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**“Einkorn – Ancient Innovation”**  
Project No 2013-1-BG1-LEO05-08705

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# Quality assurance strategy

**Project „ EINKORN – ANCIENT INNOVATION“**  
**CONTRACT 2013-1-BG1-LEO05-08705**

**Czech Republic 2014**



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## 1. Introduction

The main aim of this strategy is to describe the methodology of growing, quality of production, technical process of malting and malt analyses.

The described activities in this strategy are aiming to ensure that each stage and described results in this project will be delivered with appropriate level of quality.

The activities described in this strategy are horizontal and are implemented through whole period of duration of this project.

The main task is to create internal and external evaluation and quality assurance process, in order to safeguard the quality of the final results from the project.



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## 2. **Einkorn in the Czech republic**

Einkorn is the oldest domesticated wheat species. It has been forced out and substituted by more productive tetraploid (emmer wheat, hard wheat) and hexaploid wheat species (bread wheat, spelt wheat). It belongs to the hulled wheat species, providing good-quality crops in spite of lower yield rate. It has the following strengths: a high proportion of proteins amounting up to 20 percent in some cases. In the other hand, einkorn gluten is not suitable for the baking process and industry. It is, however, suitable for production of unyeasty products, e.g. biscuits, groats, Arabic pita, etc. Einkorn is highly suitable to be grown under organic farming conditions. It does not have any servus requirements for a nutrient supply, it is not usually infested with any common wheat diseases. Certain varieties are inclined to lodging; such crop stands might be overgrown with weeds at the beginning of the growing season as they grow very slowly. The varieties freely available at the market should be chosen and grown. Certain varieties may be also provided by the world gene bank collections. However, growing such varieties, we may face higher risks. It is always necessary to sign a contract with a supplier in order to ensure the sale. The sale price has to compensate for the lower yield rate provided by einkorn.

In the Czech Republic, einkorn wheat is not included in the species list in the Act 219/2003 Coll.; due to this fact varieties of this crop are not registered in the Czech Republic but they can be protected by law. Seed of no Czech variety of einkorn wheat is available in the distribution network in the Czech Republic. Farmers thus can only grow multiplied seed from genetic resources or use imported deeds.

In Austria, einkorn wheat is sown on limited areas. Farmers use their own seed of previously grown landraces, e.g. “Voralberger Einkorn“ or varieties obtained from the gene banks (“Ebners Einkorn“ or “Leipzig Spät“). The “Ebner Einkorn“ is distributed by the company Saatbau Linz.in Austria and also in the Czech Republic



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In Hungary, the variety Mv Alkor (sold as Elitmag Kft.) was bred from the genetic resources in the research station Martonvásár. In Germany, three winter varieties of einkorn wheat were bred in the breeding station Breeding Darzau (Albini, Tifi, Terzino) in last years.

### **Production quality**

It is generally acknowledged that wheat compared to sown wheat excels by its high protein content, yellow endosperm color and, on the other hand, low values of rheological characters. Very high protein content (more than 20%) was recorded for example by Borghi et al. (1996) and Grausgruber et al. (2004a). In protein content there are big differences, in terms of amino acid composition (amount of amino acids per grain gram) no big differences compared to sown wheat were found (Acquistucci et al., 1995; Graugruber and Arndorfer, 2002). Certain differences in favor of einkorn wheat were found only in glutamic acid (Abdel-Aal and Hucl, 2002). Total fiber content is less than 10% and it is significantly lower than in durum wheat or sown wheat (Abdel-Aal et.al., 1995; Grausgrober et al., 2004a). This difference is due to a insoluble component of fiber (Abdel-Aal et.al., 1995).

In terms of the grain mineral composition, Bálint et.al. (2001) reported slightly higher content of iron and magnesium compared to wheat sown, while Jantsch and Trautz (2003) reported increased zinc and magnesium contents. Abdel-Aal et.al. (1995) recorded significantly higher contents of phosphorus and potassium compared to wheat sown. The ash content in wholemeal or classic flour was generally higher than that of wheat durum or wheat sown (D’Egidio et al., 1993; Grausgruber et al., 2004b).

Although grain hardness exhibits a considerable variability, most einkorn wheat samples have a very soft texture (Corbellini at al., 1999). Grain hardness is one of principal characters for the determination of the grain final use. As a result of soft grain, the individual grain fractions are bigger at milling and bran production lower if we assess portion of the individual flour passages (Frégeaz-Reid and Abdel-Aal, 2005). D’Egidio et al. (1993) explains higher flour yield as a result of the absence of a deeper crease in the caryopsis, which is



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characteristic for species with higher ploidy levels.

Many authors describe high protein content but gluten is very flowable. Low bakery quality of einkorn wheat is given by low gluten strength, low sedimentation values and rheological characters of pastry. For this reason einkorn wheat is not suitable for preparation of classic yeast bread (D’Egidio et al., 1993). Gluten quality pre-determines a perspective use of einkorn wheat for example for production of biscuits, cakes and other sweet products.

The ratio of gliadin and glutenin protein fraction of einkorn is different in comparison with wheat flint. Portion in einkorn is 2:1 while in sown wheat it is usually 1:1 (Frégeaz-Reid and Abdel-Aal, 2005). Nevertheless, varieties with better characters were found (high volume of pastry etc) (Borghi et al. 1996). These authors also state that some varieties can have bakery characters nearly similar to those of wheat sown. Currently these varieties are registered in Italy and on the market they are traded under the name Monlis.

Einkorn wheat also has higher carotenoid content than other wheats (Frégeaz-Reid and Abdel-Aal, 2005; Hidalgo et.al., 2006 ; Kischmaier et al., 2012). Carotenoids are quite stable in the endosperm even during longer storage (Hidalgo and Brandolini, 2008), probably as a result of lower lipoxygenase activity (Leenhardt et al., 2006).



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### 3. **Quality assurance strategy**

To ensure corresponding quality of einkorn wheat, technology of growing and processing must be focused on the following areas:

#### **Growing Technology**

##### **Requirement for the environment**

- Placement in the sowing procedure
- Soil – soil type, it is possible to grow on less fertile fields, heavy or wet soils are unsuitable

Basic soil processing – standard plowing

Preparation of soil for sowing

Stand establishment

- Seed – germination power, thousand grain weight
- Sowing – number of grains per 1 m<sup>2</sup>, sowing quantity kg.ha<sup>-1</sup>, sowing date, sowing depth
- Number of plants after emergence per 1m<sup>2</sup>

Regulation of weed occurrence

Harvest and post harvest treatment

- Harvest date – in full ripeness, grain from hulls should not be threshed during harvest
- Post harvest treatment – to clear and dry after harvest

##### **Quality of production**

- Grain traits – volume weight, thousand grain weight, germination capacity, germination energy, grain hardness
- Grain composition – starch content, protein content, vitamin content, content of mineral substances, bakery quality



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**Malting**

- Steeping - length of steeping, length of air breaks, temperature of steeping water, steeping degree
- Germination – germination temperature, germination length
- Kilning

Parameter	Description of the parameter	Value of the parameter
Time (hour)	Total malting time	168 ± 1
Water content (%)	at the beginning of germination	43 ± 1
Temperature (°C)	of water during steeping	14 ± 1
	of air during germination and air rests	14 ± 1
	At the beginning of kilning (below the floor)	55 ± 2
	At the end of kilning (above the floor)	80 ± 2
Weight of the sample (g)	-	500 ± 0.3; 1000 ± 0.5

**Malt analysis**

**Basic parameters of malt**

- Moisture content, protein content in einkorn grain, extract yield in d.m., relative extract at 45 °C, Kolbach index, diastatic power, apparent final attenuation, malt friability, wort colour, □-glucan content in wort, haze, viscosity, pH, total polyphenols

**Special parameters of malt**

- Vitamin E content, activity of  $\alpha$  – amylase and  $\beta$  – amylase, activity of superoxid dismutase, gluten content



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#### **4. Conclusion**

The Quality assurance strategy includes concrete actions in order to monitor all scientific actions and transfer of the results.

The strategy monitors the growing technology, quality of production, the malting technology and malt analyses.



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