

POULTRY SCIENCE

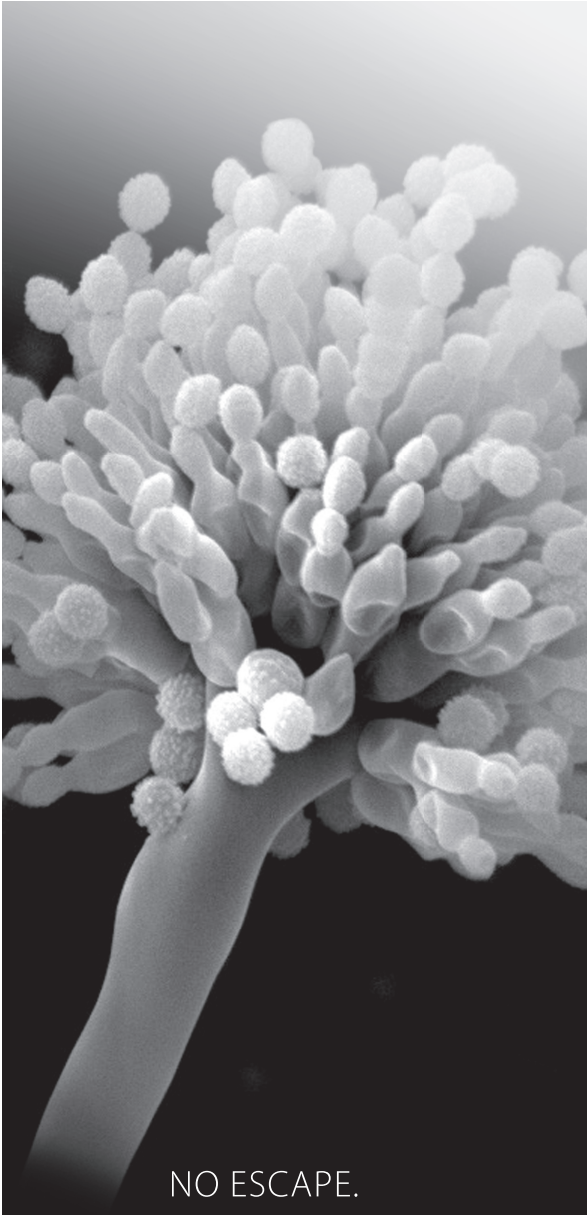
WORLD'S JOURNAL

education
organization
research



www.wpsa.com

volume 66, december 2010 number 4



NO ESCAPE.

WWW.NUTREX.BE

Nutrex is a research-driven company, specialized in development, production and marketing of additives for feed and food. It is our aim to engage in a sustainable partnership as your most reliable supplier of optimal solutions for better nutrition.

Free-Tox

MYCOTOXIN BINDER

DESCRIPTION

- Multi-component mycotoxin binder
 - Clay minerals
 - Yeast cell walls
 - Organic acids and salts
- For use in poultry, swine and ruminant diets

EFFECTS

- Detoxifies feed and raw materials
- Binds polar mycotoxins, such as aflatoxins, as well as non-polar mycotoxins, including ochratoxin and zearalenone
- Improves immunity
- Inhibits mould growth

BENEFITS

- Efficient capture and retention of mycotoxins disables their toxic effects in animals
- No binding of nutrients such as vitamins and minerals
- Safe product handling

nutrex^{NV}
the finishing touch for nutrition

Achterstenhoek 5 • 2275 Lille • Belgium • Tel: +32 14 883111 • sales@nutrex.be • www.nutrex.be

WORLD'S
POULTRY SCIENCE
JOURNAL

Volume 66 December 2010 Number 4

629 **Editorial**

630 **Sponsorship**

Reviews

633 Poultry diseases – their control and effects on nutritional requirements

S.A. Lister

639 Early nutritional strategies

Y. Noy and Z. Uni

647 Artificial insemination in geese

E. Łukaszewicz

659 Genetic and physiological factors influencing feather pecking in chickens

M. Wysocki, W. Bessei, J.B. Kjaer and J. Bennewitz

673 Uses and management of poultry litter

N.S. Bolan, A.A. Szogi, T. Chuasavathi, B. Seshadri, M.J. Rothrock Jr. and P. Panneerselvam

699 Box-Behnken Design: alternative multivariate design in broiler nutrition research

A.C. De Leon, M.T. Kidd and A. Corzo

707 Sea buckthorn: new feed opportunity for poultry in cold arid Ladakh region of India

A. Biswas, V.K. Bharti, S. Acharya, D.D. Pawar and S.B. Singh

715 Genetic diversity and genealogical origins of domestic chicken

M. Eltanany and O. Distl

727 Chicken toll-like receptors and their role in immunity

T.R. Kannaki, M.R. Reddy, M. Shanmugam, P.C. Verma and R.P. Sharma

739 Influence of high environmental temperature on egg production and shell quality: a review

A.O. Oguntunji and O.M. Alabi

751 Dietary arginine: metabolic, environmental, immunological and physiological interrelationships

F. Khajali and R.F. Wideman

767 Production and welfare aspects of goose down and feather harvesting

J. Kozák, I. Gara and T. Kawada

Summaries

779 Chinese, French, German, Russian, Spanish

World's Poultry Science Association

804 Information and Officers

809 **Association News**

824 **Calendar**

827 **Education and Training**

829 **Index**

832 **Notes for Contributors**

Editor

Dr L.A. Waldron (previously Tucker)
LWT Animal Nutrition Ltd
PO Box 119, Feilding 4740
New Zealand
Phone: +64 6328 9026,
Mobile +64 21743374
Fax: +64 6328 9027
E-mail: lucy@animalnutrition.co.nz

Assistant Editor

Mrs D.M. Kleverwal
World's Poultry Science Association
PO Box 31, 7360 AA Beekbergen
The Netherlands
Phone: +31 570 541948
Fax: +31 207 508941
E-mail: wpsa@xs4all.nl

Associate Editors

Prof J.A. Castelló, Spain
Dr S. Cherepanov, Russia
Prof D.K. Flock, Germany
Dr D. Grastilleur, France
Prof N. Yang, China

International Editorial Board

Prof W. Bessei, Germany
Prof I.J. H Duncan, Canada
Prof D.J. Farrell, Australia
Prof R.M. Gous, South Africa
Dr. E.F. Guèye, Mali
Prof P. Horn, Hungary
Dr P. Hunton, Canada

Dr M. Lilburn, USA
Dr R.W.A.W. Mulder, Netherlands
Prof. Y. Nys, France
Prof Jun-ichi Okumura, Japan
Prof H. Pingel, Germany
Dr R.A.E. Pym, Australia
Prof J.R. Roberts, Australia

Prof G.D. Rosen, UK
Prof P.J. Sharp, UK
Prof P.B. Siegel, USA
Prof S.E. Solomon, France
Dr M. Tixier-Boichard, France
Prof S. Yahav, Israel

The **World's Poultry Science Journal** is published in March, June, September and December by the World's Poultry Science Association. The Secretary of the Association is Dr Roel W.A.W. Mulder, PO Box 31, 7360 AA Beekbergen, The Netherlands (phone: +31 6 51519584, fax: +31 55 506 4858, e-mail: roel.mulder@wpsa.com, website: www.wpsa.com).

Disclaimer: The Editors of the World's Poultry Science Journal take all reasonable steps to ensure the accuracy of material published. However, all statements, conclusions and opinions expressed in it are those of the authors and contributors; the Editors, Associate Editors, Members of the Editorial Board and the Publishers accept no responsibility or liability for them.

2010 subscription rates: £166/\$300 for organisational online & print; £128/\$238 for organisational online only; £86/\$158 for individuals online & print; £75/\$137 for individuals online only.

Subscription enquiries and orders: Orders, which must be accompanied by payment, may be sent to a bookseller, subscription agent or to the Publisher: Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge, CB2 2RU, UK; or in the USA, Canada and Mexico: Cambridge University Press, Journals Fulfillment Department, 100 Brook Hill Drive, West Nyack, New York 10994-2133. EU subscribers (outside the UK) who are not registered for VAT should add VAT at their country rate. VAT registered subscribers should provide their VAT registration number. Japanese prices for institutions are available from: Kinokuniya Company Ltd, PO Box 55, Chitose, Tokyo 156, Japan. Periodicals postage pending at New York, NY, and at additional mailing offices. Postmaster: send address changes in USA, Canada and Mexico to: World's Poultry Science Journal, Cambridge University Press, 100 Brook Hill Drive, West Nyack, New York 10994-2133. Claims for missing issues should be made immediately on receipt of the subsequent issue.

Back issues: Dr Roel Mulder, PO Box 31, 7360 AA Beekbergen, The Netherlands.

Advertising enquiries: Dr Roel Mulder, PO Box 31, 7360 AA Beekbergen, The Netherlands (phone: +31 6 51519584, fax: +31 55 506 4858, e-mail: roel.mulder@wpsa.com) or Dr Piet Simons (piet.simons@wur.nl).

Copyright: All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, optical, mechanical, photocopying, recording or otherwise without the written permission of the copyright holder. © World's Poultry Science Association.

Reprints and Photocopying: Readers who require multiple copies of papers published in this journal may either purchase reprints (minimum order 100) or obtain permission to copy from the Editor. However, permission is granted for the making of single copies of articles for internal or personal use. In North America, this permission is granted by the copyright owner for libraries and others registered with the Copyright Clearance Center Inc. (CCC) to make single copies of any article herein for the flat fee of \$3 per article. Payment should be sent directly to CCC, 2 Congress Street, Salem, MA 01970, USA. The item-free Code for this publication indicates that authorization is to make single copies only for internal or personal use. Serial-free Code: ISSN 0043-9449, \$3. In the UK, the Copyright Licensing Agency (CLA), 90 Tottenham Court Road, London W1P 9HE is mandated to grant permission to make single copies.