

**Pesticide Dose: Effects on the
Environment and Target and
Non-Target Organisms**



Library of Congress Cataloging-in-Publication Data

Names: Duke, Stephen O., 1944- editor. | Kudsk, Per, editor. | Solomon, Keith R., editor. | American Chemical Society. Division of Agrochemicals.

Title: Pesticide dose : effects on the environment and target and non-target organisms / Stephen O. Duke, editor, Agricultural Research Service, U.S. Department of Agriculture, Oxford, Mississippi, United States, Per Kudsk, editor, Aarhus University, Slagelse, Denmark, Keith Solomon, editor, University of Guelph, Ontario, Canada ; sponsored by the ACS Division of Agrochemicals.

Description: Washington, DC : American Chemical Society, [2017] | Series: ACS symposium series ; 1249 | Includes bibliographical references and index.

Identifiers: LCCN 2017028809 (print) | LCCN 2017029478 (ebook) | ISBN 9780841232099 (ebook) | ISBN 9780841232112 (hardcover OP) | ISBN 9781713889243 (pod)

Subjects: LCSH: Pesticides--Environmental aspects. | Pesticides and wildlife.

Classification: LCC QH545.P4 (ebook) | LCC QH545.P4 P47835 2017 (print) | DDC 363.738/498--dc23

LC record available at <https://lcn.loc.gov/2017028809>

The paper used in this publication meets the minimum requirements of American National Standard for Information Sciences—Permanence of Paper for Printed Library Materials, ANSI Z39.48-1984.

Copyright © 2017 American Chemical Society

Distributed in print by Oxford University Press

All Rights Reserved. Reprographic copying beyond that permitted by Sections 107 or 108 of the U.S. Copyright Act is allowed for internal use only, provided that a per-chapter fee of \$40.25 plus \$0.75 per page is paid to the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, USA. Republication or reproduction for sale of pages in this book is permitted only under license from ACS. Direct these and other permission requests to ACS Copyright Office, Publications Division, 1155 16th Street, N.W., Washington, DC 20036.

The citation of trade names and/or names of manufacturers in this publication is not to be construed as an endorsement or as approval by ACS of the commercial products or services referenced herein; nor should the mere reference herein to any drawing, specification, chemical process, or other data be regarded as a license or as a conveyance of any right or permission to the holder, reader, or any other person or corporation, to manufacture, reproduce, use, or sell any patented invention or copyrighted work that may in any way be related thereto. Registered names, trademarks, etc., used in this publication, even without specific indication thereof, are not to be considered unprotected by law.

PRINTED IN THE UNITED STATES OF AMERICA

Contents

| | |
|--|------------|
| Preface | ix |
| 1. Pesticide Dose – A Parameter with Many Implications | 1 |
| Stephen O. Duke | |
| 2. Herbicide Dose: What Is a Low Dose? | 15 |
| Per Kudsk and Stephen Moss | |
| 3. Dose, Drift, and Non-Target Organisms | 25 |
| Jens C. Streibig and Jerry M. Green | |
| 4. Variations in Pesticide Doses under Field Conditions | 47 |
| E. D. Velini, C. A. Carbonari, M. L. B. Trindade, G. L. G. C. Gomes, and U. R. Antuniassi | |
| 5. Catch 22: All Doses Select for Resistance. When Will This Happen and How To Slow Evolution? | 61 |
| Jonathan Gressel | |
| 6. Reduced Fungicide Dose in Cereals: Which Parameters To Consider? | 73 |
| Lise Nistrup Jørgensen and Jens Erik Ørum | |
| 7. Perspectives on Hormesis and Implications for Pesticides | 83 |
| Edward J. Calabrese | |
| 8. Occurrence and Significance of Insecticide-Induced Hormesis in Insects | 101 |
| G. Christopher Cutler and Raul N. C. Guedes | |
| 9. Chemical Hormesis on Plant Pathogenic Fungi and Oomycetes | 121 |
| Sumit Pradhan, Francisco J. Flores, Hassan Melouk, Nathan R. Walker, Julio E. Molineros, and Carla D. Garzon | |
| 10. Herbicide-Mediated Hormesis | 135 |
| Regina G. Belz and Stephen O. Duke | |
| 11. Effects of Herbicides on Non-Target Terrestrial Plants | 149 |
| Beate Strandberg, Céline Boutin, Solvejg K. Mathiassen, Christian Damgaard, Yoko L. Dupont, David J. Carpenter, and Per Kudsk | |
| 12. Low Dose Effects of Pesticides in the Aquatic Environment | 167 |
| Nina Cedergreen and Jes J. Rasmussen | |

Editors' Biographies 189

Indexes

Author Index 193

Subject Index 195