

RESEARCH ON BIOLOGY, PRODUCTIVITY AND YIELD QUALITY OF *TRIGONELLA FOENUM-GRÆCUM* L. SPECIES (FENUGREEK) IN THE CENTRAL PART OF THE SOUTH ROMANIAN PLAIN

Alina Maria IONESCU, Gheorghe Valentin ROMAN

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăști Blvd,
District 1, 011464, Bucharest, Romania

Corresponding author email: alinamariaionescu@yahoo.com

Abstract

The main objective of the research was to study the biology, ecology and productivity of *Trigonella foenum-graecum* L. species, in order to know the adaptability of the species to the natural conditions of the reddish preluvosoil area in the central part of South Romanian Plain and in organic farming system.

In these experiments, a program of observations and measurements was developed, concerning: morphological and biological peculiarities of species, productivity elements and seeds yields, yield chemical composition and quality.

The experiment was carried out in Moara Domneasca Experimental Field, during 2007-2009.

Research carried out revealed that fenugreek cultivated in South Romania reaches harvesting maturity in the third decade of July, after 95 days of vegetation and the accumulation of 922.24 GDD ($St > 10^{\circ}\text{C}$). When harvested, fenugreek plants were characterized by following productivity elements: 20.1 pods/plant, 11.4 seeds/pod, 3.9 g seeds/plant and TGW values of 16.7 g.

Fenugreek seeds had as chemical composition, in average: 21.3% proteins, 4.65% fats, 63.83% glucides and 5.69% ash.

On the reddish preluvosoil from Moara Domneasca, a soil with average fertility and without irrigation, in years with various weather conditions, fenugreek achieved good yields of over 1013 kg/ha in a dry experimental year (2007), and over 1250 kg

Key words: fenugreek, organic agriculture, productivity and yield quality.

INTRODUCTION

Fenugreek (*Trigonella foenum-graecum* L., Fam. *Fabaceae*) is one of the oldest medicinal plants and spice. The species name '*foenum-graecum*' means 'Greek hay' indicating its use as a forage crop in the past. Fenugreek is believed to be native to the Mediterranean region (Petropoulos, 2002), but now is grown as a spice in most parts of the world. It is reported as a cultivated crop in regions of Europe, northern Africa, west and south Asia, Argentina, Canada, United States of America (USA) and Australia (Edison, 1995; Petropoulos, 2002). India is one of the major producer and exporter of fenugreek; about 40,000 hectares of land is cultivated under fenugreek in India, yielding about 20,000 tonnes of which only 3,100 to 4,000 tonnes are exported annually.

Is a leguminous plant, it has tri-foliolate, obovate and toothed, light green leaves and stems are erect, long and tender. Blooming period occurs

during summer and flowers are yellow-white, occurring singly or in pairs at the leaf axils.

The seeds are brownish, about 35 cm long, oblong, rhomboidal, with a deep furrow dividing them into two unequal lobes. They are contained, ten to twenty together, in long, narrow, sickle-like pods.

Applications of fenugreek were documented in ancient Egypt, where it was used in incense and to embalm mummies. In modern Egypt, fenugreek is still used as a supplement in wheat and maize flour for bread-making.

In traditional Chinese medicine, fenugreek seeds are used as a tonic, as well as a treatment for weakness and edema of the legs. In India, fenugreek is commonly consumed as a condiment and used medicinally as a lactation stimulant.

Fenugreek seed contains 45-60% carbohydrates, mainly mucilaginous fiber (galactomannans), 20-30% proteins, 5-10% fixed oils (lipids), pyridine alkaloids, mainly trigonelline (0.2-0.38%), choline (0.5%), free

amino acids, such as 4-hydroxyisoleucine (0.09%), arginine, histidine and lysine, calcium and iron, saponins (0.6-1.7%), vitamins A, B1, C and nicotinic acid and 0.015% volatile oils (Mehrafarin et al., 2011).

Fenugreek can be a very useful legume crop for incorporation into short-term rotation and for hay and silage for livestock feed, for fixation of nitrogen in soil and its fertility (Sadeghzadeh-Ahari et al., 2009).

MATERIALS AND METHODS

The main objective of the research was to study the biology, ecology and productivity of *Trigonella foenum-graecum* species, in order to know the adaptability of the species to the natural conditions of the reddish preluvisoil area in the central part of South Romanian Plain and in organic farming system.

The experiment was carried out in Moara Domneasca Experimental Field, located near Bucharest, during 2007-2009 and it was organized based on the multi-stage block method with randomized variants in 4 replications.



Figure 1. Aspects from fenugreek experiment (Moara Domneasca Experimental Field, 2009)

Sowing took place between 4 and 12th of April, and the sowing parameters were: 50 cm spacing between rows; density of 30 plants/m²; sowing depth of 3-4 cm.

The cultural practices performed during the vegetation period concerned the manual weeding works, carried out as often as necessary.

In these experiments, a program of observations and measurements was developed, concerning: morphological and biological peculiarities of species, productivity elements

and seeds yields, yield chemical composition and quality.

RESULTS AND DISCUSSIONS

Phenological data. During the 3 experimental years, fenugreek was sown at the beginning of optimum recommended period for this area, between April 4 and April 12. Under these conditions, fenugreek plants emerged in the second decades of April, the period between sowing and emergence being 7-9 days.

Fenugreek crop bloomed in the third decade of May, after 45 days from the emergence and after the accumulation of 277.1 GDD (St> +10°C), with exception of spring 2008 when the fenugreek plant flowering occurred later, in the first decade of June, after the accumulation of 331.1 GDD.

Research showed that in the experimental area, fenugreek reached harvesting maturity in the second half of July, after 96 days from the emergence and after the accumulation of 922.24 GDD (St> +10°C). An exception was 2007, when the plant reached maturity earlier, in a first half of July, due to drought (Figure 2).

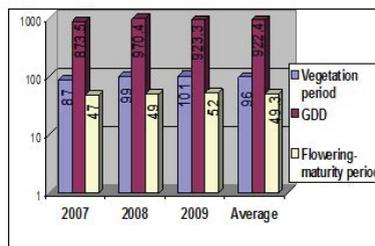


Figure 2. Duration of vegetation and flowering-maturity period at fenugreek plants (Moara Domneasca Experimental Field, 2007-2009)

Throughout the experimental cycle, under the experimental area conditions, fenugreek plants had: an average height of 44.5 cm, with a growing rate of 0.46 cm/day; 27 leaves formed on stems, with 2.73 days necessary for a leaf formation and the average heat consumption was 22.38 GDD/leaf; the maximum leaf area value was 211.1 cm²/plant.

Morphological characters and productivity compounds. The analysis of productivity elements in the three years of experiments showed the following:

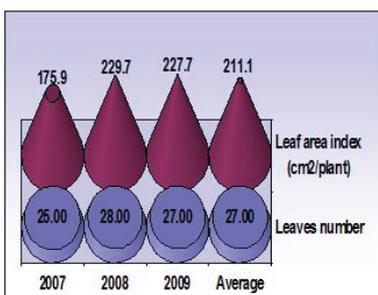


Figure 3. Dynamics of leaves growing at fenugreek (Moara Domneasca Experimental Field, 2009)

Seed moisture was of 14.2% at harvesting and it was according to the moisture standards for this species. After harvesting the seeds were dried and reached moisture of 4.54%

Chemical analysis showed following chemical composition of fenugreek seeds: 21.3% proteins, 4.65% fats, 63.83% glucides, 5.69% ash, while the energetic value was 396.54 kcal. The data on productions harvested in the three years of experiments illustrate a very good favourability of the natural conditions for fenugreek and the productivity of the tested biological material.

Seeds yield were on average 1199 kg/ha, with variation limits of 1013 and 1328 kg/ha.

Figure 4 presents protein yields calculated based on seed yields and protein content.

The protein yields ranged between 228 kg/ha and 282 kg/ha, the average being 261 kg protein/ha.

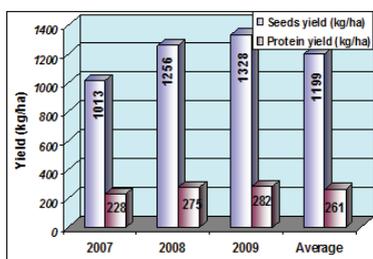


Figure 4. Seeds yield and chemical composition at fenugreek (Moara Domneasca Experimental Field, 2007-2009)

CONCLUSIONS

Research carried out revealed that the fenugreek cultivated in the south of Romania reaches harvesting maturity in the second half

of July, after 95 days of vegetation and the accumulation of 922.24 GGD ($St > 10^{\circ}C$).

When harvested, fenugreek plants were characterized by following productivity elements:

Fenugreek seeds had as chemical composition: 21.3% proteins, 4.65% fats, 63.83% glucides and 5.69% ash.

Productivity of fenugreek plants was well illustrated by yields of over 1000 kg seeds/ha in the dry year and over 1250 kg

Research showed the adaptability of fenugreek crop to the conditions of reddish preluvisoil area from the central part of Romanian Plain, as well as the possibility to cultivate this species in this area, in order to diversify the assortment of crops and to develop a correct rotation, in which, particularly grain legumes have an important role as soils improvement crops. However, introduction and expansion of growing of this species may contribute to diversification of human nutrition and as well as of animal feeding.

REFERENCES

- Edison S., 1995. Spices-Research support to productivity. The Hindu Survey of Indian Agriculture, Kasturi and Sons Ltd., National Press, Madras, 101-105.
- Mehrafarin A. et al, 2011. A Review on Biology, Cultivation and Biotechnology of Fenugreek (*Trigonella foenum-graecum* L.) as a Valuable Medicinal Plant and Multipurpose. Journal of Medicinal Plants. Volume 10, No. 37.
- Petropoulos G.A., 2002. Fenugreek-The genus *Trigonella*, Taylor& Francis Inc Publishing House, London.
- Roman Gh.V., Toader M., Ionescu (Truta) A.M., Ion V., Epure L.I., Dusa E.M., Basa A.Gh., 2009. Best practice guides for alternatives crops in the ecological agriculture system. Alpha MDN, Publishing House, Buzau.
- Sadeghzadeh-Ahari D., Kashi A.K., Hassandokht M.R., Amri A., Alizadeh Kh., 2009. Assessment of drought tolerance in Iranian fenugreek landraces. Journal of Food, Agriculture & Environment, 414-419.
- Truta (Ionescu) A.M., 2009. Research regarding alternative crops in the ecological agriculture system for the southern part of Romania. PhD Tesis, USAMV. Bucharest.
- <http://botanical.com/botanical/mgmh/f/fenugr07.html>
- <http://www.organicfacts.net/nutrition-facts/herbs-and-spices/nutritional-value-of-cumin-seed-and-fenugreek-seed.html>.