

## Effect of Organic Fertilizer on the Vegetative Growth and Sugar Content of Carrots in Different Areas in Zawia Libya

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### Abstract

### Original Research Article

This study was conducted at a private farm in Zawia Libya during the winter of 2016/2017 to study the effect of organic fertilizer (decomposed sheep residues) on vegetative growth and sugar content (TDS) of raw, boiled and steam carrots. The results showed that the organic fertilizer of the decomposed sheep revealed significant effect on studied characteristics, except the diameter of the bulb where it was not affected. Steam whole and cut carrots have substantial effect on composition, generally increasing the content of total TDS (sugar content) in comparison with cut and whole boiled carrots. However, cut and whole boiled carrots have TDS content more than raw carrots.

**Keywords:** Private farm organic fertilizer boiled carrots raw carrots.

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## INTRODUCTION

The carrot, *Daucus carota* (Apiaceae), a storage root vegetable, is the most widely consumed vegetable in the UK, second only to the potato [1]. *D. carota* is a biennial plant, which grows an aerial rosette of leaves that produce Photosynth ate for storage in the tap root, which is the edible part of the vegetable. The large amount of sugar stored in the taproot enables the plant to flower and set seed in its second year of growth [2]. Carrots are usually orange in color due to high amounts of carotenoid pigments, which absorb light between 450-600nm.

Carrots are consumed raw and cooked and are also used in a range of canned, frozen and dehydrated products [3]. Optimal conditions for carrot cultivation are well-drained, stone-free sands or light, loamy peat with good water holding capacity, to allow easy root penetration and unrestricted root expansion [4]. The main sugars present in carrots are sucrose,  $\alpha$ - and  $\beta$ -glucose and fructose [5]. Glucose and fructose accumulate early in carrot root development with sucrose accumulating at harvest time. Sucrose is a transport molecule in plants and occurs naturally as a product of photosynthesis [6]. The fresh carrot contains about 3.39% sucrose, 1.89 %  $\beta$ - glucose, 1.45%  $\alpha$ -glucose and 1.05% fructose [7]. Also Svanberg *et al.* [8] found that dry matter of raw carrot contained sucrose

353 g/kg, glucose 120 g/kg and fructose 113 g/kg. Factors affecting sugar content in carrots include soil conditions, genotype and climate. Levels of reducing sugars were found to be genetically variable and sucrose and total sugar contents were environmentally variable in carrots. The roots sugar content is extra to the plants requirements, in the first year, but both sugar and nitrogenous compounds are essential to the plant flowering and seed production in its second year [9-11]. The effect of climate on the sugar content may be because carrots cannot adjust their cell volume by the production of supernumerary cambia [12, 13].

Organic farming is an approach to agriculture which aims to create integrated, humane, environmentally and economically sustainable production systems. Organic, in terms of agriculture, follows the concept of the farm as an organism in which all parts-the soil minerals, organic matter, micro-organisms, insects, plants, animals and humans – interact to create a coherent and stable whole [14]. Organic, in terms of food, means ‘organically grown,, without the use of chemosynthetic herbicides, pesticides, fungicides and water-soluble, mineral N and P fertilizers, and KCl. Foodstuffs must be grown on land that has not been treated with chemical fertilizer or pesticides (herbicides insecticides, or fungicides) for at least three years [15]. The organic farming method

produces crops grown without artificial fertilizers or most pesticides, relying on organic means of fertilization such as manure and composts. Organic farmers utilize protection methods such as crop rotation, tillage and netting to help overcome the problems of weeds, insects and disease. There are still some non-organic crop protection measures that are used within the boundaries of organic farming such as pyrethrum, rotenone, *Bacillus thuringiensis*, copper and sulphur based fungicides. Organic agriculture is practiced in almost every country across the world. The total organically managed area exceeds 26 million hectares worldwide and is still growing [16]. The market for organically produced food is also growing, not just in North America and Europe, but worldwide, and is thought to have reached \$25 billion in 2003 [16]. This

study aims to answer questions. Is the organic fertilizer has an effect on vegetative growth of carrots? Is the organic fertilizer has effect on the sugar content of raw, cut and whole (steam or boiled) carrots?

## MATERIALS AND METHODS

Effect of organic fertilizers on carrots growth and yield, this study was conducted at a private farm in Zawia, Libya during the winter season 2016/2017 to study the effect of organic fertilizer (decomposed sheep residues) on vegetative growth and yield of carrots under sandy soil conditions. The result of the chemical analysis of the components of the field soil as shown in Table 1

**Table-1: Chemical analysis of a sample of an experimental field soil**

Parameter	The proportion of presence
Nitrogen	87 ppm
Potassium	114 ppm
PH	7.5
Organic Materials (DM)	0.07%
Translation of salinity (CEC)	18.0 mg / g soil

Organic fertilizer was then added to decomposed sheep at once during soil preparation and

the chemical analysis of the organic fertilizer showed in table (2).

**Table-2: Shows the result of chemical analysis of compost**

Parameter Assessed	The proportion of presence
PH	6.7
Degree of electrical conductivity (EC)	3.6
Total organic carbon	26.6
Total Nitrogen	0.85 %
Total Potassium	0.31 %
Total phosphorus	0.43 %
Carbon to nitrogen ratio	1.33 %
Ash	6.11 %
Humidity	54.0 %

Seedlings were obtained from an adjacent nursery at the age of 75 days and the seedlings were planted on 15/12/2016 lines (line length 3 m and the distance between the line and the other 0.60 m) and planting in the middle of the line and the distance between the plant and the other 0.1m, each experimental unit included four lines With an area of 5.4 m<sup>2</sup> and the plant density is about 166666 plants / hectare, the service of the field of irrigation and weeding by manual method continued as needed and after 100 days of transplanting the plants were removed from all experimental units. After 100 days of transplantation, three plants from each experimental unit were randomly taken and the following data were recorded.

- Plant Length (cm): Measurement by tape measure from the soil surface to the end of the longest leaf in the plant.

- Number of plant tubular leaves: Calculation of tubular blades of randomly selected plants in the experimental unit.
- Foliar area (DSM2): Foliar area was calculated by applying a special formula for tubular carrots leaf [17].

### Total TDS (Sugar content) analysis

The sugar concentration of raw and boiled carrots was measured in BRIX units with a hand refractometer (Bellingham and Stanley Eclipse refractometer, range 0-30 BRIX). Carrot juice was extracted from the carrot pieces using a garlic crusher. This was rinsed and dried between each sample, to avoid contamination. Each reading was repeated with nine different pieces for accuracy and the mean was used. A paper by Alabran & Mabrouk [7] identified the sugar composition of carrots, as the percentage of glucose, fructose, sucrose and moisture in fresh carrot

mass. This data was converted to grams per 100 ml and total moisture content was taken into account. A standard solution with the same relative contribution of each type of sugar: 7.822 g 100 ml<sup>-1</sup>, glucose 2.459g 100 ml<sup>-1</sup> fructose and 7.939 g 100 ml<sup>-1</sup> sucrose was prepared, to provide a standard curve for the conversion of BRIX to gram sugar per 100 ml. One BRIX unit corresponded to 1.170g 100 ml<sup>-1</sup>.

## RESULTS AND DISCUSSION

**Table-3: Shows the effect of the of organic fertilizers used in plant length, number of leaves per plant, bulb diameter of leaf (cm<sup>2</sup>). Averages that share the same alphabet have no significant differences below the probability level of 0.05**

Parameter Assessed	Plant height (cm)	Number of leaves	Bulb diameter (cm)	Root total (cm)	Vegetative total (cm)
Mean and Std. Dev					
Abo Sorra	18.13 ± 3.88	8.00 ± 1.89	0.28 ± 0.13	18.16 ± 2.38	19.15 ± 3.89
Bir Ben Hassan	26.05 ± 12.28	8.33 ± 2.33	1.74 ± 2.70	12.98 ± 1.98	28.66 ± 5.54
Bir of Tervas	35.33 ± 6.43	11.50 ± 2.58	0.53 ± 0.38	13.91 ± 1.28	37.66 ± 6.08
Jodaem	29.00 ± 2.19	7.16 ± 1.16	0.28 ± 0.16	14.08 ± 2.53	30.41 ± 2.10
Comparison	P = 0.005	P = 0.009	P = 0.23	P = 0.002	P = 0.000

In Table 3, the significant effect of the type of fertilizer used was show organic manure (decomposed sheep) where averages were 35.33 cm, cm, 11.50, 37.66 cm and 14.08 cm for each plant length, number of leaves, vegetative total, root total respectively on Bir of Tervas and Bir Ben Hassan and no significant effect of the organic manure (decomposed sheep where on bulb

## STATISTICAL ANALYSIS

The RCBD design was used with three replicates and resulted in coefficients and replicates 12 (4 x 3) experimental units the mean was compared to all traits according to LSD test and the probability level was 0.05.

diameter between them. The reason may be due to the transfer of processed food to the part stored in the plant (bulb) as the length and size of the plant increases and thus the weight of the carrot formed, which ultimately led to an increase in the total yield [18] and these results are consistent with the results obtained [19] in his study On the potato plant.

**Table-4: Shows the effect of the of organic fertilizers and treatment used in TSS ratio**

Parameter Assessed	Total TDS (sugar content)	Treatment	Total TDS (sugar content)
Mean ± SE Of city		Mean ± SE Of city	
Abo Sorra	4.11	Raw carrots	2.75 ± 1.86
Bir Ben Hassan	2.82	Cut boiled carrots	1.54 ± 0.99
Bir of Tervas	2.95	Whole boiled carrots	3.46 ± 1.25
Jodaem	4.08	Cut steam carrots	3.94 ± 1.46
Comparison	P = 0.000	Whole steam carrots	4.43 ± 1.96

In Total TDS there was very highly significant main effect of organic fertilizers (decomposed sheep) (Table 4). The total TDS content was lowest in Bir Ben Hassan and highest in Abo Sorra in raw carrots (Table 4). The total TDS (sugar) content was higher in carrots under whole and cut steam carrots as compare with Whole and cut boiled carrots and it was lowest in raw carrots (Table 4) Kidmose and Martens [20] showed that boiling can cause a considerable loss of low molecular weight carbohydrates (e.g. monosaccharides and disaccharides) due to leaching into the processing water,. Another factor which causes variation in the sugar content of carrots is mechanical or environmental stress [21].

The cut boiled carrots had lower % of fresh weight, sugar content (total TDS) and dry matter content than whole boiled carrots (Figures 1, 2, 3 and 4). This means that boiled carrots lost water when

boiled, for both whole and cut boiled carrots (Figure 2), but the % of water lost was higher in whole boiled carrots than in carrots after cutting (Figure 3). This means the water was taken up by the carrots when they were boiled after cutting, replacing sugar lost by leaching while in whole boiled carrots mainly that only water was lost from the carrot. So the cut boiled carrots had low concentration of sugar and lower dry matter than whole boiled carrots, which had higher dry matter since they had the highest sugar content (Figures 4 and 5). The increase in vegetative growth characteristics such as the soft and dry weight of the plant as a result of the addition of organic fertilizer and sheep manure may be due to the role of organic fertilizer in improving the physical, chemical and biological properties of the soil and increase its water retention, especially since the soil of the experiment field is sandy soil in addition to increasing their content of nutrients Zoubi *et al.* [22]. These all led to the formation of significant vegetative

growth that increased the leafy area of the plant. So, These results are in line with what Magdi found in [23] and Kaack *et al.* [12] who stated that principle factors that affect sugar content ( in carrots are genotype, climate factors and soil conditions.

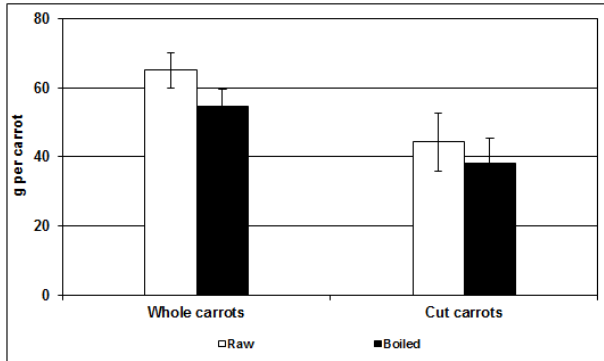


Fig-1: Comparison of the weight of whole and cut carrots before and after boiling

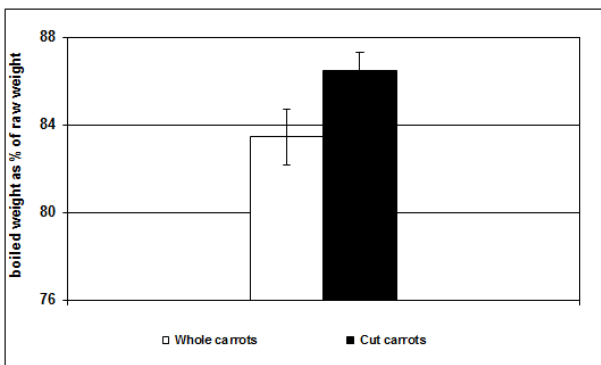


Fig-2: Comparison of % of weight before processing of whole and cut boiled carrots

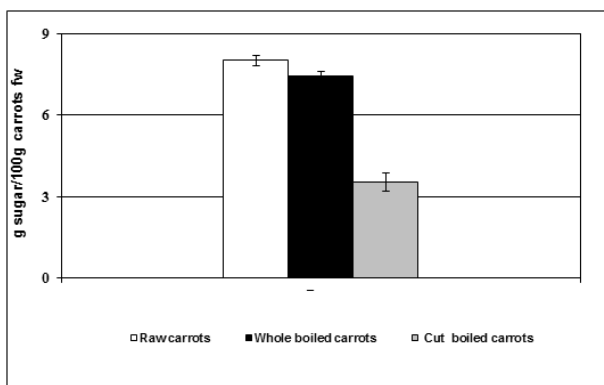


Fig-3: Comparison of the sugar content between raw and boiled whole and cut carrots

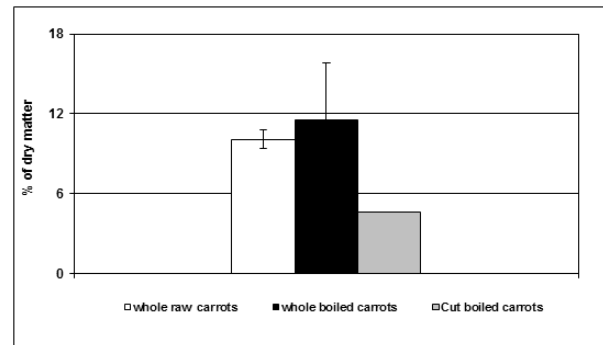


Fig-4: Comparison of the dry matter content between raw and boiled whole and cut carrots

## CONCLUSION

Regarding the effect of method processing on the levels of sugar (total TDS), steam and boiled whole carrots gave higher quality due to higher sugar (total TDS) content than cutting carrots before cooking as compared with raw carrots. The recommendation for this study from consumers is that they should steam or boil the whole carrots to obtain high quality.

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