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Buckwheat – an old crop with new health prospects

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Introduction: Buckwheat (Fagopyrum esculentum Moench) is an old dicotyledonous crop of the Polygonaceae and is believed to originate from mountainous areas of South-China, Asia, and Siberia. Buckwheat was introduced into Europe via Russia during the Middle Ages and probably came to Germany from Siberia in the 15th century. In the 17th century it was grown in most European countries (Campbell 1997). In Finland it was mostly cultivated in the eastern regions.

Buckwheat is classified as a pseudo-cereal because its seeds resemble those of cereals in terms of chemistry, structure and edibility. The grain, dark-hulled triangular achenes, must be dehulled before being used for human consumption or animal and poultry feed because the hull contains antinutrient phenolic compounds. Whole groats of buckwheat contain starch (55%), proteins (12%), total dietary fibre (7%), lipids (4%), ash (2%) soluble carbohydrates (2%) and other compounds (18%) such as organic acids, phenolic compounds, tannins, phosphorylated sugars, nucleotides, nucleic acids and unclassified compounds (Steadman et al. 2001). In the past, the cultivation area of buckwheat was significantly larger than it is today as it has gradually lost ground to cereals. In 2005 the main producers of buckwheat were China, Russian, Ukraine, Poland, France, USA, Kazakhstan, Brazil and Japan (FAO 2005). In Finland the annual area under buckwheat is 500–1000 ha (Tike 2006). Currently buckwheat is mainly known because it contains no gluten and can be included as a wheat substitute in the diet of celiac patients.

Interest in buckwheat has increased due to it being a valuable raw material for functional food production. It has been reported to have general beneficial effects on health (Wieslander and Norbäck 2001). Buckwheat contains relatively high concentrations of free D-chiro-inositol and fagopyritols, which are galactosyl derivatives of D-chiro-inositol. These were shown to lower serum glucose concentration in animal experiments and could therefore be useful in the treatment of type 2 diabetes (Przybylski et al. 2004). Furthermore, results from human and animal studies suggest that buckwheat consumption prevents hypercholesterolemia (He et al. 1995, Tomotake et al. 2006).

In addition to its nutritional properties in the human diet, buckwheat is a low input crop and therefore its cultivation burdens the environment to a small extent in comparison with many other crops. Buckwheat competes well with weeds and suffers little from other pests. This may be because buckwheat contains allelopathic compounds and its cultivation was observed to reduce weed biomass (Iqbal et al. 2001). In practice, buckwheat is cultivated without pesticides. Furthermore, its soil nutritional requirements are low and therefore buckwheat was often the last crop in slash and burn farming systems of the past. Buckwheat is also one of the few crops to produce pollen and nectar for a long period, enhancing the environmental conditions of many pollinators.

The objective of this research was to generate knowledge on the factors causing variation in yield, on the concentration of potential health compounds and on the food processes suitable for buckwheat.

Materials and methods: New buckwheat varieties were studied at MTT Jokioinen in 2003 – 2007 with respect to their yield potential, chemical composition (including fagopyritol content of seeds) and new sensory profiles. In addition, research on the stability of buckwheat components in food processes and buckwheat-containing food development were carried out.

Results: Among 21 buckwheat varieties tested ‘Anita’ and ‘Karmen’ from Belarus produced the best yields (1200 – 1300 kg/ha), which were higher compared with varieties currently grown in Finland. Free D-chiro-inositol, five fagopyritols (A1, B1, A2, B2, and B3), sucrose, myo-inositol, glucose, raffinose and galactinol were identified from whole buckwheat seeds, in line with previous results (Steadman et al. 2000). The total soluble carbohydrate content, excluding sucrose, ranged from 372 to

898 mg/100g. The total content of fagopyritols, which are the major soluble carbohydrates, was 346 - 617 mg/100 g, depending on variety. Often those varieties with high seed yield produced lower levels of fagopyritols. The sensory properties of six buckwheat varieties were evaluated using a method developed specifically for sensory profiling of buckwheat.

Conclusions: New and higher yielding buckwheat varieties were identified, with high fagopyritol contents, with potential for functional food production. Experiments to identify new buckwheat containing products produced promising results. Stability of D-chiro-inositol in different food processes showed that it could be used as a raw material in many new products. A sensory profile for six varieties was created and it appears that at least some of the varieties can also be distinguished by sensory impression.

Buckwheat could have a promising future since many farmers are interested in the low-input aspect of the crop. For example, to produce raw materials suitable for patients suffering from celiac, a buckwheat production chain without cereal contaminants has been instituted in central Finland. However, in order to benefit to the maximum extent from the heath potential of buckwheat more R&D will be necessary. Most importantly, an upgrading company, ready to invest in and utilize pure Finnish buckwheat, is urgently needed.

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