

# CONTENTS

	Page
<b>INTRODUCTION</b> .....	1
<b>REVIEW OF LITERATURE</b> .....	7
<b>1. Effect of different substrate mixtures on strawberry plans</b> .....	7
<b>a. Effect of different substrate mixtures</b> .....	8
1. Vegetative growth characteristics .....	8
2. Chemical constituents of plant foliage .....	12
3. Yield and its components.....	14
4. Fruit quality.....	18
a. Macro-and microelements content.....	18
b. Heavy metals content.....	19
c. Organic components content.....	19
<b>2. Effect of different resources of nutrient solutions on strawberry plants</b> .....	21
<b>b. Effect of different nutrient solution</b> .....	22
1. Vegetative growth characteristics .....	22
2. Chemical constituents of plant foliage .....	26
3. Yield and its components.....	30
4. Fruit quality.....	35
a. Macro-and microelements content.....	35
b. Heavy metals content.....	38
c. Organic components content.....	39
<b>MATERIALS AND METHODS</b> .....	43
1. Plant material.....	43
2. Experimental materials.....	43
3. Experimental treatments.....	44
a. Preparing of the substrate mixtures.....	44
b. Preparing of the nutrition tea.....	45
4. Treatments.....	46
5. Data recorded.....	47
a. Vegetative growth.....	47
b. Chemical composition.....	48
c. Yield and its components.....	48
d. Fruits quality.....	49
e. Chemical composition of fruit.....	50
6. Statistical analysis.....	51

<b>RESULTS .....</b>	<b>53</b>
<b>Effect of substrate mixtures, nutrient solutions and their interaction on strawberry plants under nutrient film technique.....</b>	<b>53</b>
a. Vegetative growth characteristics .....	53
b. Chemical constituents of plant leaves .....	61
c. Yield and its components.....	67
d. Fruit quality.....	74
1. Macro-and microelements content.....	74
2. Heavy metals content.....	80
3. Physical and organic components of fruits.....	82
<b>DISCUSSION.....</b>	<b>93</b>
<b>SUMMARY.....</b>	<b>105</b>
<b>REFERENCES .....</b>	<b>117</b>
<b>ARABIC SUMMARY .....</b>	<b>128</b>

## LIST OF TABLES

No.	Title	Page
1.	Physical and chemical properties of the different substrate mixtures before transplanting in the two studies.....	45
2.	Concentration of the different nutrient solutions (ppm).....	46
3.	Effect of substrate mixtures, nutrient solutions and their interaction on number of leaves of strawberry plants at 120, 180 and 240 day after transplanting (DAT) during 2012/2013 and 2013/2014 seasons.....	54
4.	Effect of substrate mixtures, nutrient solutions and their interaction on plant height (cm) of strawberry plants at 120, 180 and 240 day after transplanting (DAT) during 2012/2013 and 2013/2014 seasons.....	56
5.	Effect of different substrate mixtures, nutrient solutions and their interaction on leaf chlorophyll reading (SPAD) of strawberry plant at 120, 180 and 240 day after transplanting (DAT) during 2012/2013 and 2013/2014 season.....	58
6.	Effect of different substrate mixtures, nutrient solutions and their interaction on total leaf area (cm <sup>2</sup> ) of strawberry plant at 240 days after transplanting (DAT) during 2012/2013 and 2013/2014 seasons.....	60
7.	Effect of different substrate mixtures, nutrient solutions and their interaction on fresh and dry weight (g) of shoot strawberry plant at 240 days after transplanting during 2012/2013 and 2013/2014 seasons.....	62
8.	Effect of substrate mixtures, nutrient solutions and their interaction on nitrogen percentage in fourth leaf of strawberry plants at 180 and 240 day after transplanting (DAT) during 2012/2013 and 2013/2014 seasons.....	64
9.	Effect of substrate mixtures, nutrient solutions and their interaction on phosphorus percentage in fourth leaf of strawberry plants at 180 and 240 day after transplanting (DAT) during 2012/2013 and 2013/2014 seasons.....	66
10.	Effect of substrate mixtures, nutrient solutions and their interaction on potassium percentage in fourth leaf of strawberry plants at 180 and 240 day after transplanting (DAT) during 2012/2013 and 2013/2014 seasons.....	68

11.	Effect of substrate mixtures, nutrient solutions and their interaction on early yield (kg/m <sup>2</sup> ) of strawberry fruits during 2012/2013 and 2013/2014 seasons.....	70
12.	Effect of substrate mixtures, nutrient solutions and their interaction on total yield (kg/m <sup>2</sup> ) of strawberry fruits during 2012/2013 and 2013/2014 seasons.....	70
13.	Effect of substrate mixtures, nutrient solutions and their interaction on average fruit weight (g/plant) of strawberry fruits during 2012/2013 and 2013/2014 seasons.....	72
14.	Effect of substrate mixtures, nutrient solutions and their interaction on number of fruits per strawberry plant during 2012/2013 and 2013/2014 seasons.....	72
15.	Effect of substrate mixtures, nutrient solutions and their interaction on nitrogen, phosphorus and potassium concentration in strawberry fruits during 2012/2013 and 2013/2014 seasons.....	75
16.	Effect of substrate mixtures, nutrient solutions and their interaction on iron and manganese concentration (ppm) in strawberry fruits during 2012/2013 and 2013/2014 seasons.....	77
17.	Effect of substrate mixtures, nutrient solutions and their interaction on copper and zinc concentration (ppm) in strawberry fruits during 2012/2013 and 2013/2014 seasons.....	79
18.	Effect of substrate mixtures, nutrient solutions and their interaction on lead, nickel and cadmium concentration (ppm) in strawberry fruits during 2012/2013 and 2013/2014 seasons.....	81
19.	Effect of substrate mixtures, nutrient solutions and their interaction on firmness and titratable acidity (TA) of strawberry fruits during 2012/2013 and 2013/2014 seasons.....	83
20.	Effect of substrate mixtures, nutrient solutions and their interaction on total soluble solids and fruit taste of strawberry fruits during 2012/2013 and 2013/2014 seasons.....	85
21.	Effect of substrate mixtures, nutrient solutions and their interaction on vitamin C of strawberry fruits during the two 2012/2013 and 2013/2014 seasons.....	87

22.	Effect of substrate mixtures, nutrient solutions and their interaction on total carbohydrates and Percentage of dry matter in fruits of strawberry fruits during the two 2012/2013 and 2013/2014 seasons.....	89
-----	---	----

**Name of Candidate:** Doaa Abuo Baker Mohamed Gad  
Ph.D.

**Degree:**

**Title of Thesis:** Effect of Some Nutrient Solutions and Different Substrate mixtures on Growth, Yield and Quality of Strawberry Plants under Soilless Culture Conditions.

**Supervisors:** Dr. Sayed Fathey EL-Sayed  
Dr. Hassan Ali Hassan  
Dr. Mohamed Abul-Soud Mohamed

**Department:** Vegetable Crops.

**Approval:** 22 / 11 /2016

### ABSTRACT

The impact of three substrate mixtures and three nutrient solutions on the vegetative growth, mineral content, production and fruit quality of strawberry (*Fragaria×ananassa*, cv. Festival) was studied under unheated double-span covered with shade plastic house conditions, at the Central Laboratory for Agricultural Climate, Agricultural Research Center during the two winter seasons of 2012/2013 and 2013/2014. The three substrate mixtures were perlite:peat-moss (1:1 v/v), perlite:plant compost (4:1 v/v), and perlite:vermicompost (4:1 v/v), while the three nutrient solutions were vermicompost-tea, animal compost-tea and mineral nutrition (control). The tested factors were arranged in factorial design with three replicates.

Obtained results indicated that all studied characteristics of the vegetative growth, yield and its component, fruit quality and chemical characteristics were greater by using the substrate mixtures perlite:peat-moss as compared to the other two mixtures, whereas firmness, titratable acidity (TA) and vitamins C in fruits were highest by using substrate mixtures perlite:vermicompost. The highest concentration of heavy metals (Ni and Pb), Percentage of dry matter of fruits and total carbohydrates percentage in fruits was detected when using substrate mixtures perlite: plant compost was used.

Regarding effect of nutrient solution, the mineral fertilizer (control) significantly increased vegetative growth, yield and its component, TSS, fruit taste, vitamins C and chemical characteristics compared to other tested nutrient solutions. However, the fruit firmness, TA and heavy metals were significantly higher when using animal compost tea.

The highest significant values of vegetative growth, yield and its component, fruit quality and chemical characteristics were recorded for plants grown in perlite:peat-moss mixture and fertigated with the mineral nutrient (control), but using perlite:peat-moss combined with vermicompost-tea led to increase total leaf area and average fruit weight. Plants grown in perlite:vermicompost mixture and got animal compost-tea as nutrient gave the highest values of fruit firmness, TA and heavy metals. Moreover, the highest percentage of total carbohydrates and dry matter of fruits were assessed by using perlite: plant compost combined with animal compost tea and with vermicompost tea, respectively. It's notable that, the illustrated trend of results was confirmed during the both studied seasons.

**Key words:** Strawberry cv. festival, growth, yield, quality, mineral content, substrate mixtures, vermicompost tea, animal compost, soilless culture.