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

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

AISTEC
50 YEARS ANNIVERSARY

ICC
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.

The ICC/AISTEC Conference Editorial Board

Rita Acquistucci (CREA, Roma, Italy)
Massimo Blandino (University of Turin, DISAFA, Italy)
Marina Carcea (CREA, Roma, Italy)
Maria Grazia D'Egidio (CREA, Roma, Italy)
Stefania Iametti (University of Milan, DeFENS, Italy)
Emanuele Marconi (University of Molise, DIAAA, Italy)
Alessandra Marti (University of Milan, DeFENS, Italy)
M. Ambrogina Pagani (University of Milan, DeFENS, Italy)
Massimo Palumbo (CREA, Acireale, Italy)
Rita Redaelli (CREA, Bergamo, Italy)
Papers Index

The World Food Security Issue: what role for consumption, production and trade of grains?.................................................17
H. Guyomard

Volatility and trading activity in commodity futures markets...............................................................21
M. Donati, M. Riani, G. Verga, M. Zuppiroli

Multidimensional performance-based approach for the assessment of Global and Local food chains: the GLAMUR Project..........................................................25
F. Goli, G. Brunori, F. Bartolini, O. Gava, A. Zinnai, F. Venturi, G. Andrich

Fortification of baby food with local foodstuffs................................................................................29
C. E. Bouka Goto, A. Bangana, S. Sidi-Toure

Buckwheat: sustainability, safety and nutritional traits...................................................................35
C. Nobili, V. Tolaini, S. Proacci, A. Del Flore, P. De Rossi, G. Baviello, A. Brunori

Small grain that can feed the world: the Zimbabwean Case study, as a model.............................40
J. P. Muchineri

An γ-gliadin derived peptide with potential anti-inflammatory activity in celiac disease
And its occurrence in Triticum monococcum.................................................................................46
L. Gazza, E. Galassi, G. Gazzelloni, M. Mazza, G. Mamone, N.E. Pogna

Pigmented rice: phytochemical profile and thermal processing......................................................50
V. Melini, A. Fratianni, E. Marconi, G. Panfili, R. Acquistucci

The HealthBread EU project: clean label bread, tasting like white bread with nutrient levels similar to wholegrain bread, for increasing the eco-efficiency of food intake..............................................54
J.W. van der Kamp, M. Noort, R. Ranieri, S. Folloni

Relationship between homologue composition of 5-n-alkylresorcinol extracted from durum wheat and their antifungal properties........................................................................58
F. Nocente, M. Pasquini, D. Sgrulletta, R. Ciccoritti

Pre- and post-harvest strategies to minimize the occurrence of novel or emerging mycotoxin in wheat and maize chains.................................................................63
M. Blandino, V. Scarpino, F. Vanara, M. Sulyok, A. Reynerl

Wheat milling by-products and sourdough fermentation: nutritional, functional and technological advantages.........................................................................................67
C.G. Rizzello, L. Nionelli, A. Lorusso, M. Gobbetti

Whole grain flour technology, stability and functionality: an overview.........................................71
A.V. Moroni, W. Chung, B.D. Croft, C. Gancel, L.R. King, Y. Bouvet, S.M. Vaz
Tef as an efficient ingredient in wheat-based breads: a physico-chemical, sensory and nutritional approach
F. Ronda, W. Abebe, D. Santos, S. Pérez-Quirce, C. Collar

Effect of the extrusion process on the physicochemical properties of the mixture of roasted coffee and sorghum flours
D.W.H. Chávez, C.W.P. Carvalho, J.L.R. Ascheri

Influence of genotype and soil on nutrients concentration of two Italian oat cultivars
E. Antonini, G. Diamantini, A. Mezzolani, G. Nanni, L. Pierini, P. Ninfali

Agronomic characteristics of rye landraces from Aosta Valley (NW Alps)
M. Bassignano, D. Arlian, C. Tarello, M. Letey

Yield assessment of 16 Proso millet (Panicum miliaceum L.) varieties cultivated in Central Italy
A. Brunori, M. Ricci, M. Colonna, V. Sidorenko, Zh. V. Starikova, G. Suvorova

Enhancing the Productivity of Maize by Resource-Poor Farmers in Ghana Using Effective Technology Dissemination System

Effect of conventional and organic farming on bio-agronomic and quality traits of durum wheat in southern Italy
A. Iannucci, C. Fares, G. Petruzzino, P. Codignani

AMicoGrano: preliminary impact of conventional and organic farming on agronomic adaptability, quality performance and food safety traits of ancient grains
A. Rossetti, G. Galaverna, C. Dall’Asta, R. Reggiani, C. Piazza, P. Battilani, S. Folloni, R. Ranieri

Genetic and environmental effects on agronomic, technological and nutritional traits in four perennial wheat derivatives grown in Central and Southern Italy
E. Galassi, R. Ciccoritti, P. Cacciatori, G. Russo, B. Messina, L. Gazza, N.E. Pogna

Old Sicilian wheat landraces as a tool to optimize organic and low-input farming systems
P. Guarnaccia, S. Blangiforti, A. Spina, P. Caruso, C. Amato, E. Mattiolo, U. Anastasi

Carbon footprint of artisan pasta production: a case study
A. Guisso, L. Guerrini, A. Parenti, P. Spagnoli

National organic durum wheat network: genotypes performance over a four-year period
F. Quaranta, G. Aureli, A. Belocchi, C. Cecchini, M.G. D’Egidio, M. Fornara, A. Iori, S. Melloni, F. Nocente, M. Pasquini

Evaluation of agronomic strategies on crop production quality and environmental parameters of rainfed durum wheat in Southern Italy
L. Tedone, S. Alkajj Ali, L. Verdini, G. De Mastro
Effect of debranning on T-2 and HT-2 toxin content in durum wheat kernels and milling fractions..........................................................128
G. Aureli, S. Melloni, M.G. D'Egidio, F. Quaranta, M. Haidukowski, M. Pascale, V.M.T. Lattanzio

GMO monitoring in conventional seed lots in Italy: the results of the national programme started in 2003 and still ongoing..........................................................133

Stagonospora nodorum blotch on durum and common wheat varieties in organic farming: preliminary phytopathological and qual-quantitative data..........................................................137
A. Iori, V. Scala, M. Fornara, M. Reverberi, C. Pietricola, V. Farina, V. Mazzon, C. Cristofori, F. Quaranta

How safe are cereals, pseudocereals and products thereof in Austria in comparison with RASFF notifications?..........................................................141
P. Lins, F. X. Steemann, R. Buttlinger, S. Masselter

The importance of the analytical laboratory in incident management and avoidance..........................................................145
F.X. Steemann, P. Lins, S. Masselter

Effect of soil tillage on grain yield, flour rheological quality and mycotoxin contamination in common wheat..........................................................148
F. Marinaccio, M. Blandino, V. Scarpino, A. Reyneri

Effect of cereal bug damage on rheological and enzymatic quality of common and durum wheat evaluated through Mixolab® analysis..........................................................151
M. Blandino, F. Marinaccio, B.L. Inegno, M.G. Pansa, D. Gerna, L. Tavella, A. Reyneri

Einkorn flour improves the nutritional quality of snap cookies..........................................................155
A. Hidalgo, A. Brandolini

Getting nutritional and organoleptic advantages of pea and faba bean variability..........................................................158
B. Carbas, D. Lourenço, M.R. Bronze, M.C. Vaz Patto, C. Brites

Barley: a promising crop for the human nutrition..........................................................162
E. Lamonaca, C. Tricase

Characterization of the nutritional, sensorial composition and pesticide residues of peanut kernel produced at Córdoba, Argentina..........................................................167
M.J. Martinez, M.P. Silva, R. Aguilar, D. Cristos, A.P. Ricca, R.G. Badini, M.C. Inga

Antioxidant properties of some traditional Italian wheat varieties..........................................................171
A. Durazzo, G. Casale, V. Melini, G. Maiani, R. Acquistucci

Micronutrients in durum wheat: comparative analysis of mineral concentration in ancient Sicilian landraces and in modern varieties..........................................................175
Preliminary data on the content in β-Glucan of cultivated hulless oats in Sicily
G. Russo, B. Messina, S. Maddlona, L. Gazza, N.E. Pogna

Investigation on nutritional value of derivatives of durum wheat landraces in Sicily
N. Amato, S. Cremona, S. Turco, S. Maddlona, B. Rizzo, B. Messina, G. Russo

Biochemical, qualitative and technological characterization of bread wheat (T. aestivum) for the identification of high nutritional value genotypes
M. Ghidotti, D. Gerna, P. Vaccino

Evaluation of pasting properties of milled rice by Rapid Visco Analyser (RVA) and Fourier Transform Infrared Spectroscopy supported by Two Dimensional Correlation Analysis: preliminary results
R. Acquistucci, S. Ceconi, V. Melini, M. Mecozi

Use of microbial enzyme on brewing
V. Alfo, V. Giannone, D. Planeta, O. Corona, S. Muccilli, A. Spina, E. Schimenti, A. Todaro

Durum wheat semolina gluten content predicted by means of GlutoPeak parameters
T. Amorillo, V. Turfani, M. Carcea

Protein composition of durum wheat grown with organic and synthetic fertilizers
E. De Stefani, S. Pucciarmati, A. Belocchi, M. Fornara, C. Cecchini, G. Aureli, F. Quaranta

New mill process for the production of bioactive-rich ingredients based on industrial progressive pearling of common wheat
D. Giordano, M. Blandino, A. Gazzola, V. Scarpino, A. Reymeri, M. Locatelli, F. Travaglia, M. Bordiga, M. Arlorio, J.D. Coisson

Exploring common bean resistant starch variability as function of genetic resources and seed fractions
A. Castanho, B. Carbas, C. Serrano, MC. Vaz-Patto, E. Mecha, M. Bronze, C. Brites

Influence of Misak lupine (Lupinus albus L.) flour on dough rheology and texture of bread
B. Carbas, M.V. Salinas, M. C. Puppo, C. Brites

Use of debranning fractions and debranned kernels for the development of pasta with high nutritional and healthy potential
D. Martini, R. Ciccoritti, F. Toddei, L. Gazza, I. Nicoletti, D. Corradini, M.G. D'Egidio

An innovative milling process to improve the technological properties and the nutritional profile of whole grain einkorn pasta
R. Ciccoritti, E. Galassi, A. Cammerata, R. Mortaro, D. Sgrulletta, L. Gazza

Biochemical composition of soybean grains from Argentina
M.J. Martínez, M.B. Cuniberti, R. Herrero, M. Córdoba, M. Balzarini

Biological activity of wheat sprouts modified by natural elicitor
D. Dzikl, U. Gawlik-Dzikl, M. Kordowska-Wiater, M. Domani-Pytko
Influence of unicellular algae (Chlorella vulgaris spp.) as an ingredient on cooking behavior and antioxidant properties of pasta. C. Fares, R. Beleggia, M. Fragasso, A. Botto, V. Menga

Chemical, physical and sensorial characterization of fresh quinoa sprouts (Chenopodium quinoa Willd.) and effects of modified atmosphere packaging. T. D’Ambrosio, G. De Santis, A. Rascio, C. Fares, D. Pastore, M. L. Amodio, G. Colelli

How grain yield and protein content of the durum wheat grown in Mediterranean conditions are affected by 17 years of six different rotations. A. Troccoli, D.B.M. Ficco, A. Ficco, N. Pecchioni, M. Russo

Bread enriched with green coffee as a functional product. U. Gawlik-Dziki, D. Dziki, M. Świeca, A. Jakubczyk

Application of innovative processing techniques to improve the potential nutritional value of cereal products: the brown rice pasta case. F. Taddei, S. Bellato, G. Valè, D. Sgrulletta, L. Gazza

Effect of natural sea salt on physicochemical and textural properties of low sodium durum wheat bread. V. Giannone, S. Muccilli, A. Todaro, V. Alfeo, D. Planeta, O. Corona, A. Spina

Influence of genotype, environment and year on antioxidants in durum wheat (Triticum turgidum L. var. durum). D. Martini, F. Taddei, R. Ciccortiti, F. Nocente, I. Nicoletti, D. Corradini, M.G. D'Egidio

The EU scheme of “protected designations of origin” as a tool to guarantee cereal quality and authenticity. F. Mellini, M. Carcea

Bread formulation with legume flours: technological and nutritional characteristics. F. Mellini, M. Carcea

Investigations on consumer habits of durum wheat products in Sicily. B. Messina, G. Russo

Study of the correlations between agronomic management and quality traits of four durum wheat varieties. B. Messina, A. Fonti, M. Ventimiglia, G. Russo, V. Campanella, C. Miceli

Effect of the use of a reduced-sodium salt substitute on aroma compounds formation and sensory properties of wheat bread. A. Raffo, M. Carcea, E. Moneta, V. Narducci, S. Nicolò, M. Peparaio, F. Sinesio, V. Turfani

Comparison of 5-n-alkylresorcinol accumulation rate over grain development in different *Triticum* species.................................................................................................................. 289
R. Ciccoritti, P. Cacciatori, L. Gazza, D. Sgrulletta, F. Nocente

Chemical and textural characterization of reduced-sodium breads enriched in beta-glucans........................................................................................................................................ 293
I. Centomani, A. Pasqualone, V. M. Paradiso, F. Minervini, F. Caponio, T. Gomes, C. Summo

Evolution of volatile compounds during biscuit-making from purple wheat wholemeal flour........................................................................................................................................ 298
A. Pasqualone, V.M. Paradiso, C. Summo, I. Centomani, R. Nasti, F. Caponio, A. Blanco

Rheological properties of triticale (*Triticosecale Wittmack*)................................................................................................................................. 302
E. Straumite, M. Sabovics, A. Kronberga, L. Labanovska, R. Galoburda

Monitoring of technological quality of imported cereals in Italy: the CONTRIMPCER Project...................................................................................................................... 306
V. Turfani, V. Narducci, V. Galli, T. Amoriello, F. Mellara, L. Bartoli, M. Carcea

Estimating Italian rice viscoamilographic properties by near-infrared spectroscopy................................. 310
M. Limonta, P. Vaccino, S. Barzaghi, T. Cattaneo

Effects of acidification and exogenous protein on rheological properties of gluten-free starch-based doughs.................................................................................................................................. 314
M. Villanueva, C. M. Catfas, C. Collar, F. Ronda

Pasting viscosity properties of raw and extruded whole colored sorghum genotypes....................... 318
J.W. Vargas-Solórzano, C.W.P. Carvalho, J.L.R. Ascheri
Rheological properties of triticale (Triticosecale Wittmack)

E. Straumite1*, M. Sabovics2, A. Kronberga3, L. Labanovskā3, R. Galoburda1

1Latvia University of Agriculture, Faculty of Food Technology, Jelgava, Latvia
2State 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 Kocłuba, 2013). Farinograph is often used to assess the dynamics of changes in the consistency of dough during mixing (Miš 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 (Miš 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 BPEA 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](image)

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 Hosseiniyan (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.
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.

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).
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