Pesticide Formulations and Application Systems:
A New Century for Agricultural Formulations

TWENTY FIRST VOLUME

Jane C. Mueninghoff, Alan K. Viets, Roger A. Downer, editors

ASTM INTERNATIONAL

STP 1414
Pesticide Formulations and Application Systems: A New Century for Agricultural Formulations, Twenty First Volume

Jane C. Mueninghoff, Alan K. Viets, and Roger A. Downer, editors

ASTM Stock Number: STP1414

ASTM
100 Barr Harbor Drive
PO Box C700
West Conshohocken, PA, 19428-2959

Printed in the U. S. A.
Copyright © 2001 AMERICAN SOCIETY FOR TESTING AND MATERIALS, West Conshohocken, PA. All rights reserved. This material may not be reproduced or copied, in whole or in part, in any printed, mechanical, electronic, film, or other distribution and storage media, without the written consent of the publisher.

Photocopy Rights

Authorization to photocopy items for internal, personal, or educational classroom use, or the internal, personal, or educational classroom use of specific clients, is granted by the American Society for Testing and Materials (ASTM) provided that the appropriate fee is paid to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923; Tel: 978-750-8400; online: http://www.copyright.com/.

Peer Review Policy

Each paper published in this volume was evaluated by two peer reviewers and at least one editor. The authors addressed all of the reviewers' comments to the satisfaction of both the technical editor(s) and the ASTM Committee on Publications.

To make technical information available as quickly as possible, the peer-reviewed papers in this publication were prepared "camera-ready" as submitted by the authors.

The quality of the papers in this publication reflects not only the obvious efforts of the authors and the technical editor(s), but also the work of the peer reviewers. In keeping with longstanding publication practices, ASTM maintains the anonymity of the peer reviewers. The ASTM Committee on Publications acknowledges with appreciation their dedication and contribution of time and effort on behalf of ASTM.

Printed in Bridgeport, NJ
November 2001
Foreword

This publication, Pesticide Formulations and Application Systems: A New Century for Agricultural Formulations, Twenty First Volume, contains selected papers presented at the symposium of the same name held in Orlando, Florida, on 24–26 October 2000. The symposium was sponsored by Committees E-35 and E-35.22 on Pesticide Formulations and Application Systems. The symposium chair was Jane C. Mueninghoff, Huntsman Corporation. The symposium co-chairs were Alan K. Viets, Bayer Corporaton and Roger A. Downer, Ohio State University.
Contents

Overview vii

SESSION I: EFFICACY


Sulfosulfuron Efficacy is Affected by Surfactants, pH of Spray Mixture and Salts—Z. WOZNICA, J. D. NALEWAJA, AND C. G. MESSERSMITH 11


SESSION II: METHODS

Pesticide Solubility and Other Tools to Use to Optimize an Emulsifiable Concentrate Formulation—R. S. TANN, P. D. FRISCH, AND K. P. KUO 39

Dynamic Surface Tension of Selected Nonionic Agricultural Surfactants at Surface Ages Relevant to Component Processes in Spray Application—J. A. COOPER, R. D. FOX, R. D. DEXTER, AND M. J. BUKOVAC 50

SESSION III: FORMULATION STRATEGY

Recent Trends in Pesticide Formulation in Japan—K. TSUJI 63


Formulating Options for Aerosol Insecticides—L. STOCKY, D. CANTALUPI, J. LUCAS, AND R. KOWALIK 90

The Physical Chemistry of Water Dispersible Granules, Part II: The Influence of Dispersant Molecular Weight and Paste Rheology on the Physical Properties of Extruded WDGs—I. W. DOERING AND H. T. DELLI COLLI 99
Design and Performance of Crop Oil Concentrate Emulsifiers—A. J. STERN AND J. L. HAZEN

SESSION IV: FORMULATION INGREDIENTS I

Novel Polymeric Dispersants for Water Dispersible Granules—R. HERBERT

Alkoxylated Glyceride Emulsifiers in Agricultural Applications—T. H. ANDERSON AND H.-G. MAINX

SESSION V: REGULATORY ISSUES

Environmental Management Strategies for Biodegradable Nonylphenol Ethoxylates in Agricultural Products—E. M. MIHAICH, C. G. NAYLOR, AND C. A. STAPLES

SESSION VI: APPLICATION AND SPRAY DRIFT

Pesticide Spray Droplet Adhesion Modeling—W. A. FORSTER, M. O. KIMBERLEY, AND J. A. ZABKIEWICZ


Spray Deposition Effect on Abscission Efficacy of CMN-Pyrazole in Harvesting Oranges—M. SALYANI, E. BensaLEM, AND J. D. WHITNEY


SESSION VII: FORMULATION INGREDIENTS II

Monobranched Alcohol Alkoxylates: A New Generation of Surfactants for Use in Crop Protection—J. C. G. ROMMENS AND S. J. DAVIES

Foam Control Strategies for Formulating with Alkypolyglycoside Surfactants—F. J. LACHUT

Low Dose Urea-Surfactant Adjuvant for Sulfonyleurea Herbicides—F. D. J. HARTMANN AND J. M. GREEN

Overview

The Twenty First Symposium on Pesticide Formulations and Applications Systems was held October 24 and 25, 2001 in Orlando, Florida. Not only was this event the twenty first symposium sponsored by the ASTM E35.22 subcommittee, it was the first symposium of the new century. Hence, the theme was chosen was "A New Century for Agricultural Formulations." The symposium program emphasized the external factors affecting the global growth of the agricultural industry as well as new options available for formulating and delivering agricultural products to meet this global growth. The twenty first symposium was a valuable forum for formulators, researchers, applicators, and marketers to share ideas, opinions, and knowledge on a variety of important topics.

Invited speakers tackled the complicated subjects of 1) the effect of biotechnology on the food industry and consumer and government response to changes in how our food supply is generated; 2) recent trends in pesticide formulations in Japan and the Asia-Pacific region; and 3) recent regulatory-actions of the United States Environmental Protection Agency. While these papers are not included in this book, extensive interest and discussion was generated by these presentations.

Papers from the technical sessions covering efficacy, methodology, formulation strategy, formulation ingredients, regulatory issues and application, and spray drift can be found in this publication.

Efficacy

This session was intended to present studies relating to efficacy enhancement of pesticide products. The presentations and papers found in this book cover the effects of adjuvants, surfactants, and inorganic cations on pesticide activity.

Methods

Techniques and methodology for determining the stability and efficacy of pesticide formulations are important tools not to be overlooked by the developer of agricultural products. This session addressed various issues of methodology, including new techniques under consideration in Europe.

Formulation Strategy

Procedures used by formulators to develop pesticide and adjuvant products are ever changing and progressing in order to decrease development time and improve optimization steps. Four papers from this session are in this STP, covering various statistical design techniques and other formulating options.

Formulation Ingredients

The development and application of inert ingredients for agricultural formulations are areas of high interest to symposium attendees. Inert ingredients can improve formulation stability, efficacy, and
OVERVIEW

Handling. These effects are discussed in six papers from the two sessions on formulation ingredients. Some of the inerts discussed are new to agricultural use, while others are completely new chemistry or new applications for known chemistry.

Regulatory Issues

Actions taken by governmental authorities can have broad impact not just on pesticide active ingredients, but on inert ingredients and formulation additives as well. While only one of the papers from this session is included in this book, the topic of environmental strategies for nonylphenol ethoxylates is certainly of great interest to formulators around the world.

Application and Spray Drift

Another key component of a successful agricultural product is its application in the field. This session concentrated on spray drift characteristics, testing, measurement, and distribution. Each paper in this area discusses useful measurement techniques and effects on pesticide efficacy.

Jane C. Mueninghoff
Symposium Chair
Huntsman Corporation
Houston, Texas