10th AISTEC Conference

GRAINS FOR FEEDING THE WORLD

Jointly organized with ICC
on the occasion of the World Expo Milan 2015
1 – 3 July 2015

Conference Proceedings

LE UNIVERSITÀ PER EXPO 2015
COMITATO SCIENTIFICO DEL COMUNE DI MILANO

EXPO MILANO

Milano Comune di Milano

Edited by

R. Acquistucci, M. Blandino, M. Carcea, M.G. D'Egidio, S. Iametti, E. Marconi, A. Marti, M.A. Pagani, M. Palumbo, R. Redaelli

In collaboration with

1955 - 2015 ICC 60 YEARS ANNIVERSARY

The present volume collects 80 papers that have been presented as oral communications or posters at the ICC/AISTEC Conference in Milan. These papers have been reviewed for publication by the Conference Editorial Board who wishes to thank Mr. Francesco Martiri for his patient and careful collection and assembly of manuscripts for printing.

Papers Index

Rheological properties of triticale (*Triticosecale Wittmack*)

E. Straumite[1*], M. Sabovics[1], A. Kronberga[2], L. Labanovska[1], R. Galoburda[1]

[1]*Latvia University of Agriculture, Faculty of Food Technology, Jelgava, Latvia*
[2]*State Priekuli Plant Breeding Institute, Zinatnes 1a, Priekuli, Priekuli region, Latvia*
[*]E-mail: evita.straumite@llu.lv

Abstract

Triticale (*Triticosecale* Wittmack) is a man-made cereal formed by crossing wheat and rye. It possesses the genomes of the genus *Triticum* ssp. and *Secale* ssp., and thus the advantageous properties of wheat grain with the features of rye, such as resistance to abiotic and biotic stresses (Ukalska and Kociuba, 2013). Farinograph is often used to assess the dynamics of changes in the consistency of dough during mixing (Miś *et al.*, 2012).The aim of the research was to evaluate the rheological properties of triticale grown under conventional and biological conditions.

Three varieties and two breeding lines of winter triticale (*Triticosecale* Wittmack) from breeding program in Priekuli Plant Breeding Institute cultivated in 2014 under conventional and organic farming conditions were used in the current research. The following parameters were determined: moisture content and rheological properties - water absorption (WA) of grains, dough development time (DDT), stability of dough (S), and farinograph quality number (FQN).

The triticale varieties 'Inarta' and 'Ruja' had the highest dough stability value 10.30–12.29 min. Farinograph quality number of analysed triticale grain samples was in the range from 54.5 to 160.0. Growing conditions of triticale did not have significant ($p>0.05$) effect on moisture content, dough development time, dough stability, and farinograph quality number.

Introduction

Triticale is a high yielding cereal grain, however low milling yields have discouraged its utilisation as a wheat alternative in processed flour products. Triticale (× *Triticosecale* Wittmack) is a potential alternative to wheat in processed flour products such as bread, flat bread, cakes or pasta (Dennett and Trethowan, 2013). Triticale grains, flours, and prepared products are available through both health foods and commercial outlets on a limited basis (Doxastakis *et al.*, 2002). In Latvia recently an increased attention is paid to triticale breeding and growing. Thereby, there are studies on potential triticale use for pasta production (Kalnina *et al.*, 2015) and for bread making (Sabovics et al., 2011).

It is very important to understand rheological properties of flour for its use to fruitful realize various products. Many rheological tests that measure elasticity have proved to be inadequate as methods of predicting the eventual baking performance of dough. A study of rheological characteristics of dough as influenced by the added ingredients should have great relevance in predicting the machinability of dough as well as the quality of the end-product (Indrani and Venkateswara Rao, 2007). The results of farinographic tests are analysed primarily in the aspect of the changes in the consistency of dough during mixing (Miś *et al.*, 2012).

The aim of the research was to evaluate the rheological properties of triticale grown under conventional and biological conditions.

Materials and methods

Plant materials. Winter triticale (*Triticosecale* Wittmack) 3 varieties ('Inarta', 'Dinaro', 'Ruja') and 2 breeding lines (9405-23 and 0314-29) from breeding program in Priekuli Plant Breeding Institute (Latvia) cultivated in 2014 under conventional and organic farming conditions were used in the current research.

Determination of moisture content. Moisture content of grain flour was determined using heating

oven Memmert UNB 200 (GmbH Memmert, Germany): 5.00±0.03 g sample was dried for 1 hour at 110 ± 1 °C temperature (LVS EN ISO 712:2010A). All analyses were performed in triplicate and results were averaged.

Determination of rheological properties using Brabender Farinograph. For analysis of rheological properties Brabender ICC BIPEA 300 method was used. The farinographic test measures and records the resistance of dough during the mixing time. For all samples there were determined the following parameters: water absorption (WA), dough development time (DDT), stability of dough (S) and farinograph quality number (FQN).

All samples were weighed and placed into the corresponding farinograph mixing bowl (Brabender Farinograph-AT, GmbH & Co. KG, Germany). Water was added automatically from the farinograph water container to flour and mixed to form dough. Farinograph was connected to a circulating water pump and a thermostat which operated at 27±2 °C. The mixing speed of the farinograph was 63 rpm and sample running time 20 min. All analyses were performed in triplicate and results were averaged.

Statistical analysis. The results were processed by mathematical and statistical methods (mean, standard deviation, *p*-value). Significance was defined at $P < 0.05$.

Results and discussion

Moisture content

The optimum moisture content of wheat flour is 14.0%, in case if moisture content is higher it is difficult to maintain quality during storage, on the other hand, if moisture content is very low, during dough formation it would not bind sufficient amount of water.

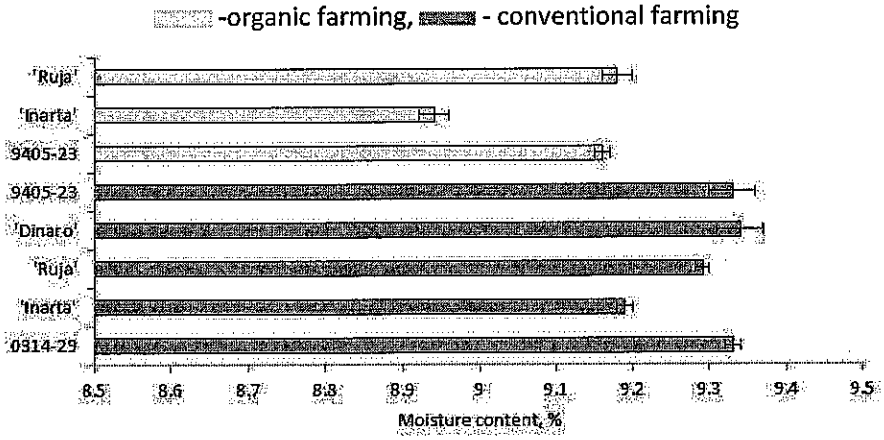

Figure 1. Moisture content of analysed triticale samples

Moisture content in the studied triticale grain samples was from 8.94±0.04% ('Inarta', organic farming) to 9.34±0.02% (Fig. 1). Growing conditions of triticale did not influence ($p>0.05$) the grain moisture content and differences in the moisture content between analysed samples were not established. These results correspond to the studies of Agil and Hosseinian (2014), who found that moisture content in triticale bran was 8.6%, and of Dennett and Trethowan (2013), who revealed triticale grain and flour moisture content between 8.79 and 11.98%.

Rheological properties of triticale

The farinograph is a dynamic physical dough testing instrument involving the measurement of torque. The following parameters were considered: water absorption, development time of dough, stability of dough and farinograph quality number.

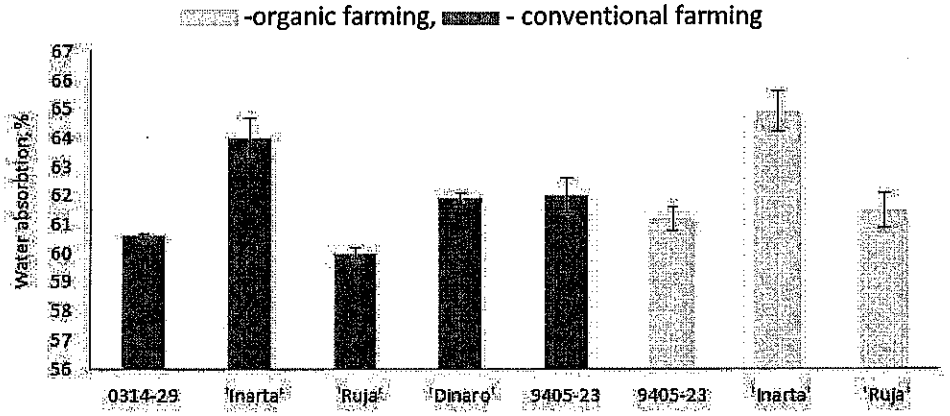

Figure 2. Water absorption of analysed triticale samples

Water absorption of analysed triticale samples was in the range from 60.0±0.1% to 64.9±0.7% (Fig. 2) and the growing conditions did not influence ($p>0.05$) water absorption of grains, but variety or breeding line have a significant ($p<0.05$) effect on flour water absorption. If flour has low water absorption capacity it means that during dough production larger amount of water will be required and there will be bigger dough yield.

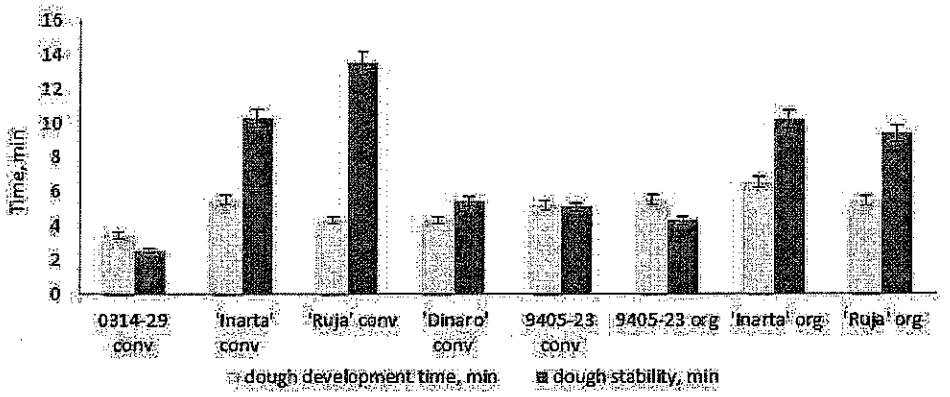

Figure 3. Triticale dough development time and dough stability

Dough development time (DDT) is the time required for water absorption in the flour until the dough mixing reaches the point of the greatest torque (500 FU). Dough development time and stability of analysed triticale grain samples are shown in Figure 3. Dough development time for the samples was from 3.45±0.11 min (breeding line 0314-29 conventional farming) to 6.56±0.02 min (variety 'Inarta' organic farming). The triticale varieties 'Inarta' and 'Ruja' had the highest dough stability value 10.30–12.29±0.16 min. Farming system had significant effect on dough development time and dough stability time of triticale varieties 'Inarta' and 'Ruja'. Results agree with Martinek et al. (2008) who studied rheological properties of several triticale varieties. Their study revealed that due to poor dough viscoelastic properties in triticale as indicated by farinographic and bread making parameters, lower values were expected than in bread wheat cultivars (Martinek et al., 2008).

The farinograph quality number represents the quality of flour in a single value. Farinograph quality number (Fig. 4) of analysed triticale grain samples was in the range from 54.5 (breeding line 0314-29 - conventional farming) to 166.0. (variety 'Ruja' - conventional farming).

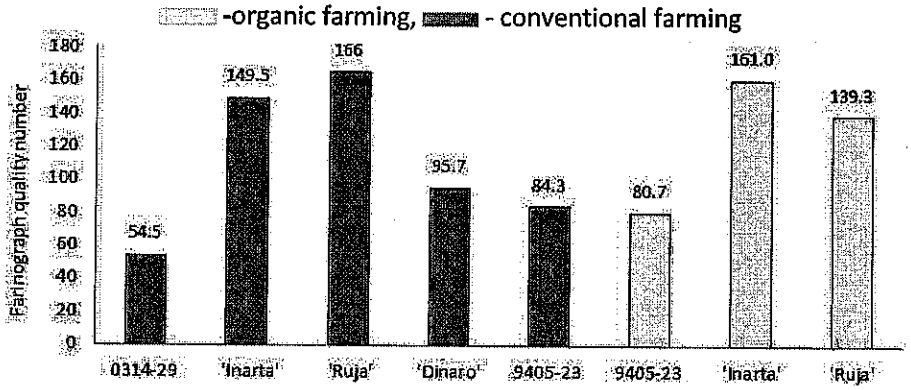

Figure 4. Farinograph quality number of anlysed triticale samples

The results partially agree with results from study of Sabovics and Straumite (2012), where quality number of triticale flour and triticale flour blends was between 97.0 (triticale flour) and 122.0 (triticale flour blend).

Farming system of triticale influence ($p<0.05$) the dough development time, dough stability and farinograph quality number of some varieties.

Acknowledgments

The research leading to these results has received funding from the Norwegian Financial Mechanism 2009-2014 under Project Innovative approach to hull-less spring cereals and triticale use from human health perspective (NFI/R/2014/011).

References

Agil R., Hosseinian F. 2014. Determination of water-extractable polysaccharides in triticale bran. *Journal of Food Composition and Analysis*, 34(1): 12-17.

Dennett A. L., Trethowan R. M. 2013. Milling efficiency of triticale grain for commercial flour production. *Journal of Cereal Science*, 57(3): 527-530.

Doxastakis G., Zafiriadis I., Irakli M., Marlani H., Tananaki C. 2002. Lupin, soya and triticale addition to wheat flour doughs and their effect on rheological properties. *Food Chemistry*, 77(2): 219-227.

Indrani D., Venkateswara Rao G. 2007. Rheological characteristics of wheat flour dough as influenced by ingredients of parotta. *Journal of Food Engineering*, 79(1): 100-105.

Kalnina S., Rakcejeva T., Kunkulberga D., Galoburda R. 2015. Rheological properties of whole wheat and whole triticale flour blends for pasta production. *Agronomy Research*, 13(4): 948-955.

Martinek P., Vinterová M., Burešová I., Vyhnánek T. 2008. Agronomic and quality characteristics of triticale (x *Triticosecale* Wittmack) with HMW glutenin subunits 5+10. *Journal of Cereal Science*, 47(1): 68-78.

Miś A., Grundas S., Dziki D., Laskowski J. 2012. Use of farinograph measurements for predicting extensograph traits of bread dough enriched with carob fibre and oat wholemeal. *Journal of Food Engineering*, 108(1): 1-12.

Sabovics M., Straumite E. 2012. Rheological properties of triticale (*Triticosecale Wittmack*) flour blends dough, In: *Proceedings of the Research for rural development 2012,* Jelgava, Latvia, pp. 143-148.

Sabovics M., Straumite E., Galoburda R. 2011. Detection of volatile compounds during wheat dough fermentation. In: *Proceedings of the Research for rural development 2011,* Vol. 1. Jelgava, Latvia, pp. 93-99.

Ukalska J., Kociuba W. 2013. Phenotypical diversity of winter triticale genotypes collected in the Polish gene bank between 1982 and 2008 with regard to major quantitative traits. *Field Crops Research*, 149: 203-212.