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Bread wheat (*Triticum aestivum* L.) improvement for the production conditions of Kosovo

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Abstract

Winter wheat production in Kosovo relies on varieties which were selected and released in foreign countries. Therefore, the currently cultivated varieties are not best adapted to fluctuations in the prevailing growing conditions. The objective of the present work was to estimate agronomic and quality traits of new wheat breeding lines and check cultivars. Within check cultivars the best performance for grain yield, grain mass and hectolitre weight exhibited cultivars Pobeda and Luna from Serbia and Croatia, respectively, whereas for protein content, SDS sedimentation, loaf volume and dough rheological traits the best performance was observed for the Austrian cultivars Brutus and Justus. Concerning the new germplasm breeding line 24/O/31.04.4 shows a very solid performance over all traits with extremely high protein contents. The other lines with good overall performance were 66/O/31.15.5, 125/O/28.07.4 and 142/C/22.27.1 which showed intermediate or inferior performance in only one of the investigated traits. Line L1 which was selected as single plant off-type from a Kosovan wheat field did not show acceptable overall performance but was satisfying only in regard to grain yield. Generally, concerning the new breeding lines their variability demonstrated that the currently grown check cultivars can be outperformed in all traits. Hence, selection in the present material should be successful to improve the present wheat material in the nearest future.

Keywords

Baking test, dough rheology, micro scale testing, loaf volume, yield

Introduction

Common wheat (*Triticum aestivum* L.) is the most important food crop in the world for the production of leavened bread and associated products. Approximately 70 000-90 000 ha of winter wheat are planted annually in Kosovo. The national wheat production with average yields of 2500-3000 kg ha^{-1} does not guarantee Kosovan self-supply, i.e. wheat for human consumption has to be imported. The limiting factor for wheat production is drought at different growth stages and unstable winter conditions. Up to now wheat cultivars grown in Kosovo were originally released in other, often neighbouring countries. Selection of these cultivars was at no time carried out at the specific production contraints predominating in Kosovo. As a first step to improve wheat production a set of international wheat cultivars and breeding lines were tested from 2000 to 2002 (SALIHU et al. 2006). This work was focused on the identification of wheat germplasm with a high potential for high quality and stable yields under conditions of Kosovo agriculture. In the following specific crosses from the BOKU wheat breeding programme were selected for testing in Kosovo. The present work gives first results of the agronomic and quality performance of the new breeding lines compared to check cultivars.

Material und methods

49 winter wheat breeding lines ($F_{3:7}$) were grown in 2008 alongside with 5 check cultivars, i.e. Pobeda (Institute of Field and Vegetable Crops, Novi Sad, Serbia), Lenta, Luna (Agrigenetics d.o.o., Osijek, Croatia), Justus and Brutus (Saatbau Linz, Linz, Austria), which were the predominant winter wheat cultivars in recent years. Check cultivars were replicated throughout the field, whereas breeding lines were arranged in plots within crossing blocks. A representative square meter per entry was harvested by hand and threshed by a stationary thresher (Wintersteiger, Ried, Austria). Protein content was determined by near-infrared transmittance spectroscopy (Infratec Food and Feed Analyzer 1255, Tecator AB, Höganäs, Sweden). Dough mixing characteristics were determined on 10 g flour samples using a Promylograph T3 apparatus (Max Egger, St. Blasen, Austria). Dough extension tests on a micro-scale were performed using a TA.XT2i texture analyzer (Stable Micro Systems Ltd., Godalming, Surrey, UK) equipped with the Kieffer dough and gluten extensibility rig (SMEWING 1995). Analysis of the extension curves was carried out as described by GRAUSGRUBER et al. (2002) with the modification that dough was mixed to optimal consistency by the Promylograph apparatus. SDS-sedimentation test was determined according to DICK and QUICK (1983) using

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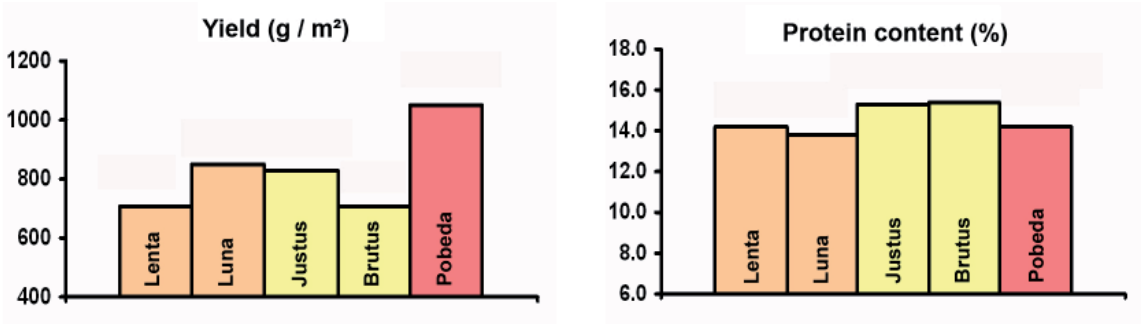

Figure 1: **Mean yield and protein content performance of check cultivars**

1 g whole-meal flour, milled with a Cyclotec mill equipped with a 1 mm sieve. Baking tests on a micro-scale (SHOGREN and FINNEY 1984) were used to describe loaf volume and colour, and crumb texture. Performances in yield, 1000 kernel weight (grain mass), hectolitre (test) weight, protein content, sedimentation volume, extensograph quality defined as KEZ according to GRAUSGRUBER et al. (2002), mixing quality defined as Promylograph quality number according to SALIHU et al. (2006) and baking (loaf) volume were transformed into relative values by setting the respective highest performance as 100 (concept of floating checks; JENSEN 1976). With these relative values star plots were created with SAS 9.1 software to display the multivariate data (FRIENDLY 1991).

Results

Among check cultivars Pobeda and Luna exhibited the best performance for most agronomic parameters (grain yield, grain mass and hectolitre weight). For protein content and other quality parameters (mixing and extension characters, loaf volume, SDS sedimentation) the best performance was observed for the Austrian cultivars Brutus and Justus Austria (*Figure 1*). Overall variability of check cultivars and breeding lines for yield, protein content, mixing and extension quality is demonstrated in *Figure 2*. Average grain yield of the checks was 8228 kg ha^{-1}, whereas new breeding lines yielded 8871 kg ha^{-1}. Concerning quality traits the majority of the breeding lines outperformed the check cultivars. Especially significant was the outperformance for parameters related to dough extensibility measured by the micro extensograph.

Studying the star plots of the single genotypes the multivariate performance becomes more highlighted. Check cultivar Pobeda shows good performance in regard to yield, grain mass, test weight and sedimentation volume, however, is inferior concerning baking volume (*Figure 3*). Compared to Pobeda the other two widely grown cultivars from Novi Sad, i.e. Europa and Renesansa, are inferior in their performance with the exception of the high loaf volume realized by Europa. The Austrian cultivar Brutus shows excellent performance in almost all traits, however, is inferior in grain yield and intermediate in baking volume. Concerning the new germplasm breeding line 24/O/31.04.4 shows a very solid performance over all traits with extremely high protein contents. The other lines with good overall performance were 66/O/31.15.5 (inferior in grain mass), 125/O/28.07.4 (intermediate in dough extension test) and 142/C/22.27.1 (inferior in test weight). Line L1 which was selected as single plant off-type from a Kosovan wheat field did not show acceptable overall performance but was satisfying only in regard to grain yield.

Discussion

From the wheat cultivars currently grown in Kosovo Pobeda seems to be best adapted for the realization of high yields. Pobeda was selected and released by the Institute of Field and Vegetable Crops in Novi Sad (Serbia), a region were similar climatic conditions can be supposed. Other cultivars

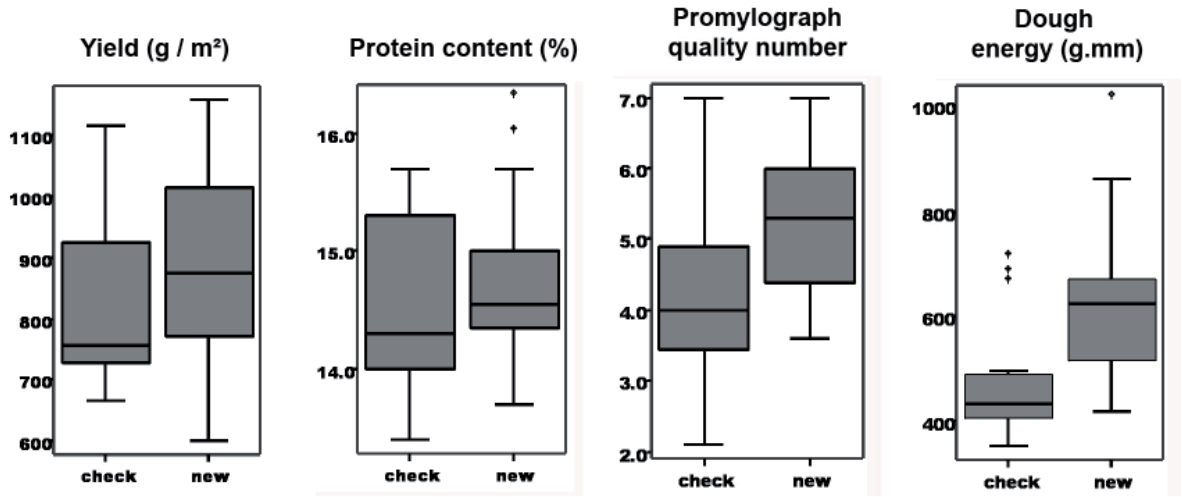

Figure 2: **Variation in selected agronomic and quality traits of check cultivars and new breeding lines**

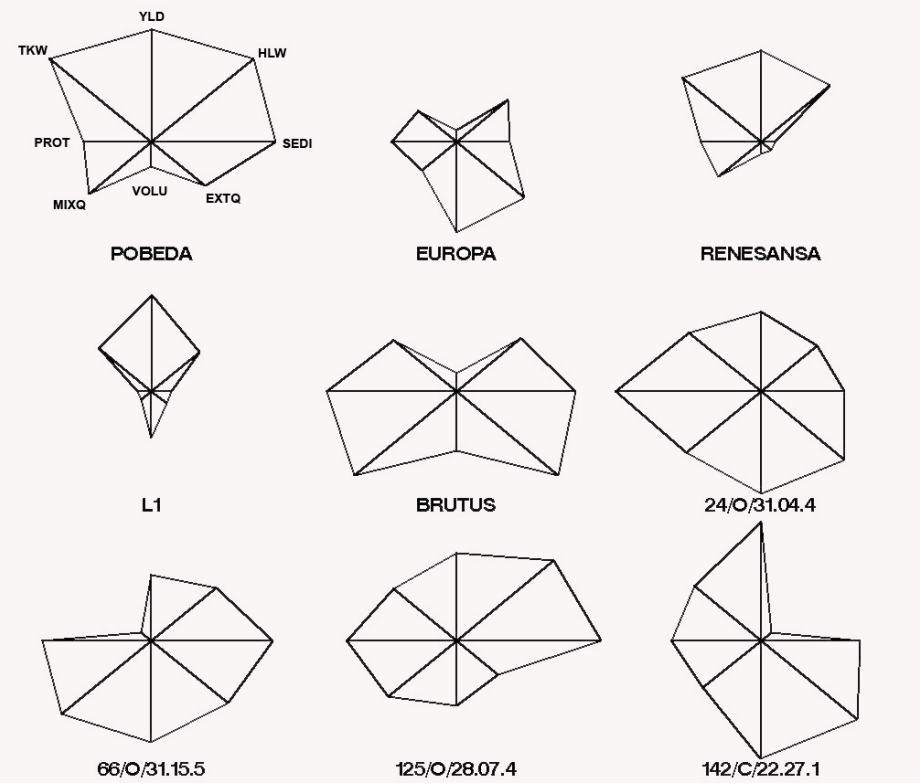

Figure 3: **Star plots of check cultivars and selected breeding lines. The length of each ray is proportional to the size of that variable (YLD, grain yield; TKW, grain mass; HLW, test weight; PROT, protein content; SEDI, sedimentation volume; MIXQ, mixing quality; EXTQ, extensograph quality; VOLU, baking volume)**

from the same breeder, e.g. Europa and Renesansa, however, were generally inferior to Pobeda, which supports the necessity for testing and selection under the specific conditions of Kosovo. Cultivars introduced from Austria exhibited high levels of diverse quality traits, however, missed grain yield. Yield levels in the experiment were significantly higher than average wheat yields in Kosovo. This is due to many reasons. First no yield loss occurred in the experiment since harvest was carried out by hand and at optimal time. Moreover, only a representative square meter was harvested and the experiment obtained optimal treatment. In practical Kosovan agriculture, however, significant yield losses occur due to poor seed quality (e.g. low germination capacity and low seedling vigour), inferior seedbed preparation, low input of fertilizers and weed control, and grain losses by old combine harvester technology. Concerning the new breeding lines their variability demonstrated that the check cultivars can be outperformed in all traits. Some breeding lines already revealed solid outperformance for multivariate observations. Hence, selection in the present material should be successful to improve the present wheat material in the nearest future. Therefore, significant improvements can be expected for Kosovo wheat production in the near future which should contribute to wheat self-sufficiency.

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References

DICK JW, QUICK JS, 1983: A modified screening test for rapid estimation of gluten strength in early generation durum wheat breeding lines. Cereal Chem 60, 315-318.

FRIENDLY M, 1991: SAS® System for Statistical Graphics, 1st Ed. SAS Institute Inc., Cary, NC.

GRAUSGRUBER H, SCHÖGGL G, RUCKENBAUER P, 2002: Investigation on the validity of the micro-extensograph method to measure rheological properties of wheat dough. Eur Food Res Technol 214, 79-82.

JENSEN NF, 1976: Floating checks for plant breeding nurseries. Cereal Res Commun 4, 285-295.

SALIHU S, GRAUSGRUBER H, RUCKENBAUER P, 2006: Agronomic and quality performance of international winter wheat genotypes grown in Kosovo. Cereal Res Commun 34, 957-964.

SHOGREN MD, FINNEY KF, 1984: Bread making test for 10 grams of flour. Cereal Chem 61, 418-423.

SMEWING J, 1995: The measurement of dough and gluten extensibility using the SMS/Kieffer rig and the TA.XT2 texture analyser. Stable Micro Systems Ltd.,Godalming, Surrey, UK.