Original scientific paper
10.7251/AGSY1404409M

QUALITATIVE CHARACTERISTICS OF BUCKWHEAT

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Abstract

During the two-year study (2011-2012) buckwheat samples from individual agricultural producers from the area of municipalitiy Cajnice were taken. Production of buckwheat in area of this municipality is carried out under the supervision of consulting services. To test the quality of buckwheat, samples were taken from four farms on which the same agricultural practices were applied and the grown variety was Gray. Analyses of samples were carried out in the accredited laboratory *System Qualitas* Pale. The analysis included moisture content, mineral matter content, fat content, protein, crude fiber, carbohydrate content. We analyzed the biogenic elements (K, P, Ca, Mg, Fe).

In terms of content of moisture, protein, crude fiber and carbohydrates there were no significant differences in years of research and the research areas in which buckwheat was grown. Highly statistically significant differences have been found in mineral content and fat content in the fruit of buckwheat. The quality of hulled buckwheat fruit has been affected by location because buckwheat has been grown at different altitudes, and the quality of the soil on which it was grown varied. In 2012, the buckwheat was of poor quality compared with buckwheat grown in 2011.

Key words: *buckwheat, quality, fats, proteins, carbohydrates*.

Introduction

Buckwheat is grown for grain used in human nutrition, and crop residues are used as animal feed or bedding, and the above-ground portion is used for extraction of rutin. In addition to grain and flour as a food product, buckwheat honey is also valued. Due to its favorable chemical composition buckwheat is suitable nutrition for diabetics and children. Nutritionists classify it in the group of plants suitable for the production of biologically valuable food and as such they have declared it a health beneficial food. Hulled fruit of buckwheat contains 9.07% of total protein, 70.98% of BEM, 3.7% cellulosic material, 1.73% oil, 1.72% mineral salts, I2,8% water (Glamočlija, 2004). The most important ingredients of plant are flavonoids (Arsic et al., 2008). Seeds of buckwheat contains flour endosperm, and the shell of the fruit makes from 25% to 40% of the total mass (Jevđović et al., 2012). Buckwheat is a plant with modest requirements to environmental conditions, grown on poor soils, it is suitable when it comes to crop and we do not use chemicals for its protection (Glamočlija et al., 2011). It is suitable for growing in ecological or organic farming system (Vera Popovic et al., 2013; Vesna Milic et al., 2013). It is of particular importance for people with diabetes because food grain buckwheat impact on reducing blood sugar and blood fat levels. The aboveground biomass of buckwheat contains a bioflavonoid rutin which is of great importance in the pharmaceutical industry to obtain drugs that lower blood pressure, stop capillary bleeding, and reduce cholesterol in the blood. Because of these qualities buckwheat was declared the medicinal herb in Germany in 1999 (Gadžo, 2009).

Material and methods

Two-factorial study included the effect of location (A) and of the year (B) on the quality of buckwheat. Seeding of variety Gray was conducted on 20th May 2011 and 15th May 2012. Area of elementary plot was 12 m2 (4 m long and 3 m wide). Experiments have been conducted in 4 repetitions on private farms in the municipality Cajnice.

Municipality Čajniče is on the border of the Republic of Srpska, Serbia and Montenegro. It is located in the upper part of the Drina valley. Municipality Čajniče is located on extremely rough terrain. The lowest elevation in the river valleys is 400 meters and the highest 1,491 meters at Vucevici (top of Maple Hill). Land in the region where the municipality is located differs from one another, and the most common are younger and moderately developed area of land. Younger land is generally shallow, dry and relatively secured with nutrients. Moderately developed land is medium deep to deep, relatively dry and mostly poor with nutrients. In the municipality of Cajnice, sub-alpine and mountainous climate is represented. The winters are slightly cooler than average winter in moderate-continental climate in the upper Drina valley, and they last longer, depending on location and altitude. Summer temperatures are regularly lower than in other climate areas. Humidity is high even in the warmer part of the year. In the summer period, the relative humidity is slightly lower than in the winter, so the fluctuation is not big. Cajnice boasts with the thing that it is brighter than the area in the valley of the Drina River (which can be explained with small thickness of fog, and because it is located directly behind the high mountain barriers). With the increase of altitude, there is more precipitation, while the short summer rains are very typical in this region. This area, as a whole, is not windy and is not characterized by strong winds. Regarding farming areas, those sown with cereal crops are negligible, mainly the area from 0.2 to 0.3 hectares that are planted with wheat, barley, corn and buckwheat, primarily for personal needs.

Production of buckwheat in area of this municipality is carried out under the supervision of consulting services. To test the quality of buckwheat, samples were taken from four farms on which the same agricultural practices were applied and the grown variety was Gray:

1. Kulelija Esad’s farm (Miljeno, Kapov Han),
2. Ismail Vahid’s farm (Lađevci, Ledine),
3. Ristanović Radoš’s farm (Miljeno, lend near river)
4. Mašić Darko’s farm (Luke, Luke)

Analyses of samples were carried out in the accredited laboratory System Qualitas Pale. The analysis included moisture content, mineral matter content, fat content, protein, crude fiber, carbohydrate content. We analyzed the biogenic elements (K, P, Ca, Mg, Fe).

Table 1. The parameters examined in the laboratory and methods

No.	Parameters	measure	Method
1.	moisture content	%	Sl.l. SFRJ : 74/88 M.BR.8,II-1
2.	mineral matter content	%	Sl.l. SFRJ : 74/88 M.BR.10
3.	fat content	%	Sl.l. SFRJ 74/88 M.BR.I-15
4.	protein content (N x 6,25)	%	ISO 20483:2006
5.	crude fiber content	%	JUS ISO 5498:1996 Identičan sa ISO 5498:1981
6.	carbohydrate content	%	Sl.l. SFRJ 74/88 M.BR.28
7.	potassium content (K)	mg kg–1	EN 14082:2003
8.	phosphorus content (P)	mg kg–1	EN 14082:2003
9.	Calcium content (Ca)	mg kg–1	EN 14082:2003
10.	magnesium content (Mg)	mg kg–1	EN 14082:2003
11.	Iron content (Fe)	mg kg–1	EN 14082:2003

The results were analyzed using the analysis of variance of two-factorial experiment (ANOVA) using SPSS 4.5 software. The significance of differences in mean values of treatments was tested with LSD test.

Results and discussion

In terms of content of moisture, protein, crude fiber and carbohydrates there were no significant differences in years of research and the research areas in which it is grown buckwheat (Table 2). Highly statistically significant differences are found in mineral content and fat content in the fruit of buckwheat. A highly statistically significant difference we found in mineral content, which was the largest on the site 1 (3.1%), and lowest at the site 3 and 4 (2.5%), and in 2011 was (2.85%), compared to 2012 (2.65%). The fat content ranged from 1.8% (site 4) to 3.1% (site 2). In 2011, the fat content was 2.35% and in 2012 2.15%. In studies of Vera Popovic et al. (2013) the average starch content in the grain was 52%, the average protein content of 12.6% and 2.25% fatty oil. According to the literature (Fachmann-Souci-Kraut, 1989/90) shelled fruit of buckwheat contained 9.1% of crude protein and 1.73% of fat oils. In our experiments, the contents of protein and fat was higher.

Table 2. Influence of locality and year on the content of moisture, mineral matter, fat, protein, crude fiber, carbohydrate of buckwheat

Location	moisture (%)			Mineral matter (%)			Fats (%)			Proteins (%)			crude fiber vlakna (%)			carbohydrate (%)		
	201	20	Pro	201	201	Pr	201	201	Pro	201	201	Pr	201	201	Pro	20	201	Pro
1	9,0	9,2	9,1	3,2	3,0	3,1	2,4	2,0	2,2	14,2	13,6	13,9	1,1	1,5	1,3	64,1	63,5	63,8
2	8,9	9,3	9,1	3.1	2,7	2,9	3,0	3,2	3.1	12,3	11,9	12,1	1,3	1,5	1,4	63,2	63,8	63,5
3	9,1	9,5	9,3	2,4	2,6	2,5	2,2	1,6	1,9	11,8	12,1	11,9	1,7	1,3	1,5	63,3	63,5	63,4
4	9,0	9,4	9,2	2,7	2,3	2,5	1,8	1,8	1,8	11,5	10,7	11,1	1,6	1,4	1,5	63,6	63,0	63,3
average	9,0	9,34	9,17	2,85	2,65	2,75	2,35	2,15	2,25	12,5	12,1	12,3	1,43	1,43	1,43	63,5	63,4	63,45
Lsd			0,01		0,0	0,01		0,05	0,01		0,0	0,01		0,0	0,01		0,0	0,01
		0,05	0,01		0,0	0,01		0,05	0,01		0,0	0,01		0,0	0,01		0,0	0,01
A		0.194	0.264	A	0.1	0.191	A	0.13	0.182	A	2.6	3.604	A	0.1	0.151	A	1.1	1.524
B		0.137	0.186	B	0.0	0.135	B	0.09	0.129	B	1.8	2.548	B	0.0	0.110	B	0.7	1.077
Ax		0.274	0.373	Ax	0.1	0.270	Ax	0.18	0.258	AxB	3.7	5.097	Ax	0.1	0.213	Ax	1.5	2.155

Table 3**.** Influence of locality and year on the content of biogenic elements (K, P, Ca, Mg, Fe), mg kg–1

Location	potassium (K)			phosphorus (P)			Calcium (Ca)			Magnesium (Mg)			iron (Fe)		
	2011	2012	Pros	2011	2012	Pros.	2011	2012	Pros.	2011	2012	Pros.	2011	2012	Pro
1	290,2	287,9	288,6	257,9	240,2	248,63	42,2	41,8	42,0	71,4	75,0	73,2	6,7	6,3	6,5
2	250,1	260,1	255,1	244,9	252,9	248,93	32,0	33,6	32,8	82,7	86,1	84,4	5,0	5,2	5,1
3	210,9	224,9	217,4	236,9	241,6	238,83	44,6	44,0	44,3	67,0	60,0	63,5	4.4	3,8	4,1
4	301,2	308,9	305,1	218,6	220,2	219,43	46,1	44,3	45,2	74,4	70,0	72,2	3,2	3,8	3,5
aver.	263,08	270,02	266,55	239,13	238,73	238,93	41,23	40,93	41,08	73,88	72,78	73,33	4,83	4,77	4.8
Lsd		0,05	0,01		0,05	0,01		0,05	0,01		0,05	0,01		0,05	0,01
	A	2.663	3.650	A	2.223	3.022	A	0.907	1.234	A	1.836	2.413	A	0.137	0.187
	B	1.903	2.589	B	1.573	2.138	B	0.641	0.873	B	1.298	1.765	B	0.097	0.132
	AxB	3.806	5.178	AxB	3.148	4.276	AxB	1.283	1.746	AxB	2.596	3.531	Ax B	0.195	0.265

Table 3 provides an analysis of biogenic elements (potassium, phosphorus, calcium, magnesium and iron) in shelled fruit of buckwheat. The potassium content was statistically influenced with locality and year, the content of phosphorus, calcium and magnesium was statistically influenced with the location/site, while the iron content was not affected with the site and year. The minimum content of potassium was at the site 3 (217,4 mg kg-1), and the largest at the site 4 (305,1 mg kg-1). In 2011 the average potassium content was 263,08 mg kg-1, and in 2012 it was 270,02 mg kg-1. The minimum content of phosphorus was at the site 4 (219,4 mg kg-1), and the largest at the site 2 (248,9 mg kg-1). The minimum content of calcium was at the site 2 (32,8 mg kg-1), and the largest at the site 4 (45,2 mg kg-1). The minimum content of magnesium was at the site 3 (84,4 mg kg-1),), and the largest at the site 2 (63,5 mg kg-1).

Conclusion

With the achievement of high and stable yield of buckwheat special attention should be paid to the quality, especially due to the fact that the buckwheat has found extensive application in the diet of man, but also as a medicinal herb, and the surface on which it was grown cannot even remotely satisfy the needs of consumers. In our country buckwheat is mostly grown in rural, mountainous areas, where the land is of poor quality and where the ecological conditions are worse. In experiments in the area of Čajniče we obtained buckwheat of good qualitative traits. The quality of hulled buckwheat fruit is affected with site because buckwheat is grown at different altitudes, and the quality of the soil on which it was grown varied. Such research in this area is necessary to be continued in the future, but because of the importance of this kind it is needed to include multiple genotypes to determine which genotypes in these areas give high yields and buckwheat fruit of good quality.

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