

Effect of Nutrition and Pruning Methods on Productivity and Quality of Cucumber Hybrids in Greenhouse

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Abstract

Two experiments were carried out on cucumber (*Cucumis sativus*. L) under greenhouses conditions at Kaha Research Farm, Hort. Res. Inst., ARC, Egypt during successive spring seasons of 2014 and 2015 to compare the effect of NPK fertigation rates and some pruning types on the fruit quality, yield, and minerals contents of some cucumber hybrids grown under plastic greenhouse conditions. The investigation consisted of three fertilization levels *i.e.* 75%, 100% and 125% from the recommended dose of NPK fertilizers, two pruning methods (one shoot and two shoots/plant) and two cucumber F₁ hybrids *i.e.* Sina 1 and Sina 2 were used. The results indicated that cultivar Sina 2 was the best comparing with the Sina1 concerning yield and fruit characteristics, fruit mineral contents (nitrogen, phosphorus and potassium), ascorbic acid and total sugars. Similar results were obtained by using pruning plants on one branch per plant. Using 125% from the recommended doses of NPK fertilizers gave the highest values of yield and different fruit characteristics, fruit mineral contents (nitrogen, phosphorus and potassium), ascorbic acid and total sugars content compared with the other treatments. The highest values for fruit characteristics N,P,K, TSS, and V.C content in cucumber fruits were obtained from the interaction treatment between cv. Sina1, pruning the plant on one branch and fertilizing with 125% from the recommended dose of NPK fertilization level.

Key words: Nutrition, pruning, cucumber, Hybrids, Greenhouse

Introduction

Cucumber (*Cucumis sativus* L.) is one of the most popular and widely grown vegetable crops in the world, one of the oldest vegetables cultivated by early man (Eifediyi and Remison, 2010), as considered the main greenhouse crop in Egypt. Whereas, cucumber fruit is a moisturizer for the human body and reduce the body's need for water. The total numbers of plastic houses in Egypt are 17173 and the cucumber plastic houses are 8408 (Ministry of agriculture, 2015).

With the increasing zeal for its cultivation, the farmers are aptly looking towards improved cultivars to meet out the higher standards of quality and quantity. Among cucumber cultivars, hybrids have really brought the revolution in cucumber cultivation. Many cultivars of cucumber exist with varying shapes and sizes, skin colour and carotene content (Simon, 1992). The variation in the performance of cucumber cultivars has been widely documented by many scholars (Axelson Fors, 1980; Manyong, 1997), which could be as a result of genetic composition or environmental factors. Greenhouse production technology of cucumber emphasizes the need for proper density in order to boost up the production per unit area by utilizing the available space and nutrients applied. There is not much information available on greenhouse cultivation and its response to varying plant population. There is need to assess the optimum plant density for its cultivation in greenhouses. Cucumber requires a lot of nutrient for proper growth and yield. Thus, the need for fertilizer application is widely recognized as it is readily

observed that plants grown in soil with freshly applied fertilizer shows better response to growth and yield. (Cooke, 1972) reported that the major nutrients required by the crop are Nitrogen (N), Phosphorus (P) and Potassium (K). Inadequate supply of any of these nutrients during crop growth is known to have negative impact on the reproductive capability, growth and yield of the plant (Vine, 1953; Solubo, 1972) and supplementary amount of nutrients can be added to soil in form of inorganic fertilizer to correct inadequate supply of nutrients to the crop (Dirk and Hagarty, 1984). Moreover, to their role in increasing meristemic activities and its importance in the metabolism of many constituents such as amino acids, chlorophyll, auxins enzymes and general protein synthesis (Thompson and Troeh, 1978). Use of drip irrigation in the vegetable production, under the greenhouse, causes a restriction of the plant root system spread and that concentrated only in the wetness root zone. For this reason it is requires to the frequent supplying of irrigation water and fertilizers (fertigation) for the root zone soil (rhizosphere), through critical periods of nutrient demand of crop (Mikkelsen, 1989; Kohzushka and Romanets, 1994; Qasim *et al.*, 2008). However, the excessive use of NPK fertilizers create pollution of agro-ecosystem through contamination the underground water with nitrate (NO₃) and increasing NO₃ accumulation in food chain causing hazardous effects, as well as destroy micro-organisms and friendly insects, making the crop more disposed to diseases and reduced soil fertility (Fischer and Richter, 1984; Mahdi *et al.*, 2010).

In greenhouse vegetables production are greatly dependent on the quantity and quality of the yield, pruning of leaves and side shoot contribute to the ultimate yield in various ways. Training maximized the plant's ability to obtain the sunlight needed for growth (Guo *et al.*, 1991). It is also important to maintain adequate air movement around the plant to reduce risk of fungus and insect problems (<http://www.hydro-gardens.com>).

Pruning the cucumber plant is important to maintain a proper balance between vegetative growth and fruit load to achieve maximum production of marketable fruits (Humphries and Vermillion, 1994). Gobeil and Gosselin (1990) asserted that pruning is a factor that most likely affects productivity of cucumber. Many varieties of cucumber exist with varying shapes and sizes, skin colour and carotene content (Simon, 1992). The variation in the performance of cucumber varieties has been widely documented by many scholars (Axelson and Fors, 1980; Manyvong, 1997), which could be as a result of genetic composition or environmental factors. The aim of this work was to investigate the effect of NPK fertigation rates and some pruning types on the vegetative growth, fruit quality, yield, and minerals contents of some cucumber hybrids grown under plastic greenhouse conditions.

Materials and Methods

Two experiments were carried out under unheated plastic houses at Kaha Research Station, Kalubia Governorate during the two successive spring seasons of 2014 and 2015 to study the effect of three fertilization levels and two pruning methods on growth and productivity of two cucumber F₁ hybrids in greenhouse. The dimensions of the plastic house are 9x60x3.5m. Cucumber seeds hybrids Sinal and Sina 2 were sown in speedling trays (84 cells) on February 3rd and 1st for the first and second seasons, respectively. The growing media consisted of peat moss and vermiculite (1:1 volume: volume) and enriched with macronutrients (250g ammonium nitrate, 200g super phosphate, 100g potassium sulphate and 25g magnesium sulphate per peat moss bale) and 50g for micronutrients (Fe, Zn, Mn and Cu) as well as fungicides (50g topsen) and 3 kg calcium carbonate to adjust pH (Smith, 1971).

Soil characteristics

Before transplanting the cucumber seedlings, a composite soil sample (0-30 cm depth) was taken from the experimental field and important physical and chemical characteristics of the soil were determined by standard methods (Table a). Soil samples were analyzed at Soil, Water and Environment Research Institute, Agriculture Research Center. The chemical properties of the soil were determined using the methods described in Association of Official Agriculture Chemists A.O.A.C. (1990)

Table a. Physical and chemical analysis of plastic house soil in both seasons 2014 and 2015.

Physical analysis:	Seasons	
	2014	2015
Sand%	20.8	23.0
Silt%	18.40	16.80
Clay%	60.80	60.20
Soil Texture	Clay	Clay
Chemical analysis		
Soluble cations (meq/L)		
Na ⁺	4.0	4.1
Ca ⁺⁺	11.43	11.29
Mg ⁺⁺	6.20	6.3
K ⁺	0.15	0.17
Soluble anions (meq/L)		
Cl ⁻	2.0	4.0
HCO ₃ ⁻	1.0	1.10
SO ₃ ⁻	18.78	16.76
pH	7.70	7.75
EC (dSm ⁻¹)	2.10	2.30
Organic matter (%)	2.86	2.45
Available elements		
N %	1.34	1.10
P%	0.17	0.18

The plastic house was divided into five ridges. Each ridge was 1x59 m. Two rows of plants were transplanted on each ridge. Cucumber seedlings with three true leaves (20 days old) were

transplanted in a greenhouse. The distance between plants was 50 cm apart, with plant population of 2.2 plant/m². Culture practices such as drip irrigation, diseases and insect control were carried out as

recommended by Ministry of Agriculture, Egypt. Plants were trained vertically by intertwining the main stem with a vertical piece of polyethylene twine suspended from a horizontal, overhead support wire 2 m above the plant rows.

The treatments were arranged in a split-split plot design with four replicates, where the two hybrids arranged in the main plots, the pruning methods were assigned at random in the sub plots, while the levels of nutrition were randomly distributed in the sub-sub plots.

Treatments used:

1- Hybrids

Two hybrids were used, i.e. sina1 and sina2

2-Pruning methods

Cucumber plants were pruned by removing flower buds and lateral branches on the main stem up to 50 cm from the base of the plant (or approximately 5-6 nodes). After the previous steps the main-stem and the fruits were developed at the base of each leaf at each node and after 30-35 days of transplanting plants were trained according to different treatments like one shoot and two shoots and staked with the help of nylon threads connected to the wire inside the greenhouse. Other cultural practices and standard plant protection measures were also adopted from time to time to ensure good and healthy crop stand.

3-Levels of fertilization:

The recommended fertilizers were add as follow

- a- After 10 days from transplanting for three weeks, add 1.5 kg ammonium nitrate+ 0.75 Liter phosphoric acid (P_2O_5 85%)+ 1 kg potassium sulphate + 0.75kg magnesium sulphate twice week/ greenhouse. In addition foliar nutrition spray (1g/liter) weekly.
- b- After three weeks to before 10 days from the end of experiment, add 3kg ammonium nitrate+ 1.5 Liter phosphoric acid (P_2O_5) +3 kg potassium sulphate + 1kg magnesium sulphate/ greenhouse. In addition 1 kg micronutrient (iron, zinc, manganese) twice weekly
- c- Also add calcium nitrate once weekly.

Three levels of nutrition rates were used as follow:

- 1-75% of recommended NPK fertilizers i.e. 2.25kg ammonium nitrate, 1.125 Liter phosphoric acid (P_2O_5), 2.25kg potassium sulphate and 0.75kg magnesium sulphate/ greenhouse.
- 2-100% of recommended NPK fertilizer i.e. 3kg ammonium nitrate, 1.5 Liter phosphoric acid (P_2O_5), 3 kg potassium sulphate and 1kg magnesium sulphate/ greenhouse.
- 3-125% of recommended NPK fertilizer i.e. 3.75 kg ammonium nitrate, 1.875 Liter phosphoric acid (P_2O_5), 3.75 kg potassium sulphate and 1.25kg magnesium sulphate greenhouse.

The levels of NPK fertilizers were added weekly to the greenhouse.

Measurements:

1- Yield

- a- **Early yield:** the early yield was considered as number and weight of fruits picked at the first four harvests.
- b- **Total yield of fruits:** the total yield was considered as total number and weight of fruits for all picks during the harvesting period.

2-Fruit quality:

Data concerning fruit characters were collected when the market flowers reached the marketing fruit size according the E.E.C standard. The following parameters were recorded:

- a- Average fruit length.
- b- Average fruit diameter.
- c- Average fruit fresh weight.
- d- Fruit dry weight.

3- Fruit chemical composition:

Fruit mineral contents: Chemical analysis of fruits were carried out to determine mineral contents.

1- Nitrogen, phosphorus and potassium:

Nitrogen content was determined in the digested solution by the " Modified micro- Kheldahl" method as described by **Plummer (1971)** , Phosphorus was determined calorimetrically according to the method of **Jakson (1973)**. While potassium was measured using "flam- photometer" as described by **Brown and Lilliand (1964)**.

2- Ascorbic acid.

It was determined in fruits using 2.6 dichlorophenol indophenol method as described in **A.O.A.C. (1990)**.

3-Total sugars: Total sugars of cucumber fruits were determined using the methods described by **Snel & Shell (1953)**

The experimental design: -

All obtained data were statistically analyzed using split -split block design with four replicates, each replicate consisted of five plants for both seasons and the main of different treatment were compared by using the least significant difference test (L.S.D.) at 5% level of probability (**Snedicor and Cochran, 1980**).

Results and Discussion

4-1-Yield and fruit characters:

Data presented in Table (1) clear the effect of different cultivars (F_1 hybrids),pruning, fertilization levels and their interaction on yield and fruit characters of cucumber plants expressed as plant yield (kg/plant) and total yield(kg/m²), fruit weight (g), fruit length and diameter (cm) under greenhouse condition during 2014 and 2015 seasons.

Table1. Effect of cultivars, pruning, fertilization levels and their interaction on fruit yield and it components of cucumber plants under greenhouse condition during 2014 and 2015 seasons.

Treatments			First Season(2014)					Second season(2015)				
cultivars	Pruning	Fertilization levels	Plant yield (kg/plant)	Total Yield (kg/m ²)	Fruit weight (g)	Fruit diameter (cm)	Fruit length	Plant yield (kg/plant)	Total Yield (kg/m ²)	Fruit weight (g)	Fruit diameter (cm)	Fruit length
Sina1			2.34	5.82	169.17	2.57	13.14	2.47	6.14	178.42	2.60	13.43
Sina2			2.10	5.34	162.46	2.52	12.95	2.18	5.51	168.63	2.55	13.43
	L.S.D		0.16	0.06	3.26	N.S	N.S	0.19	0.09	3.94	N.S	12.98
	One branch		1.52	3.84	178.00	2.80	14.46	1.60	4.04	186.83	2.90	0.23
	Two branches		2.92	7.32	153.63	2.28	11.63	3.05	7.61	160.21	2.25	14.55
	L.S.D		0.10	0.11	2.21	0.20	1.01	0.20	0.08	5.53	0.13	11.86
		75% NPK	1.93	4.98	153.06	2.37	12.34	2.05	5.25	159.19	2.39	0.46
		100% NPK	2.21	5.58	159.63	2.49	12.87	2.32	5.77	166.81	2.54	12.33
		125% NPK	2.51	6.18	184.75	2.77	13.93	2.60	6.45	194.56	2.79	13.16
	L.S.D		0.15	0.10	3.74	0.15	0.75	0.14	0.08	3.97	0.18	0.62
Sina1	One branch		1.59	4.02	181.83	2.80	14.56	1.65	4.27	193.00	2.93	14.89
	Two branches		3.08	7.61	156.50	2.33	11.72	3.29	8.01	163.83	2.28	11.98
Sina2	One branch		1.43	3.65	174.17	2.80	14.36	1.55	3.82	180.67	2.87	14.22
	Two branches		2.75	7.02	150.75	2.23	11.55	2.81	7.21	156.58	2.23	11.74
	L.S.D		0.04	0.04	N.S	N.S	N.S	0.08	0.03	N.S	N.S	N.S
Sina1		75% NPK	2.08	5.22	155.00	2.36	12.51	2.09	5.46	162.87	2.41	12.54
		100% NPK	2.30	5.76	163.13	2.53	12.93	2.49	6.06	171.75	2.58	13.41
		125% NPK	2.64	6.47	189.37	2.81	13.98	2.83	6.89	200.63	2.83	14.35
Sina2		75% NPK	1.80	4.73	151.13	2.38	12.16	2.01	5.04	155.50	2.36	12.13
		100% NPK	2.13	5.39	156.13	2.45	12.81	2.16	5.48	161.88	2.51	12.84
		125% NPK	2.38	5.88	180.13	2.73	13.89	2.37	6.02	188.50	2.76	13.98
	L.S.D		N.S	N.S	N.S	N.S	N.S	0.07	0.04	N.S	N.S	N.S
	One branch	75% NPK	1.19	3.07	165.00	2.61	13.45	1.32	3.30	172.13	2.68	13.79
		100% NPK	1.52	3.78	173.38	2.74	14.25	1.57	3.99	183.25	2.81	14.24
		125% NPK	1.83	4.67	195.63	3.06	15.68	1.90	4.84	205.13	3.20	15.64
	Two branches	75% NPK	2.68	5.89	141.13	2.13	11.23	2.79	7.21	146.25	2.10	10.88
		100% NPK	2.91	7.38	145.88	2.24	11.49	3.07	7.54	150.38	2.28	12.01
		125% NPK	3.16	7.69	173.87	2.48	12.19	3.31	8.07	184.00	2.39	2.691
	L.S.D		N.S	0.05	N.S	N.S	N.S	N.S	0.04	1.93	N.S	N.S
Sina1	One branch	75% NPK	1.24	3.20	167.75	2.54	13.65	1.28	3.40	177.25	2.70	14.10
		100% NPK	1.57	3.91	176.75	2.75	14.28	1.60	4.20	188.00	2.83	14.65
		125% NPK	1.96	4.97	201.50	3.13	15.75	2.07	5.19	213.75	3.25	15.93
	Two branches	75% NPK	2.91	7.25	142.25	2.18	11.38	2.90	7.52	148.50	2.13	10.98
		100% NPK	3.02	7.61	150.00	2.30	11.58	3.38	7.91	155.50	2.33	12.18
		125% NPK	3.32	7.98	177.25	2.50	12.20	3.60	8.59	187.50	2.40	12.78
Sina2	One branch	75% NPK	1.15	2.94	162.25	2.68	13.25	1.36	3.19	167.00	2.65	13.48
		100% NPK	1.46	3.64	170.50	2.73	14.23	1.55	3.79	178.50	2.80	13.83
		125% NPK	1.76	4.37	189.75	3.00	15.60	1.73	4.49	196.50	3.15	15.35
	Two branches	75% NPK	2.45	6.52	140.00	2.08	11.08	2.66	6.90	144.00	2.08	10.78
		100% NPK	2.80	7.15	141.75	2.18	11.40	2.77	7.18	145.25	2.23	11.85
		125% NPK	3.01	7.40	170.50	2.45	12.18	3.01	7.55	180.50	2.38	12.60
	L.S.D		N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

4-1-1-Effect of cultivars:

The data pertaining to yield and fruit characters as influenced by hybrids have been summarized in Table (1). A perusal of data in Table 1 showed that fruit yield and fruit characters were significantly influenced by the cultivars except fruit diameter during the two season and fruit length during the first season only which did not reach the level of 5% significance. Significantly highest fruit yield and fruit characters of 2.340 kg, 5.82kg/m², 169.17g, 2.57cm, and 13.14cm for plant yield (kg/plant), total yield (kg/m²), fruit weight (g), diameter (cm), and fruit length respectively during the first season, were obtained from cultivar Sina 1 which was significantly higher than the cultivar Sina 2. The higher fruit yield (kg/m²) and comparatively better performance of hybrid Sina 1 over hybrid Sina 2 could be ascribed to more number of higher fruit weight, higher fruit length fruit yield per plant (Table 1) such differences in fruit yield. Significant variation for fruit yield between cucumber cultivars have been also reported by **Cardoso (2006)**; **Utobo et al. (2010)**; **Bisht et al. (2010)**; **Odaa (2015)** and **Sharma (2016)**.

4-1-2-Effect of pruning:

Concerning the effect of pruning types on fruit yield and fruit characters under greenhouse conditions, data at Table (1) show clearly that pruning the plants to two branches recorded significantly higher fruit yield kg / plant and total fruit yield kg/m² than plants trained to one branch during the first and second season. Meanwhile pruning the plants to one branch recorded significantly higher fruit characters (fruit weight, fruit diameter and fruit length) than plants trained to two branches. The reason for more weight, length and diameter of the fruits harvested from one branch plants was probably due to the better exposure of the plants to light, enhanced synthesis of photosynthates and more assimilation of carbohydrates. These results are in conformity with the earlier findings of **Aniekwe and Anike (2015)**, **Oga and Umekwe (2015)**, **Sharma (2016)**.

Moreover, the higher yield from the plants trained to two branches may be attributed to its better performance in yield per plant which ultimately resulted in increase in yield per m². Similar results were also reported by **Utobo et al. (2010)**; **Sharma (2016)** and **Mardhiana et al. (2017)**.

4-1-3-Effect of fertilization levels:

With respect to the effect of fertilization levels (75,100 and 125% from the recommended doses of NPK fertilizers) on fruit yield and fruit characters of cucumber plant under greenhouse conditions, the results showed that increasing NPK fertigation rate was associated with significant increments in plant fruits yield, total fruit yield/m², average fruit weight, fruit length and diameter (Table 1). The highest

significant meanvalues of all above mentioned characters were resulting from the highest NPK fertigation rate (125% of recommended) in both seasons the positive effect of increasing NPK fertilizers on fruit yield and its components may be attributed to the enhancing effect of such elements on vegetative growth parameters which affect consequently on physical quality of produced fruits. These results are in accordance with those obtained by **Jilani et al. (2009)** and **Feleafel et al. (2014)** who found that application of NPK fertigation up rate 125% showed better results for more fruits per vine, maximum fruit weight, vine length and total yield. Therefore, **Pushendra and Hardaha(2016)** indicated that the number of fruits per plant, fruit weight per plant, fruit number per plant and total yield per hectare were increased significantly with increase NPK fertilizer application.

4-1-4-Effect of the interaction between tested cultivars and pruning:

Concerning the effect of the interaction treatments between the studied cultivars and pruning types on the fruit yield and fruit characters, data at table (1) reveal that the highest significant differences were found in fruit yield (kg/plant) and total fruit yield(kg/m²) among the studied cultivars due to pruning the plants on two branches during both the growing seasons of study. Meanwhile, data on fruit length, diameter and weight in Table (1) indicated that interaction effect of cultivars and pruning systems was found to be non-significant effect on these characters during 2014 and 2015 season of studies average fruit weight, fruit length and diameter gave the highest values in such due to pruning the plants on one branch combined with cv. Sina1. These results are in conformity with the earlier findings of **Oga and Umekwe (2015)** and **Sharma (2016)**.

4-1-5-Effect of interaction between different cultivars and different used fertilizer levels:

As the effect of combination treatments between used cultivars and NPK fertilizers levels, data illustrated at Table (1) show clearly that there were no significant differences in fruit yield and fruit characters of both cultivars sina1 and sina2 due to the application of NPK fertilizer levels during the first and second seasons except plant fruit yield (kg) and total fruit yield (kg/m²) in the second season which reach significance, The interaction treatment between cv. Sina1 with 125% from the recommended dose of NPK fertilizers level gave the highest values for fruit yield and its components traits which mentioned above during the first and second seasons of growth. Similar results were reported by **Eifediyi and Remison (2010)**; **Nwofia et al (2015)**; **Shafeek et al. (2015)**, **Pushendra and Hardaha(2016)**

4-1-6-Effect of the interaction between pruning and different used fertilizer levels:

As for the effect of combination treatments between pruning types and different used fertilizers levels, data illustrated at Table (1) show clearly that there were significant differences in total fruit yield (kg/m^2) treat as a result of the interaction treatments during the two seasons of this study and average fruit weight during the second one only, all other yield and its components characters were not reach the level of significance. The highest values of fruit yield (kg/m^2) and fruit weight were obtained from the interaction treatment between pruning the plant on two branches and fertilize with 125% from recommended dose of NPK fertilizers level compared with other interaction. Treatments whereas, fruit weight, yield length and diameter recorded the highest values with the interaction treatment between pruning the plants on one branch and fertilized with the same NPK fertilizer level (125% from the recommended dose). These results were true during the two seasons of study. The findings of present investigation are in accordance with the findings of earlier workers **Choudhari and More (2002)**; **Mir (2007)**; **Sharma (2016)**.

4-1-7-Effect of the interaction between all different treatments:

As the effects of the interaction treatments between all used treatments on fruit yield and fruit characters of cucumber plants (plant fruit, total fruit yield/ m^2 , fruit weight, length and diameter), data in Table (1) indicate clearly that there were no significant differences between all interaction treatments effects on all studies fruit yield and fruit characters during the two studied seasons the interaction treatment between the cultivars sina1 and pruning on two branch and fertilization with 125% from the recommended dose of NPK fertilizers rate recorded the highest values for each of fruit yield per plant and per meter square. Meanwhile, the highest values for fruit weight, length and were obtained when application of the interaction treatment between the same cultivar (sina1) and pruning on one branch and fertilization with the same level of NPK fertilizers (125% from the recommended dose). Similar results were also reported by **Mardhiana et al. (2017)**.

4-2-Chemical content of cucumber fruits:

Data presented in Tables (2and3) show the effect of different cultivars (F_1 hybrids), pruning, fertilization levels and their interaction on chemical composition of cucumber fruits expressed as nitrogen, phosphorus, potassium, total soluble solids, vitamin-c and total sugars contents under greenhouse condition during 2014 and 2015 seasons.

4-2-1- Effect of cultivars:

As regard to the nitrogen, phosphorus, potassium, total soluble solids, vitamin-c and total sugars contents in cucumber fruit, data presented in Tables (2and3) show significant differences between the two cultivars Sina1 and Sina2 (F_1 hybrids). Sina1 was higher in all chemical composition mentioned traits in cucumber fruits than Sina2 in the two studied seasons. Such increasing in the content of estimated mineral and organic constituents of produced fruits were related with higher chemical constituents of plant foliage which in turn affected on fruit composition. Similar observations were reported by **Al-Harbi et al. (1996)**; **Bisht et al. (2010)**; **Dogra (2012)** and **Sharma (2016)**.

4-2-2-Effect of pruning:

Obtained results in Tables (2and3) indicated that the pruning types have a positive effect in nitrogen, phosphorus, potassium, total soluble solids, vitamin-c and total sugars content in cucumber fruit under greenhouse. There were significant differences between all measured chemical compositions. Traits in cucumber fruits as affected by pruning types (one or two branches) during two season of growth. Data cleared that the pruning on one branch gave the higher values for all recorded traits during the first and second seasons compared with two branches. Similar results were obtained by **Hong (2000)**; **Ekwu and Utobo (2010)**.

4-2-3-Effect of fertilization levels:

NPK fertigation rates seemed to have clear significant effect on nitrogen, phosphorus, potassium, total soluble solids, vitamin-c and total sugars content in cucumber fruit under greenhouse as noticed from the comparisons listed in Table (2and3).The results indicated that the applying NPK fertigation up to 125% of recommended caused a significant increase in nitrogen, phosphorus, potassium, total soluble solids, vitamin-c but decreased total sugars content in cucumber fruit. These results are true during two season of study. These results are in accordance with those obtained by **Darwesh (2002)** who found that using recommended dose of NPK caused a marketable increase in plant contents of N, P and K as compared with no mineral fertilization in tomato. Also, **yang et al (2010)** stated that with increasing K rate (k fertilization) in the range of 240-720kg/ha increased the contents of soluble sugar and ascorbic acid. Moreover, **Shafeek, et al.(2015)** who indicated that the highest level of NPK fertilizers (100%) significantly improved the chemical characters of cantaloupe fruits compared to the intermediate and the lowest levels of NPK (75 and 50%). The highest significant values of vitamin-c were recorded with the highest level of NPK fertilizers. While, no significant differences were detected among the levels of NPK fertilizers on the percentages of total sugars in cantaloupe.

4-2-4-Effect of the interaction between tested cultivars and pruning:

Concerning the effect of the interaction treatments between the studied cultivars and pruning types on the chemical content of cucumber fruit, data in Tables (2and3) reveal that no significant differences were found in all studied N,P, K and total soluble solid content of cucumber fruit among the studied cultivars due to pruning the plants on one or two branches during both the growing seasons of study and vitamin c during the

first season only. Whereas, total sugars during two season and vitamin-c during two seasons and vitamin-c during the second season only reach the level of significance. Moreover, the highest values in such nitrogen, phosphorus, potassium, total soluble solids, vitamin-c and total sugars contents of cucumber fruits were obtained due to pruning the plants on one branch combined with cv. Sina1 during both season of growth These results are in agreement with **Hong (2000)** and **Sharma (2016)**.

Table 2. Effect of cultivars, pruning, fertilization levels and their interaction on chemical content of cucumber fruits under greenhouse condition during 2014 and 2015 seasons.

Treatments			First Season(2014)			Second season(2015)		
cultivars	pruning	Fertilization levels	N%	P%	K%	N%	P%	K%
Sina1			3.51	0.79	1.49	3.63	0.79	1.56
Sina2			3.16	0.71	1.43	3.34	0.72	1.51
	L.S.D		0.22	0.03	0.03	0.10	0.02	0.04
	One branch		3.45	0.79	1.49	3.633	0.78	1.56
	Two branches		3.22	0.71	1.43	3.34	0.74	1.51
	L.S.D		0.12	0.03	0.01	0.04	0.01	0.03
		75% NPK	3.05	0.68	1.41	3.19	0.67	1.48
		100% NPK	3.33	0.76	1.46	3.48	0.77	1.52
		125% NPK	3.63	0.82	1.51	3.80	0.83	1.60
	L.S.D		0.25	0.02	0.02	0.10	0.04	0.03
Sina1	One branch		3.62	0.83	1.51	3.78	0.82	1.58
	Two branches		3.40	0.75	1.46	3.48	0.76	1.53
Sina2	One branch		3.28	0.75	1.47	3.48	0.73	1.53
	Two branches		3.04	0.67	1.40	3.20	0.72	1.49
	L.S.D		N.S	N.S	N.S	N.S	N.S	N.S
Sina1		75% NPK	3.22	0.71	1.43	3.36	0.70	1.51
		100% NPK	3.52	0.81	1.48	3.58	0.80	1.55
		125% NPK	3.79	0.86	1.55	3.95	0.88	1.61
Sina2		75% NPK	2.87	0.64	1.39	3.01	0.65	1.46
		100% NPK	3.15	0.71	1.43	3.38	0.74	1.50
		125% NPK	3.47	0.78	1.48	3.64	0.78	1.50
	L.S.D		N.S	N.S	N.S	N.S	N.S	N.S
	One branch	75% NPK	3.14	0.70	1.44	3.30	0.67	1.56
	s	100% NPK	3.49	0.79	1.48	3.62	0.78	1.55
		125% NPK	3.72	0.88	1.54	3.98	0.87	1.62
	Two branches	75% NPK	2.95	0.65	1.39	3.07	0.68	1.46
		100% NPK	3.18	0.73	1.43	3.34	0.75	1.50
		125% NPK	3.54	0.76	1.48	3.61	0.78	1.57
	L.S.D		N.S	0.01	N.S	N.S	0.02	N.S
Sina1	One branch	75% NPK	3.34	0.74	1.45	3.50	0.69	1.52
		100% NPK	3.70	0.84	1.50	3.75	0.82	1.59
		125% NPK	3.82	0.92	1.57	4.10	0.96	1.65
	Two branches	75% NPK	3.11	0.69	1.41	3.23	0.71	1.49
		100% NPK	3.34	0.77	1.46	3.41	0.77	1.52
		125% NPK	3.76	0.80	1.52	3.81	0.80	1.58
Sina2	One branch	75% NPK	2.95	0.67	1.43	3.10	0.65	1.48
		100% NPK	3.28	0.73	1.47	3.49	0.75	1.51
		125% NPK	3.62	0.84	1.51	3.86	0.79	1.59
	Two branches	75% NPK	2.79	0.61	1.36	2.92	0.65	1.44
		100% NPK	3.02	0.69	1.40	3.28	0.73	1.48
		125% NPK	3.33	0.73	1.44	3.45	0.76	1.56
	L.S.D		N.S	N.S	N.S	N.S	0.03	N.S

Table 3. Effect of cultivars, pruning, fertilization and their interaction on Tss,v.c and total sugars of cucumber fruits under greenhouse condition during 2014 and 2015 seasons.

Treatments			First Season(2014)			Second season(2015)		
cultivars	Pruning	Fertilization levels	TSS	V.C	Total sugars	TSS	V.C	Total sugars
Sina1			3.04	10.33	5.34	3.21	10.58	5.32
Sina2			2.82	9.92	4.47	3.05	10.28	4.48
	L.S.D		0.07	0.26	0.08	0.12	0.24	0.20
	One branch		3.35	11.29	5.78	3.57	11.94	5.79
	Two branches		2.51	8.96	4.03	2.70	8.92	4.00
	L.S.D		0.25	0.32	0.12	0.23	0.28	0.12
		75% NPK	2.64	9.53	6.40	2.89	9.68	6.39
		100%NPK	2.90	10.01	4.89	3.10	10.38	4.88
		125%NPK	3.25	10.83	3.43	3.41	11.23	3.43
	L.S.D		0.18	0.47	0.11	0.18	0.33	0.14
Sina1	One branch		3.46	11.47	5.87	3.64	12.39	5.84
	Two branches		2.62	9.19	4.81	2.78	8.80	4.79
Sina2	One branch		3.23	11.11	5.69	2.49	11.53	5.74
	Two branches		2.41	8.73	3.25	2.62	9.03	3.22
	L.S.D		N.S	N.S	0.05	N.S	0.12	0.05
Sina1		75% NPK	2.69	9.58	7.15	2.99	9.76	7.08
		100%NPK	2.99	10.29	5.29	3.15	10.58	5.29
		125%NPK	3.44	11.13	3.59	3.49	11.40	3.59
Sina2		75%NPK	2.59	9.49	5.66	2.77	9.60	5.70
		100%NPK	2.81	9.73	4.49	3.05	10.19	4.47
		125%NPK	3.06	10.54	3.27	3.33	0511.	3.27
	L.S.D		N.S	N.S	0.06	N.S	N.S	0.07
	One branch	75%NPK	3.06	10.78	8.00	3.36	11.28	8.06
		100%NPK	3.29	11.00	5.56	3.46	11.73	5.55
		125%NPK	3.69	12.09	3.79	3.88	12.83	3.76
	Two branches	75%NPK	2.21	8.29	4.80	2.41	8.09	4.71
		100%NPK	2.51	9.01	4.21	2.74	9.04	4.21
		125%NPK	2.81	9.58	3.07	2.94	9.63	3.09
	L.S.D		N.S	N.S	0.06	N.S	N.S	0.07
Sina1	One branch	75% NPK	3.08	10.83	8.54	3.45	11.60	8.52
		100%NPK	3.38	11.20	5.37	3.53	12.20	5.35
		125%NPK	3.93	12.38	3.70	3.95	13.28	3.66
	Two branches	75%NPK	2.30	8.33	5.75	2.53	7.93	5.63
		100%NPK	2.60	9.38	5.20	2.78	8.95	5.22
		125%NPK	2.95	9.88	3.47	3.03	9.53	3.51
Sina2	One branch	75%NPK	3.05	10.73	7.45	3.28	10.95	7.60
		100%NPK	3.20	10.80	5.75	3.40	11.25	5.74
		125%NPK	3.45	11.80	3.87	3.80	12.38	3.87
	Two branches	75%NPK	2.13	8.25	3.86	2.30	8.25	3.80
		100%NPK	2.43	8.65	3.23	2.70	9.13	3.20
		125%NPK	2.68	9.28	2.67	2.85	9.73	2.67
	L.S.D		N.S	N.S	0.08	N.S	N.S	0.10

4-2-5-Effect of interaction between different cultivars and different used fertilizer levels:

Concerning the interaction treatments between used cultivars and NPK fertilizers levels, data

illustrated at Tables (2and3) show clearly that there were no significant differences in N,P,K total soluble solids and vitamin-c content of cucumber fruit traits of both cultivars sina1 and sina2 due to

the application of different fertilizer levels, meanwhile, total sugars was significant during the two season of growth. Whereas, the interaction treatment between cv. Sina1 and 125% from the recommended dose of NPK fertilizers level gave the highest N,P,K, TSS and V.C, while the interaction treatment between cv. Sina1 and 75% from the recommended dose of NPK fertilizers level gave the highest value of total sugars content. Such trend was true during both seasons of study. Obtained results were also in agreement with those of **Yang et al. (2010)** and **Hassan (2015)**.

4-2-6-Effect of the interaction between pruning and different used fertilizer levels:

As the effect of interaction treatment between pruning and different used fertilizers levels, data illustrated at Tables (2 and 3) show clearly that there were significant differences in phosphorus and total sugar content of cucumber fruit treats as a result of the interaction treatments while, nitrogen, potassium, total soluble solids and vitamin-c did not reach the level of significance during the two seasons of this study. The highest values for nitrogen, phosphorus, potassium, total soluble solids and vitamin-c content in fruit were obtained from the interaction treatment between pruning the plant on one branch and fertilize with 125% from recommended dose of NPK fertilizers level. Meanwhile, the highest values for total sugar content in fruit were obtained from the interaction treatment between pruning the plant on one branch and fertilize with 75% from recommended dose of NPK fertilizers level. These results were true during the two seasons of study. These results are in agreement with **Bisht et al. (2010)** and **Sharma (2016)**

4-2-7-Effect of the interaction between all different treatments:

As the effects of the interactions between all used treatments on N,P,K, TSS, V.C and total sugars content of cucumber fruit traits of cucumber plants, data in Tables (2 and 3) indicate clearly that there were no significant differences between all interaction treatments effects on all chemical composition of cucumber fruit during the two seasons of growth, except phosphorus content of cucumber fruit gave significance differences during the second season only and total sugars during both season of study. The highest values for N,P,K, TSS, and V.C content in cucumber fruits were obtained from the interaction treatment between cv. Sina1, pruning the plant on one branch and fertilize with 125% from the recommended dose of NPK fertilization level. On the other hand, the lowest values were obtained from cv. Sina2 with two branches and 75% from the recommended dose of NPK fertilizer level. Moreover, the highest values for sugar content in fruit were obtained from the

interaction treatment between Sina 1, pruning the plant on one branch and fertilize with 75% from recommended dose of NPK fertilizers level followed by the interaction treatment between Sina 2, pruning the plant on one branch and fertilize with 75% from recommended dose of NPK fertilizers level. These results were true during the two season of study. These results are in agreement with **Bisht et al. (2010)**; **Yang et al. (2010)**; **Hassan (2015)** and **Sharma (2016)**

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تأثير التغذية وطريقة التقليم علي انتاجية وجودة ثمار هجن الخيار داخل الصوب

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أجريت تجربتان على الخيار تحت ظروف الصوب البلاستيكية في مزرعة لها للأبحاث، معهد البساتين، مركز البحوث الزراعية، مصر. خلال موسمي ربيع متتاليان لعامي 2014 و2015. لمقارنة تأثير معدلات التسميد (النيتروجين والفسفور والبوتاسيوم) وبعض أنواع التقليم على جودة الثمار والمحصول والمحتوى المعدني علي بعض أنواع هجن الخيار التي نمت تحت ظروف الصوب البلاستيكية. تم الدراسة على ثلاثة مستويات للتسميد (75% و 100% و 125% من الجرعة الموصى بها من الأسمدة النيتروجين والفسفور والبوتاسيوم) ، وطريقتين للتقليم (التقليم علي فرع وعلي فرعين/النبات) و استخدم اثنين من هجن الخيار جيل اول (سيناء1 وسيناء2). أشارت النتائج إلى أن الصنف سيناء2 هو الأفضل مقارنة مع سيناء1 فيما يتعلق بالمحصول وخصائص الثمار والمحتوى المعدني للثمار (النيتروجين والفسفور والبوتاسيوم) وحمض الأسكوربيك والسكريات الكلية. تم الحصول على اعلي نتائج باستخدام نباتات التقليم على فرع واحد لكل نبات مع استخدام 125 % من مستوي التسميد الموصى بها من الأسمدة (النيتروجين والفسفور والبوتاسيوم) أعطت أعلى قيمة من المحصول وخصائص الثمارالمختلفة ومحتويات الثمار المعدنية (النيتروجين والفسفور والبوتاسيوم) ، وحمض الأسكوربيك ومجموع السكريات الكلي مقارنة مع المعاملات الأخرى. تم الحصول على أعلى قيم لخصائص الثمار (النيتروجين والفسفور والبوتاسيوم ، المواد الصلبة الذئبة الكلية ، وحمض الاسكوربيك) من محتوى ثمار الخيار نتيجة التفاعل الثلاثي بين الهجين سيناء1 وتقليم النبات على فرع واحد وتسميدة بنسبة 125 % من مستوي التسميد الموصى بها من الاسمدة (النيتروجين والفسفور والبوتاسيوم).