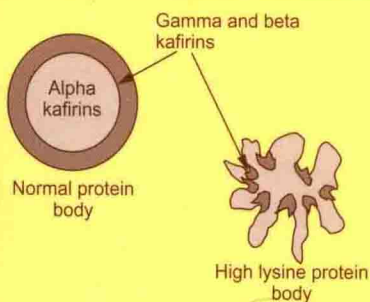


# Using cereal science and technology for the benefit of consumers

Proceedings of the 12th International ICC  
Cereal and Bread Congress  
23 – 26th May 2004, Harrogate, UK



Edited by Stanley P. Cauvain, Susan S. Salmon  
and Linda S. Young



**WP**

# **USING CEREAL SCIENCE AND TECHNOLOGY FOR THE BENEFIT OF CONSUMERS**

**Proceedings of the  
12th International ICC Cereal and Bread Congress  
23–26th May 2004, Harrogate, UK**

**Edited by**

**Stanley P. Cauvain, Susan S. Salmon and Linda S. Young**

**Campden & Chorleywood Food Research Association  
Chipping Campden, UK**



**CRC Press**

**Boca Raton Boston New York Washington, DC**

**WOODHEAD PUBLISHING LIMITED**  
Cambridge England

Published by Woodhead Publishing Limited, Abington Hall, Abington  
Cambridge CB1 6AH, England  
www.woodhead-publishing.com

Published in North America by CRC Press LLC  
2000 Corporate Blvd, NW  
Boca Raton FL 33431  
USA

First published 2005, Woodhead Publishing Limited and CRC Press LLC  
© 2005, Campden & Chorleywood Food Research Association Technology Limited  
The authors have asserted their moral rights.

This book contains information obtained from authentic and highly regarded sources. Reprinted material is quoted with permission, and sources are indicated. Reasonable efforts have been made to publish reliable data and information, but the authors and the publishers cannot assume responsibility for the validity of all materials. The publishers make no representation, express or implied, with regard to the accuracy of the information contained in this book and cannot accept any legal responsibility or liability for any errors or omissions.

Neither the authors nor the publishers, nor anyone else associated with this publication, shall be liable for any loss, damage or liability directly or indirectly caused or alleged to be caused by this book.

Neither this book nor any part may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, microfilming and recording, or by any information storage or retrieval system, without permission in writing from the publishers.

The consent of Woodhead Publishing Limited and CRC Press LLC does not extend to copying for general distribution, for promotion, for creating new works, or for resale. Specific permission must be obtained in writing from Woodhead Publishing Limited or CRC Press LLC for such copying.

Trademark notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation, without intent to infringe.

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library.

Library of Congress Cataloging-in-Publication Data

A catalog record for this book is available from the Library of Congress.

Woodhead Publishing ISBN 1 85573 961 5

CRC Press ISBN 0-8493-3771-2

CRC Press order number WP3771

Printed by Antony Rowe Limited, Chippenham, Wilts, England

## PREFACE

The Cereal & Bread Congresses which are run under the auspices of the International Association for Cereal Science & Technology (ICC) have a long and distinguished history. They take place every four years in different locations around the world.

The UK was chosen to host the 12<sup>th</sup> Cereal & Bread Congress and brought together cereal scientists, technologists, millers, bakers, plant breeders, nutritionists, engineers, equipment and ingredients suppliers from around the world to exchange their knowledge through verbal and poster presentations (the contents of this publication), exhibitions and informal networking.

The ICC congresses provide a unique opportunity to learn from others working in the many different fields of cereal science and technology and their associated disciplines. I have attended quite a few in my career and have never failed to come away impressed with the scale and quality of the work in cereal science. I have always found that my own thinking has been challenged, adjusted and strengthened by the experience. I have always enjoyed the occasion and the 12<sup>th</sup> such event was no exception.

The Congress theme – Using cereal science and technology for the benefit of consumers – was chosen with the aim of getting presenters to think about the process from beginning to end, ‘plough to plate’ or ‘farm to fork’ are much used phrases in this context. However, while such grand visions fit well with the modern jargon of ‘joined-up thinking’ or ‘joined-up business’ they tend to over-simplify the process and the link to the consumer.

Even the concept of ‘the consumer’ has been hijacked to be the ‘person in the street’. Surely if you have a product then the ‘consumer’ is the next person/company in the chain. So millers consume wheat supplied by the farmer, at least in the sense of taking wheat and modifying into another form, bakers become the consumers of the miller’s product and the people in the street consumers of the baker’s product.

Who then is the ‘consumer’ of the product of cereal scientists and technologists? Their product is knowledge and so we are all consumers of that product, wherever we fit in the ‘grain chain’. Ultimately if we are to benefit we need access to that knowledge and it must be provided in a readily assimilated form. Conferences provide one form but then we cannot attend all of these and so access to their proceedings provide another form.

We hope that you, as a consumer of knowledge, will gain benefit from accessing the proceedings of the 12th ICC Cereal & Bread Congress and be encouraged to attend the next event in 2008.

Please note that abstracts **only** are included for the following papers in this collection: Integrated development of *Amaranthus* as a high-value commercial grain (p. 68); The role of cereals in the diet (p. 89); The effects of dough mixing on GMP re-aggregation and dough elasticity during dough rest (p. 187); Measure of damaged starch by an improved amperometric method (p. 259); Quality control with BRABENDER instruments (p. 260); Adding an acoustic note to texture analysis (p. 283); Predicting grain, flour, and bread quality using NIR spectroscopy (p. 303); Fibre by the slice: bringing consumer value and market leadership (p. 370).

Stanley P. Cauvain  
Chairman of UCST2004 and ICC President Elect 2002-2004

# CONTENTS

<b>Preface</b>	
S. Cauvain, Campden & Chorleywood Food Research Association, UK	xi
<b>Part I Keynote lectures</b>	<b>1</b>
<b>Congress welcome address</b>	
Lord Plumb of Coleshill, President of Campden & Chorleywood Food Research Association, UK	3
<b>Opening technical address: Supporting the path from wheat genomics to a slice of bread</b>	
P. Biscoe, HGCA, UK	5
<b>Part II Wheat breeding around the world</b>	<b>11</b>
<b>Evaluation of wheat quality for the UK in the HGCA recommended list system</b>	
J. McVittie, G. Jellis and A. Flux, HGCA, UK	13
<b>Breeding breadmaking varieties for European markets</b>	
I. Foot and W. Angus, Nickerson, UK	18
<b>Selection of breeders' lines for wheat quality: Australian innovations</b>	
W. Rathmell and A. Kilian, Triticarte, Australia; C. Wrigley and I. Batey, Food Science Australia, Australia; N. Howes and P. Sharp, University of Sydney, Australia	24
<b>Wheat breeding in Australia</b>	
L. O'Brien, Solheimar Pty Ltd, Australia	29
<b>Roles of the four ARS regional wheat quality laboratories in U.S. wheat quality improvement</b>	
O. Chung, C. Gaines, C. Morris and G. Hareland, USDA-ARS, USA	34
<b>Wheat breeding in the Great Plains of North America – past, present and future</b>	
R. Graybosch, USDA-ARS, USA; P. Baenziger, F. Hundera and I. Dwiekat, University of Nebraska, USA	39
<b>Breeding for improved stability in bread-making quality</b>	
E. Johansson, M-L. Prieto-Linde, R. Kuktaite, A. Andersson, and G. Svensson, The Swedish University of Agricultural Sciences, Sweden; J. Jönsson, Svalöf Weibull AB, Sweden	44
<b>Part III The potential for using other cereals</b>	<b>49</b>
<b>Developments in sorghum bread making</b>	
J. Taylor, L. Hugo and S. Yetnerberk, University of Pretoria, South Africa	51

<b>New developments in sorghum proteins</b>	
P. Belton, University of East Anglia, UK	57
<b>Comparison of the breadmaking potential of different sorghum hybrids</b>	
E. Arendt, T. Schober, and M. Messerschmidt, University College, Ireland; S. Bean, USDA-ARS, USA	62
<b>Integrated development of <i>Amaranthus</i> as a high-value commercial grain</b>	
H. Corke, University of Hong Kong, Hong Kong	68
<b>Flavour of rye bread made with scalded flour</b>	
G. Juodeikiene, A. Venskaityte, and A. Sventickaite, Kaunas University of Technology, Lithuania; M. Petersen and Å. Hansen, Royal Veterinary and Agricultural University, Denmark	69
<b>Pasta production from the pseudocereals amaranth, quinoa and buckwheat</b>	
R. Schoenlechner, K. Jurackova and E. Berghofer, Boku-University of Natural Resources and Applied Life Sciences, Austria	74
<b>Food functionality of sprout rice grain, Super Rice</b>	
Y. Fujino, University Food Institute, Japan; J. Kuwata, Red Cross Blood Centre, Japan	82
<b>Part IV Creating health benefits with cereal products</b>	87
<b>The role of cereals in the diet</b>	
R. Pickard and B. McKevith, British Nutrition Foundation, UK	89
<b>Lifestyle, diet &amp; the consumer</b>	
A. Alldrick, Campden & Chorleywood Food Research Association, UK	90
<b>Low GI cereal foods: the role of dietary fibre and food structure</b>	
C. Brennan, L. Symons and C. Tudorica, Plymouth University-Seale-Hayne, UK	95
<b>Cereals as a source of dietary antioxidants</b>	
G. Tucker, L. Carrier, J. Simcox, H. Marson, P. Swatsitang, A. Salter and D. Gray, University of Nottingham, UK	102
<b>Effect of processing on bioactivity of whole grain</b>	
K-H. Liukkonen and K. Poutanen, VTT Biotechnology, Finland	107
<b>Fibre and whole grains and their role in disease prevention</b>	
J. Miller Jones, College of St. Catherine, USA	110
<b>New methods for assessment of nutritional and health effects of cereal products</b>	
J. van der Kamp, R. van den Berg, K. Venema and R. Havenaar, TNO Nutrition and Food Research, The Netherlands	118
<b>Part V What makes bread?</b>	125
<b>How much more bread research do we need?</b>	
S. Cauvain, Campden & Chorleywood Food Research Association, UK	127

## **Flour quality and dough development interactions - the critical first steps in bread production**

S. Millar and J. Alava, Campden & Chorleywood Food Research Association, UK;  
C. Bar L'Helgouac'h and C. Massin, Wheat quality assessment laboratory, France 132

## **Bubbles in bread – the potential role of the aqueous phase of doughs in determining crumb structure**

E. Mills, L. Salt, J. Jenkins and P. J. Wilde, Institute of Food Research, UK;  
P. Skeggs, R. H. M. Technology Ltd, UK 137

## **Modifying tyrosine crosslink formation in wheat dough by controlling innate enzymatic activity**

M. Tilley, USDA-ARS, USA; K. Tilley, Kansas State University, USA 142

## **Lipopan F BG - unlocking the natural strengthening potential in dough**

F. Rittig, Novozymes, Switzerland 147

## **Impact of microbial transglutaminase on the fresh quality and keepability of enzyme supplemented pan breads**

C. Bollaín and C. Collar, Instituto de Agroquímica y Tecnología de Alimentos (CSIC), Spain 152

## **Microencapsulation of bakery ingredients and the impact on bread characteristics: effect of tartaric acid encapsulated with carnauba wax**

O. Al-Widyan and D. M. Small, RMIT University, Australia 158

## **Wheat sourdough fermentation: Effects of time and acidification on fundamental rheological properties**

C. Clarke, T. Schober, P. Dockery and E. Arendt, University College, Ireland 163

## **COVAD – The continuous vacuum dough process**

J. Alava, Campden & Chorleywood Food Research Association, UK;  
E. Navarro, Verein Zur Förderung des Technologietransfers an der Hochschule Bremerhaven e. V., Germany; A. Nieto, Centre de Recerca i Investigació de Catalunya, Spain; O. Schäuble, Werner & Pfliederer Industrielle Backtechnik, Germany 169

## **Effects of mixing speed and work input on dough development and aeration**

N. Chin and G. Campbell, UMIST, UK 174

## **The conformation and aggregated structure of gluten fractions**

W. Li and B. Dobraszczyk, The University of Reading, UK; A. Dias and A. Gil, University of Aveiro, Portugal 180

## **The effects of dough mixing on GMP re-aggregation and dough elasticity during dough rest**

R. Hamer, C. Don, W. Lichtendonk and J. Plijter, TNO Nutrition, The Netherlands 187

## **Investigating the porosity of dough using ultrasound**

H. Elmehdi, J. Page and M. Scanlon, University of Manitoba, Canada 188

**Measurement of bread cell structure by image analysis**

- M. Whitworth and S. Cauvain, Campden & Chorleywood Food Research Association, UK; D. Cliffe, Calibre Control International Ltd, UK 193

**Use of MRI for the characterization of the bread process**

- L. Tiphaine, T. Lucas, A. Grenier, S. Quellec, G. Collewet and A. Davenel, Cemagref, France; A. Le Bail, UMR GEPEA, France 199

**Part VI Grain processing 205*****In situ* measurement of the rheological properties of wheat and barley grain using the SKCS 4100**

- B. Osborne, BRI Australia Ltd, Australia; R. Anderssen and H.-N. Huynh, CSIRO Mathematical and Information Sciences, Australia 207

**Characterizing the maturation and germination processes in wheat by NIR methods**

- A. Salgó, S. Gergely and R. Juhász, Budapest University of Technology and Economics, Hungary 212

**Physiological traits influencing hardness and vitreosity in wheat grain**

- R. Weightman, ADAS Consulting Ltd, UK; J. Foulkes, University of Nottingham, UK; J. Snape and L. Fish, John Innes Centre, UK; J. Alava, and P. Greenwell, Campden & Chorleywood Food Research Association, UK 220

**Investigation of the fracture of wheat grains by Environmental Scanning Electron Microscopy**

- N. Zakowsky and A. Donald, University of Cambridge, UK 225

**Rheological behaviour, structural and physicochemical characteristics of vitreous and piebald durum wheat endosperm**

- M.-F. Samson, M.-H. Morel, F. Mabilille and J. Abécassis, INRA, France 230

**Distribution of the aleurone layer during the common wheat milling process**

- V. Greffeuille, J. Abécassis and V. Lullien-Pellerin, INRA, France; C. Bar L'Helgouac'h, ARVALIS, France 236

**Debranning technology to improve cereal-based foods**

- S. Pandiella, Z. Mousia and C. Webb, UMIST, UK; A. Laca and M. Díaz, Universidad de Oviedo, Spain 241

**The practical use of the fumigant sulfuryl fluoride to replace methyl bromide in UK flour mills**

- M. Drinkall and C. Pye, Dow AgroSciences, UK; C. Bell, Central Science Laboratory, UK; M. Braithwaite, Igrox, UK; S. Clack, Smiths Flour Mills, UK; J. Ive, Heygates, UK; S. Kershaw, EcoLab, UK 245

**Wheat and flour quality in South Africa. From regulation to free market**

- A. Fowler, Foodcorp Milling & Baking, South Africa; J. Taylor, University of Pretoria, South Africa; P. Cownie, SA Chamber of Baking, South Africa 250



<b>Part VII ICC Corporate Members session</b>	<b>257</b>
<b>Measure of damaged starch by an improved amperometric method</b> A. Dubat, Tripette et Renaud, France	259
<b>Quality control with BRABENDER instruments</b> W. Sietz, BRABENDER® OHG, Germany	260
<b>Perten instruments AB – new NIR Flour Analyser IM 9140</b> M. Lindgren and B. Allvin, Perten Instruments, Sweden	261
<b>Nordic Flour Network - a joint solution to increasing the value of NIR analysis in the flour industry</b> J-Å Persson, R. Sjödin and H. Andrén, FOSS Analytical AB, Sweden	265
<b>Molecular biology: the way forward for Megazyme</b> B. McCleary, S. Charnock, R. Lloyd and P. Rossiter, Megazyme International Ireland, Ireland	269
<b>Comparison of the doughLAB and Farinograph for testing flour quality</b> M. Bason and J. Dang, Newport Scientific Pty Ltd, Australia; C. Charrié, Newport Scientific Europe Ltd, UK	276
<b>Adding an acoustic note to texture analysis</b> J. Bank, Stable Micro Systems, UK	283
<b>Baked products enriched with dietary fibre</b> H. Bollinger, J. Rettenmaier & Sohne GMBH & Co, Germany	284
<b>Polish measuring and monitoring devices for evaluation of cereals and flour</b> J. Sadkiewicz, Sadkiewicz Instruments, Poland	286
<b>Part VIII Evaluating wheat and flour</b>	<b>291</b>
<b>Wheat quality and wheat varietal identification</b> G. Lookhart and S. Bean, USDA-ARS GMPRC, USA; C. Culbertson, Kansas State University, USA	293
<b>Extra-strong dough properties associated with over-expression of HMW glutenin subunit <i>GLU-B1 7X</i></b> G. Cornish, M-J. Vawser and R. Tonkin, SARDI, Australia	298
<b>Predicting grain, flour, and bread quality using NIR spectroscopy</b> F. Dowell, E. Maghirang and O. Chung, USDA ARS GMPRC, USA; F. Xie, Kansas State University, USA; R. Pierce, USDA GIPSA, USA	303
<b>Development of a controlled dough mixing system</b> R. Dempster, M. Olewnik and V. Smail, American Institute of Baking, USA	304
<b>Spectroscopic techniques for investigating the effect of growing environment on endosperm cell wall composition</b> G. Toole, E. Mills and R. Wilson, Institute of Food Research, UK	315

**Objective measurement of blackpoint in kernels of durum wheat**

- S. Symons and M. Shahin, Canadian Grain Commission, Canada; F. Colucci, Experimental Institute for Cereal Research, Italy 320

**Part IX Developing new wheat-based products 327****Selling the science – how to ensure that good science makes successful products?**

- C. Huscroft, CSM Bakery Supplies Europe, The Netherlands 329

**Bread without flour "TONUS" - a high-grade product for healthy nutrition**

- V. Antonov, U. Staroverov, and D. Vorobjev, Moscow 334

**Pilot-scale isolation of glucuronoarabinoxylans from wheat bran**

- J. Hollmann and M. Lindhauer, Institute of Cereal, Potato and Starch Technology, Germany 339

**Functional properties of food products from purple wheat**

- E. Berghofer, I. Kreilmayr and M. Rogenhofer, Boku-University of Natural Resources and Applied Life Sciences, Austria; A. Mar, Technical High School for Food Technology, Austria 344

**Effect of disulphides in *Allium* on breadmaking properties**

- M. Seguchi, Kobe Women's University, Japan; M. Abe, Gakushuin Women's College, Japan 349

**Novel ingredients in optimising gluten-free bread acceptability**

- E. Gallagher, D. McCarthy and T. Gormley, The National Food Centre, Ireland; E. Arendt, National University of Ireland, Ireland 355

**Part X Bringing benefits for industry and consumers 363****Sustainability with sanity**

- A. Giesecke, American Bakers Association, USA 365

**Fibre by the slice: bringing consumer value and market leadership**

- M. Croghan, National Starch Ltd, UK 370

**An integrated approach to improve bread nutritional quality**

- E. Chanliaud and A. Messenger, ULICE, France; F. Balfourier, F. Oury, G. Charmet, and M. Beckert, INRA-UBP UMR, France; B. Duperrier, Mais Angevin-Nickerson SA, France; S. Peyron, J. Abecassis, F. Leenhardt and C. Remesy, INRA, France 371

**Post baking bread chilling; evaluation of water pulverisation on bread surface to control weight loss and cooling rate**

- J. Monteau, J. Cournil, P. Bransolle, N. Hamdami and A. Le-Bail, ENITIAA, France 376

**Data mining bread quality and process data in a plant bakery**

- A. Wilson and M. Morgenstern, Crop & Food Research Ltd, New Zealand; B. Pfahringer, University of Waikato, New Zealand; C. Leschi, Institut National des Sciences Appliquées de Lyon, France 383

**'We'll have it for T'**

L. Young, Campden & Chorleywood Food Research Association, UK 389

**A comparison of visual assessment and digital fractal texture analysis of bread-crumbs features**

U. Gonzales-Barron and F. Butler, University College Dublin, Ireland 395

**Reduction of acrylamide formation in bakery products by application of *Aspergillus Niger* asparaginase**

L. de Boer, C. Heeremans and R. Meima, DSM Bakery Ingredients, The Netherlands 401

**Whole grain knowledge and environmental influences among health club members**

L. Marquart, M. Croy and T. Burgess Champoux, University of Minnesota, USA; J. Sobal, Cornell University, USA 406

**Part XI Cakes, cookies and pastries**

413

**Biochemical correction of flour properties for biscuits and ginger bread**

I. Matveeva, and A. Byistrov, Moscow State University of Food Industries, Russia; E. Bannikov, ZAO EXPORTKHLEB, Russia 415

**Biscuit baking – a model approach**

S. Cook and A. Hall, Campden & Chorleywood Food Research Association, UK 424

**New lipase functionality in bakery products**

S. Sahi and R. Guy, Campden & Chorleywood Food Research Association, UK 428

**Texture analysis of cookies by acoustic method: a comparison to mechanical method**

G. Juodeikiene and L. Basinskiene, Kaunas University of Technology, Lithuania; G. Schleining, University of Natural Resources and Applied Life Science, Austria; V. Kunigelis, Vilnius University, Lithuania 434

**Modelling biscuit checking using the Finite Element Method**

Q. Saleem, R. Wildman, and J. Huntley, Loughborough University, UK; M. Whitworth, Campden & Chorleywood Food Research Association, UK 439

**Wheat functionality for puff pastry**

S. Salmon, Campden & Chorleywood Food Research Association, UK 445

**The icing on the cake - digital colour and appearance for baked goods**

S. Williams, DigiEye, UK 451

**Non-destructive imaging of bread and cake structure during baking**

M. Whitworth and J. Alava, Campden & Chorleywood Food Research Association, UK 456

**Wheat starch granule size**

F. Stoddard, University of Wolverhampton, UK 461

<b>Part XII Extruded foods, pasta and noodles</b>	<b>467</b>
<b>Factors affecting the shape of extruded products</b>	
R. Guy, Campden & Chorleywood Food Research Association, UK	469
<b>The comparison of the effects of extrusion conditions on the physicochemical properties and sensory characteristics of maize, rice and wheat-based expanded snacks</b>	
Q. Ding, P. Ainsworth and A. Plunkett, The Manchester Metropolitan University, UK	474
<b>Structural basis of the crispy properties of cereal products</b>	
H. Chanvrier, L. Chaunier, P. Colonna, G. Della Valle and D. Lourdin, INRA, France	480
<b>Texture and colour of pasta containing mill fractions from hull-less barley genotypes with variable content of amylose and fibre</b>	
J. Dexter, M. Izydorczyk, B. Marchylo and L. Schlichting, Canadian Grain Commission, Canada	488
<b>Australia becomes a player in the quality durum market</b>	
R. Cracknell, C. Cassidy, J. Bell and T. Watts, AWB Limited, Australia	494
<b>Use of the enzyme transglutaminase for developing pasta products with high quality</b>	
E. Kovács, University of Szeged, Hungary	498
<b>Rice pasta formulation for a conventional pasta manufacturing process</b>	
R. Ormenese, Instituto de Tecnologia de Alimentos, Brazil; Y. Chang, Faculdade de Engenharia de Alimentos/UNICAMP, Brazil	504
<b>Influence of kansui formulation on oriental noodle texture</b>	
D. Hatcher and M. Anderson, Canadian Grain Commission, Canada	511
<b>A comparison of instrumental techniques used to discriminate the cooking quality of spaghetti</b>	
M. Sissons and N. Egan, NSW Agriculture, Australia; I. Batey, Value Added Wheat CRC, Australia; L. Schlichting and B. Marchylo, Canadian Grain Commission, Canada; N. Ames and C. Rhymer, Cereal Research Centre, Canada	516
<b>Part XIII Poster abstracts</b>	<b>521</b>

**PART I**

**KEYNOTE LECTURES**



## **CONGRESS WELCOME ADDRESS**

Lord Plumb of Coleshill  
President of the CCFRA

It is perhaps appropriate to invite a humble son of the soil and grain grower to open your 12<sup>th</sup> International Cereals and Bread Congress before you hear the views on experts in science and technology. In the political world it is important to have a warm-up speaker before the real actors take the stage.

My concern through most of my life as a farmer has been to grow two ears of corn where one grew before, make a profit, and follow the motto of my ancestors: - "leaving the land in better shape than I found it". The Common Agricultural Policy in the EU was so successful because it became possible to achieve the sentiments of such a motto. Now we are encouraged to grow less, set land aside and become more environmentally friendly.

Your theme 'Using cereal science and technology for the benefit of consumers' which brings together wheat breeders, farmers, technologists, millers, bakers, nutritionists, engineers, equipment and ingredient suppliers, and consumers from over 30 countries is very commendable, and as a farmer I would like to pay tribute to the scientists and technologists who through years of research have contributed to the advancement of cereal science through your collaborative effort. So much is taken for granted as the consumer scans the supermarket shelves, and I am sure that this Conference will fully identify the current issues at a domestic and international level about biodiversity and the environment, food safety and quality and GMOs. All are central to the debate surrounding food production, processing and distribution.

These issues often hit the news headlines in a scaremongering way, yet evidence in the shops belies this concern: price, appearance, convenience and all-year-round availability still appear to be the major factors in purchasing decisions. This contradictory evidence has often resulted in a dialogue of the deaf generating more sound than light. We can produce the tenderest, tastiest, highest welfare food from cereal or grass-fed animals but if the consumer wants fish – so be it!

The changes that have been taken place in what consumers can purchase, and what and where they eat are nothing short of phenomenal. During the past 50 years, as incomes rose so demand switched from a cereal-based diet to one based on higher protein foods. This increased the pressure on land availability due principally to the poorer conversion rate of cereal into meat.

China is a striking example of this cause and effect. The higher standard of living there has led to a greatly increased demand for cereals and to a doubling of shipping rates over the last six months as they import more grain. There has been a huge increase in food miles and lower food processing costs in Thailand and Brazil enabling them to supply cheaper products like poultry and pig meat to European and U.S. markets. Migration is accelerated affecting not just the poor and deprived but exacerbating the problems in their home countries.

We are all aware that food security such as that in sub-Saharan Africa is literally a matter of life and death – an economic issue of great importance. While the discoveries of agronomists like Norman Borlaug sparked the Green Revolution and saved literally millions of lives, rising global populations, increased expectations among consumers and climate change on which Dr King, the UK's government's Chief Scientist said recently – "global warming poses a greater threat to the stability of the world than does international terrorism", all have their impact on food production.

There is an obvious need to make policy changes that counters these risks and much more co-ordinated work which I am sure will be highlighted in this Congress. It is often said that there is enough food in the world to feed everyone but droughts and disease can dramatically affect yield. I note, however, that current total stocks of wheat and coarse grain shows that the world had only sufficient grain in store to last 63 days at the end of 2003 compared with 104 days at the end of 1999 – a reduction of 37%. The so-called European butter mountains are now reduced to 6 days' supply.

But food security is also about quality and in a fiercely competitive market, most of the money consumers spend rewards activities that take place after the product has left the farm gate. Catering services are an increasing part of food expenditure – in the U.K. they represent £ 62 billion of a total £ 133 billion. While in many developed countries, food consumption is a declining part of consumer expenditure and farm output a declining part of the total consumer cost of food, bread is still the staff of life. As Marie Antoinette said “if they have no bread give them cake!”

So the giants in terms of added value are the manufacturers, retailers and caterers, adding eight times the added value and employing five times more people than the producers. In these days, caterers do the washing-up as well!

None of this development would succeed without cereals-related research and we have a fine example of the development of new wheat varieties and improved agricultural practices in the U.K. through the work of our HGCA and our cereals authority is a government-industry partnership which fosters closer links between producers and users encouraging quality assurance.

I am aware that support for this event, held for the first time in the U.K., comes from the HGCA together with CCFRA, whose staff form the backbone of the organising committee for this Conference. CCFRA has a history of cereal based research going back to 1926 and it has a significant international reputation for excellence for the development and application of cereal science and technology. Their pioneering work on breadmaking led to many innovations encouraging the greater use of home grown wheat, and their innovative traditions established originally at Chorleywood have been maintained at Chipping Campden. They remain at the forefront of cereal science and technology with close links to cereal based industries worldwide and I am deeply proud to be associated with such a fine organisation.

I am sure that your individual contributions at this Congress will add value to the knowledge of all those who are prepared to listen or read the outcome of your deliberations making good sense with science.

I wish you well.



## **OPENING TECHNICAL ADDRESS**

### **SUPPORTING THE PATH FROM WHEAT GENOMICS TO A SLICE OF BREAD**

P. V. Biscoe  
Chief Executive

HGCA, London N1, England

#### **INTRODUCTION**

The organisers of this Congress have set the challenge that 'advancing our knowledge of cereal science and technology has limited value unless we can use it to benefit consumers'. This then raises the predictable question of 'how can that knowledge improve the availability and quality of cereal based products for consumers?'

How should this challenge be addressed? The approach adopted in this paper is to demonstrate how HGCA, from a UK perspective, is supporting the production and delivery of cereal-based products through to the consumer.

#### **THE PATH**

The achievement of consumer benefit from *Triticum* genotypes is a complex path, involving all of the scientific disciplines and technologies represented at this Congress. To be successful, the path requires the transfer of knowledge in both directions between adjacent steps while product moves efficiently from breeder via grower and processor to consumer.

HGCA is actively involved in knowledge transfer and interaction in both directions along the whole path and only by ensuring that this knowledge is understood and implemented is it possible to ensure that there is every opportunity for having the right product in the right place at the right time. HGCA's aim is to improve the effectiveness and efficiency of transfer of both knowledge and product to achieve maximum consumer benefits.

#### **ABOUT HGCA**

HGCA was established in 1965. Its major purpose is to improve the production and marketing of cereals. This improvement is achieved by providing high quality services, which are cost effective and meet the needs of its customers (levy-payers), and take account of both consumer and environmental requirements.

HGCA has an annual income of about £10 million derived from levies collected from the growers, dealers and processors of cereals throughout the UK. The collection of levies from steps along the path affords HGCA the opportunity for direct interaction with organisations involved with each step and hence, a unique opportunity to support the industry by improving the transfer of knowledge and product between those different steps. This approach is reflected in HGCA's activities, which cover variety evaluation, research and development, marketing services, product development, grain and product export and nutrition.