



STP 1470

PESTICIDE FORMULATIONS AND DELIVERY SYSTEMS, 25TH VOLUME

Advances in Crop Protection Technologies

Masoud Salyani
Gregory Lindner
Editors



STP 1470

Pesticide Formulations and Delivery Systems, 25th Volume: Advances in Crop Protection Technologies

Masoud Salyani and Gregory Lindner, editors

ASTM Stock Number: STP1470



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

Printed in the U.S.A.

ISBN: 0-8031-3496-7
ISSN: 1040-1695

Copyright © 2006 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) INTERNATIONAL, 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) International 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 International Committee on Publications.

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 long-standing publication practices, ASTM International maintains the anonymity of the peer reviewers. The ASTM International Committee on Publications acknowledges with appreciation their dedication and contribution of time and effort on behalf of ASTM International.

Foreword

This publication, *Pesticide Formulations and Delivery Systems, 25th Volume: Advances in Crop Protection Technologies*, contains papers presented at the symposium with the same name held in Washington, DC, October 5–7, 2004. The sponsor of the symposium was ASTM International Committee E35 on Pesticides and Alternative Control Agents.

The symposium chairman was Masoud Salyani, University of Florida, and the symposium co-chairman was Gregory Lindner, Uniqema.

Contents

Overview	vii
25 TH ANNIVERSARY INVITED PAPER	
The E35.22 Symposium at 25 Years, Still Growing?—A. D. LINDSAY	3
TECHNICAL PAPERS	
DEVELOPMENTS IN PESTICIDE FORMULATIONS	
Development of a Dry Applied Dispersible Granular Pesticide Carrier— C. W. ANDERSON, T. D. BIRTHISEL, and J. R. LYNCH	21
Surfactant-Enhanced Release of Permethrin from a Cellulosic Granular Carrier—A. J. STERN	26
Use of Carbodiimides as Stabilizing Agents to Deliver Water – Labile Active Ingredients in Liquid Systems Including Aqueous Medium – Amitraz as a Case Study—K. S. NARAYANAN, D. I. JON, and G. BEESTMAN	32
Dearomatized Fluids Used in Phenoxy Herbicides for Right-of-Way Sprays— M. A. KREVALIS	39
Investigation into the Use of Hydroxy-Containing Amides for Oil Flowable Formulations—M. A. KREVALIS, R. M. KOWALIK, K. K. KUO, and K. K. CHOKSHI	51
Increasing the Biological Activity of Weak Acid Herbicides by Increasing and Decreasing the pH of the Spray Mixture—J. M. GREEN and T. HALE	62
Influence of Clethodim Formulation and Oil Adjuvants on Weed Control and Overcoming Herbicide Antagonism—R. K. ZOLLINGER and K. A. HOWATT	72
Characterization of Sulfonated Lignin Dispersants by Hydrophobic Interactive Chromatography—T. WINOWISKI, S. LEBE, K. GRETLAND, and J. GUSTAFSSON	79

INNOVATIONS IN ADJUVANT CHEMISTRY

Fatty Amine Alkoxyates as Effective Adjuvants for Strobilurin Fungicide Applications on Field and Orchard Crops—J. L. HAZEN	87
Ethylenediamine Alkoxyates and Their Use as Adjuvants in Glyphosate Formulations—C. M. ELSIK and H. M. STRIDDE	94
Suitable Adjuvant to Maximize Trifloxysulfuron Efficacy and Early Assessment of Herbicide Efficacy Using Chlorophyll Fluorescence—S. SINGH and M. SINGH	103
Influence of Adjuvants on Weed Control from Tribenuron—R. K. ZOLLINGER	115
Improving the Infiltration of Water through Repellent Soils Using Synergistic Surfactant Blends Based on Alkyl Glucosides and Ethylene Oxide-Propylene Oxide Block Copolymers—P. T. BIALLY, S. J. KOSTKA, and R. C. BUCKMAN	122

ADVANCES IN APPLICATION TECHNOLOGY RESEARCH

Factors Influencing the Performance of Spray Delivery Systems: A Review of Recent Developments—P. C. H. MILLER and C. R. TUCK	133
Nozzle Formulation Interactions: Consequences for Spray Droplet Adhesion to Plant Surfaces—R. A. DOWNER, J. K. HACKER, and R. S. EBERT	146
Field-Collected and AGDISP-Predicted Spray Flux from an Aerial Application—W. C. HOFFMANN	156
Flight Line Variability in Rotary Atomizer Drop Size Distribution—M. E. TESKE, H. W. THISTLE, R. C. REARDON, D. C. DAVIES, G. CORMIER, R. S. CAMERON, M. Y. LECLERC, and A. KARIPOT	168
Comparisons of Drift Reducing/Deposition Aid Tank Mixes for Fixed Wing Aerial Applications—R. E. WOLF, D. R. GARDISSER, and T. M. LOUGHIN	177
Fluorescent Intensity of Dye Solutions under Different pH Conditions—H. ZHU, R. C. DERKSEN, C. R. KRAUSE, R. D. FOX, R. D. BRAZEE, and H. E. OZKAN	191
Development and Testing of a Recommendation System to Schedule Copper Sprays for Citrus Disease Control—L. G. ALBRIGO, H. W. BECK, L. W. TIMMER, and E. STOVER	198
Indexes	211

Overview

The 25th Symposium on Pesticide Formulations and Delivery Systems was held in Washington, D.C., on October 5–7, 2004. It was sponsored by ASTM Committee E35 on Pesticides and Alternative Control Agents and organized by Subcommittee E35.22 on Pesticide Formulations and Delivery Systems. The purpose of this symposium was to provide a forum for presenting the latest advances in crop protection technologies and to disseminate updates on regulatory issues related to the use of pesticides. The symposium consisted of five invited presentations and twenty contributed papers from national and international speakers representing academia, agrochemical industry, and government agencies.

The program started with the invited presentation of David Lindsay (Formulation Scientist, Degussa), chairman of the first E35.22 symposium on pesticide formulations and application systems. He reviewed the themes and scopes of the previous symposia and identified the changing trends in formulation and application research, development, and regulations, during the past 25 years. Don Erbach, Lois Rossi, Paul Miller, and Barbara Losey gave four more invited presentations before the morning and afternoon technical sessions. Erbach (National Program Leader in Engineering and Energy, USDA) outlined the Agricultural Research Service perspective on pesticide application technology. He emphasized the ARS priorities on increasing productivity, protecting the environment, and improving the safety and health of agricultural workers. Rossi (Director of Registration Division, Office of Pesticide Programs, U.S. EPA) talked about the EPA's pesticide registration process. She explained the statutes that provide shape and direction to the Agency's pesticide program. Miller (Research Leader, Chemical Application Technologies, Silsoe Research Institute, UK) gave an overview of factors influencing the performance of spray delivery systems. He emphasized the effect of spray liquid properties on nozzle performance. Losey (Executive Consultant, RegNet Environmental Services) gave an update on North American regulatory issues on NPEs. She spoke about risk assessment activities being used by the U.S. EPA, European Union, and Canadian PMRA.

Technical papers of the symposium covered a wide range of the topics. In this publication, they are divided into three groups: 1) Developments in pesticide formulations, 2) Innovations in adjuvant chemistry, and 3) Advances in application technology research.

1- Developments in pesticide formulations:

Anderson et al. report on the development of a granular pesticide carrier. Stern discusses the release rate of the carriers. Narayanan et al. address difficulties encountered in formulating unstable active ingredients in liquid delivery systems. Krevalis reports on the use of de-aromatized fluids in phenoxy herbicides for railroad applications. Krevalis et al. discuss the use of hydroxy-containing amides in oil-flowable pesticide formulations. Green and Hale discuss the effect of spray mixture pH on biological efficacy of weak acid herbicides. Zollinger and Howatt present the techniques for overcoming herbicide antagonism. Winowski et al. describe a technique for evaluating compatibility of pesticides and fertilizers in spray tank mixes.

2- Innovations in adjuvant chemistry:

Jim Hazen introduces a new application for fatty amine alkoxyates as efficacy enhancers for strobilurin fungicides. He presents the results of the applications in several field crops. Elisk and Stridde

discuss the use of ethylenediamine alkoxyates as a new class of surfactants in glyphosate formulations. Singh and Singh present data on the use of trifloxysulfuran with several adjuvants for early detection of herbicide efficacy by visual mortality and chlorophyll fluorescence. Richard Zollinger evaluates several adjuvants in efficacy enhancement of tribenuron herbicide. Bially et al. demonstrate the promising effects of formulations containing alkyl glucosides and ethylene oxide-propylene oxide block copolymers on improving the infiltration of water in repellent soils.

3- Advances in application technology research:

The paper of Miller and Tuck discusses the interactions of spray liquid properties (formulation and adjuvant), air temperature, and nozzle performance. Downer et al. discuss nozzle/formulation interactions in terms of rebound characteristics of spray droplets. Clint Hoffmann compares the field-collected data and the AGDISP model predictions of spray flux in aerial applications to soybeans and cotton. Teske et al. explain the variation of droplet size distribution along the flight line of rotary atomizers. Wolf et al. compare several deposition-aid/drift-reducing additives in aerial applications. Zhu et al. discuss the effect of pH on emission intensity of fluorescent tracers used in assessment of spray deposition. Albrigo et al. describe an expert system for efficient scheduling of copper sprays in citrus applications.

This publication is a collection of the symposium's peer-reviewed papers. It does not include the presentations of Erbach, Rossi, and Losey. The technical papers of this collection will also be published electronically in the Journal of ASTM International.

Masoud Salyani

University of Florida

Lake Alfred, Florida

Symposium Chairman and editor

Gregory Lindner

Uniqema Crop Protection Additives

New Castle, DE

Symposium Co-chairman and
editor



www.astm.org

ISBN: 0-8031-3496-7

Stock #: STP1470