



Evaluating the Acclimatization Potential of Pruvian Faba Bean (*Vicia faba* L.) in Greece

Panteleimon STAVROPOULOS, Ioannis ROUSSIS, Antonios MAVROEIDIS, George PAPADOPOULOS, Athanasia GALANOU, Nikoleta KARAVIDA and Ioanna KAKABOUKI*

Faculty of Crop Science, Agricultural University of Athens, Iera Odos 75, Athens, 11855, Greece

*Corresponding author: I. Kakabouki e-mail: i.kakabouki@aua.gr

RESEARCH ARTICLE

Abstract

Faba bean (*Vicia faba* L.) is one of the most important sources of plant – based protein, for human and animal consumption. In Greece, faba beans are cultivated as annual, winter crop. The aim of this study was to evaluate the growth of faba bean seeds from Peru and the comparison of its characteristics with a variety, mainly cultivated in Greece (control). A field experiment was laid out at the experimental field of Agricultural University of Athens. Measurements included the agronomic traits, the yield characteristics, and the seed quality. According to the results, there were not significant differences between the two cultivars for the plant height, the number of seeds per pod, the yield and the crude protein content. The number of branches and the Thousand Seeds Weight were significant higher at the seeds from Peru. The fat content of the seed and the number of pod's were higher at the control. In the present research work, we demonstrated that faba bean population from Peru can be cultivated in the Mediterranean region. The measurements showed that the crop's growth was normal, and some characteristics of Peruvian beans showed better results than the cultivated varieties.

Keywords: agronomic traits, Faba bean (*Vicia faba* L.), seed quality, yield characteristics


Received: 12 October 2023

Accepted: 10 April 2024

Published: 15 May 2024

DOI:

10.15835/buasvmcn-hort:2023.0023

 © 2024 Authors. The papers published in this journal are licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License

INTRODUCTION

Faba bean (*Vicia faba* L.) is an annual, winter season crop (Singh et al., 2013). It has been cultivated from ancient years – 6,000 B.C.- and it has multiple applications (Kosterin, 2014). For example, faba bean seeds were used in ancient Greece and Rome for voting (Singh et al., 2013). They have also been used for divination in Ubykh culture (Singh et al., 2013). In Sicily, it was the only crop that survived after a big disaster, saving people from starvation (Tanno & Willcox, 2006). Its plants are 0.5 – 1.8 m tall, with a square stem and 2 – 4 branches. Leaves are pinnate with 2 – 7 leaflets, with no tendrils (Alghamdi, S. S., & Migdadi, H. M., 2020). The flowers are white, with a black spot. They have five petals and a strong sweet scent to attractive bees and other pollinators (Singh, A. K., 2013). Following the pollination, the pods which are 5 – 20 cm long, green and getting blackish at the senescence stage, are formed. Pods contain two to eight seeds (Alghamdi, S. S., & Migdadi, H. M., 2020). The seeds are oblong to oval Figure 1, with different colors, depending on the variety, with a distinctive hilum (Punia, S., 2019). Faba's growth is divided in five stages. The first stage, Stage 0, durates from the germination until the unfolding of the first leaf. The germination is hypogeal, and cotyledons are remaining below ground, in order to provide nutrients to the new plant. The next stage, Stage 1, is the vegetative stage. In this stage the stem and the leaves are getting developed. Stage 2 is the reproductive stage, in which, flowers and pods appear, and the seeds develop inside the pods. Stage 3 and Stage

4 are the senescence stages, where the pods darken, the seeds are getting dryer Stage 3 and the stem's color changes to brown – black Stage 4, (Knott, C. M., 1990). Faba beans are used in animal feed for pigs, horses, poultry and pigeons. They are also used for human consumption. It is worth mentioning that seed consumption may cause favism, a severe hemolytic anemia, perhaps causing collapse (Crépon et al., 2010). The use of faba bean in alternative medicine is a traditional way to cure diseases such as Parkinson etc. (Singh, A. K., 2013). Faba beans can be also used in crop rotation, as green manure, to enrich the soil with nitrogen (Maluk, M., et al., 2022). World production of faba bean can be separated in two categories, fresh and dry beans. Fresh beans are mainly cultivated in Algeria (32,315 t in 2021) and dry beans are mainly produced in China (804,320 t in 2021) (FAO, 2023).



Figure 1. Peruvian faba beans

The aim of this study was to evaluate the growth of faba bean seeds from Peru in Mediterranean conditions and the comparison of plant's agronomic traits with the respective ones of a variety cultivated in Greece.

MATERIALS AND METHODS

A field experiment was conducted in the field of the Laboratory of Agronomy, in the Agricultural University of Athens (39° 59' N, 23° 42' E) with an acreage of 180 m². The experimental design was the Completely Randomized Design (CRD). The soil was clayloam, with pH 7.45 and Soil Organic Matter 2.25 %. The plant material (faba bean seeds) originated from Peru (P), apart from the greek cultivar Tanagra [the control (C) for this study]. The sowing took place on the 14th November 2022, by hand. The sowing distances were 50 cm within row and 50 cm between rows. No fertilization was applied. The crop was rainfed and the weeds were managed by hand weeding and hoeing. The weather conditions during the experiment are presented in the figure below Figure 2. The measurements included the agronomic traits (plant height, number of branches, number of pods), yield characteristics (number of seeds per pd, Thousand Seeds Weight {TSW} and yield) and seed quality measurements (crude portein content and crude fat content). For the statistical analysis we used the SigmaPlot 12 statistical software (Systat Software Inc., San Jose, CA, USA), with the level of significance at p=0.05.

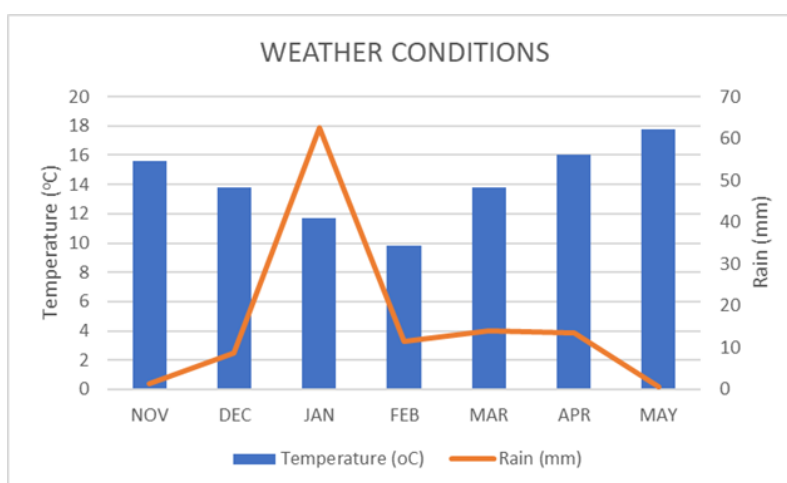


Figure 2. Weather conditions during the crop season

RESULTS AND DISCUSSIONS

According to the results Table 1, there were not statistically significant differences among P and C regarding the plant height, the seeds per pod, the yield and the crude protein content. Both cultivars belonged to the medium height varieties (Terzopoulos et al., 2004). In a study by Bedrinana (1977) in Peru, the final height was noted to be taller compared to the broadleaves of the present study. The number of branches was significantly higher in the P. According to Berdinana (1977) the number of branches in P were 6 – 6.41, which agrees with the findings of the present study. C reached 2.42 branches per plant in average, which agrees with other studies in Greece (Katsoulieri et al., 2020). The number of pods per plant was significantly different between the two types of faba bean. C had more pods than the P per plant. This observation for the C seems to agree with other studies in Greece (Katsoulieri et al., 2020). The pods per plant for the P was higher than the findings of other studies in Peru (Bedrinana, 1997). Pods of P were less than those in C, but the seeds were bigger. TSW of P was significantly higher than those in C. The results seem to agree with other studies, were the TSW of P was higher than the respective one of cv Tanagra beans (Katsoulieri et al., 2020; Bedrinana, 1977). No statistically significant differences were recorded in the number of seeds per pod and in the yield between C and P. This finding coincides with other studies in Greece and Peru (Katsoulieri et al., 2020; Bedrinana, 1977). For the seed quality, the results for the P were better than the C. Simmilar findings have been reported by Singh et al. (2014).

Table 1: Agronomic traits, yield components, and seed quality traits of C and P

CULTIVAR	AGRONOMIC TRAITS				YIELD COMPONENTS		SEED QUALITY TRAITS	
	HEIGHT	BRANCHES	NUM. OF PODS	SEEDS PER POD	TSW (g)	YIELD (kg/ ha)	CRUDE PROTEIN (%)	CRUDE FAT (%)
C	64,45 ^{ns}	2,42 ^a	23,04 ^a	3,03 ^{ns}	364,18 ^a	2508,48 ^{ns}	27,75 ^{ns}	1,63 ^a
P	54,33 ^{ns}	6,04 ^b	9,75 ^b	2,96 ^{ns}	1745,17 ^b	1871,35 ^{ns}	27,10 ^{ns}	0,78 ^b
F ratio	8,58 [*]	23,83 ^{**}	52,99 ^{***}	0,04 ^{ns}	430,96 ^{***}	5,42 ^{ns}	0,07 ^{ns}	659,20 ^{***}

CONCLUSIONS

The results of the present study suggest that the Peruvian cultivar performed adequately the in the Mediterranean climate of Greece, during the acclimatization period, though any conclusive results require further experimentation. The measurements showed that the crop's growth was normal, and some agronomic traits and yield components of the Peruvian beans showcased better results compare to the variety cultivated in Greece. Peruvian faba beans could be used in breeding programs, in order to improve the existing cultivars in Greece.

Author Contributions: I.K. Conceived and designed the analysis; A.G., N.K. and G.P. Collected the data; A.M., P.S. and I.R. Contributed data or analysis tools; A.M. and P.S. Performed the analysis; A.M. and P.S. Wrote the paper.

Funding Source: Non applicable

Conflicts of Interest

The authors declare that they do not have any conflict of interest.

REFERENCES

1. Alghamdi SS, Migdadi HM. Morphological diversity of faba bean (*Vicia faba* L.) M2 mutant populations induced by gamma radiation and diethyl sulfate. J. King Saud Univ. Sci. 2020; 32(2):1647-58. <https://doi.org/10.1016/j.jksus.2019.12.024>
2. Álvarez-Iglesias L, Puig CG, Revilla P, Reigosa MJ, Pedrol N. Faba bean as green manure for field weed control in maize. Weed Res. 2018; 58(6):437-49. <https://doi.org/10.1111/wre.12335>
3. Añaños Bedriñana MA. Respuesta de tres variedades de haba (*vicia faba*) a tres fórmulas de abonamiento Allpachaka (3,500 msnm) Ayacucho; 1997. <http://repositorio.unsch.edu.pe/handle/UNSCH/3883>
4. FAOSTAT. Crops and products; 2023. <https://www.fao.org/faostat/en/#home>
5. Katsoulieri A, Papastylianou P, Travlos I, Vlachostergios D, Tigka E, Kargiotidou A, Dordas C, Pratsinakis E, Tani E, Chachalis D, Bilalis D. Yield Performance of Faba Bean Cultivars under Different Environmental Conditions in

- Greece. Bull UASVM Hort. 2020; 77(2):30. <https://doi.org/10.15835/buasvmcn-hort:2020.0016>
6. Knott CM. A key for stages of development of the faba bean (*Vicia faba*). Annals Appl Biol. 1990; 116(2):391-404. <https://doi.org/10.1111/j.1744-7348.1990.tb06621.x>
 7. Maluk M, Ferrando-Molina F, Lopez del Egado L, Langarica-Fuentes A, Yohannes GG, Young MW, Martin P, Gantlett R, Kenicer G, Hawes C, Begg GS, Quilliam RS, Squire GR, Young JPW, Iannetta PPM, James EK. Fields with no recent legume cultivation have sufficient nitrogen-fixing rhizobia for crops of faba bean (*Vicia faba* L.). Plant Soil. 2022; 472(1):345-68. <https://doi.org/10.1007/s11104-021-05246-8>
 8. Punia S, Dhull SB, Sandhu KS, & Kaur M. Faba bean (*Vicia faba*) starch: Structure, properties, and in vitro digestibility—A review. Legume Sci. 2019; 1(1):e18. <https://doi.org/10.1002/leg3.18>
 9. Singh AK, Bharati RC, Manibhushan NC, & Pedpati A. An assessment of faba bean (*Vicia faba* L.) current status and future prospect. Afr. J. Agric. Res. 2013; 8(50):6634-41. <https://doi.org/10.5897/AJAR2013.7335>
 10. Singh AK, Bhardwaj R, Singh IS. Assessment of nutritional quality of developed faba bean (*Vicia faba* L.) lines. JAS. 2014; 1(2):96-101.
 11. Tanno KI, & Willcox G. The origins of cultivation of *Cicer arietinum* L. and *Vicia faba* L.: early finds from Tell el-Kerkh, north-west Syria, late 10th millennium BP. Veg. Hist. Archaeobot. 2006; 15(3):197-204. <https://doi.org/10.1007/s00334-005-0027-5>
 12. Kosterin. The lost ancestor of the broad bean (*Vicia faba* L.) and the origin of plant cultivation in the Near East. Vavilovskii Zhurnal. Genet. 2014; 18(4-1):831-840. <http://dx.doi.org/10.18699/VJ15.118>
 13. Crépon K, Marget P, Peyronnet C, Carrouée B, Arese P, Duc G. Nutritional value of faba bean (*Vicia faba* L.) seeds for feed and food. Field crops res. 2010; 115(3):329-339. <http://dx.doi.org/10.1016/j.fcr.2009.09.016>