



## Research paper

# Response of Carnation (*Dianthus caryophyllus*) to Ultraphyto Plus '8-8-8' fertilizer

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### Abstract

An experiment was conducted to study the effect of different doses of the liquid fertilizer (Ultra Phyto Plus '8-8-8') on growth and flowering of the carnation cultivar "Can can scarlet". The fertilizer doses were 0 ml/L, 1.25 ml/L, 2.50 ml/L and 3.75 ml fertilizer/litre of water. Treatments (doses) were laid in a completely randomized design with four replications. Data were collected on vegetative growth parameters namely; plant height, number of branches/plant and number of leaves/plants; flowering parameters namely number of flowers per plant, flower diameter and flower stalk length; leaf nutrient content, namely; leaf total nitrogen, leaf total phosphorus and leaf total potassium. Application of 2.5 ml/L of Ultra Phyto Plus '8-8-8' fertilizer resulted in significantly ( $P \leq 0.05$ ) greatest values of all growth and flowering parameters, leaf total nitrogen, leaf total phosphorus and leaf total potassium compared to other treatments. The treatment of 2.50 ml/L water of the Ultra Phyto Plus '8-8-8' liquid fertilizer may be recommended for the carnation cultivar "Can can scarlet".

**Keywords:** Carnation (*Dianthus caryophyllus*), Ultraphyto Plus '8-8-8', vegetative growth, flowering, leaf nutrient content.

## استجابة نبات القرنفل (*Dianthus caryophyllus*) لجرعات مختلفة من سماد الأترافيتو

### بلص 8-8-8 السائل

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### المستخلص

اجريت تجربة لدراسة تأثير جرعات مختلفة من السماد السائل أترافيتو بلص 8-8-8 على نمو وازهار نبات القرنفل الصنف Can can scarlet. جرعات السماد (المعاملات) كانت 0.0 مل/لتر، 1.25 مل/لتر، 2.5 مل/لتر و3.75 مل سماد/لتر ماء. تم توزيع المعاملات (الجرعات) في تصميم كامل العشوائية بأربعة مكررات. جمعت بيانات عن معايير النمو الخضري وهي ارتفاع النبات وعدد الاوراق بالنبات وعدد الافرع بالنبات، ومعايير الازهار وهي عدد الازهار بالنبات وقطر الزهرة وطول حامل الزهرة ومحتوى الأوراق من العناصر الغذائية، وبالتحديد محتوى الأوراق من النتروجين والفسفور والبوتاسيم. اضافة السماد السائل أترافيتو بلص 8-8-8 بالجرعة 2.5 مل/لتر نتج عنه وبدرجة معنوية ( $P \leq 0.05$ ) أعلى قيم النمو الخضري والازهار و محتوى الأوراق من النتروجين و الفسفور و البوتاسيم مقارنة بالمعاملات الأخرى. يمكن التوصية بالجرعة 2.5 مل/لتر ماء لـ صنف القرنفل Can can scarlet.

**كلمات مفتاحية:** القرنفل، أترافيتو بلص 8-8-8، النمو الخضري، الازهار، محتوى الأوراق من العناصر الغذائية.

### Introduction

Carnation (*Dianthus caryophyllus* L., Caryophyllaceae) is one of the most important commercial cut flower in the global florist trade owing to its excellent keeping quality, wide range of available colours and ability to withstand long distance transportation (Singh *et al.*, 2015). The efficient production of high quality herbaceous ornamental plants required a nutrition regime which will supply a constant uniform level of nutrition throughout the growth cycle (Janick, 1979). Winsor *et al.* (1970) applied Nitrogen at 20, 90, 160 and 230 ppm N and potassium at 30, 130 and 230 ppm K<sub>2</sub>O via trickle irrigation equipment and examined them on two cultivars of carnation. Flower production was highest in plots receiving 160–230 ppm N and 130–230 ppm K<sub>2</sub>O in the liquid feeds, so they concluded that concentrations of 180–200 ppm of both N and K<sub>2</sub>O appeared favourable under good growing conditions. Mukhopadhyay and Sadhu (1988) conducted an experiment on the effect of NPK on growth, flowering and chemical composition on carnation. They reported that vegetative growth of the plant was primarily determined by the added nitrogen and phosphorus. High level of nitrogen (20 g/m<sup>2</sup>) caused significant increase in plant height and number of branches over other treatments. Conversely, plants receiving no additional supply of nitrogen were not only stunted in growth, but also weak, thin and produced less branches. Mukhopadhyay and Sadhu (1988) analyzed different levels of N, P and K mineral composition of

leaf of carnation. The leaf analysis results for N, P and K contents indicate that the leaf N was significantly affected by the nitrogen fertilization both at vegetative and flowering stages. The leaf N level increased linearly and significantly with the increasing level of N fertilization. Similarly, Dawoud (1991) and Hussain (1992) detected significantly higher leaf N, K, Ca, Zn, Fe, Mn and Cu contents in guava seedlings leaves treated with foliar fertilizers than the control. In banana plants, Bakheit (1994) found higher leaf N, K, Ca, Zn, Ca and Mg contents at both mother crop and the first ratoon crop of banana as the result of foliar application of X, bayfolan, nitrofooska and Wxal than the control. In Sudan, there is an increase in using carnation as cut flower. There is no scientific research concerning carnation culture. Reliable scientific study on cultural practices is of urgent need. The objective of this work was to study the effect of 'Ultra Phyto Plus' liquid fertilizer application on growth and flowering of carnation.

### **Materials and methods**

This study was carried out in a greenhouse in the date palm Technology Company at Shambat, Sudan. Seedlings of the carnation cultivar "Can can scarlet" were transplanted on flat plots 100 × 50 cm containing a mixture of silt + sand at the ratio of 1:3. Treatments were four doses of the liquid fertilizer of Ultra Phyto Plus '8-8-8' which were 0.0, 1.25, 2.50 and 3.75 ml fertilizer/Liter of water. The liquid fertilizer was applied at each irrigation starting at the second week after transplanting. Treatments were laid in a completely randomized design with four replications. The experimental unit was a plot of 100 cm × 50 cm containing 15 plants. Statistical analysis was performed using SAS statistical software (SAS Inst. USA, V. 11, 2002). Mean separation was performed using Duncan's Multiple Range Test at 5% level of significance. Data were collected on plant height, number of branches/plant, number of leaves/plant, number of flowers per plant, flower diameter, flower stalk length, leaf total nitrogen, leaf total phosphorus and leaf total potassium. Total nitrogen was determined using micro-Kjeldahl method. Total phosphorus was determined calorimetrically according to the procedures described by Murphy and Riley (1962). Total potassium was determined by a flame photometer according to the method described by Richards (1969). Nutrient elements content of the Ultra Phyto Plus '8-8-8' liquid fertilizer is shown in table 1.

**Table (1): Nutrient elements content of Ultra Phyto Plus '8-8-8' liquid fertilizer**

<b>Nutrient elements</b>	<b>N</b>	<b>P</b>	<b>K</b>	<b>Fe</b>	<b>Mn</b>	<b>B</b>	<b>Zn</b>	<b>Cu</b>	<b>Mo</b>
<b>Percentage (%)</b>	8	8	8	3.5	1.05	0.35	0.30	0.15	0.10

Source: Alruya Company for Fertilizers Manufacturing ([www.alruya.com](http://www.alruya.com)).

### **Results**

#### **Effect of different concentrations of the liquid fertilize (Ultra Phyto Plus '8-8-8') on vegetative growth of the carnation cultivar "Can can scarlet"**

**Effect on plant height (cm):** As shown in Table 2, there was a significant difference in plant height among fertilizer treatments. The highest value (41.4 cm) was given by treatment 2.50 ml/L water followed by 1.25 ml/L water (38.9 cm), control (30.1 cm) and the lowest value was recorded by treatment 3.75 ml/L water (28.2 cm).

**Effect on number of branches per plant:** As shown in Table 2, there was a significant difference between treatments. The highest value was given by 2.5 ml/L (7.5) while the lowest one was given by the control (3.8).

**Effect on number of leaves per plant:** There was a significant difference among treatments (Table 2). The highest value was given by 2.5 ml/L (136.4) while the lowest one was given by the control (69.4).

**Table (2): Effect of different concentrations of the liquid fertilizer (Ultra Phyto Plus ‘8-8-8’) on vegetative growth of the carnation cultivar “Can can scarlet”.**

Treatment	Plant height cm	Number of branches/plant	Number of leaves/plant
0 ml/L	30.1 <sup>c</sup>	3.8 <sup>c</sup>	69.4 <sup>d</sup>
1.25 ml/L	38.9 <sup>b</sup>	6.4 <sup>b</sup>	100.25 <sup>b</sup>
2.5 ml/L	41.4 <sup>a</sup>	7.5 <sup>a</sup>	136.4 <sup>a</sup>
3.75 ml/L	28.2 <sup>c</sup>	6.1 <sup>b</sup>	86.2 <sup>c</sup>
CV(%)	1.39	0.60	3.20

Means within columns followed by the same letters are not significantly different (P=0.05) according to Duncan's multiple Range test.

**Effect of different concentrations of the liquid fertilizer (Ultra Phyto Plus ‘8-8-8’) on flowering of the carnation cultivar “Can can scarlet”**

**Effect on number of flowers per plant:** Table 3 demonstrates the effect of fertilizer on number of flowers per plant. There were significant differences among treatments. The highest value was given by 2.5 ml/L (7.0) while the lowest one was given by the control (3.6).

**Effect of on flower diameter (cm):** There was a significant difference among treatments (table 3). The highest value (4.3) was given by treatment 2.50 ml fertilizer/L water, followed by 1.25 ml fertilizer/L water (4), control (3.2) while and the lowest one (2.0) was recorded by treatment 3,75 ml fertilizer/L.

**Effect on flower stalk length (cm):** As shown in Table 3, there were significant differences among treatments. The highest value was given by treatment 2.50 ml fertilizer/L water (40 cm) followed by 1.25 ml fertilizer/L water (36 cm), control (31 cm) and the lowest value was given by treatment 3.75 ml fertilizer/L water (30 cm).

**Table (3): Effect of different concentrations of the liquid fertilizer (Ultra Phyto Plus ‘8-8-8’) on flowering of the carnation cultivar “Can can scarlet”.**

Treatments	Number of flowers/plant	Flower diameter cm	Flower stalk length cm
0 ml/L	3.6 <sup>c</sup>	3.2 <sup>b</sup>	31 <sup>c</sup>
1.25 ml/L	5.2 <sup>b</sup>	4.0 <sup>a</sup>	36 <sup>b</sup>
2.50 ml/L	7.0 <sup>a</sup>	4.3 <sup>a</sup>	40 <sup>a</sup>
3.75 ml/L	5.9 <sup>b</sup>	2.0 <sup>c</sup>	30 <sup>c</sup>
CV(%)	0.48	0.32	1.59

Means within columns followed by the same letters are not significantly different (P=0.05) as determined by Duncan's Multiple Range Test.

**Effect of different concentrations of the liquid fertilizer (Ultra Phyto Plus '8-8-8') on leaf nutrient elements content of the carnation cultivar "Can can scarlet"**

As shown in Table 4, there were significant differences among treatments. Treatment 2.50 ml fertilizer/L water resulted in significantly highest values of leaf nitrogen, phosphorus and potassium contents while lowest values of these elements were recorded by treatment 3.75 ml fertilizer/L water.

**Table (4): Effect of different concentrations of the liquid fertilizer (Ultra Phyto Plus '8-8-8') on leaf nutrient elements content of the carnation cultivar "Can can scarlet".**

Treatment	Potassium %	Phosphorus %	Nitrogen %
0 ml/L	1.2660b	0.1308b	1.64b
1.25 ml/L	1.2781b	0.1415b	1.89ab
2.50 ml/L	1.9382a	0.1653a	2.24a
3.75 ml/L	0.9692c	0.1219b	1.34b

Means within columns followed by the same letters are not significantly different (P=0.05) as determined by Duncan's Multiple Range Test

**Discussion**

Carnations are relatively slow growing plants. Description of deficiency symptoms are available, but when these symptoms appear on a commercial crop it often takes a long time to correct the problem. Therefore, application of nutrients in right amount and frequency is very important (Larson,1980).

Results revealed that, application of the liquid fertilizer "Ultra Phyto plus" promoted growth of carnation as it gave higher values of plant height, number of leaves per plant, number of branches per plant, number of flowers, flower diameter and flower stalk length compared to nonfertilized plants (control). These results are comparable with those of Winsor *et al.* (1970) and Mukhopddhya and Sadhu (1988) in carnation; Mukhtar (2002) in Zinnia, Marigold and Petunia; Abdel-Aziz (2009) in Petunia.

The significant difference obtained in growth parameters between the liquid fertilizer "Ultra Phyto plus" (8-8- 8) and control treatment could be attributed to the fact that "Ultra Phyto plus" supplied the plant directly with N, P and K together with the essential micronutrients which promote growth of carnation. Similar results were obtained by Osman (1995), who examined different foliar fertilizers on *Graptophyllum pictum*; Al Amin (1993) on banana suckers and Dawoud (1990) who used different foliar fertilizers on Foster grapefruit seedling. The positive effect of all levels of "Ultra Phyto plus" might be due to their higher content of micronutrients. Proper growth of carnation requires high concentration of micronutrients (Larson, 1980). The "Ultra Phyto plus" (8-8-8) fertilizer contains the appropriate nutrient proportion for plant. Increase in plant height due to nitrogen application may be attributed to the role of N in cell division as well as in protein synthesis which ultimately enhances the growth. Nitrogen is an important element to the carnation as research has shown that at least 200 ppm of nitrogen in solution will produce high-quality carnation (Larson, 1980). Phosphorus is 8% which is essential for photosynthesis, protein synthesis and growth of plant. Phosphorus has a role in conversion of solar energy to chemical energy in photosynthesis. Potassium is 8% which is essential for cell division, protein synthesis

and plant growth. The liquid fertilizer also contains microelements such as Fe, Mn and B that are essential for chlorophyll synthesis, protein synthesis, energy production and vegetative growth. Mn is an important element in photosynthesis, enzyme synthesis and energy production. All "Ultra Phyto plus" levels showed significant increases in all growth parameters. The 2.50 ml fertilizer/L water treatment appeared to be the best for maximizing all these growth parameters. The superiority of the 2.50 ml fertilizer/L water treatment over the 1.25 ml fertilizer/L water and 3.75 ml fertilizer/L water could be explained by the fact that fertilizers have distinct levels of uptake below which plant could be deficient and above which plant could be injured by excess fertilizer (Halfacre and Bardan,1979). Results of this study revealed that carnation leaf nutrient content was affected positively by different fertilizer concentrations. The results indicated that carnation leaf nitrogen, phosphorus and potassium content were significantly higher in treatment 2.50 ml fertilizer/L water than the other treatments and control. More or less, similar findings were reported earlier by El-Otmani *et al.* (2002) who reported that leaf N was detected in significantly higher concentration in citrus seedlings sprayed by 18-18-18 foliar fertilizer compared to 10-44-10 and 10-10-35 foliar fertilizers while leaf P content was higher in guava seedlings sprayed with 10- 44 -10 foliar fertilizer. He also found that K leaf content was significantly higher in citrus seedlings sprayed with 10-10-35 foliar fertilizers compared to the other two fertilizers. In carnation it was indicated that leaf N content increased proportionately with the increasing fertilizer doses (Singh *et al.*, 2015 and El-Naggar, 2009). In 'Foster' grapefruit trees, Dawoud (1991) sprayed different foliar fertilizers on grapefruit tree under nursery conditions and he found that all foliar fertilizers increased leaf N, Ca, Zn, Fe and Cu contents over untreated trees. Hussain (1992) reported that a significant higher leaf N, K, Ca, Zn, Fe, Mn and Cu contents were detected in plants sprayed with foliar fertilizers compared to the control. Hassan (2012) reported that leaf-N, P, K and Mg contents were significantly higher in sprayed papaya seedlings than the control. In banana, Bakheit (1994) found higher leaf N, K, Ca, Zn, Ca and Mg contents at both mother crop and the first ratoon crop as the result of foliar application of foliar-X, Bayfolan, Nitrofooska and Wxal than the control. From the foregoing discussion, it became clear that fertilization of carnations plant is an important cultural practice for improving the quality of the final product. The treatment 2.50 ml/L water of the Ultra Phyto Plus '8-8-8' liquid fertilizer may be recommended for the carnation cultivar "Can can scarlet". Further, work is needed to test other different fertilizers with different carnation cultivars.

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