on growth, yield and fruit quality of Flame seedless grapevines. First Egyptian & Syrian Conf, titled as Agriculture and nutrition in the Arab world. Drawbacks and Future prospects, ٨-١١ Dec. Minia Univ. Egypt.

**Hayes M. H.B. and Wilson, W.S. (١٩٩٧):** Humic substances, pests and sludges, Health and Environmental Aspects Royal Soc. of Chemistry, Cambridge pp.٧٣.

**Kabeel H., Abd El- Latif, F.M. and Basa, M.S.A. (٢٠٠٨):** Growth, fruiting and nutritional status of le- Conte pear trees in response to mineral and humate fertilizers. Annals of Agric. Sc. Moshtohor Vol. ٤٦(٢), ١٣٩-١٥٦.

**Kamel, M. Kh. (٢٠٠٢):** Physiological studies on pruning and fertilization of Flame seedless grapevines *(Vitis vinifera L.)* Ph. D. Thesis . Fac. of Agric. Minia Univ.

**Kassem, H.A. and Marzouk, H.A. (٢٠٠٢):** Effect of organic and/ or mineral nitrogen fertilization on the nutritional status, yield and fruit quality of Flame seedless grapevines grown in calcareous soils. J. Adv. Agric. Res., ٧ (٣): ١١٧-١٢٦.

**Kose, C. and Guleryuz, M (١٩٩٩):** Effects of some organic biostimulants on the quality of table grapes. Dorddrecht, Netherlands Academic publishers (٢١٥- ٢١٨) , Turkey.

**Krajnc, M. (٢٠٠٠):** The effect of various organic manures on the growth and development of graft of the first year of planting of Laski. Riesling. PSAD, Revija Ze Sadarstvo Vinogradnistvo in Vinarstvo ١١(٣)- ٣٩-٣١.

**Masoud, S.E.Y. (٢٠٠٨):** Attempts for alleviating the adverse effects of soil salinity on growth and fruiting of Superior grapevines. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.

**Mengel, K. (١٩٨٤):** Nutrition and Metabolism of plants. Fisher Verlage Stutgart and New York, pp,. ١٠- ٣٠.

**Mengel, K. and Kirkby, E.A. (١٩٨٢):** Principles of Plant Nutrition, publisher International Potash Institute, Worblaufen- Bern. Switzerland, pp.١ ٥٩٣ and ٦٥٥.

**Miller R.W., Donahue, R. L. and Miller, J.U. (١٩٩٠):** Soils, An Introduction to Soil and Plant Growth. Prentice Hall. Inter Englewood Cliffs, New Jersy, ٣٠٨-٣٣٩.

**Nijjar, G.S. (١٩٨٥):** Nutrition of Fruit Tress. Kalyani Publishers New Delhi-Ludhiana Mrs. Usha Raj. Kumarp. ١-٣٢٠.

**Omar, A.H. (٢٠٠٥):** Fertilization of Thompson seedless vines with mineral and organic sources of nitrogen. J. Agric. Sci. Mansoura Univ., ٣٠ (١٢): ٧٨٥٥-٧٨٦٢.

**Omar, A.H. and Abd El-aal, A.H. (٢٠٠٥):** Influence of sulphuric acid, humic acid, sulphur and irrigation water on growth and productivity of Superior seedless vines grown under saline conditions. J. Agric. Sci. Mansoura Univ., ٣٠ (١١): ٦٩٥١-٦٩٦١.

**Page A.L., Miller, R.H. and Keeney, D.R. (١٩٨٢):** Methods of Soil Analysis. Part ٢, edition. Agronomy ser No-٩ Ameri, Soci. of Agronomy Madison, Wisconsin, U.S.A. ٥٩٥-٦٢٢.

**Piper, C.S. (١٩٥٠):** Soil and Plant Analysis. Inter. Sci. New Delhi pp. ٤٨- ١١٠.

**Ragab, M.A. and Mohamed, G.A. (١٩٩٩):** Effect of some organic and nitrogen fertilization treatments on Flame seedless grapevines. Minia J. of Agric. Res. & Develop., ١٩- ٢٧-٤٣.

**Ridnour- Lisa A., Sim- Julia E., Michael, A.H. David, A.W. Sean M.M., Garry R.P. and Douglas, R.S. (٢٠٠٠):** A spectrophotometric method for the direct and quantitation of Nitric oxide, Nitrite and Nitrate in cell culture Media. Analytical Biochemistry, ٢٨١, ٢٢٣- ٢٢٩.

**Salama, A.S.M.(٢٠٠٢):** Response of some fruit species transplants and trees to organic fertilization. Ph. D. Dissertation, Fac. Agric. Moshtohor Zagazig Univ. Benha Univ.

**Saleh, M.M.S.; El- Ashry, S. and Gomaa, A.M. (٢٠٠٦):** Performance of Thompson seedless grapevines as influenced by organic fertilizer Humic acid and biofertilizers under sandy soil conditions. Res. J. of Agric. and Biological Sci., ٢ (٦): ٤٦٧-٧٤١.

**Snedecor, G. W. and Cochran, G.W. (١٩٦٧):** Statistical Methods ٦''' Ed-Iowa state, Univ. Press, U.S.A. pp. ٦٠- ٧٠.

**Stevenson, F.J. (١٩٨٢):** Humic chemistry, Genesis, composition, Reactions ٢nd Ed., "Wily, New York.

**Vercesi, A. (٢٠٠٠):** Soil and foliar applied organic fertilizers in Viticulture. Informatore Agrario ٥٦ (٦): ٨٣- ٨٩ Italy.

**Wilde, S.A.; Corye, R.B. Layer, J.G and Voigt, G.K. (١٩٨٥):** Soil and Plant Analysis for tree culture. Mohan Primlani & Oxford & IBH publishing Co New Delhi. ٤٤- ١٠٥.

**Zachariakis M.; Tzorakakis, E.; Kritsotkis, I.; Siminis, C.I.; Manio, V.; Bachar, C. (ed.); Stentiford, E. (ed.) and Lopez Real, J. (٢٠٠١):** Humic substances stimulate plant growth and nutrient accumulation in grape rootstock. Proceedings of the International Symposium on Composting of Organic Matter, Acta. Hort. No. ٥٤٩:١٣١- ١٢٦.

**Application of humic acid to flame seedless grapevines in sandy soil**

# تحسين خصوبة التربة وإنتاجية كرمات العنب الفلام سيدلس النامية فى التربة الرملية باستخدام حامض الهيوميك

**حسن محمد عبد الحميد – أحمد محمد أحمد**

قسم الفاكهة بمعهد بحوث البساتين وقسم بحوث الأراضي والمياه والبيئة – مركز البحوث الزراعية– الجيزة– مصر

**تم تسميد كرمات العنب الفليم سيدلس النامية فى التربة الرملية بالكمية المناسبة من النيتروجين ( ٨٠ جرام / الكرمة) من خلال ٢٥ الى ١٠٠% صورة غير عضوية بدون او مع حامض الهيوميك بمعدل ما بين ٢.٥ الى ٤٠سم³ / كرمة كمحاولة لتحسين خصوبة التربة الرملية ، والحالة الغذائية للكرمات وإنتاجية الكرمات ، ولقد تركزت الدراسة على تقليل كمية النيتروجين الغير عضوى جزئيا عن طريق استخدام حامض الهيوميك وذلك لتقليل تلوث الحبات بالنتريت والنترات.**

**أشارت نتائج الدراسة أن تقليل كمية النيتروجين الغير عضوى من ١٠٠ الى ٥٠% من الكمية الموصى بها من النيتروجين وفى نفس الوقت زيادة كمية حامض الهيوميك المستخدمة من ٢.٥ الى ٤٠سم لكل كرمة كان مصحوبا بتحسين خصوبة التربة، النمو، النسب المئوية للنيتروجين والفوسفور والبوتاسيوم وكمية المحصول والخصائص الطبيعية والكيميائية للثمار أدى تقليل الكمية المستخدمة من النيتروجين الغير عضوى من ٥٠ الى ٢٥% من الكمية الموصى بها حتى مع استخدام حامض الهيوميك الى آثار غير مرغوبة على الصفات تحت الدراسة وكان الاستخدام المشترك للنيتروجين الغير عضوى مع حامض الهيوميك مفضلا عن استخدام النيتروجين الغير عضوى فقط فى هذا الصدد**

**أمكن الحصول على أفضل النتائج بخصوص خصوبة التربة والحالة الغذائية للكرمات والإنتاجية لكرمات العنب الفليم سيدلس النامى فى التربة الرملية عند تسميد الكرمات بالنيتروجين بمعدل ٨٠ جرام للكرمة على أساس ٥٠% ، فى الصورة الغير عضوية مع حامض الهيوميك بمعدل ٢٠سم³ / الكرمة وهذه المعاملة تقلل كثيرا من محتوى عصير الحبات من النيتريت والنترات.**