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Enhancing Sustainable Productivity of Faba Bean (*Vicia faba* L.) Through Genetic Analysis Under Seaweed Extract Biostimulant Irrigation

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Abstract: The study was conducted under the conditions of Nineveh Governorate, Iraq, to investigate the inheritance pattern of some growth and yield traits in three faba bean cultivars (Local, Franchi, and Aquladis) under the influence of three concentrations of the seaweed extract Stymulant (0, 4, and 8 ml/L) during the fall growing season of 2023/2024 at the College of Agriculture and Forestry, University of Mosul, as a factorial experiment with nine treatments in a completely randomized block design with three replications. Analysis of variance demonstrated that there were high differences between cultivars regarding the following traits number of pods per plant, seed weight, total seed number, percentage of pod-filling, 100-seed weight, pod-weight, and biomass. Local cultivar was much better than the other two cultivars when in terms of the number of pods per plant, seed weight, and 100-seed weight, whereas Aquladis was much better in terms of total seed number and percent pod-filled. The highest pod weight was observed in the Franchi cultivar, which was significantly superior only to Aquladis. Foliar application of Stymulant at a concentration of 8 ml/L was significantly superior to other concentrations for the traits of number of pods per plant and pod weight. The highest pod weight was recorded in plants of the Aquladis cultivar treated with Stymulant at 8 ml/L. Genetic variance was significant in all except plant height, number of lateral branches, pod length, and total seed weight whereas the environmental and phenotypic variances was significant in all traits. The heritability values in the broad sense, and expected genetic gain per cent of the mean were high in the number of pods per plant and seed weight, total seed weight, percent pod-filling, 100-seed weight and biomass. High heritability indicates that the phenotype of an individual is strongly related to its genotype, suggesting the possibility of directly improving these traits in subsequent growing seasons.

Key words: Stymulant, heritability and genetic improvement, faba bean.

1. Introduction

Faba bean (*Vicia faba* L.) happens to be one of the most significant crops of legume family (Fabaceae). It is also important as it is used as food to people since its pods and seeds contain vital nutrients such as carbohydrates, amino acids, vitamins, fats among other nutrients **(Diaz *et al*., 2006)**. Besides having high percentage of protein in its seeds that range between 31.8-39.7 **(Alghamdi, 2008)**, faba beans also have vitamin A in 217 international units per 100 grams of its seeds. Moreover, faba bean seeds contain high amounts of iron and calcium **(Rahate *et al*., 2021)**, and thus, this crop is also nutritionally relevant since it can be used as a replacement of the costly animal protein **(Abdelhalim, 2010).** The plant remains of it are also employed as feed to livestock, and it fosters the fertility of soil and improves soil texture when grown in direct rotation with other legumes, therefore remedying nitrogen and ensuring the soil remains fertile and productive (**Abdalla *et al*., 2020)**. Research shows that the Mediterranean basin is the original source of faba beans which have been able to spread to other parts of the world **(Sinha, 1977).** In 2022, the faba beans planted on the area in Iraq amounted to about 20,811 hectares, with the average yield of 1950.2 kg/ hectare and a production totaling about 40,586 tons **(Central Statistics Organization, 2023).** Consequently, there is a need to make sure that the concerned parties in this crop strive to ensure that its yield per unit area, in terms of quantity and quality improves. Plant breeders have an important role in it since they introduce new genetic characteristics, varieties or hybrids that are adapted to the environmental conditions in Iraq. The genotypic analysis of the varieties is especially significant since it is a good source of information in breeding programs to produce genetically superior varieties particularly where adequate genetic information about the varieties is lacking **(Al-Kamer, 1999).** Foliar fertilization is a significant mode of providing plants with both macro and micronutrients and other growth regulators resulting into higher vegetative growth, higher yield and quality **(Kuepper, 2003).** The use of biofertilizers is one form of foliar fertilization, and this has been shown to be effective in raising the population of desirable microorganisms and in stimulating microbial activities leading to better nutrient availability and uptake by the plants. They also have considerable contribution to enhancing the soil fertility; they fix the atmospheric nitrogen, stimulated root development by synthesizing hormones and metabolites, and increased soil minerals and nutrient availability **(Chen and Yada, 2011).** The expression of any trait in a crop plant is a result of genotype-environment interaction; therefore, the objectives of plant breeders should focus on understanding the relationship between plant traits, metabolic processes, and phenotypic characteristics, as these are all genetically controlled. This is possible only through estimating genetic and phenotypic variance to come up with a selection program that would focus on more than one trait at a given time **(Al-Adhari, 1992).** One of the most critical factors to the plant breeders is estimating heritability of quantitative traits. Using estimates of heritability in the broad sense, it is possible to isolate the role of both genetic and environmental factors in the expression of a trait. Heritability may then be used as a measurement of parent-child relationship. A significant genetic parameter required to know in any quantitative trait is heritability.

The optimal breeding strategy that is to be employed in enhancing a given trait is determined by estimating some genetic parameters. Also, the estimation of these parameters is important in estimating the expected genetic gain, which is the greatest application of quantitative genetics theory in plant breeding programs **(Allard, 1960).**

2. Materials and Methods

The experiment was carried out in the vegetable field of the Horticulture and Landscape Engineering Department, College of Agriculture and Forestry, University of Mosul, Mosul, Iraq, which is at 36.35 o N latitude, 43.15 o E longitude, the elevation was 223 meter above sea level **(Guest, 1966).** The objective was to estimate some genetic parameters under the conditions of

Nineveh Governorate for three faba bean cultivars (Local, Franchi, and Aquladis) under the influence of three concentrations of the seaweed extract Stymulant (0, 4, and 8 ml/L). The seeds of the three cultivars were sown on November 5, 2023, in rows 3 m long, with a spacing of 25 cm between plants and 75 cm between rows. The experiment was a factorial design with three replications using a Randomized Complete Block Design (RCBD), resulting in eight treatments (3 x 3 = 9). Each treatment consisted of two rows, resulting in a total of 54 experimental units (3 x 3 x 3 x 2 = 54). All agronomic practices were performed uniformly for all treatments **(Matalab *et al*., 1989).** Data were collected from ten randomly selected plants per experimental unit. Data were analyzed statistically using **SAS software (2010)**, and Duncan's Multiple Range Test was used to compare means at a significance level of 0.05. The phenotypic, genetic, and environmental variances, as well as the coefficients of phenotypic and genetic variation, were estimated according to **Steel and Torrie (1980)** and as follows:

Where:

Phenotypic variance = (δ^2P)

Genotypic variance = (δ^2G)

Environmental variance = (δ^2E)

$\delta^2G = (\delta^2Cultivars – \delta^2E) / R$

$\delta^2E = Mse$

Where:

Mean square of cultivars = δ^2Cultivars

Mean square of experimental error = δ^2E

Mse = δ^2E

Number of replications = R

$PCV\% = (\sqrt{\delta^2P} / \tilde{Y}) \times 100$

$GCV\% = (\sqrt{\delta^2G} / \tilde{Y}) \times 100$

Where:

Phenotypic coefficient of variation = (PCV)

Genotypic coefficient of variation =(GCV)

($\tilde{Y}$) is the mean of the trait Heritability in the broad sense

H^2(b.s) was estimated according to **Hanson *et al*. (1955)** using the following equation:

$H^2(b.s) = (\delta^2G / \delta^2P)$

Expected genetic advance (E.G.A.) was estimated using the equation proposed by **Kempthorne (1969)**: $E.G.A. = [K \times H^2(b.s) \sqrt{\delta^2P}]$

Where:

Expected genetic advance (E.G.A)

K = 2.06 (selection intensity for 5% of plants

The expected genetic advance as a percentage of the mean (%E.G.A.) was calculated as follows:

$\%E.G.A. = [(K \times H^2(b.s) \sqrt{\delta^2P}) / \tilde{Y}] \times 100$

3. Results and Discussion

Table (1) shows the results of the analysis of variance for the studied traits in faba bean. Evidently, there were notable differences among the various cultivars at the 0.01 probability level on the characteristics of the number of pods per plant, weight of seeds, total number of seeds, weight of pod and at the 0.05 level on traits of weight of pod. Such high differences among cultivars are necessary to be able to study their genetic behavior so as to select and make the best ones. Moreover, the variations and differences among cultivars form the foundations on which the breeders of plants use them in coming up with new superior hybrids with at least one or more desirable qualities. The probability level of 0.01 revealed significant differences with fertilization with the seaweed extract Stymulant in plant height, number of lateral branches, number of pods per plant, pod length, seed weight, pod-filling percentage, 100-seed weight, and pod weight, and probability level of 0.05 in total seed weight. The interaction between cultivars and seaweed extract Stymulant fertilization reached significance at the 0.05 probability level for average pod weight and at the 0.01 probability level for number of pods per plant and pod weight. The presence of significant effects of the genotype-environment interaction (cultivars x seaweed extract Stymulant fertilization) indicates that the contribution of this interaction to the total variance for these traits was high, suggesting that this interaction will have a significant impact on future breeding programs. This is consistent with the findings of **Andualem *et al*. (2022), Tadele *et al*. (2022), Manish *et al*. (2023), Torabian *et al*. (2024) and Jassim Al-Saedy *et al*. (2025),** who also observed significant differences in growth and yield traits in faba bean.

Table (2) indicates the effect of the various varieties on the features under study of faba bean, it clearly shows that the various varieties do not differ significantly with respect to the plant height, number of lateral branches, average pod weight and total seed weight. The local variety showed significant superiority over the other two varieties for the traits of number of pods per plant, individual seed weight, and 100-seedweight. The Aquladis variety, however, was significantly superior to the other two varieties for total seed number and pod-filling percentage. The highest values for average pod weight and biomass were observed in the Franchi variety, which was significantly superior only to the local variety. The highest pod weight was also observed in the Franchi variety, which was significantly superior only to the Aquladis variety. These results are consistent with those reported by **Al-Shakarchy *et al*. (2021), Al-Shakarchy (2021), Prateek and Aman (2022), Manish *et al*. (2023), Ahmad *et al*. (2024a,b), and Kebede *et al*. (2025)**.

Table (3) shows the effect of foliar application of the seaweed extract Stymulant on the studied traits in faba bean. The results indicate that foliar application of Stymulant at a concentration of 8 ml/L showed the highest values for plant height, number of lateral branches, pod length, total number of seeds, and total seed weight, significantly outperforming the control treatment (no application), which yielded the lowest values for these traits. The same concentration (8 ml/L) also significantly outperformed the other two treatments for the traits of number of pods per plant and pod weight. The treatment with Stymulant at 4 ml/L also showed significant superiority over the control treatment for these two traits. No significant differences were observed among the three treatments for pod weight per plant and biomass. The treatment with 4 ml/L recorded the highest values in individual seed weight and 100-seed weight, which is significantly higher than the control treatment, which had recorded the lowest values in these traits. In terms of the percentage of pod-filling, the control treatment (no application) was greatly superior to the two foliar application treatment (4 and 8 ml/L), with the 8 ml/L treatment recording the lowest value of this trait.

This increased performance of foliar application of these biofertilizers which is evident on most of the characteristics could be explained by the fact that bio-stimulants improve the efficiency of nutrient uptake, tolerance to stresses and quality of crops. Bio-stimulants may be referred to as compounds or mixtures of compounds of natural origin, including any benefit-giving microorganisms like fungi and bacteria that enhance the growth of plants without any side effects **(Du Jardin, 2015 and Alsultan *et al*., 2023).** In addition to their primary role in supplying nutrients to plants, they also play a significant role in protecting plants from pathogens. For example, the antagonistic activity of Bacillus bacteria against the growth of fungal hyphae has been observed, thus preventing fungal infections and promoting plant growth and development. Furthermore, they have been shown to reduce viral diseases and enhance resistance to root-knot nematodes **(Chowdhury *et al*., 2015).** These positive effects of bio-stimulants ultimately lead to improved growth and yield characteristics.

Table (1). Analysis of variance for the studied traits in faba beans, showing the mean square values

Sources of disagreement	degrees of freedom	Mean Squares											
		Plant height	Number of side branches	Number of pods per plant	Length of the horn	Average weight of the pod	weight of a single seed	Total number of seeds	Degree of horn fullness	Weight of 100 seeds	Total seed weight	Horn weight	Biological weight
Duplicates	**2**	6.037	5.444	0.444	20.703	0.953	0.031	53.444	2.592	311.148	883.592	2169.000	202435.69
Types	**2**	12.703	2.111	92.111 **	15.814	51.227	1.737 **	3012.111 **	12.773 **	17371.370 **	4365.481	12420.333 *	353515.69 **
fertilization	**2**	358.037 **	85.444 **	348.777 **	260.259 **	0.380	0.424 **	742.111	15.460**	4244.481 **	8989.481*	57894.111 **	35571.83
Types of plants x Fertilization	**4**	73.925 **	4.222	236.222 **	17.037	75.340 *	0.048	743.888	5.144	487.148	6445.537	20859.777 **	31229.19
Experimental error	**16**	8.870	1.569	9.694	10.120	19.434	0.021	289.361	1.618	211.939	2417.842	3196.875	43380.233

Table (2). Effect of varieties on the studied traits in faba beans

Types	Plant height	Number of side branches	Number of pods per plant	Length of the horn	Average weight of the pod	The weight of a single seed	Total number of seeds	Degree of horn fullness	Weight of 100 seeds	Total seed weight	Horn weight	Biological weight
local	A 68.000	A 14.6667	A 24.556	A 22.889	B 14.433	A 2.316	B 119.333	B 5.3611	A 231.667	A 271.78	A B 316.11	B 229.88
Franchi	A 68.778	A 14.7778	B 19.444	A 23.222	A 19.144	B 1.763	B 131.111	B 6.3056	B 176.333	A 236.78	A 363.11	A 614.00
Aquladis	A 66.444	A 15.5556	B 18.667	A 20.778	A B 16.133	C 1.448	A 155.222	A 7.7278	C 144.889	A 231.33	B 289.78	A 506.67

Table (3). Effect of fertilization treatments with the marine extract Stymulant on the studied traits in faba bean

Concentration of extract Stymulant (mg/L)	Plant height	Number of branches	Number of pods per plant	Length of the horn	Average weight of the pod	The weight of a single seed	Degree of horn fullness	Degree of horn fullness	Weight of 100 seeds›	Total seed weight	Horn weight	Biological weight
0	B 61.111	B 11.444	C 14.556	B 16.333	A 16.333	B 1.592	B 126.556	A 7.963	B 159.222	B 210.44	C 239.33	A 378.61
4	AB 68.444	A 16.666	B 21.111	A 23.778	A 16.700	A 1.971	AB 134.444	B 5.898	A 197.111	A 259.78	B 330.44	A 496.49
8	A 73.667	A 16.888	A 27.000	A 26.778	A 16.678	A 1.965	A 144.667	B 5.532	A 196.556	A 269.33	A 399.22	A 475.45

The interaction between faba bean cultivars and foliar application of the seaweed extract Stymulant on the studied traits is shown in Table (4). It is evident that plants of the local cultivar treated with Stymulant at a concentration of 8 ml/L exhibited the highest values for plant height and number of pods per plant, compared to the control treatments for both the local and Aquladis cultivars, which showed the lowest values for these traits, respectively. The highest values for number of lateral branches, average pod weight, total number of seeds, total seed weight, and pod weight were observed in plants of the Aquladis cultivar treated with 8 ml/L of Stymulant. The lowest values for number of lateral branches were observed in the control treatment for the Franchi cultivar, for average pod weight in the local cultivar treated with 8 ml/L, for total number of seeds in the control treatment for the local cultivar, and for total seed weight and pod weight in the control treatment for the Aquladis cultivar. The longest pods were observed in the Franchi cultivar treated with 8 ml/L, compared to the shortest pods in the control treatments for both Franchi and Aquladis cultivars. Plants of the local cultivar treated with 4 ml/L showed the highest values for individual seed weight and 100-seed weight, compared to the control treatment for the Aquladis cultivar, which showed the lowest values for these traits. The control treatment for the Franchi cultivar exhibited the highest pod-filling percentage, compared to the lowest percentage in the control treatment for the same cultivar. The highest biomass was observed in plants of the Franchi variety treated with a concentration of 4 ml/L, compared to the lowest biomass in plants of the local variety treated with the marine extract Stymulant at a concentration of 8 ml/L.

Table (5) indicates that the values of phenotypic variance, genetic and environmental components, and estimation of heritability of the studied traits in faba bean were obtained. These values were determined in terms of the analysis of variance (Table 1). It is clear that the genetic variance was not equal to zero in all the traits except plant height, number of lateral branches, pod length, and total weight of seed. The environmental and phenotypic variances were significantly different from zero for all traits. These findings are consistent with those of **Upendra *et al*. (2021), Prateek and Aman (2022), and Shferaw and Tarekegne (2024),** who also observed significant differences in variance from zero in faba bean. The results also indicate that the genetic variance was higher than the environmental variance for the traits of number of pods per plant, seed weight, total number of seeds, pod filling percentage, 100-seed weight, and biomass.

The highest values for both genetic and phenotypic coefficients of variation were recorded for the traits of number of pods per plant, average pod weight, individual seed weight, total seed number, pod-filling percentage, 100-seed weight, and biological yield. It is evident that the phenotypic coefficient of variation values were much higher than the genetic coefficient of variation values for all traits, indicating the influence of the environment on the studied traits to varying degrees. Since most of these traits are quantitative, selection based on phenotype is effective for these traits **(Al-Mukhtar, 1988).** Heritability in the broad sense was high for number of pods per plant, individual seed weight, total seed number, pod-filling percentage, 100-seed weight, and biological yield; moderate for pod weight; and low for the remaining traits. High heritability values indicate that the phenotype of an individual is strongly related to its genetic makeup, suggesting the possibility of directly improving these traits in subsequent seasons. **Al-Hamdani (2017) and Bishnoi *et al*. (2018)** found that previously, various traits have been reported as having a low to moderate to high heritability value **(Waly *et al*., 2021 and Manish *et al*., 2023).** A large heritability percentage of any trait gives a good chance to the breeders to enhance the traits by direct selection **(Allard, 1960).** Table 5 results show that the values of the expected genetic gain in terms of a percentage of the trait mean were also in agreement with the values of the broad-sense heritability. The values of heritability corresponding to the number of pods per plant, seed weight, total seed number, percentage pod-filled, 100-seed weight, and biological yield were found to have a high value. The heritability of pod weight and pod weight per plant was moderate whereas the heritability of the other characteristics was low. The same authors of **Behailu *et al*. (2018), Amit *et al*. (2020), Atif *et al*. (2022), Prateek and Aman (2022), Manish *et al*. (2023), and Kebede *et al*. (2025)** also found that the values of genetic gain were low, moderate, and high in relation to the studied traits.The pairing between the genetic parameters (coefficients of genetic and phenotypic variation, heritability and the expected genetic gain as percentage) indicate that their values were similar in their change either increasing or decreasing most of the traits studied, hence there was a strong relationship between the genetic and phenotypic parameters. Hence, this is a very high correlation and the anticipated genetic gain in the selection cycles to follow can be predicted, given the phenotypic coefficient of variation. Mass selection can be effectively used in such instances where the target improvement goals in crops are intended to be attained **(Welsh, 1981).**

Table (4). Effect of interaction between cultivars and fertilization treatments with extract Stymulant on the studied traits in faba bean

Types	Stimulant extract concentration (mg/L)	Plant height	Number of branches	Number of pods per plant	Length of the horn	Average weight of the pod	The weight of a single seed	Total number of seeds	Degree of horn fullness	Weight of 100 seeds	Total seed weight	Horn weight	Biological weight
Local	**0**	B 56.333	C 11.333	D 13.000	C 18.333	AB 15.633	B 2.0467	C 107.67	CD 5.887	B 204.67	AB 236.67	DE 199.00	B C 286.2
	4	A 71.333	AB 17.333	C 19.333	AB 25.333	AB 17.333	A 2.4867	C 120.00	D 4.750	A 248.67	A 298.33	BC 325.33	C 207.5
	8	A 76.333	B 15.333	A 41.333	AB 25.000	B 10.333	A 2.4167	BC 130.33	D 5.447	A 241.67	A 280.33	AB 424.00	C 196.0
Franchi	**0**	AB 64.000	C 11.000	BC 19.667	C 15.333	AB 18.200	D 1.6133	BC 139.67	A 9.423	D 161.33	AB 241.00	ABC 359.33	ABC 501.0
	4	A 71.667	AB 16.667	C 18.667	A 26.000	A 21.733	BC 1.9200	BC 129.33	D 5.107	BC 192.00	A 249.67	AB 394.33	A 712.0
	8	A 70.667	AB 16.667	BC 20.000	A 28.333	AB 17.500	CD 1.7567	BC 124.33	D 4.387	CD 175.67	AB 218.67	ABC 335.67	AB 629.0
Aquladis	**0**	AB 63.000	C 12.000	D 11.000	C 15.333	AB 15.167	E 1.1167	BC 132.33	AB 8.580	E 111.67	B 153.67	E 159.67	ABC 348.7
	4	AB 62.333	B 16.000	B 25.333	BC 20.000	B 11.033	D 1.5067	AB 154.00	ABC 7.840	D 150.67	AB 231.33	CD 271.67	ABC 570.0
	8	A 74.000	A 18.667	BC 19.667	A 27.000	A 22.200	CD 1.7233	A 179.33	BCD 6.763	CD 172.33	A 309.00	A 438.00	ABC 601.3

Table (5). Mean values, components of phenotypic variance (genetic and environmental), and genetic parameters in faba bean

Genetic landmarks	The traits studied					
	plant height	Number of branches	Number of pods per plant	Length of horn	Average weight of pod	The weight of a single seed
Genetic variation	1.278 2.033±	0.181 0.343±	27.472 13.132±	1.898 2.488±	10.598 7.564±	0.572 0.247±
Environmental diversity	8.870 2.805±	1.569 0.496±	9.694 3.066±	10.120 3.200±	19.434 6.146±	0.021 0.007±
Phenotypic variation	10.148 2.762±	1.750 0.476±	37.166 10.115±	12.018 3.271±	30.032 8.174±	0.593 0.161±
Genetic variation coefficient	1.669	2.836	25.093	6.179	19.646	41.058
Phenotypic coefficient of variation	4.703	8.819	29.186	15.549	33.073	41.805
Inheritance in a broad sense	0.126	0.103	0.739	0.158	0.353	0.964
Expected genetic improvement	0.826	0.281	9.281	1.128	3.984	1.530
Expected genetic improvement as a percentage	1.220	1.873	44.443	5.059	24.043	83.061
overall average for this trait	67.740	15.000	20.888	22.296	16.570	1.842

Genetic landmarks	The traits studied					
	Total number of seeds	Degree of horn fullness	Weight of 100 seeds	Total seed weight	Weight of the pods	Biological weight
Genetic variation	907.583 429.208±	3.718 1.823±	5719.810 2469.160±	649.213 670.786±	3074.486 1797.224±	103378.486 50454.171±
Environmental diversity	289.361 91.504±	1.618 0.512±	211.939 67.021±	2417.842 764.589±	3196.875 1010.941±	43380.233 13718.034±
Phenotypic variation	1196.944 325.767±	5.336 1.452±	5931.749 1614.418±	3067.055 834.747±	6271.361 1706.848±	146758.719 39942.664±
Genetic variation coefficient	22.279	29.831	41.037	10.336	17.167	71.421
Phenotypic coefficient of variation	25.585	35.737	41.790	22.465	24.518	85.097
Inheritance in a broad sense	0.758	0.697	0.964	0.212	0.490	0.704
Expected genetic improvement	54.022	3.316	152.945	24.185	79.936	555.573
Expected genetic improvement as a percentage	39.951	51.299	82.988	9.810	24.747	123.410
overall average for this trait	135.222	6.464	184.296	246.518	323.000	450.182

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تعزيز الإنتاجية المستدامة للفول (*Vicia faba* L) من خلال التحليل الجيني تحت الري بمحفز حيوي مستخلص من الأعشاب البحرية Biostimulant

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الخلاصة

أجريت الدراسة تحت ظروف محافظة نينوى- العراق حول طبيعة توريث بعض صفات النمو والحاصل لثلاثة اصناف من الباقلاء هي (محلي ، Franchi و Aquladis) تحت تأثير ثلاثة تراكيز من المستخلص البحري Stymulant (0 ، 4 و 8 مل/لتر) ، خلال موسم النمو الخريفي لعام 2024/2023 في كلية الزراعة والغابات /جامعة الموصل كتجربة عامليه بتسعة معاملات وفق تصميم القطاعات العشوائية الكاملة وبثلاثة مكررات. تشير النتائج لتحليل التباين إلى وجود اختلافات معنوية بين الاصناف لصفات عدد القرنات للنبات الواحد ووزن البذرة الواحدة و عدد البذورالكلي و درجة امتلاء القرون ووزن 100 بذره ووزن القرنات والوزن البايلوجي. الصنف المحلي اظهر تفوقا معنويا على الصنفين الاخرين لصفات عدد القرنات للنبات الواحد ووزن البذرة الواحدة ووزن 100 بذره ، بينما تفوق الصنف Aquladis معنويا على الصنفين الاخرين لصفتي عدد البذور الكلي ودرجة امتلاء القرون ، اما اعلى وزن للقرنات فكان في الصنف Franchi الذي تفوق معنويا فقط مع الصنف Aquladis. الرش بالمستخلص البحري Stymulant بتركيز (8 مل/لتر) اظهر تفوقا معنويا على التراكيز الاخرى لصفتي عدد القرنات للنبات الواحد ووزن القرنات. اعلى وزن للقرنات كان في نباتات الصنف Aquladis المعاملة بالمستخلص البحري Stymulant بتركيز (8 مل/لتر). التباين الوراثي كان معنويا عن الصفر لجميع الصفات باستثناء ارتفاع النبات وعدد الافرع الجانبية وطول القرنة ووزن البذور الكلي ، بينما كان التباين البيئي والمظهري معنويا عن الصفر للصفات جميعها. فيما كان التوريث بالمعنى الواسع وقيم التحسين الوراثي المتوقع كنسبة مئوية من المتوسط عاليا لعدد القرنات للنبات الواحد ووزن البذرة الواحدة وعدد البذور الكلي ودرجة امتلاء القرون ووزن 100 بذرة والوزن البايولوجي، أن ارتفاع نسبة التوريث دليل على أن مظهر الفرد ذو علاقة كبيرة بتركيبة الوراثي وهذا يدل على إمكانية إدخال تحسينات مباشرة على هذه الصفات في المواسم التالية.

كلمات مفتاحية : Stymulant ، التوريث والتحسين الوراثي ، الباقلاء.