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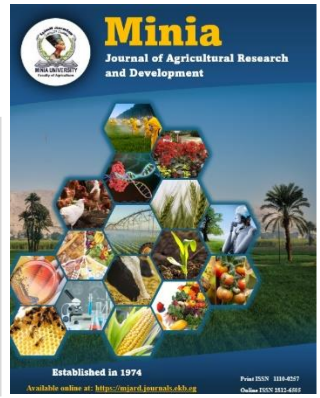

Genetic variability and correlation analysis of some quantitative traits in cucumber

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ABSTRACT

Fifteen cucumber genotypes were tested in the present study. Some genetic parameters, as well as simple correlation coefficients, were studied among internode length “IL”, vine length “VL”, number of days to the first male flower “NDMF”, number of days to female flower “NDFF”, ovary length “OL”, number of branches “NB”, fruit length “FL” fruit girth “FG”, total number of fruits /20 plants “TFN/P”, and total fruit weight per 20 plants “TFW/P”. Values of phenotypic and genetic coefficients of variation were low for vine length, internode length, ovary length, and medium for days to first male flower, fruit girth.

Broad sense heritability values were high for fruit length and medium for days to the first female flower, fruit girth, ovary length, and vine length. Out of 45 estimated correlation coefficients, 8 were statistically significant. The highest magnitude was between total number of fruits per plant and total fruit weight per plant (r=832**) followed by days to the first female flower and fruit length (r=0.414**). Also, vine length correlated significantly with the total number of fruits per plant and total fruit weight per plant. Total number of fruit per plant showed highly significant and positive correlation with picking numbers 3, 9, 10, 11, 12, 14, 15, 16, and 18 in the first season. In the second season, it was highly significant with picking numbers; 3, 4, 5, 6, 9, 10, 12 and 13. But in the third season, it was highly significant with all picking times except number 7. Fruit weight per plant was correlated significantly with picking number 3, 5, 9, 10, 14, 15 and 18 in the first season and with picking numbers 4, 5, 6, 7, 8, 9, 10, 12, and 13 in the third season, it was highly significant with all picking times, except number three. These results indicate that the number of fruits per plant was the most important character for improving and evaluating cucumber genotypes. Evaluation may be done at an early stage of harvest decrease the evaluation experiments cost but care should be taken since the obtained results showed inconsistency.

Keywords: Cucumis sativus, Heritability, Genetic advance, Correlation analysis.

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INTRODUCTION

Cucumber (*Cucumis sativus* L.), a member of the *Cucurbitaceae* family, is considered the second most popular cucurbit crop after watermelon and the fourth most economically important vegetable in Asia after tomatoes, cabbage, and onions (Tatlioglu, 1993). It is believed that it is originated in India and has been cultivated for the past 3,000 years. As a result, there is a great deal of genetic variation across the nations. Consumed in salads or pickles, immature cucumber fruits have cooling properties and are said to be beneficial for those with indigestion, jaundice, and constipation. The crop is Asian in origin, and its progenitor may be closely linked to its wild relative *Cucumis sativus* var. hardwickii, which was originally discovered in the foothills of Nepal in the Himalayan Alps and was used as a laxative by indigenous peoples in Northern India (Deakin *et al.*, 1971).

Yield component traits should be considered in developing new inbred lines in cucumber. However, correlation coefficient measures the degree of genetic and/or nongenetic association between two or more traits (Shet *et al*., 2018). Several investigators studied the correlation in cucumber (Kupper and Staub 1988, Rastogi and Aryadeep, 1990). Yield in cucumber is the most important trait for growers and breeders (Gadelhak *et al*., 1989). It is the product of various physiological and morphological traits. Studying genetic parameters in cucumber populations is to discover characteristics that are associated with yield during the selection and evaluation of genotypes (Hanchinamani and Patil, 2009; Kumer *et al*., 2013; Ragawat and Collis, 2017). The Phenotypic coefficient of variance (PCV) and Genotypic coefficient of variance (GCV) values were recorded for various traits in cucumber (Afangideh and Uyoh, 2007; Shet *et al.*, 2018; Chandan *et al*., 2018). Values of heritability and genetic advance of yield attributing traits, and their association will help plant breeders to identify the traits that are effective for selection (Shukla *et al*., 2004; Tazeen *et al.*, 2009; Albert *et al*., 2024). The aims of this study were to study genetic variability and to investigate the simple correlation between fruit yield and some other quantitative characteristics in cucumber.

MATERIALS AND METHODS

Plant Materials

Fifteen imported cucumber hybrids grown widely in Egypt were used. The hybrids were grown in two different locations for three agricultural seasons: March 20, 2021 April 5, 2022, and August 15, 2023 under Giza and Beni-Sweif conditions. The first and second experiments were located at Giza (latitude: 30 013056 and longitude: 31 208853) and the second experiment was located at Beba (Beni-Sweif); (altitude was 28 55 30 and the longitude 28 55 30) above mean sea level. The source of these hybrids is shown in Table 1.

Table 1. Source of fifteen cucumber hybrids used in this study.

Serial	Hybrids	Company	Origin
1	Bahi	Seminis	USA
2	Zeina	Sakata	China
3	Aden	Sun rise	USA
4	Waffir	Vilmorin	France
5	Saffir	Fine seeds	China
6	Jawad	Infinity seeds	USA
7	Victor	Discovery seed	USA
8	Krestal	Frasim	New Zeland
9	Faris	Namdahari	India
10	Officer	Clause	Chili
11	Jude	Genome seeds	USA
12	Masira	Mirro seed	USA
13	Rocket	Landen	Spain
14	Prince	Asgrow	USA
15	Elnems	Royal Sluis	USA

Three hundred plants were planted in each replicate. The experiment was laid out in a Randomized Complete Block Design (RCBD) with 3 replications. The area of each plot was 3 m^2. It was comprised of two beds at a width of 1 m and 3 m long. There were 10 plants per bed and the distance between the plants was 30 cm. Each hybrid was sown in two beds to minimize environmental variations associated with large plots with furrow irrigation. All agricultural practices recommended by the Egyptian Ministry of Agriculture were applied. The first pick was done 45 days to 60 days after planting in the three seasons. However, the plants were harvested every two to three days.

Data recorded

1- Vine length (cm): It was measured from the cotyledon node to the final terminal growth point at harvest on five plants after picking number 6.
2- No. of main branches per stem: It was recorded on five plants at the last harvest
3- No. of days to the first male flower: It was recorded as number of days from planting to the appearance of a fully opened male flower.
4- No. of days to the first female flower: It was recorded as number of days from planting to the appearance of a fully opened female flower.
5- Internode length (cm): It was measured as the length of the internode numbers 10 to 15 on five plants at the six picking numbers.
6- Fruit length (cm): It was measured as the average fruit length of five fruits at picking numbers 4 and 6.
7- Fruit girth (cm): It was measured as the average fruit girth of five fruits at picking numbers 4 and 6.
8- No. of fruits per plot: It was estimated as the total number of fruits in all pickings in each plot.
9- Weight of fruits per plot (kg): It was estimated as the total weight of fruits in all pickings in each plot.

Statistical analysis

The statistical analysis was done for all recorded data, and all means were compared using the Duncans Multiple Test level of probability as described by Gomez and Gomez (1984). The MSTAT-C program version 4 was used. The genetic parameters were estimated by using proper equations as reported by Singh and Chaudhary (1979) as follows:

Genotypic Variance $\sigma^2 g = \frac{MSt - MSe}{r}$

Whereas, MS_t = Mean sum of squares for genotypes
MSe = Mean sum of squares for error
r = Number of replications

Phenotypic Variance "$\sigma^2 p$" = $\sigma^2 g + \sigma^2 e$
$\sigma^2 p$ = Phenotypic Variance
$\sigma^2 g$ = Genotypic Variance
Whereas $\sigma^2 e$ = environmental variance

Phenotypic Coefficient of Variance (PCV) $= \frac{\sqrt{\text{Phenotypic Variance}}}{\text{Mean}} \times 100$

Genotypic Coefficient Variance (GCV) $= \frac{\sqrt{\text{Genotypic Variance}}}{\text{Mean}}$ **x 100**

The PCV and GCV expressed as percentages, as suggested by Burton (1953) were classified according to Sivsubramanian and Menon (1973) as follows:

Less than 10% = Low
10 – 20 % = Moderate
More than 20% = High

Heritability in a broad sense: It is the ratio of genetic variance to the phenotypic variance as reported by Allard (1970)

Heritability (H) = $\frac{\text{Genotypic variance}}{\text{Phenotypic variance}} \text{X } 100$

It is categorized according to Robinson *et al*., (1949) as follows:

0 -30 % = Low
31 – 60 = Medium
Above 60 % = High

Genetic advance from selection as a percentage of mean "GAM %"

It was estimated and categorized as reported by Johnson *et al.*, (1955) by the following formula:

GAM Percentage = (K * H *P)/Mean

Whereas.
k = 2.06 at 5 % selection intensity
H = Heritability
P = Phenotypic standard deviation
GAM less than 10 % = Low
GAM equal to 10 – 20 % = Moderate
GAM more than 20 % = High

Correlation coefficient (r) the association between yield components characteristics and pickes were estimated using the following formula as reported by Singh and Singh (1993).

r = Cov. x*y / (Vx * Vy)$^{1/2}$

Whereas,
Cov x*y = Covariance X and Y
Vx = Variance "x"
Vy = Variance y

RESULTS

Genetic parameters

Data in Table 2 provided the genetic parameters for 15 cucumber hybrids, as follows:

Range: The range indicates the variation observed for each trait across the cucumber hybrids. For example, the number of branches ranges from 3.000 to 4.167, while fruit weight ranges from 18.2 to 28.7 grams.

Mean Squares of trait (MST): This reflects the total variability (phenotypic variance) observed in the traits. Traits such as "vine length" show a very high MST (2169.2), indicating a significant phenotypic variation among genotypes.

Environmental Variance (EV); ($\sigma^2 e$): It captures the portion of the variation due to environmental factors. EV is generally smaller than MST for most traits, showing that genetics plays a more significant role. For example, EV for " vine length " is 244.3

compared to a genotypic variance (σ^2g) of 213.8.

Genotypic Variance (GV); (σ^2g): Represents the heritable genetic component of the variance. High σ^2g values suggest that these traits are more influenced by genetic factors than the environment. For example, " vine length " has a genotypic variance (σ^2g) of 213.8, indicating a strong genetic contribution.

Phenotypic coefficient of variation (PCV) and Genotypic coefficient of variation (GCV).

The PCV includes both genetic and environmental variation, while GCV includes only genetic variation. Traits such as "fruit length" (PCV = 6.07, GCV = 5.31) and "vine length" (PCV = 10.00, GCV = 6.83) exhibit minimal differences between PCV and GCV.

Heritability: is expressed as a percentage and measures the proportion of total variance attributed to genetic factors. It was noticed that the heritability percentage of the studied characteristics ranged from 0.70 to 76.70%. High heritability values (76.70%) were found for fruit length indicated that this trait is strongly influenced by genetic values and is less affected by the environment.

Genetic Advance as a percent of mean (GAM): It indicates the expected improvement from selection as a percentage of the mean. Higher GAM values suggest that traits are amenable to selection. For example, " vine length " has a GAM of 205.88, indicating a significant potential for improvement through breeding.

Table 2. Some genetic parameters in a 15 cucumber hybrids evaluation experiment in the Giza location.

Traits \ Genetic parameter	Range	Mean	MST	MSE (EV)	GV	PV	PCV	GCV	EVC	Heritability	GAM %	CV %
Number of branches	3.000-4.167	3.7	0.583	0.571	0.004	0.58	20.49	1.71	0.15	0.70	0.22	21.8
Fruit girth (cm)	8.683-10.450	9.59	1.097	0.17	0.10	0.27	5.45	3.35	0.02	37.73	2.21	4.3
Ovary Length (cm)	3.250-4.700	4.18	0.392	0.073	0.034	0.10	7.87	4.50	0.02	32.68	1.75	6.48
Days to first female flower	38.667-45.167	42.47	15.148	1.546	1.51	3.06	4.12	2.90	0.04	49.50	7.35	2.92
Days to first male flowers	38- 42	39.35	11.47	9.375	0.23	9.60	7.84	1.22	0.24	2.42	1.21	7.75
Node length (cm)	6.167-7.250	6.66	0.301	0.21	0.01	0.22	7.05	1.50	0.03	4.59	0.31	6.73
Vine length (cm)	166.3- 274.6	214.00	2169.2	244.3	213.8	458.1	10.00	6.83	1.14	46.68	205.88	7.3
Fruit length (cm)	14.083- 17.317	15.76	6.525	0.213	0.70	0.91	6.07	5.31	0.01	76.70	9.17	2.94
Number of fruits	173 - 245	143	780.186	170.543	67.7	238.2	10.79	5.76	1.19	28.43	97.58	9.07
Fruit weight (kg)	18.2 - 28.7	15.4	11.729	4.125	0.84	4.96	14.48	5.97	0.27	17.00	11.30	13.17

MSE(EV)= Environmental variance, MST=Mean Squares of trait, GV= Genotypic variance, PV= Phenotypic variance, PCV= Phenotypic coefficient of variation, GCV= Genotypic coefficient of variation, GAM= genetic advance mean, CV= Coefficient of variation, EVC = Environmental coefficient of variation.

Coefficient of Variation (C.V.%): It measures the relative variability in traits. Lower values indicate higher stability. For trait, "Days of female flowers" (C.V. = 2.92%) is a stable trait, while "Number of branches" (C.V. = 21.8%) shows more variability.

Correlation analysis among some quantitative traits

Simple correlation coefficients of some traits measured in 15 cucumber genotypes are described in Table(3) showed that there were some significant correlations between some traits e.g., number of branches and vine length (0.345) and between days to first male flower and total number of fruits/plant (0.323). Also, between days to first female flower and both node length (0.33) and fruit length (0.414). A significant and positive correlation was found between node length and fruit length (0.302). The vine length showed high significant and positive correlations with fruit length (0.313), total number of fruits/plant (0.338), and total fruits weight/plant (0.391). Finally, there was a high significant and positive correlation between the total number of fruits/plant and the total fruits weight/plant (0.832). The other correlations among the traits studied here were nonsignificant correlations (Table 3).

Correlation analysis among cucumber harvests in different seasons

Correlation coefficients values between fruit total number and weight per plot (20 plants) and number and weight of fruits in each pick in the first, second, and third seasons were studied and are described in Tables 4, 5, and 6. Table 4 showed the correlation of these traits in the first season for 18 picks of cucumber harvest and data showed that the significant and positive correlations were between the total number of fruits/plot and picking No 3, 9, 10, 11, 12, 14, 15, 16, and 18 (the highest value was recorded for the pick No 15 “0.722” and lowest was recorded for the pick No 1 “0.018”). On the other hand, the total fruit weight/plot trait was positively and significantly correlated with the picking numbers 3, 5, 9, 10, 14, 15, and 18 (the highest value was recorded for the pick No 18 “0.445” and lowest was recorded for the pick No 16 “0.013”), Table (4). Table (5) shows the correlations of these two traits with the 14 picks in the third season and data showed significant correlations between the total number of fruits/plot and the picks numbers 3, 4, 5, 6, 9, 10, 12, and 13. the highest value was recorded for the pick No 3 “0.515” and lowest was recorded for the pick No 1 “0.007”. Regarding the correlation between the total weight of fruits/plot and the picks numbers 4, 5, 6, 7, 8, 9, 10, 12, and 13. The highest value was recorded for the pick No 9 “0.621” and lowest was recorded for the pick No 14 “0.007”

Table (6) shows that the correlation between both the total number and weight of fruits/plot with the picking number of cucumber harvests (7 picks) in the third season. The table shows that there are positive correlations between the total number of fruits/plot and all the pickings except for the picking No 7 and the highest value was the picking No 1 (0.533). On the other hand, the total fruit weight/plot was significantly correlated with all pickings except for picking No 3 and the highest obtained value was recorded for the picking No 4 (0.495), Table (6).

Table 3. Simple correlation coefficients of some traits measured in fifteen cucumber genotypes in the second season at Giza location 2022.

–	Number of branches	Fruit girth	Ovary length	Days for first male flower	Days first female flower	Node length	plant Hight	Fruit length	Total number of fruits/plant	Total fruits weight/plant
Number of branches	-	0.043 ns 0.77^{Y}	0.007 ns 0.965	0.176 ns 0.246	0.291 ns 0.052	0.027 ns 0.863	0.345* 0.02	0.195 ns 0.200	0.103 ns 0.500	0.061 ns 0.688
Fruit girth	-	-	0.278 0.064	0.115 ns 0.457	0.011 ns 0.943	0.010 ns 0.946	0.236 ns 0.119	0.220 ns 0.147	0.023 ns 0.882	0.093 ns 0.542
Ovary length	-	-	-	0.145 ns 0.341	0.064 ns 0.676	0.038 ns 0.804	0.164 ns 0.282	0.257 ns 0.088	0.243 ns 0.107	0.297 ns 0.048
Days for first male flower	-	-	-	-	0.342 ns 0.021	0.080 ns 0.600	0.12 ns 0.940	0.220 ns 0.147	0.323 ** 0.030	0.360 ns 0.015
Days first female flower	-	-	-	-	-	0.330 ** 0.027	0.025 ns 0.870	0.414 ** 0.005	0.106 ns 0.488	0.049 ns 0.747
Node length	-	-	-	-	-	-	0.206 ns 0.174	0.302 * 0.043	0.103 ns 0.500	0.060 ns 0.695
vine length	-	-	-	-	-	-	-	0.313 * 0.036	0.338 ** 0.023	0.391 ** 0.008
Fruit length	-	-	-	-	-	-	-	-	0.116 ns 0.447	0.092 ns 0.549
Total number of fruits/plant	-	-	-	-	-	-	-	-	-	0.832 ** 0.000
Total fruits weight/plant	-	-	-	-	-	-	-	-	-	-

Table 4. Correlation coefficients values between fruit total number and weight per plot (20 plants) and number and weight of fruits in each pick in the first season

Picks	Total number of fruits/plot	Total fruits weight/plot
1	0.018 ns	0.264 ns
2	0.231 ns	0.192 ns
3	0.460 **	0.293 *
4	0.176 ns	0.225 ns
5	0.282 ns	0.407 **
6	0.275 ns	0.261 ns
7	0.063 ns	0.283 ns
8	0.195 ns	0.066 ns
9	0.633 **	0.436 **
10	0.468 **	0.436 **
11	0.523 **	0.137 ns
12	0.521 **	0.290 ns
13	0.079 ns	0.041 ns
14	0.691 **	0.380 **
15	0.722 **	0.417 **
16	0.441 **	0.013 ns
17	0.148 ns	0.213 ns
18	0.605 **	0.445 **

ns: non-significant value at P= 0.05
*: significant value at P= 0.05
**: high significant value at P=0.05

Table 5. Correlation coefficients values between fruit total number and weight per plot (20 plants) and number and weight of fruits in each pick in the second season.

Picks	Total number of fruits/plot	Total fruits weight/plot
1	0.054 ns	0.007 ns
2	0.280 ns	0.102 ns
3	0.515 **	0.320 ns
4	0.379 **	0.482 **
5	0.398 **	0.532 **
6	0.376 **	0.351 **
7	0.266 ns	0.305 **
8	0.275 ns	0.453 **
9	0.301 *	0.621 **
10	0.434 **	0.549 **
11	0.144 ns	0.021 ns
12	0.470 **	0.583 **
13	0.459 **	0.376 **
14	0.112 ns	0.057 ns

ns: non-significant value at P= 0.05
*: significant value at P= 0.05
**: high significant value at P=0.05

Table 6. Correlation coefficients values between fruit total number and weight per plot (20 plants) and number and weight of fruits in each pick in the third season.

Picks	**Total number of fruits/plot**	**Total fruits weight/plot**
1	0.474 **	0.533 **
2	0.402 **	0.424 **
3	0.318 ns	0.390 **
4	0.495 **	0.444 **
5	0.415 **	0.408 **
6	0.463 **	0.501 **
7	0.442 **	0.301 ns

ns: non-significant value at P= 0.05
*: significant value at P= 0.05
**: high significant value at P=0.05

DISCUSSION

Germplasm collections are safeguarded globally by governments, academic institutions, botanical gardens, private investors, individuals, and businesses. Germplasm collections provide a crucial chance to characterize phenotypic and interannual diversity in many accessions under normal circumstances by preserving a variety of perennial plants in one place for several years (Migicovsky *et al.*, 2019). One benefit of germplasm preservation is the ability to assess the genetic variety of cucumber germplasm to choose new genotypes with desired features (Hakimi *et al.*, 2022). There is little influence of the environment when the Phenotypic coefficient of variation (PCV) is greater than the Genotypic coefficient of variance (GCV). But, when the environmental coefficient of variation (EVC) value is higher than the Phenotypic coefficient of variation (PCV) and Genotypic coefficient of variance (GCV) indicates that the environment is playing a significant role in the character expression and selection for the improvement of such character may be misleading.

Indirect selection of genotypes for yield improvement relies on the correlation between specific features and yield as well as other traits (Machikowa and Laosuwan, 2011). A selection procedure may be able to simultaneously improve two characters if there is a significant and positive association between them (Hayes *et al.* 1955; Fayeun *et al.*, 2012). This is because it demonstrates how personalities are related to one another and choosing one will result in choosing and enhancing the other (Fayeun *et al.*, 2012).

Fruit yield and fruit number per picking was reported by (Golabadi *et al.*, 2013 and 2015). However, breeding for cucumber fruit yield is an important objective in many cucumber breeding programs (Wehner *et al.* 2000; Hola *et al*., 2024). Moreover, Lope-Sese and Staub (2002) mentioned that trait relationships need to be considered when developing high yielding cucumber germplasm from exotic sources.

CONCLUSION

In this research, 15 cucumber genotypes were evaluated for three growing seasons. Important genetic parameters along with simple correlation coefficients for plant and fruit characteristics were determined. The results revealed that the number of fruits/plant was the most important character for improving and evaluating cucumber genotypes. Interestingly, the results obtained showed that evaluation may be done at an early stage of fruits harvesting to decrease the cost of the needed evaluation experiments.

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الملخص العربي

تحليل التباين الوراثي والارتباط لبعض الصفات الكمية في الخيار

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أجريت هذه الدراسة على 15 صنف هجين من الخيار لتقدير بعض المقاييس الوراثية وحساب الارتباط المظهري البسيط لعدد من الصفات الكمية مثل طول السلامية وطول النبات وعدد الأيام من الزراعة حتى تفتح أول زهرة مذكرة وعدد الأيام من الزراعة حتى تفتح أول زهرة مؤنثة وطول المبيض وعدد الأفرع وطول الثمرة ومحيط الثمرة وعدد الثمار الكلية في ٢٠ نبات و وزن الثمار الكلي في ٢٠ نبات.

ويمكن تلخيص النتائج المتحصل عليها في الآتي:

- كانت قيم معامل الاختلاف البيئي والوراثي منخفضة في صفات طول النبات وطول السلامية وطول المبيض ومتوسطة في صفات عدد الأيام من الزراعة حتى تفتح أول زهرة مذكرة وصفة محيط الثمرة كان قيم كفائة التوريث بالمعنى الواسع مرتفعة في صفات طول الثمرة ومتوسطة في طول المبيض وعدد الأيام من الزراعة حتى تفتح أول زهرة مؤنثة وطول السلامية ومحيط الثمرة.

- سجل معامل الارتباط بين الصفات الكمية وجود ثماني قيم معنوية من بين ٤٥ قيمة ارتباط مقدرة وكانت أعلى قيمة ارتباط موجب بين عدد الثمار ووزن الثمار الكلي لكل ٢٠ نبات وبلغت ٠.٨٣٢ وكانت قيمة الارتباط بين عدد الأيام حتى تفتح أول زهرة مؤنثة وطول الثمرة ٠.٤١٤، أيضا كان طول النبات مرتبط مع عدد الثمار ووزن الثمار الكلي

- كان عدد الثمار الكلى مرتبط ارتباط موجب عالي المعنوية مع عدد الثمار في الجمعات أرقام ٣ و٩ و١٠ و١١ و١٢ و١٤ و١٥ و١٦ و١٨ في الموسم الأول وفي الموسم الثاني ١٠ و١٢ ١٣، وفي الموسم الثالث كان الارتباط بين عدد الثمار الكلي وعدد الثمار في الجمعات المختلفة عالية المعنوية عدا الجمعة رقم ٧ فكان الارتباط غير معنويا.

- تم تقدير الارتباط بين وزن الثمار الكلي ووزن الثمار في الجمعات المختلفة في المواسم الثلاثة وكانت النتائج كالتالي:

في الموسم الأول كان الارتباط عالي المعنوية مع الجمعات ٣ و٥ و٩ و١٠ و١٤ و١٥ و١٨ وفي الموسم الثاني كان معنويا مع الجمعات ٤ و٥ و٦ و٧ و٨ و٩و١٠و١٢ و١٣ وفي الموسم الثالث كان الارتباط بين وزن المحصول الكلي معنوياً مع وزن كل جمعة من الجمعات السبعة عدا الجمعة رقم ٣.

- وكانت صفة عدد الثمار للنبات هي أهم الصفات التي يجب تقييمها لأي برنامج تقييم وانتخاب لمحصول الخيار، لذا يمكن توفير نفقات تجارب التقييم ويمكن عمل التقييم لمعدل المراحل المبكرة لا تتعدى الجمعة الخامسة لمحصول الخيار.