



The comparative study of some faba bean (*Vicia faba* L.) varieties under rainfed condition in Sulaimani – Iraqi Kurdistan Region

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Abstract

The present study was carried out at Sulaimani region- Agricultural Research Center of Bakrajo, during three successive winter seasons (2011-2014). Using seven varieties of faba bean namely Zaina, Seher, Yieldiz, Civilla, Luz di Otono, Tanyari, and local. According to randomized complete block design with three replications. The comparisons among the means were carried out using least significant difference test (LSD) at 0.05 significant level. Results of this investigation summarized as the average of all seasons as follow: The variety Seher recorded maximum values for the characters pod length, number of seeds per pod and 100 seed weight, while the variety Civilla recorded the highest value for the characters number of seeds per plant and seed yield, while local variety produced the highest value for the character number of pods per plant. Significant differences were presented between seasons due to the average of all characters. The third season exhibited maximum values due to the characters number of pods per plant, pod length, number of seeds per plant and seed yield.

Introduction

Over a period of at last 7000 to 8000 years, the common bean has evolved from a wild-growing distribution in highland of Middle America and Andes in to major leguminous food crop grown world in a broad range of environments and cropping system [1]. Common bean is an important component of agricultural and food systems throughout most of the world. Nutritionally dry bean is a nearly, perfect and rich food. It is an excellent source of protein, carbohydrates and fairly good source of minerals, vitamins, folic acid and dietary fiber [2]. Common bean has 25.2 million hectare sowing area and 19.7 million ton total production per year [3]. In addition, Faba bean is one of the most efficient fixers of the atmospheric nitrogen and, hence can contribute to sustainability or enhancement of total soil nitrogen fertility through biological N₂-fixation [4]. The weather conditions mainly the lack of rainfall during the period of flowering and pod setting which are considered as critical to the growth and development of faba bean is one of the most important factors limiting the yield [5, 6 and 7]. Faba bean is diploid species (2n=12). Botanically, it has been divided based on seed size into types as minor, equine and major. Even though there is no discontinuity in seed size between them. This species originated in southwest Asia but its immediate ancestor is not known. Faba bean is a partially auto-gamous species and naturally out crossing under field condition is normally in the range of 20 to 50% [8]. Broad bean, is an ancient crop species that originated in the near east

[9]. It is mainly grown in Europe, North Africa, the Middle East, and China. It is an important leguminous crop worldwide because of its nutrient rich seeds. It is extensively used as a legume, a vegetable, and as fodder [10]. Therefore, increases in the seed yield of broad bean will result in greater economic profits and a larger food supply. There have been many studies on improving the seed yield of broad bean. One of the main factors in the seed yield entailing of broad bean is excessive flower and pod abortion up to 87% of the flowers/pods are aborted [11]. To solve this problem, alternative plant types have been selected and developed, for example, plants with determinate growth habit and early flowering [12]. The present investigation was conducted to evaluate and select faba bean varieties for high yield and other agronomic traits in three successive seasons.

Materials and methods

Experiment procedure:-

The study was conducted in Sulaimani Bakrajo; located at 35° 53' 11". N, Long 42° 21' 14" E, with an altitude of 731 meter above of mean sea level, 7.5 km North west of Sulaimani City, six imported and one local varieties of broad bean were obtained from Sulaimani Agriculture Research Center, and were grown in the experiment during three winter seasons of (2011-2014, on clay loam soil under the rainfall region, meteorological data for three grown seasons were summarized in table (1). The experiment was laid out according to randomize complete block design with three replications, each plot consist of 4 rows of 4meter length by 0.4 meter spacing between rows. Sowing was done by hand drilling at a seed rate of 20 seeds/row or 80 seeds/plot and plant spacing were kept on 20cm and plot area (4m length × 4 row × 0.4m space) = 6.4 m² Diammonium phosphate (DAP) fertilizer was applied at the recommended rate of 160Kg/ha at sowing dates, which were Dec.1, Dec.3 and Nov26 of three seasons respectively. The experiments were subjected to the recommended cultural practices uniformly.

Studied Characters:

Data of different agronomic traits were collected on plants and plots. Observations were randomly recorded from ten plants which were:-

No. of pods plant⁻¹, Pods length (cm), No. of seeds pod⁻¹, No. of seed plant⁻¹, 100 seed weight (gm) and seed yield t. ha⁻¹.

Data analysis:-

The data were statistically analyzed according to the method of analysis of variance as a general test and combined analysis conducted [13]. Comparisons among the means were carried out using least significant difference test (L.S.D) at significant level 5%.

Table-1: Meteorological data of Bakrajo during three seasons (2011-2014)

Months	Years								
	Rainfall (mm)			Air temperature (°C)					
	2011-2012	2012-2013	2013-2014	2011-2012		2012-2013		2013-2014	
			Max	Min	Max	Min	Max	Min	
October	37.3	27.5	Zero	33	10	35.6	10.1	33.1	10.4
November	54.1	137.9	151.6	21	Zero	28	5.8	23.9	7.6
December	48.2	104.9	187	17	Zero	18.3	1.4	17.8	-2.5
January	89.2	171.5	97.6	4.8	0.8	16.1	-1.8	15.6	1.4
February	96.5	57.2	6.8	13.2	Zero	19.3	1.2	20.9	-2.3
March	145.4	16.7	138.2	14.5	5.2	27.4	2.8	24.4	1
April	34	14	36.6	30.5	6.1	31.7	7.5	31.6	2.2
May	35.9	43	18	35.5	13.7	37.5	12	38.1	13
June	Zero	Zero	Zero	38.6	17.9	40.4	23.4	42.3	17.4
Total	540.4	572.7	635.8						

Results and Discussion

- Number of pods/plant:

Data in table (2) and appendix (1) confirm the presence of significant differences among varieties due to the characters number of pods/plant during all seasons and their average except the third season which was not significant. The local variety produced maximum value at the first, second and the average of all seasons with (11.00, 10.00 and 12.00) pods/plant respectively, while the varieties Yieldiz and Luz di Otono produced the lowest number of pods/plant which was (5.00) pods. At the second season the variety Seher showed the lowest number of pods/plant with only (4.00) pods. At the average of all seasons the lowest number of pods/plant was (6.111) pods produced by Seher variety.

- Pod length (cm):-

Data present in table (2) and appendix (1) reveal significant differences between varieties due to the characters pod length at the all seasons and their average with the exception of the second season which was not significant. Maximum length of pods at the first season showed by the variety Civilla with (13.00) cm. At the third season and the average of all seasons the variety Seher which gave the maximum length of pods with 20.000, 14.333 cm respectively.

- Number of seeds/pod:-

Data in table (2) and appendix (1) confirm the presence of significant differences between varieties due to the character number of seeds/pod at the first season and highly significant differences at the average of all seasons, while there were not significant differences between varieties due to this character at the second and the third seasons. The variety Seher produced maximum number of seeds/pod at the first season and the average of all seasons with (6.00) and (5.11) seeds respectively.

- Number of seeds/plant:-

Table (2) and appendix (1) confirm the presence of significant differences between varieties due to the character number of seeds/plant at the first and second seasons only while not significant differences were observed between varieties at the third season and the average of all seasons. Maximum number of seeds/plant was (31.00) recorded by the variety Civilla at the first season and the variety Zaina at the second season. While the lowest number were (18.00) and (15.00) seeds/plant recorded by local variety and Seher variety at the first and the second season respectively.

- 100 seed weight (g):-

Highly significant differences were noticed between varieties due to the character (100) seed weight at all seasons and their average. Maximum weight lowest value of (100) seeds were (140.666, 150.000, 142.166 and 144.544)g recorded by the variety Seher at all seasons and their average respectively while the lowest (100) seeds weight were (102.333, 117.166 and 112.722)g recorded by the variety Tanyari at the first, second seasons and the average of all seasons respectively, while at the third seasons the lowest weight of (100) seeds was (118.00)g recorded by the variety Civilla.(Table 2 and appendix 1)

- Seed weight t./h. :-

Data in table (2) and appendix (1) indicated to the presence of highly significant differences between varieties due to seed yield at the first season and the average of all seasons, while at the second and the third seasons not significant differences between varieties were observed. The variety Cvillia produced maximum seed yield at the first season and the average of all seasons with (2.539 and 3.450 t./h.) respectively, while the lowest seed yield was (1.345 t./h.) recorded by Zaina variety at the first season and (2.562 t./h.) recorded by Seher variety at the average of all seasons.

These results were in agreement with the results of [14] and [15] which indicated that the yield varies greatly from year to year, this variation could be due to behavior of varieties grown and their interaction with the environments. And Preliminary studies have shown that determinate varieties of some legumes are poorer yielders and are more sensitive to water deficit [16, 17, 18 and 19] as well as to high

temperatures at blooming [20 and 21] than indeterminate varieties. At the same time, they gave a smaller biomass yield which may be linked to a lower requirement for water during growth [22] related to lower transpiration.

Table-2: Means of studied characters for seven faba bean varieties during three seasons and their average.

Varieties	Growth Yield Component	No. of pods plant-1	Pod length (cm)	No. of seeds pod-1	No. of seeds plant-1	100 seeds weight (gm)	Seeds yield t/ha
First year							
Zaina		8.000	8.000	4.000	20	104.666	1.345
Seher		6.000	10.000	6.000	22	140.666	1.417
Yieldiz		5.000	10.000	5.000	28	134.000	2.359
Civilla		7.000	13.000	5.000	31	118.666	2.359
Lus di Otono		5.000	11.000	5.000	23	104.333	2.014
Tanyari		6.000	11.000	5.000	24	102.333	1.885
Local		11.000	8.000	3.000	18	137.33	2.531
L.S.D		1.339**	1.901**	1.692*	3.081**	11.424**	0.826**
Second year 2012-2013							
Zaina		9.000	11.000	4.000	31	127.166	2.775
Seher		4.000	13.000	4.000	15	150.000	2.306
Yieldiz		5.000	11.666	4.000	20	149.633	2.593
Civilla		6.000	12.000	4.000	24	132.666	2.739
Lus di Otono		5.000	13.000	3.000	20	123.466	2.868
Tanyari		9.000	16.000	4.000	25	117.666	2.614
Local		10.000	14.000	3.000	20	143.993	2.426
L.S.D		1.452**	3.600 N.S	1.757 N.S	3.328**	8.178**	N.S
Third year 2013-2014							
Zaina		10.333	11.500	5.000	31	119.000	3.937
Seher		8.333	20.000	5.333	42.333	142.166	3.965
Yieldiz		9.000	17.333	5.000	53.333	135.667	3.945
Civilla		17.000	12.666	4.333	51.000	118.000	5.070
Lus di Otono		14.666	18.333	5.000	50.666	118.933	4.282
Tanyari		13	13.833	4.666	50.666	118.166	4.190
Local		15	8.433	3	38.333	132.166	4.503
L.S.D		N.S	2.950**	1.684 N.S	28.522 N.S	6.880**	0.990
Combination of three years							
Zaina		9.111	10.166	4.333	27.333	116.944	2.685
Seher		6.111	14.333	5.111	26.444	144.544	2.562
Yieldiz		6.333	13.000	4.666	27.777	139.760	2.965
Civilla		10.000	12.565	4.444	35.333	123.110	3.450
Lus di Otono		8.222	14.111	4.333	31.111	112.722	2.896
Tanyari		9.333	13.611	4.555	33.111	112.722	2.896
Local		12.000	10.000	3.000	25.444	137.811	3.153
L.S.D		3.245**	1.560**	0.919**	8.961 N.S	4.854 **	0.437**

Data in table (3) and appendix (1) explain the effect of seasons in seed yield and some of its important components. It was observed that all studied characters respond high significantly to this effect. Regarding to the characters number of pods per plant, pod length, number of seeds per plant and seed yield the third season exhibited maximum values which were 12.476, 14.585 cm, 42.714 and 4.270 t/ha respectively, while the first season showed maximum value due to the character number of seeds per pod which was 42.714 and

the second season exhibited maximum value due to the character 100 seed weight which was 135.047g. The lowest value due to the character number of pods per plant was 6.857 produced by both the first and the second season. The first season showed the lowest values due to the characters pod length, number of seeds per pod, 100 seed weight and seed yield which were 10.142 cm, 3,714, 120,285g and 2.012 t/ha respectively. The second season showed the lowest value due to the character number of seed per plant, which was 22.142. It was noticed that the third season produced superior values due to seed yield and most of its components, this may be due to the suitable environmental condition during the third season specially temperature and precipitation. These results were in agreement with the results of [6] which indicated that shortage of rainfall is one of the major factors that restrict the yields of legumes, especially in the so-called critical period i.e. at blooming and pod setting if occurring in that period the drought causes substantial reduction of yield and yield components [17, 23, 24, 25 and 26]. It is a common opinion that large year-to-year variation [27] is one of the reasons behind little interest that farmers show in the production of that crop. Given the situation, it seems to be advisable to look for genotypes that resist drought stress. The problem has been gaining in importance recently as climatic changes are bringing about more and more frequently long drought spells in the months of spring and summer [28]. Yield reduction observed in the years in which weather conditions were not propitious for lupin was caused by reduced values of yield components, primarily of number of pods per plant and number of seeds per plant since 1000- seed weight was not altered significantly. It is corroborated by the study of [29] concerned with the response of yellow lupin to drought in which was shown that water deficit in soil significantly restricts number of seeds per plant but does not change weight of 1000 seeds.

Table-3: Effect of seasons in studied character.

Seasons	No. of pods/plant	Pods length (cm)	No. of seeds/pods	No. of seeds/plant	100 seeds weight (cm)	Seeds/yield t/ha
2011-2012	6.857	10.142	4.714	23,714	120.285	2.012
2012-2013	6.857	12.952	3.714	22.142	135.047	2.617
2013-2014	12.467	14.585	4.619	42.714	126.300	4.270
L.S.D	2.601**	1,259**	0.503**	6.337**	3.890**	0.453

Table-4: Mean squares of variance analysis for studied characters for three seasons and combine analysis.

S.O.V	d.f	No. of pod/plant	Pod Length (cm)	No. of seed/pod	No. of seed/plant	100 seed weight (g)	Yield Tons/ha
First year 2011-2012							
Block	2	2.285	0.142	0.571	4.000	27.571	0.546
Treat	6	13.428	9.428	2.714	60.714	858.714	3.035
Error	12	0.619	1.142	0.904	3.000	41.238	0.885
Total	20						
L.S.D		1.399	1.901	1.692	3.081	11.424	5.292
Second year 2012-2013							
Block	2	1.000	3.761	0.142	1.000	22.880	0.258
Treat	6	17.428	8.380	0.714	77.428	521.915	0.048
Error	12	0.666	4.095	0.976	3.500	21.134	0.429
Total	20						
L.S.D		1.452	3.600	1.757	3.328	8.178	3.684
Third year 2013-2014							
Block	2	32.333	4.440	0.619	206.285	308.251	3.636

Treat	6	32.873	51.265	1.825	200.492	14.959	2.068
Error	12	33.277	2.751	0.891	257.063		1.274
Total	20						
L.S.D		10.262	2.950	1.684	28.522		6.349
Average of all seasons (combine analysis)							
Season	2	221.015	106.505	6.398	2753.286	1157.122	117.465
B/S(a)	6	11.873	2.781	0.444	70.428	26.547	1.480
Treat	6	38.513	27.618	3.830	125.211	1556.885	3.207
T.S	12	12.608	20.728	0.711	106.711	65.997	1.190
E.b	36	11.521	2.663	0.925	87.854	25.777	0.862
Total	62						
L.S.D		3.245	1.560	0.919	8.961	4.854	2.905

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