

CHEMICAL COMPOSITION AND NUTRITIONAL VALUES OF SOME ALTERNATIVE CROPS PROMOTED IN ORGANIC AGRICULTURE

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Abstract

The paper present the results of the research made in 2007-2009 period regarding chemical composition and nutritional value of some alternative crops promoted in organic agriculture: pseudocereals (amaranthus, quinoa, and buckwheat), grain legumes (faba bean, chickpea, and lentil) and oil seeds (safflower, camelina, and oil flax).

In average, the chemical composition of these crops cultivated in Moara Domneasca Training and Experimental Farm was the following: for pseudocereals – 64.32-66.87% glucides; 16.03-16.71% proteins; 3.53-4.91% lipids; 2.31-2.89% minerals; for grain legumes – 33.29-63.90% glucides; 21.23-22.18% proteins; 3.03-4.40% lipids; 3.41-5.85% minerals; for oil crops – 26.41-36.27% glucides; 12.60-22.56% proteins; 28.38-34.10% lipids; 3.60-5.25% minerals. It is important to point out the nutritional values of tested alternative crops as mean to supplement and to diversify the common human diet: pseudocereals as sources rich in glucides and proteins (and lipids too); the grain legumes as sources rich in proteins, glucides (and minerals too); oil crops as sources rich in lipids and proteins (and glucides too).

INTRODUCTION

Some various factors have stimulated interest of specialists in crop diversification in recent years: instability of commodity prices decreased or eliminated farm subsidies, increased pesticide-resistance in damaging organisms, and losses in genetic biodiversity. At the same time, consumer dietary changes have generated new markets for alternative food products [2].

Risk reduction through diversification (related to climatic and biotic factors, particularly in fragile ecosystems and commodity fluctuations) by expanding locally adapted or introducing new species and related production systems, will contribute to improved food security and income generation for resource poor farmers and protect the environment.

To increase income the farmer needs a higher value product that can be obtained by adding value to primary or secondary products. Fruits, vegetables, herbs and spices, flavourings, natural colourants, medicinal plants and others all offer an opportunity for farmers to produce higher value products. Nevertheless, introducing new crops on their own is unlikely to be successful as the whole technological and commercial package needs to be introduced at the same time.

Alternative field crops are categorized as: pseudocereals and less common cereals (amaranth, quinoa, buckwheat, teff, finger millet, pearl millet, foxtail millet, wild rice); grain legumes (varieties of dry beans and dry peas, faba bean, chickpea and lentils); oilseeds (camelina, canola, crambe, cuphea, jojoba, lesquerella, meadowfoam, perilla, sesame, safflower); industrial crops (euphorbia, fanweed, gopher plant, vernonia); and fiber crops (kenaf, milkweed) [2].

Feasibility of a specific crop depends on a number of factors including the suitability of the crop for local growing conditions. Climate, soil characteristics, and pest problems affect crop productivity.

Alternative crops could play a huge role in the world's food supply. They may be less important in comparison to the major crops but they offer much needed nutritional value and variety needed in the diet. Studying of nutritional value of the alternative crops in organic farming conditions arising from the very special role it occupies at present this system of agriculture and these plants in the world, Europe and Romania, both in the development of biodiversity, environmental protection, and food diversification.

MATERIAL AND METHODS

The alternative crops that have been investigated are the following: pseudocereals (amaranthus, quinoa, and buckwheat), grain legumes (faba bean, chickpea, and lentil), oil seeds (safflower, camelina, and oil flax).

The biologic material for studies comes from Moara Domneasca Experimental Field in the years 2007-2009.

The biochemical compounds (glucides, starch, proteins, lipids and minerals) have been determined by using the common chemistry laboratory methods: for glucides, Bertrand Method; for proteins, Kjeldahl Method; for lipids, Soxhlet Method; for minerals, Spectrophotometric Method.

RESULTS AND DISCUSSION

After their role in metabolism, useful substances in food, the human body needs, is divided into several groups: substances with energy by oxidation in the body which provide necessary heat and energy expenditure due to life processes work, such substances are mainly fat and glucides; substances with plastic, regenerative cells and tissues, such as proteins; substances with a catalytic role, such as vitamins and minerals; substances sensory role, which impresses the senses.

In the scientific literature in the fields of biochemistry and food hygiene, food technology and merceology, nutritional value is often presented as percentage of chemical composition, underlining the presence of one or other of component (glucides, proteins, lipids, minerals, etc.) or/and sometimes accompanied by the potential energy expressed in kcal/100 g product [5].

Chemical composition and nutritional value of pseudocereals. The glucides content of pseudocereals grains oscillated between 64.32% at quinoa and 66.86% at amaranthus. On protein content, as can be seen in table 1, all three crops had similar content, over 16%, higher content in comparison with safflower (12.6%). There are remarked the higher values of lipids content (over 3.5%) and over 5% for the best variants, in comparison with grain legumes (3-4%). The average energy value of pseudocereals was around 376 kcal/100 g, similar with the grain legumes (340 kcal/100 g).

Table 1

**Nutritional values of alternative crops
(Moara Domneasca Experimental Field, 2007-2009)**

Alternative crops	Species	Glucides (g/100g)	Proteins (g/100g)	Lipids (g/100g)	Minerals (g/100g)	Energy value (kcal/100 g)
Pseudocereals	Amaranthus spp.	66.87	16.47	4.91	2.61	389.97
	Quinoa	64.32	16.71	5.80	2.89	389.06
	Buckwheat	65.50	16.03	3.53	2.31	351.05
Grain legumes	Faba bean	63.90	21.50	4.40	5.85	396.58
	Chickpea	56.20	21.23	4.31	3.41	360.95
	Lentils	33.29	22.18	3.03	4.00	259.60
Oil crops	Safflower	26.41	12.60	28.38	3.60	426,73
	Camelina	36.27	20.43	31.75	4.28	532.02
	Oil Flax	27.73	22.56	34.10	5.25	528.56

Chemical composition and nutritional value of grain legumes. About content in glucides, lower content was analyzed at lentils, only 33.23% compared with the other two legumes species, faba bean and chickpea, which had 63.90%, respectively 56.20%. Protein contents were around 21%, comparatively with two alternative oil crops, flax and camelina. The lipids content oscillated between 3.03% at lentil and 4.40% at faba bean. The highest minerals content was analyzed at faba bean (5.95%), and the lowest at chickpea (3.41%). According with these results, the highest energy value registered at faba bean, with 396.58 kcal/100 g.

Chemical composition and nutritional value of oil crops. After analyzing the chemical composition of oilseed species, lowest glucides content was recorded in the safflower (26.41%), and higher values were determined at camelina (over 36%). The highest proteins content found at flax seeds with 22.56% and lowest values were determined at safflower seeds with 12.60%. Camelina had

intermediate contents of 20.43%. The lipid content varied between 28.38% and 34.10%, the average being 31.24%. The lowest content was identified at safflower, and the higher at flax. Minerals content varied between 3.60% at safflower and 5.25% at oil flax.

The nutritional value of oil crops seeds was as follows: 426.73 kcal/100 g at safflower, 528.56 kcal/100 g at camelina and 532.02 kcal/100 g at oil flax.

CONCLUSIONS

1. After research carried on Moara Domneasca Farm, the results of pseudocereals chemical composition are as follows: 64.32-66.87% glucides; 16.03-16.71% proteins; 3.53-4.91% lipids; 2.31-2.89% minerals.
2. For grain legumes were recorded following data: 33.29-63.90% glucides; 21.23-22.18% proteins; 3.03-4.40% lipids; 3.41-5.85% minerals.
3. In the same conditions, the chemical composition of oil crops was: 26.41-36.27% glucides; 12.60-22.56% proteins; 28.38-34.10% lipids; 3.60-5.25% minerals.
4. The study of the nutritional value of alternative crops in organic farming conditions evidenced the very special role which should they occupy in the development of biodiversity, environmental protection, and diversification of food.
5. Organic agriculture could ensure that agriculture's natural base remains productive and agricultural production can be competitive in the future and that farming works to promote positive environmental impact.

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