Minia J. of Agric. Res. & Develop.
Vol. (٣١) No. ٣ pp ٤٢١-٤٣٤,
٢٠١١

FACULTY OF AGRICULTURE

THE EFFECT OF NITROGEN ALTERNATIVE SOURCES ON GROWTH, YIELD AND QUALITY OF JEW'S MALLOW (*Corchorus olitorius* L.)

N. A. Mohammad* and A. G. Haridi**
*Hort. Dept., Fac. of Agric., Al-Azhar University, Assiut branch, Assiut, Egypt
** Hort. Dept., Fac. of Agric., Assiut University, Assiut, Egypt.

Received ٢٠ Dec. ٢٠١١ Accepted ٢٩ Dec. ٢٠١١

ABSTRACT

The present study was conducted in a clay soil at the Experimental Farm, Faculty of Agriculture, Al-Azhar University, Assiut branch, Assiut, Egypt, during planting summer of ٢٠١٠ and ٢٠١١, to investigate the effect of two alternatives sources of nitrogen on growth, yield and quality of *Corchorus olitorius*. The nitrogen sourses were ammonium nitrate, effective microorganisms (EM) and nitrobein (*Azospirillium sp. a*nd *Azotobacter sp*). The EM was added either to the soil or sprayed at the plants.

The results indicated that using both EM and nitrobein treatment gave the highest value of plant stem weight, plant fresh weight and leaves fresh weight in both seasons. Further of application EM to soil gave better results than spraying the plants. On the other hand, at market maturity carotene (g/١٠٠ FW), nitrate (mg/kg DW) and vitamin C (mg/١٠٠ g FW) increased using Nitrobein and spraying plants by EM. Increasing nitrate

level is of particular interest to researchers because of its effects on health.

Effect of N sources yield and quality of jew's mallow

INTRODUCTION

Jew's Mallow (*Corchorus olitorus*) belongs to family, *Tilliaceae* is one of the most popular vegetables in Egypt. It is one of the major leafy vegetable, widely grown and utilized as pot–herb (Akoroda and Akintabi, ١٩٨٧) .The leaves are cooked into a thick viscous soup added to stews.

Corchorus olitorus contained on average per ١٠٠-g fresh leaves, ٨٥ - ٨٧ g H_2O, ٥ – ٦ g protein, ٠.٧ g oil, ٥ g carbohydrate, ١ – ٥ g fiber, ٢٥٠- ٢٦٦ mg Ca, ٤ – ٨ mg Iron, ٣٠٠٠ iu vitamin A potency, ٠.١ mg thiamine, ٠.٣ mg riboflavin, ١٥ mg nicotinamide and ٥٣ – ١٠٠ mg ascorbic acid (as reported by Oke, ١٩٦٨).

Nutrition value is an important aspect of cropping system and this includes adequate supply of essential nutrients like nitrogen (N) , phosphorus (P), potassium (K), Magnesium (Mg), Calcium (Ca), etc to the plant. The availability of these nutrients to plant contributes to its growth and yield. Too much nitrogen in the soil may result in excessive vegetative growth in the leafy vegetables yield. Therefore adequate amount of nutrients need to be supplied to plant at the right quantity and also at the right time to favor the growth.

The effective Microorganisms product (EM), known to contain about ٦٠ active and useful organisms including photosynthetic bacteria, lactic acid bacteria , yeast and others. It was mentioned that EM reduce the amount of agro-chemicals. It gives earlier crop, hastens seed germination and seedling, growth improves the quantity and quality of the yield and increases soil fertility. (Unknown)

The EM technology depends on using a liquid culture. It was used in agriculture through spraying, and then with EM compost. This technology has shown beneficial effects on many aspects of the environment, agricultural crops. It leads to improvement of soil nutritional status, physical, chemical and microbiological properties, helping crops to grow healthy and strong. The results was so promising to the point that it could be said that there is no more need to use chemical and pesticides. It helps the farmer maintain an eco-friendly system, minimizing the damage to natural cycles (Correa, ٢٠٠١).

Nitrogen is an important element for Jews Mallow production. Many studies revealed that the application of chemical N fertilizers exhibited much significance for maintaining high yield. However, the chemical N fertilizers are not only a costly input, but also a polluting to agro-ecosystem. Protection of the environment with the sustainability of the soil and agro-ecosystem should gain as much concern as maintains of high yield. Therefore, there is a current trend, at the local as well as the global scale, to reduce the use of chemical N fertilizers with keeping high crop productivity at the same time (El-Aggory et al., ١٩٩٦). On the way to achieve such valuable goal, bio-N fertilizers (Nitrobein) drew the attention as partial good alternative to substitute the chemical N fertilizers through serving as a safe effective, source N requirement as about ٢٥ %, increases the availability of nutrient elements, reduces the environmental pollution, economical source of nitrogen and improves the potential yield (Bohiool et al., ١٩٩٢ and Saber, ١٩٩٣;). Bio-fertilizers including microbial inoculations are capable of enhancing soil fertility, increase crop's fertilizer use efficiency consequently crop growth and yield (El-Naggar *et al.*, ٢٠٠٥). Therefore, the present investigation was designed to study the effect of bio-N fertilization treatments combined with EM substance on growth and quality of Jews Mallow Egyptian cultivar.

MATERIALS AND METHODS

The present study was conducted in a clay soil at the Experimental Farm, Faculty of Agriculture, Al-Azhar University, Assiut Branch, Assiut, Egypt, during summer planting season of ٢٠١٠ and ٢٠١١, to investigate the effect of nitrogen and two alternative sources on growth, yield and quality parameters of *Corchorus olitorius*. These nitrogen sources were:

A) - Ammonium nitrate (٣٣.٥٪ nitrogen), at ١٠٠ kg/feddan.

b) - Nitrobein (*Azospirillium sp. a*nd *Azotobacter sp*). (Center of vital nutrients – Ain shams University), at ٢٥٠ g/feddan.

c) - EM (Effective Microorganisms).(Center of vital nutrients – Al-Minia University), at ٥ Liter/feddan.

Effect of N sources yield and quality of jew's mallow

Before sowing, soil samples for the experimental site were taken and analyzed at the soil-testing laboratory, Faculty of Agric., Al-Azhar Univ., Assiut. Results of some physical and chemical characteristics of experimental soil site are presented in Table ١.

Table ١: Mean of some physical and chemical properties of the experimental site.

Partial size distribution, %				pH	E.Ce (ds/m)	$CaCO_3$ g/kg^{-1}	Water soluble Ions (meq/L) in the soil paste							Available nutrients (mg/kg^{-1})		
Sand	Silt	Clay	Texture				CO_3 + HCO_3	Cl -	SO_4 $^{2-}$	Ca $^{+2}$	Mg $^{+2}$	Na +	K	N	P	K
٢٥.٥	٣٩.٨	٣٤.٧	Clay loam	٧.٩	١.٢	٢.٧	٢.٩	٢.٢	٦.٦	٣.٤	١.٩	٦.٢	٠.٢١	٦٢.٤	٩.٢	٣٥٦

The listed fertilizer treatments, in both seasons were as follows:

١- Ammonium nitrate (٣٣.٥٪ nitrogen).
٢- Nitrobein: mixed with the soil.
٣- EM: was mixed with the soil
٤- EM: sprayed on the leaves.
٥- Nitrobein (mixed with the soil) + EM (mixed with the soil)
٦- Nitrobein (mixed with the soil) + EM (sprayed on the leaves).

Before planting, the seeds were dipped in water at ٩٧°C for ٥ seconds to improve seed germination and seedling emergence (Oladiran, ١٩٨٦). Seeds were sown on the ٥th, March for summer plantings of both ٢٠١٠ and ٢٠١١ seasons.

A randomized complete block design was used with three replicates. Area of each plots, was ١٠.٥m. During the growing season,

plots were subjected to normal cultural practices for irrigation, hand-weeding and pest control).

Growth, yield and quality parameters collected by using plants from ٠.٥ m^2 in the middle of each plot after ٤٥ days from sowing. The response of *Corchorus olitorius* to fertilizer treatments parameters were, number of leaves per plant, fresh weight/plant gm, weight of stems, fresh weight of leaves gm, and % moisture in the plant, total fresh yield /Fed kg and total dry yield/Fed kg. Also, β-carotene (g/١٠٠ g FW), Vitamin C (mg/١٠٠ g FW) and Nitrate (mg/kg DW) at the marketable stage were determined.

Chemical analysis

Nitrate content in samples was determined by the calorimetric method described Sjoberg and Alanko, (١٩٩٤)

Ascorbic acid content was determined by ٢, ٦-dichlorophenol indophenols method (Eleri and Hughes, ١٩٨٣). Carotene content was determined by ethanol and petroleum ether extraction method as described by Musa *et al* (٢٠١٠) as follow.

- ٢.٠ grams of Na_2SO_4 was added to ١٠.٠g of vegetable leaves and ground in a mortar with pestle.
- The ground leaves were extracted with ١٠٠ cm^3 of hot ٩٥٪ ethanol for ٣٠ min in hot water bath.
- The extract obtained was filtered and was added to the extract to bring the percentage of the ethanol extract to ٨٥٪.
- The ٨٥٪ ethanol extract was cooled in a cold water bath for few minutes.
- After cooling, the ethanol extract was put in a separating funnel and ٣٠ cm^2 of petroleum ether was added and the mixture shaken.
- The separating funnel was clamped to the retort stand for some time to allow the solution to settle down into layers.
- The bottom layer containing ethanol was collected into the beaker while the top layer of the petroleum ether was stored in ٢٥٠ cm^3 conical flask.

- The ethanol layer in the beaker was re-extracted twice with ١٠ cm^3 of petroleum ether.
- The ether layers from the re-extraction was added to the original petroleum extract in the conical flask and re-extracted with ٥٠ cm^3 of ٨٥٪ ethanol in order to remove any xanthophylls which may be present.
- The top petroleum ether layer which contained carotene was collected, measured and the volume noted. Lastly, the optical density (OD) of the final petroleum ether extract was determined at wave length of ٤٥٠ nm with spectrophotometer using petroleum ether as blank. The concentration of β-carotene was calculated as follow:

  $A = E\% \times C \times l$

  Where, A = absorbance of the sample; E% = extinction coefficient of carotene; l = path length (usually ١.٠ cm).

Statistical analysis

All obtained data were statistically analyzed according to Gomez and Gomez (١٩٨٤). The Duncan's Multiple Range Test at ٥٪ level was used for testing the significance of the differences among the mean values.

RESULTS AND DISCUSSION

Effect of the studied treatments on growth, yield and quality characteristics.

Data in Table ٢ show the effect of adding Nitrobein or EM substance on number leaves in Jews Mallow. The data indicated that treatment No. ٥ (Nitrobein mixed with the soil + EM mixed with the soil) gave the highest leaves number in both seasons. Spraying EM only produced the lowest leaves number in both seasons. Adding nitrobein to plants in addition to EM gave better results than EM alone. Spraying plants with EM improved leaves number than other treatments.

Table ٢: The effect of a different sources of nitrogen on leaves number/plant of (*Corchorus olitorius* L.).

Season	Nitrobein addition	Ammoniu m nitrate	EM treatments	
			soil	spry
٢٠١٠	Without nitrobein	١٢.٠٠ bc	١٤.٦٧ ab	١٠.٣٣ c
	nitrobein	١١.٨٣ bc	١٤.٣٣ ab	١٦.١٧ a
٢٠١١	Without nitrobein	١٢.٠٠ bc	١٤.٨٧ b	١٠.٧٠ c
	nitrobein	١٢.٨٠ bc	١٣.٩٧ bc	١٩.٤٧ a

Tables ٣, ٤ and ٥ show the effect of tested treatments on plant stem weight (gm), leaves fresh weight (gm) and plant fresh weight (gm). The data indicated that nitrobin plus EM infested soil treatment gave the highest value of the plant stem weight and leaves fresh weight in both seasons. Also, this treatment as well as EM spraying treatment gave the highest value of plant fresh weight. On the other hand, using nitrobin treatment resulted in producing the lowest value of plant stem weight and plant fresh weight in both seasons. While, ammonium nitrate treatment gave the lowest valu of fresh leaves weight in both seasons.

Table ٣: The effect of a different sources of nitrogen on plant stem weight (gm) of (*Corchorus olitorius* L.).

Season	Nitrobein addition	Ammonium nitrate	EM treatments	
			soil	spray
٢٠١٠	Without nitrobein	١٩٥.٠٠ cd	٢٢٦.٦٧ bc	٢٦٠.٠٠ ab
	nitrobein	١٥١.٦٧ d	٢٩٨.٣٣ a	١٩٨.٣٣ cd
٢٠١١	Without nitrobein	١٩٩.٦٧ bc	٢٢١.٦٧ b	٢٦٦.٦٧ a
	nitrobein	١٥٦.٦٧ c	٣٠٠.٠٠ a	٢٠٥.٠٠ b

Table ٤: The effect of a different sources of nitrogen on leaf fresh weight (gm) and of (*Corchorus olitorius* L.).

Season	Nitrobein addition	Ammonium nitrate	EM treatments	
			soil	spray
٢٠١٠	Without nitrobein	١٣٥.٠٠ c	١٦١.٦٧ bc	٢١٠.٠٠ ab
	nitrobein	١٤٠.٠٠ c	٢٤٥.٠٠ a	١٦٠.٠٠ bc
٢٠١١	Without nitrobein	١٢٥.٠٠ d	١٨٠.٠٠ c	٢٠٦.٦٧ b
	nitrobein	١٣٦.٦٧ d	٢٥٣.٣٣ a	١٦٨.٣٣ c

Table ٥: The effect of a different sources of nitrogen on plant fresh weight (gm) of *Corchorus olitorius* L.).

Season	Nitrobein addition	Ammonium nitrate	EM treatments	
			soil	spray
٢٠١٠	Without nitrobein	٣٥٨.٣٣ cd	٤٢٥.٠٠b c	٦٧٣.٣٣ a
	nitrobein	٣٣٣.٣٣ d	٦٥٠.٠٠ a	٤٥٠.٠٠ b
٢٠١١	Without nitrobein	٣٦٨.٣٣ bc	٤٢٩.٦٧ bc	٦٧٠.٠٠ a
	nitrobein	٣٥١.٦٧ c	٧٤٢.٦٧ a	٤٥٥.٠٠ b

Table ٦ shows the effect of adding nitrobein or EM substance on plant moisture percentage of Jews Mallow. Ammonium nitrate treatment gave the highest percentage of plant moisture in both seasons. Adding nitrobein to the soil with spraying EM substance on plant leaves gave the lowest value.

Tables ٧ and ٨ show the effect of adding Nitrobein or EM substance on total fresh and dry yield of leaves per feddan. In both seasons, nitrobein plus EM infested soil treatment gave the highest yield of dry leaves per feddan, while using chemical fertilizer alone or in combination with nitrobein gave the lowest values. Concerning total fresh leaves yield per feddan,, spraying EM substance resulted in the highest yield in both seasons. Addition of Nitrobein to the soil produced the lowest fresh leaves yield in both seasons.

Table ٦: The effect of a different sources of nitrogen on moisture percentage of plant of *Corchorus olitorius* L.).

Season	Nitrobein addition	Ammonium nitrate	EM treatments	
			soil	spray
٢٠١٠	Without nitrobein	٩٤.٧٧ a	٨٩.٦١ c	٩٢.٤١ b
	nitrobein	٩٢.١٢ b	٩٠.٣٢ bc	٨٩.٣٦ c
٢٠١١	Without nitrobein	٩٤.٤٥ a	٩٢.٦٣ b	٩٣.١٠ a b
	nitrobein	٩٢.٤٧ b	٩٠.٦٧ c	٩١.٠٣ c

Table ٧: The effect of a different sources of nitrogen on total fresh yield/feddan (kg) of (*Corchorus olitorius* L.).

Season	Nitrobein addition	Ammonium nitrate	EM treatments	
			soil	spray
٢٠١٠	Without nitrobein	٦٠٢٠.٠ cd	٧١٤٠.٠ bc	١١٣١٢.٠ a
	Nitrobein	٥٦٠٠.٠ d	١٠٩٢٠.٠ a	٧٥٦٠.٠ b
٢٠١١	Without nitrobein	٦٠٧٠.٠٠ c	٧٩٠٠.٠٠ b	١٢٠٣١.٦٧ a
	nitrobein	٥٢٤٥.٠٠ c	١١٧٦٣.٣٣ a	٧٥٦٩.٦٧ b

Table ٨: The effect of a different sources of nitrogen on total dry yield/feddan (kgm) of (*Corchorus olitorius* L.).

Season	Nitrobein addition	Ammonium nitrate	EM treatments	
			soil	spray
٢٠١٠	Without nitrobein	٢٧٢.٢٧ c	٣٠٩.١٢ bc	٣٩٥.٨٧ b
	nitrobein	٢٧٧.٠٣ c	٥٧٢.١٥ a	٣٩٠.٥٤ b
٢٠١١	Without nitrobein	٣٥٨.٩٤ c	٣٣٧.٧٩ c	٤٩٣.٩٦ b
	nitrobein	٣٣٣.٦٩ c	٥٧٢.١٥ a	٤٥٧.٢١ b

Effect of the studied treatments on some chemical quality characteristics.

Table ٩ shows the effect of adding nitrobein or EM suspension on carotene at market maturity (g/١٠٠ FW), nitrate at market maturity (mg/kg DW) and vitamin C at market maturity (g/١٠٠ FW). In both seasons, the data indicated that spraying EM plus adding nitrobein to the soil treatment gave the highest value, while using ammonium plus EM adding to the soil treatment gave the lowest value of these characters.

Unfortunately, all the tested biofertilizer increased the nitrate levels as compared to level of ammonium nitrate application. However, nitrate content can vary from genotype to genotype and from environment to environment (Santamaria, ٢٠٠٦). In the meantime, this crop by the classification of JECFA as reported by Anjana *et al* (٢٠٠٧) is considered high nitrate accumulated vegetable. Therefore many studies should be carried out in the application of biofertilizers to minimize the risk of antinutrients and toxic substances in Jew's Mallow cv. Egyptian.

Table ٩ : Carotene at market maturity (g/١٠٠ FW), nitrate at market maturity (mg/kg DW) and vitamin C at market maturity (g/١٠٠ FW) of (*Corchorus olitorius* L.).

Season	β-Carotene at market maturity (g/١٠٠g FW)				Nitrate (NO_3^{-1}) at market maturity (mg/kg DW)			L-Ascorbic acid at market maturity (mg/١٠٠ g FW)		
	Nitrobein addition	Ammonium nitrate	EM treatments		Ammonium nitrate	EM treatments		Ammonium nitrate	EM treatments	
			Soil	spray		Soil	spray		Soil	spray
٢٠١٠	Without nitrobein	١٠٤٣٠ f	١٠٥٢٠ e	١١٣١٥ b	٢٩١١ e	٣٠٣٧ d	٣١١٥ c	٨٩.٠٠ e	٩٠.٣٣ d	٩٠.٧١ cd
	nitrobein	١١١٢٠ d	١١١٩٠ c	١١٦٣٠ a	٣٠٤٠ d	٣٢٢٢ b	٣٣٢٧ a	٩٢.٠٧ ab	٩١.٣٠ bc	٩٢.٩٣ a
٢٠١١	Without nitrobein	١٠٤٢٠ F	١٠٥٢٥ E	١١٣١٠ B	٢٩٨٥ E	٣٠٥٢ D	٣١١٩ C	٨٩.٣٣ D	٩٠.٠٠ Cd	٩٠.٨٠ Bc
	nitrobein	١١١٢٠ d	١١٢٠٠ c	١١٦٢٠ a	٣٠٦٧ d	٣٢٤٥ b	٣٣٤٦ a	٩١.٤٧ ab	٩١.٠٣ bc	٩٢.٤٣ a

REFERENCES

Akoroda, M.O&O.A.Akinlabi (١٩٨٧):.Seed Production in *Corchorus olitorius*. Acta Horticulture,١٢٣:٢٣١-٢٣٦.

Anjana, S.U., Muhammed, I., Abrol, Y.P. (٢٠٠٦). Are nitrate concentrations in leafy vegetables within safe limits. Cur٨rent Sci., ٩٢ (٣): ٣٥٥-٣٦٠.

Bohiool, B. B.; F. K. Ladha; D. P. Garrity and T. Geoge (١٩٩٢). Biological nitrogen fixation for sustainable agriculture. A perspective Plant and Soil ١٤١: ١ – ١١.

Correa,M.٢٠٠٢. The impact of effective microorganisms (EM) in various farming systems. ٧th International Conferences in Nature Farming in New Zealand,January٢٠٠٢ (http://www.auroville.org/environment/EM_impact.pdf).

El-Aggory, Eglal A.; S. Alloam; Nadia O. Monged and A. Kh. Ahmed (١٩٩٦). A comparative study on using biofertilizer, and micronutrients to reduce the rate of mineral N-fertilizers for wheat plant in sandy soil. Egypt J. Appl. Sci. ١١ (١١): ٢٨٦ - ٣٠٠.

Eleri T, Hughes RE (١٩٨٣). Foliar ascorbic acid in some Angiosperms. Phytochemistry, ٢(١١): ٢٤٩٣.

El-Naggar, A. A. M.; F. M. El-Fawakhry and A. I. Sharaf (٢٠٠٥). Effect of biofertilizers, organic manure, and mineral fertilizer on production of Narcissus tazetta, L. bulbs grown on sandy loam soil. J. Agric. Sci. ٣٠(٣): ١٧٩٥-١٨١٦ Mansoura Univ., Egypt.

Fawusi, M.O.A.,١٩٨٣. Quality and compositional changes in *Corchorus olitorius* as influenced by N fertilization and post-harvest handling. Scientia Horticulturae, Vol.٢١,Iss.١,Sept.١٩٨٣,P:١-٧.

Gomez K.A. and A.A. Gomez (١٩٨٤) Statistical procedures for agricultural research. Second edition, John Wiley & Sons, Inc., New York, PP.٦٨٠.

margarita@auroville.org.in: The impact of effective microorganisms (EM) in various farming systems.

Musa, A.; Ezenwa, M.I.S.; Oladiran, J.A; Akanya, H.O. and Ogbadoyi, E.O (٢٠١٠). Effect of soil nitrogen levels on some micronutrients, antinutrients and toxic substances in *Corchorus olitorius* grown in Minna, Nigeria. Afr. J. Agric. Res. Vol. ٥(٢٢): ٣٠٧٥-٣٠٨١.

Oke, O.I., ١٩٦٨. Chemical changes in some Nigerian vegetables during growth. Experimental Agricultural, ٤:٣٤٥:٣٤٩.

Oladiran, J.A., ١٩٨٦. Effects of stage of harvesting and seed treatment on germination, seedling emergence and growth in *Corchorus olitorius*, Oniyaya Scientia Horticulture, ٢٨: ٢٢٧-٢٣٣.

Saber, M.S.M. (١٩٩٣). A multi-strain biofertilizer. The sixth international symposium on nitrogen fixation with non-legumes. Ismailia Egypt, ٦-١٠ September.

Santamaria, P (٢٠٠٦). Nitrate in vegetables : toxicity , content, intake and EC regulation. J.Sc. Food Agric. ٨٦: ١٠-١٧.

Sjoberg AMK, Alanko TA (١٩٩٤). Spectrophotometric determination of nitrate in baby food: Collaborative study. J. AOAC Int., ٧٧(٢): ٤٢٥-٤٣٠.

Effect of N sources yield and quality of jew's mallow

تأثير التسميد ببدائل مختلفة من النيتروجين علي نمو وجودة محصول الملوخيه (*Corchorus olitorius* L.)

*** نبيل أحمد محمد ** أشرف جلال هريدي**

* قسم البساتين – كلية الزراعة – جامعة الأزهر – فرع أسيوط

** قسم البساتين – كلية الزراعة – جامعة أسيوط

أجريت هذه الدراسة في المزرعة التجريبية لكلية الزراعة ، جامعة الأزهر، فرع أسيوط خلال الموسم الصيفي لعامي ٢٠١٠ و ٢٠١١ . لدراسة تأثير التسميد ببدائل مختلفة من النيتروجين على نمو وجودة ومحصول الملوخية (*Corchorus olitorius* L.).

واستخدمت المعاملات التالية في التسميد :

- **نترات الامونيوم**
- **EM (Effective Microorganisms)**
- **Nitrobein (*Azospirillium sp. a*nd *Azotobacter sp*) .**

حيث أضيفت معاملات EM إما إلى التربة أو رشاً على النباتات. وأشارت النتائج إلي أن إضافة EM إلى التربة أعطى نتائج أفضل من رش EM علي النباتات.

وكذلك أوضحت النتائج أن استخدام EM و Nitrobein أعطى أعلى قيمة من الوزن الطازج للسيقان والوزن الطازج للأوراق والوزن الطازج للنبات في كلا موسمي الزراعة . وعلي الجانب الآخر فقد كانت نسبة كلا من الكاروتين والنيترات وفيتامين سي أفضل مع التسميد بالنتروبين و رش ال EM علي النباتات ، هذه النتائج الخاصة بمحتوي النبات من النترات في المعاملات الحيوية لها أهمية خاصة لما للنترات من تأثير ضار علي صحة الإنسان.