

SHORT COMMUNICATION

Emmer Wheat Rudico Can Extend the Spectra of Cultivated Plants

ZDENĚK STEHNO

*Division of Genetics, Plant Breeding and Product Quality, Crop Research Institute,
Prague-Ruzyně, Czech Republic*

Abstract: Emmer wheat (*Triticum dicoccum* Schübl. or also *T. dicoccon* Schrank) tetraploid wheat species was grown in the Czech territory till the 6th century A.D. when it was replaced by bread wheat. At present only landraces and wild forms of this species are available in collections of genetic resources. With the aim to extend the spectra of grown crops, a collection of emmer genetic resources in the Czech Gene Bank was studied. An accession later in ripeness, with a good level of resistance to fungal diseases and with a high yield potential was selected from the collection. After bulk selection procedure and three year testing it gained a certificate of legal protection as cultivar Rudico. The cultivar with high protein content and very good resistance to fungal diseases was found to be able to meet the requirements for organic growing systems as well.

Keywords: emmer wheat; grain yield; protein content; legal protection

Among tetraploid wheat species (genome AB), particularly durum wheat (*Triticum durum* Desf.) has been cultivated for semolina production. Nevertheless, another tetraploid species – emmer wheat (*T. dicoccum* Schübl. or also *T. dicoccon* Schrank) that has a wild form (*T. dicoccoides* [Körn. Ex Aschers. & Gtraebn.] Schweinf.) was grown in history. The emmer wheat species is subdivided into 99 botanical varieties, most of them spring forms.

Cultivation of emmer wheat in history

Emmer wheat has a very long tradition in its growing and use in human nutrition. The interest of humankind in this wheat species corresponds with findings that it was introduced in cultivation (domesticated) probably more than once. In the territory

of the present Czech Republic it was an important crop till the coming of Slavs in the 6th century A.D. when it was replaced by bread wheat. In spite of its considerable importance it was not bred very much and at present only landraces and wild forms of this species are available. However, owing to increasing requirements for diversification and improvement of the quality of food products, an interest in this wheat species is growing.

Plant architecture

Owing to a wide scale of botanical varieties (99) into which the emmer wheat is divided, the morphological differences are considerable. Plant height of accessions in the collection of emmer genetic resources varies from 75 cm to 120 cm. The

Table 1. Quality parameters of selected emmer wheat accessions – averages 1997–1998

Accession	Proportion of naked seeds (%)	Protein content (%)	Wet gluten content (%)	SDS – sedimentation (ml)
<i>T. dicoccum</i> (Astirien)	74.7	17.73	35.5	a
Rudico	79.9	20.41	44.8	ab
<i>T. dicoccum</i> (Tapioszele)	81.4	22.20	48.9	bc
Landrace Dolní Tisovník (Durka)	79.1	21.42	49.0	bc
Bajonettfoermiger	77.0	21.61	49.3	bc
<i>T. dicoccum</i> (Kew)	74.4	22.35	54.3	c
Average	78.3	21.60	49.3	29
<i>F</i> -test	Ns	Ns	**	Ns
md			9.4	
<i>T. aestivum</i> Sandra – check cultivar	100.0	12.28	26.2	61

**significant differences $P = 0.95$; Ns – non significant differences $P = 0.95$

Wet gluten content – values of parameters marked by same letters are not significantly different at $P \leq 0.95$

stem is hollow and in the part below the spike it is thick. Spike colour differs from variety to variety, nevertheless, spikes are nearly always awned.

Agronomical and use properties

Because rather a low attention was paid to emmer breeding in the past, the yield of hulled grain in this crop is lower in comparison with bread wheat and durum wheat as well. Nevertheless, it can reach the yield level of spring bread wheat in the years that are not favourable for bread wheat growing. TKW is usually at a similar level (from 31 g to 58 g according to our results) like in bread wheat or lower. The proportion of glumes in the crop yield ranges from 14.2% to 29.3% (Table 1).

The high grain quality of emmer is mainly conditioned by a high protein content (Table 1) and its composition (content of lysine up to 3.65%). In a selected set of emmer genotypes we determined protein content between 17% and 23.4%. The high protein content in grain affects significantly the yield of protein per unit area which can be even higher than in bread wheat – e.g. in 2000 the yield of crude protein of spring bread wheat Sandra was 420 kg/ha due to unfavourable conditions for spring wheat and consequently low yield of grain. However, the accession of *T. dicoccon* Schrank cv. Jaroslav Emmer produced 494 kg of crude protein/ha under the same conditions and certain other accessions over 500 kg protein per hectare (Figure 1).

The intraspecific diversity of emmer landraces and unbred genotypes is manifested in a high variability of the grain protein composition that is simultaneously influenced, similarly like in other wheat species, by climatic and soil conditions. Gluten proteins have low swelling capacity and consequently emmer flour is not very suitable for baking purposes. That is also confirmed by relatively low values of sedimentation that are roughly half compared to bread wheat or even lower (Table 1). Nevertheless, a wide range of food products is produced from emmer wheat and some of them are registered by the Commission for Organic Farming.

Legislation background

Emmer wheat is not listed in the List of Species of Act No. 316/2006. Although the cultivars of such crops are not registered, they can be legally protected by Act No. 408/2000.

Legally protected cultivar Rudico

With the aim to extend the spectra of grown crops mainly for organic farming, a collection of emmer genetic resources in the Czech Gene Bank was studied and some promising genotypes were selected. The genotype 01C02-00948 appeared to be very promising. A material later in ripeness, with a good level of resistance to fungal diseases and with a high yield potential among the geno-

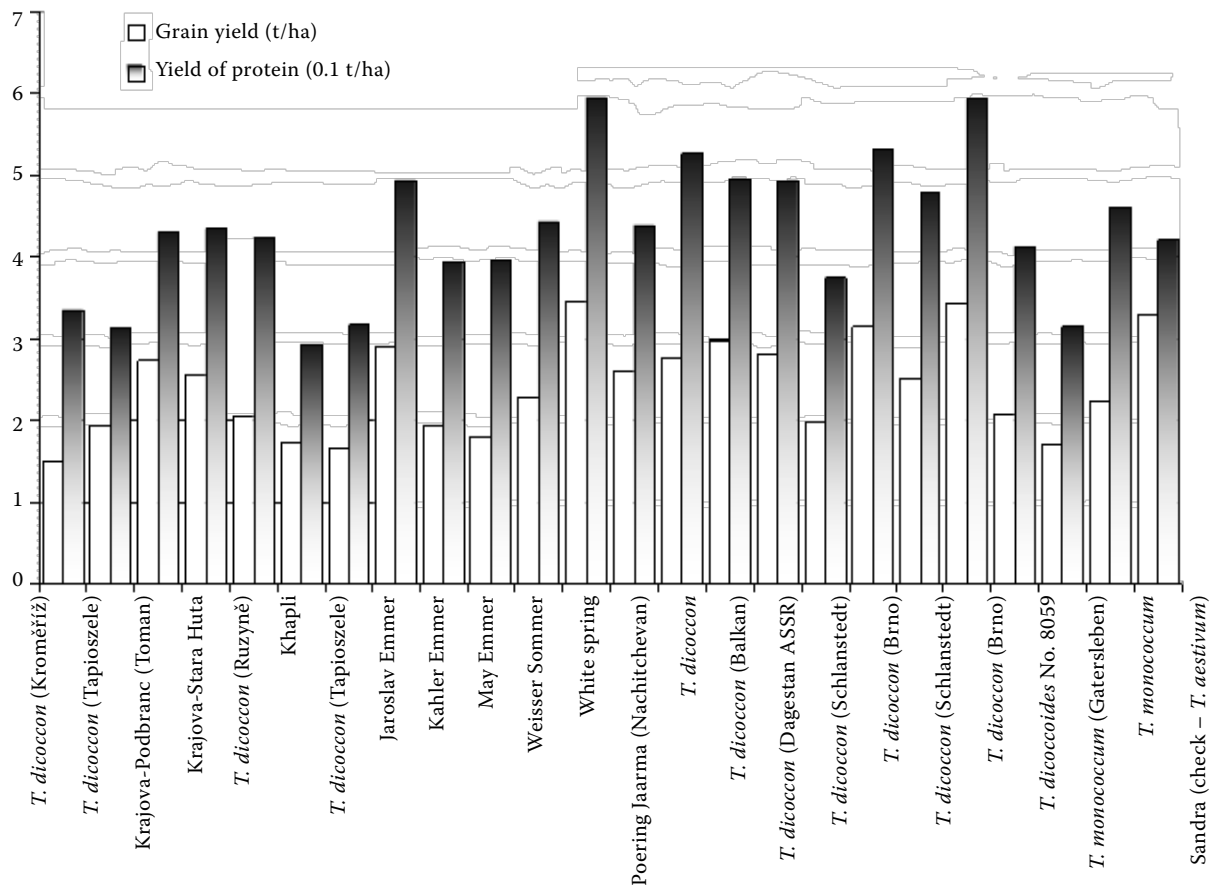


Figure 1. Yield of grain and protein per area unit (2000) of accessions in emmer wheat collection in comparison with Sandra bread wheat cultivar

types of this species was selected by bulk selection from this genetic resource. After three-year testing (DUS) it gained a certificate of legal protection as cultivar Rudico. This emmer wheat has a proportion of glumes in harvested spikelets ranging closely around 20%. It is resistant to most fungal diseases such as powdery mildew, *Pyrenophora*, *Septoria tritici*, *Septoria nodorum*. By resistance to these diseases it exceeds registered spring bread wheat cultivars. Its resistance to Fusarium head blight was found to be medium. Among the grain quality parameters, high crude protein content (19–20%) and gluten content ca. 45% are the most important ones. The values of SDS sedimentation test range between 35 and 40 ml. Grain yield is very high in comparison with the other emmer genotypes and may reach 3 t/ha under favourable conditions; on an experimental plot in 1998 at the

location Prague-Ruzyně it amounted to 4.38 t of naked grain per hectare.

Possible use of Rudico emmer cultivar

In general, emmer wheat is not widespread in conventional agricultural practice, but this crop is likely to be used preferably in the organic growing systems. The cultivar Rudico was found to be able to meet the requirements for organic growing systems and is designed for these systems. Maintenance breeding which is in progress in the Crop Research Institute and ensured seed growing under an organic system creates favourable conditions for successful utilization of this legally protected cultivar. With this cultivar the use of emmer wheat for the production of bio-food products can be extended.

Corresponding author:

Ing. ZDENĚK STEHNO, CSc., Výzkumný ústav rostlinné výroby, v.v.i., Odbor genetiky, šlechtění a kvality produktů, Drnovská 507, 161 06 Praha 6-Ruzyně, Česká republika
tel.: + 420 233 022 364, fax: + 420 233 022 286, e-mail: stehno@vurv.cz