

EFFECT OF SOME GENOTYPE ON CHEMICAL COMPOSITION OF FABA BEAN (*Vicia faba L.*)

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ABSTRACT

This study was carried out to study the variability on chemical composition of four genotypes of faba bean (*Vicia faba L.*) at two locations (Field Crop for Agriculture College and Kamaka village). Six chemical factors were studied, Moisture, protein, carbohydrate, Nitrogen, potassium, and phosphorus. There were highly significant differences were recorded for most traits depend on the genotypes and two locations. The highest potassium content were recorded for Turkish variety in first location (0.386%), also the same variety recorded the highest value for nitrogen, carbohydrate, protein, and moisture content in second location (3.04%, 54.47%, 19.04% and 83.64%) respectively.

INTRODUCTION

Faba bean is a high protein food that used for human and a storage feed especially in Europe, China, Middle East and Northern Africa (Link et al., 1994; Minyi, 1996). The composition of faba bean and their nutritional value is considered that is very similar to meat (Ali et al., 1982). The faba bean is always traditionally attributed to its high content of protein and ranged between (27 – 34 %) Duc, 1997; Haciserogullari et al., 2003) depending on genotype. There is a recent evidence of genetic variation of faba bean composition (Waly & Abd EL-Aal, 1986). The protein content of faba bean seeds is between 20% to 40%. (Griffiths & Lawes, 1978). Faba bean is a diploid plant with a relatively few number of chromosomes ($2n=2x=12$) (Al-Barri and Shataya, 2013; Basheer et al., 2013 and Terzo pouls et al., 2008). The last genetic and breeding program has resulted to improved faba bean that has high yield protein content (Duranti and Cristina, 1997). The research of faba bean quality is generally concentrated on carbohydrate and protein (Hill-Cottingham,

1983; Tewatia & Virk, 1996). A few are known about other chemical composition of faba bean seeds, the faba bean seeds has a high level of carbohydrate content and is between 52.3- 64.4 %. (Salih & El Hardallou, 1986). The remarkably high level of protein and carbohydrate in some genotypes underlines their importance as sources of vital nutrients, which may be considered in future breeding programs.

The objective of this study is to assess the effect of different locations on chemical composition of four genotypes of faba bean, and selection of high quality genotypes under different conditions in the Duhok Region.

MATERIALS AND METHODS

The experiment was conducted during growing seasons (2015 – 2016) in two different locations (first location in Kamaka village (B₁), which is faraway about 16 Km from Duhok city at longitude 43° 38' E, latitude 51° 56' N. and (B₂) the second location is Field Research of College of Agriculture, University of Duhok.

Table (1): Temperature, Rainfall, and Relative Humidity during 2015/ 2016 growing season at both locations.

Moth	Max.Temp.(C ^o)		Min.Temp.(C ^o)		Rainfall (mm)		RH (%)	
	B ₁	B ₂	B ₁	B ₂	B ₁	B ₂	B ₁	B ₂
November	16.2	18.7	6.0	6.8	86.4	59.5	66	72
December	10.8	13.5	1.1	7.2	92.6	87.0	65	74
January	6.9	10.6	-1.0	1.4	144.4	91.5	73	78
February	13.8	16.8	3.9	4.5	68.8	39.0	67	74
March	15.1	18.8	5.3	6.5	115.4	88.0	67	70
April	22.0	25.6	9.7	15.8	51.8	40.5	53	56
May	26.8	31.5	13.3	19.4	14.8	0.0	45	41

B₁: first location (Kama village) and B₂: second location field research of agriculture college.

Experimental material comprised four genotypes of faba bean (Italy (A₁) ; Spain (A₂); Turkish (A₃); Duhok (A₄)).

Seeds for four genotypes are sown in (November, 2015) manually in two location. The plot was lay out in a Random Complete Block Design (RCBD), with three Replication, each plot consist of three rows with 5m long and distance between plants are 40 cm. All agricultural operation was followed to obtain a good crop.

The sample of seeds from each plot were analyzed for chemical composition on dry weight. The seed sample are grinding to a fine powder for proximate analysis for Nitrogen, Phosphorus,

Potassium, Carbohydrate, Protein (Nx 6.25) and moisture.

RESULT AND DISCUSSION

Data in table (2) showed significant differences between genotypes for all parameters ranged between 0.01% and 0.05%, while the location exhibited significantly effect in nitrogen, protein and moisture. Regarding the interaction between genotype and location showed significant differences for all parameters.

Table (2): Mean squares from analysis of variance for chemical composition of some genotypes of faba bean at two t locations.

	d.f	Potassium	Phosphorus	Nitrogen	Carbohydrate	Protein	Moisture
Replication	2	0.0002	0.371	0.552	0.131	1.284	0.106
Genotypes(G)	3	0.017**	3.624**	0.474**	104.852**	17.549*	4.966*
Locations (L)	1	0.0006	0.004	0.119*	1.242	2.940*	9.462*
GxL	3	0.0018*	1.426**	0.129*	70.302**	6.678**	11.185**
Error	14	0.00035	0.007	0.250	0.489	0.643	1.466

*, ** are significant at $P \leq 0.05$ and $P \leq 0.01$, respectively

In table (3) noticed that Turkish variety exhibited the maximum value of potassium percent with value (0.356) in both location followed by Duhok variety with (0.329). As shown in the same table the Italy variety recorded

the minimum value with (0.267). Concerning the phosphorus percent, all genotype involved in this study were differ significantly in character phosphorus percent and Duhok variety was superior and gave maximum value with (2.51) in

both location, while the Italy variety recoded the lowest value with (0.68). Regarding the nitrogen percent also, the same table shows that Duhok variety gave the maximum value with (2.90) and followed by Turkish variety and recorded (2.82).

From the above result the Duhok variety was superior in phosphorus and nitrogen percent. (El-

Saber, 2010) stated that variability in chemical composition between faba bean genotypes is due to variations in genetic background or origin of that genotype. Patrick and Stoddard (2010). They found that the genotypes of broad bean are varying in potassium percentage.

Table (3): Effect of four genotypes and two locations on potassium, phosphorus and nitrogen content of Faba bean.

genotype	Potassium %		A	Phosphorus %		A	Nitrogen%		A
	B			B			B		
	B ₁	B ₂	B ₁	B ₂	B ₁	B ₂			
A ₁	0.243 d	0.290 c	0.267 c	0.72 d	0.64 d	0.68 c	2.61 bc	2.41 cd	2.51 b
A ₂	0.243 d	0.237 d	0.240 d	1.06 d	2.43 b	1.75 b	2.29 d	2.29 d	2.29 c
A ₃	0.368 a	0.344 ab	0.356 a	2.36 b	1.73 c	2.04 b	2.59 bc	3.04 a	2.82 a
A ₄	0.344 ab	0.314 bc	0.329 b	2.89 a	2.13 bc	2.51 a	2.75 b	3.06 a	2.90 a
B	0.299 a	0.296 a		1.76 a	1.73 a		2.56 b	2.70 a	

Mean with a column, row and their interaction following with the same latter are not significantly different according to Duncan multiple of 0.05 level.

The data in table (4) represented the effect of four genotypes of faba bean and locations in carbohydrate, protein and moisture, the data exhibited that the Turkish variety was superior in carbohydrate, protein and moisture percent with values, (50.82, 17.61 and 82.09) respectively, while, the Duhok variety gave the high value for protein percent (19.05) in location two and Spain variety recorded highest value in moisture in the location two with value (83.64). The tables above concluded results are close in conformity with the Kelly (1973) referred differences in the content of protein in legume depending on environmental condition and genotypes. (Barratt, 1982; Karamons *et al.*, 1994) they found significant variation between different genotype of faba bean

for two locations under study for carbohydrate content. (Alghamdi S.S. 2009) revealed that genotypes of faba bean are differed significantly in moisture, protein and carbohydrate.

Table (5) show the correlation coefficient between chemical composition characters were calculated at combined two locations. The result noticed different correlations between most of parameter. Protein show positive and significant correlation with each of potassium, nitrogen and carbohydrate (0.504, 0.979, 0.537) respectively. The carbohydrate gave positive and significant correlation only with nitrogen character with value (0.500). Nitrogen and phosphorus show positive and significant correlation with potassium and gave (0.560, 0.505) respectively.

Table (4): Effect of four genotypes and two locations on carbohydrate, protein and moisture of Faba bean.

genotype	Carbohydrate%		Protein%		Moisture%				
	B		A		B		A		
	B ₁	B ₂	B ₁	B ₂	B ₁	B ₂			
A ₁	46.21 b	38.81 e	42.51 b	17.00 b	15.09 cd	16.05 b	78.51 d	82.52 ac	80.51 b
A ₂	44.67 c	39.83 e	42.25 b	14.33 d	14.31 d	14.32 c	83.25 ab	81.56 ac	82.41 a
A ₃	47.16 b	54.47 a	50.82 a	16.19 bc	19.04 a	17.61 a	80.54 cd	83.64 a	82.09 a
A ₄	41.08 d	44.19 c	42.64 b	17.16 b	19.05 a	18.11 a	81.12 bc	80.73 cd	80.92 ab
A	44.78 a	44.33 a		16.17 a	16.87 a		80.86 b	82.11 a	

Mean with a column, row and their interaction following with the same latter are not significantly different according to Duncan multiple of 0.05 level.

Table (5): Simple correlation between Chemical Composition of Faba Bean in both locations.

characters	Potassium%	Phosphorus%	Nitrogen%	Carbohydrate%	Protein%
Moisture%	0.049	-0.031	-0.141	0.160	-0.189
Protein%	*0.504	0.175	**0.979	**0.537	
Carbohydrate%	0.366	-0.032	*0.500		
Nitrogen%	**0.560	0.222			
Phosphorus%	*0.505				

*,** Significant and highly significant at 0.05 and 0.01 probability levels, respectively.

CONCLUSION

From the previous discussion we conclude that the faba bean chemical composition is varying according to genotypes and different location. The Turkish variety recorded the best result for most characters in the research field in college of agriculture. It is appear that the faba bean is rich in carbohydrate and protein, for this it is considered a cheap source of protein.

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كارتيكرنا هنده ك بيكهايتن زينيتيكي ل سه ر بيكهايتي كيميائي ياباقلكا

پوخته

نه ف ڦه كولينه هاته نه نجامدان ژبو تاقيرنا ژيکجودابونئ دناف ساخله تين كيميائي بين چوار بيكهايتن زينيتيكي ژباقلكا ل دوو جهان (زه قيين كوليزا چاندني وگوندئ كه مهكا). شهش فاکته رين كيميائي هاتته تاقيرن. نه نجامان دياركر جياوازين بهرچاف هه بوون دناقهه را زوربه ي ساخله تين هاتينه تاقيرن ل سه ر بناغي بيكهايتن زينيتيكي دهه ردوو جهان دا. بلندترين ريژهيا پروتيني هاته توماركرن بو توخمى توركى ل جهئ ئيكي (0.386%)، ديسان هه مان توخم مه زنترين ريژين ننتروجيني، كاربوهيدراتا وپروتيني وريژهيا شهئ ل جهئ دووي (83.64%، 19.04%، 54.47%، 3.04%) ل دويف ئيك دا.

تأثير بعض التراكيب الوراثية على التركيب الكيميائي للباقلاء (*Vicia faba L.*)

الخلاصة

اجريت التجربة لدراسة التباين في بعض الصفات الكيميائية لاربعة تراكيب وراثية من الباقلاء في موقعين (حقول كلية الزراعة وقرية كمكا). تم دراسة ستة عوامل كيميائية. اظهرت التجربة وجود فروقات معنوية عالية لمعظم الصفات المدروسة اعتمادا على التركيب الوراثية وكلا الموقعين. تم تسجيل اعلى محتوى بروتين للسنف التركي في الموقع الاول (0.386%)، كذلك نفس السنف سجل اعلى قيمة، للننتروجين، كاربوهيدرات، بروتين ومحتوى الرطوبي في الموقع الثاني (83.64%، 19.04%، 54.47%، 3.04%) على التوالي.