Scientific Works. Series C. Veterinary Medicine. Vol. LXIII (2)
ISSN 2065-1295; ISSN 2343-9394 (CD-ROM); ISSN 2067-3663 (Online); ISSN-L 2065-1295

COMPARATIVE STUDY ON YIELD QUALITY OF GRAIN LEGUMES PROMOTED BY ORGANIC AGRICULTURE

Alina Maria IONESCU[1], Maria TOADER[2], Mirela Elena DUȘA[2], Emil GEORGESCU[3]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest, Faculty of Veterinary Medicine, 105 Splaiul Independentei Bv., District 5, 050097, Bucharest, Romania,
Phone: + 4021 318 0469, Fax: + 4021 318 0498
[2] University of Agronomic Sciences and Veterinary Medicine of Bucharest,
Faculty of Agriculture, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania,
Phone: +4021.318.25.64, Fax: + 4021.318.25.67
[3]Plant Protection Laboratory, NARDI Fundulea, 1 Nicolae Titulescu Street, Fundulea, Calarasi County, 915200, Phone: +4-0242-642080

Corresponding author email: alinamariaionescu@yahoo.com

Abstract

This paper presents the results of the research on the yield quality of some grain legumes (lentil, faba bean, chickpea, fenugreek, mung bean and adzuki bean) promoted by organic agriculture.
In order to determine the quality of grain legumes, there were analysed several physical indicators, such as the thousand grain weigh (TGW), the hectolitre mass (MH), the moisture content (%) and chemical indicators, such as the protein content (% d.m.), the carbohydrates content (%), the fat content (% d.m.), the ash content (%). The seeds energetic value (Kcal.%) was calculated as well.
In order to determine the TGW, 8 *samples of 100* seeds *were weighed, while to determine the MH, the Hectolitre Measuring System - Chondrometer, with a capacity of 0.5 l, was used. The following methods were used for the determination of the biochemical compounds of seeds: for carbohydrates - the Bertrand method; for proteins - the Kjeldahl method; for fats - the Soxhlet method and for ash - the Spectrophotometer method.*
On average, the chemical composition of these crops was the following: for lentil - 22.50% proteins, 2.81% fats, 63.56% carbohydrates, 3.95% ash, and an energetic value of 358.47 kcal.; for faba bean - 21.60% proteins, 4.45% fats, 63.90% carbohydrates, 5.90% ash, and an energetic value of 366.77 kcal; for chickpea - 21.19% proteins, 4.30% fats, 56.17% carbohydrates, 3,31% ash, and an energetic value of 356.16 kcal; for feenugreek - 21.24% proteins, 4.66% fats, 63.81% carbohydrates, 5.71% ash, and an energetic value of 360.58 kcal.; for mung bean - 23.23% proteins, 2.08% fats, 68.09% carbohydrates, 3.88% ash, and an energetic value of 362.89 kcal.; for adzuki bean- 21.9% proteins, 2.6% fats, 69.3%carbohydrates, 4.1% ash, and an energetic value of 361.14 kcal.
The nutritional value results for these grain legumes highlighted the very special role that they should play in the development of biodiversity as well as in the diversification of human and animal feeding.

Key words*: chemical composition, grain legumes, nutritional value.*

INTRODUCTION

Grain legumes (or pulses) are important food crops that can play a major role in addressing global food security and environmental challenges and they contribute as well in healthy diets (www.fao.org/fsnforum/activities/discussions/pulses).
Grain legumes are a vital food resource that helps meet food requirements in human diets in different parts of the world (Roman et al., 2011).
Grain legume seeds are excellent sources of proteins, vitamins, minerals, fibres and polyunsaturated fatty acids (Tharanathan, 2003; Bouchenak & Lamri-Senhadji, 2013).
Depending on species, the protein represents between 20 and 40% of the grain mass (Roman et al., 2011).
In general, the grain legumes are rich in lysine but poor in methionine content, thereby complementing the reverse amino acid pattern found in cereals (Hymowitz, 1990).
Legumes are normally consumed after processing, which not only improves palatability of foods but also increases the bioavailability of nutrients, by inactivating trypsin and growth inhibitors and hemagglutinins (Tharanathan, 2003).

Leguminous plants can be used in animal feed, green or silage, alone or in mixtures. The by-products of legumes (stems, leaves and husks) resulted after threshing, have a high protein content (8-14%) which is exceeding 10 times the protein content of cereal straws (0.7-1.3%) making them suitable for feed purposes (Roman et al., 2011).
Additionally, all grain legumes fix their own nitrogen, thereby reducing, in many situations, the cost of nitrogen inputs by farmers (Hymowitz, 1990).

MATERIALS AND METHODS

The aim of the paper is to present the results of the research conducted in 2016 on the quality of some grain legumes promoted by organic agriculture.
The biological material used in the research came from agricultural product markets in Romania, Greece, Turkey, France and Slovenia and from the UASVMB Biobase field.
The studied species were the following: lentil (*Lens culinaris*), faba bean (*Vicia faba*), chickpea (*Cicer arietinum*), fenugreek (*Trigonella foenum-grecum*), mung bean (*Vigna radiata*) and adzuki bean (*Phaseolus angularis*).

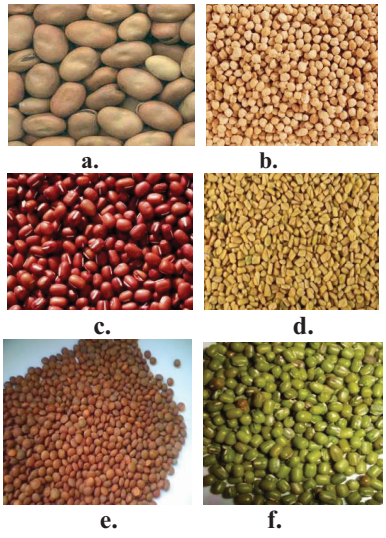

Figure 1. Biological material used in the research a- faba bean, b- chickpea, c- adzuki bean, d- fenugreek, e- lentil, f- mung bean

The determinations were performed in laboratory and targeted the physical quality parameters (thousand grain weight, hectolitre mass and moisture) as well as the chemical parameters (carbohydrates, protein, fats and ash contents).
The TGW was determined by weighing 8 samples of 100 seeds, while MH by using the Hectolitre Measuring System - Chondrometer with a capacity of 0.5 l. In order to determine the biochemical compounds, chemistry laboratory methods were used: for carbohydrates - the Bertrand method; for proteins - the Kjeldahl method; for fats - the Soxhlet method; for ash - the spectrophotometer method.
The determination of the energetic value involved highlighting the relationship between the necessary daily nutrients and the contribution of these substances per product unit (usually 100 g).
The formula for calculating the energetic value of grain legumes seeds (kcal) was:
Energetic value = % proteins x 4.1 + % fats x 9.3 + % carbohydrates x 4.1

RESULTS AND DISCUSSIONS

Physical quality parameters. The data from Table 1 show that for lentil, the thousand grain weight was on average of 67.83 g, the hectolitre mass - 86.58 kg/hl and the moisture content of the seeds - 12.20%. It can be observed that Turkey variety registered the lowest mass per storage volume (85.98 kg/hl), this amount being correlated with small TGW and moisture values of seeds.
For faba bean seeds, TGW was on average of 510 g, hectolitre mass - 80.8 Kg/hl and moisture content - 13%. It should be noted that for all the physical parameters analysed there were very small differences between varieties.
Chickpea seeds had the following values for the physical parameters: TGW - 370.75 g, hectolitre mass - 79.53 kg/hl, moisture content - 12.80%.
The thousand grain weight for fenugreek seeds was on average of 13.10 g, the highest value of 14.90 g being determined for Greece variety seeds and the smallest value (11.89 g), for Turkey variety. It can be observed that the Greece variety registered the highest moisture

and hectolitre mass values, i.e. 12.80% moisture and 97.7 kg/hl MH.

The mung bean seeds registered on average the following values for the physical indicators: 158.53 g for the thousand grain weight (TGW), 77.4 kg/hl for the hectolitre mass and 13.20% for the moisture content.

For adzuki bean seeds, the thousand grain weight registered values ranging from 135.9 g to 142.3 g, the average value being of 130.1 g. The hectolitre mass was on average of 76.2 kg/hl, with variation between 75.9 kg/hl for Slovenia variety and 76.4 kg/hl for Greece variety.

Table 1. Physical quality parameters of grain legumes

Species	Variety	TGW (g)	MH (Kg/hl)	Moisture (%)
Lentil	France	67.86	86.37	12.20
	Slovenia	68.23	87.40	12.50
	Turkey	67.40	85.98	11.90
	Average	**67.83**	**86.58**	**12.20**
Faba bean	UASVM Biobase	511.0	79.9	12.96
	Greece	509.0	80.7	13.01
	Turkey	510.0	81.8	13.04
	Average	**510.0**	**80.8**	**13.00**
Chickpea	UASVM-Biobase	358.93	77.9	12.80
	Slovenia	363.31	78.8	12.78
	Greece	400.67	81.7	12.83
	Turkey	360.10	78.1	12.81
	Average	**370.75**	**79.53**	**12.80**
Fenugreek	Slovenia	12.52	86.1	11.09
	Greece	14.90	87.7	11.13
	Turkey	11.89	86.0	11.07
	Average	**13.10**	**86.6**	**11.10**
Mung bean	France	162.96	76.6	13.33
	Slovenia	154.11	77.2	13.07
	Average	**158.53**	**77.4**	**13.20**
Adzuki bean	Slovenia	135.9	75.9	12.90
	Greece	142.3	76.4	12.50
	Average	**139.1**	**76.2**	**12.70**

Biochemical parameters. In the analysis of the grains legumes chemical composition, the highest protein content values were registered for faba bean seeds (27.07%), followed by mung bean seeds with 23.23% protein. The lowest values were registered for chickpea seeds i.e. 21.19%. Lentil seeds had a medium protein content of 22.50% (table 1).

The fat content of the studied species ranged from 1.90% to 4.30%. Higher fat content was observed at chickpea species (4.30%) and faba bean species (3.35%).

The lowest values were registered for lentil, fenugreek, mung bean and adzuki bean seeds with 2.81%, 2.66%, 2.08% and 1.90% fat content.

Table 2. Chemical composition of grain legumes (% d.m.)

Species	Variety	Quality parameters*			
		P (% d.m.)	F (% d.m.)	C (% d.m.)	M (% d.m.)
Lentil	France	22.50	2.87	58.10	4.00
	Slovenia	22.85	2.95	58.98	3.94
	Turkey	22.23	2.61	58.61	3.91
	Average	**22.50**	**2.81**	**58.56**	**3.95**
Faba bean	UASVM Biobase	26.65	3.40	53.90	3.85
	Grece	27.35	3.65	54.98	3.94
	Turkey	27.23	3.31	54.81	3.91
	Average	**27.07**	**3.45**	**54.56**	**3.90**
Chickpea	UASVM Biobase	21.23	4.31	56.20	3.41
	Slovenia	21.15	4.25	55.98	3.20
	Greece	21.18	4.34	56.32	3.32
	Turkey	21.19	4.30	56.17	3.31
	Average	**21.19**	**4.30**	**56.17**	**3.31**
Fenugreek	Slovenia	21.30	2.65	60.83	4.69
	Greece	21.17	2.71	60.79	4.74
	Turkey	21.24	2.62	60.81	4.71
	Average	**21.24**	**2.66**	**60.81**	**4.71**
Mung bean	France	23.30	2.10	60.10	3.93
	Slovenia	23.17	2.01	59.90	3.84
	Average	**23.23**	**2.08**	**60.00**	**3.88**
Adzuki bean	Slovenia	22.30	2.00	62.50	4.25
	Greece	21.50	1.80	62.10	3.95
	Average	**21.90**	**1.90**	**62.30**	**4.10**

*Note: P (% d.m.) - protein content; F (% d.m.) - fat content; G (% d.m.); M - moisture (% d.m.)

Regarding carbohydrates, higher contents (over 62.30%) were observed at adzuki bean seeds. Mung bean and fenugreek had a carbohydrate content which ranged between 60.81% and 60.00%, compared to 56.17% and 54.56% at chickpea and faba bean seeds.

The ash content had values ranging from 3.31% for chickpea seeds to 4.71% for fenugreek seeds.

Mung bean, faba bean and lentil seeds had a medium ash content of 3.90%, 3.95% and 3.88%.

The energetic values of grain legumes (figure 2) ranged from 356.16 kcal at chickpea to 366.66 kcal at faba bean.

Mung bean and fenugreek seeds had medium energetic values of 360.58 and 361.14 kcal.

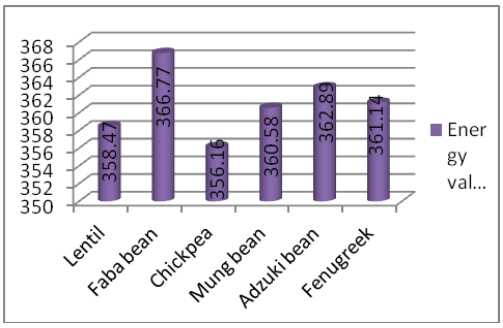

Figure 2. Energetic value of grain legumes

CONCLUSIONS

The research on the yield quality of these grain legumes highlighted the very special role that they should play in the development of biodiversity as well as in the diversification of human and animal feeding.

The highest protein content values were registered for faba bean seeds (27.07%) and the lowest values for chickpea seeds, i.e. 21.19%.

The fat content of the studied species ranged from 1.90% at adzuki bean to 4.30% at chickpea.

Regarding the carbohydrates, higher contents (over 62.30%) were observed at adzuki bean seeds, followed by mung bean and fenugreek with a carbohydrate content that ranged from 60.81% to 60.00%.

The nutritional value of grain legumes seeds was as follows: 358.47 kcal/100 g at lentil, 366.77 kcal/100 g at faba bean, 356.16 kcal/100 g at chickpea, 360.58 kcal/100g for fenugreek, 362.89 kcal/100 g at mung bean and 361.14 kcal/100 g at adzuki bean.

REFERENCES

Bouchenak M., Lamri-Senhadji M., 2013. Nutritional quality of legumes and their role in cardiometabolic risk prevention: A review. Journal of Medicinal Food, 16, pp. 185–198.

Ionescu Alina Maria, Roman Gh. V., 2013. Research regarding chemical composition and nutritional value of Lens culinaris Medik. species (lentil) in organic agriculture. Scientific works. Series C. Veterinary Medicine, Vol. LIX, pp. 98-101, Print ISSN 1222-5304.

Roman Gh.V.. Tabară V., Robu T., Parsan P., Stefan M., Axinte M., Morar G., Cernea S. 2011. Crop production vol I. Cereals and grain legumes.. Universitara Publishing House. Bucharest.

Hymowitz T., 1990. Grain legumes. In J. Janick and J.E. Simon (Eds.), Advances in new crops. Timber Press, Portland, 54-57.

Tharanathan R.N, Mahadevamma S, 2003. Grain legumes—a boon to human nutrition. Trends in food science & technology, Volume 14, Issue 12, 507–518, ISSN: 0924-2244

http://www.fao.org/fsnforum/activities/discussions/pulse