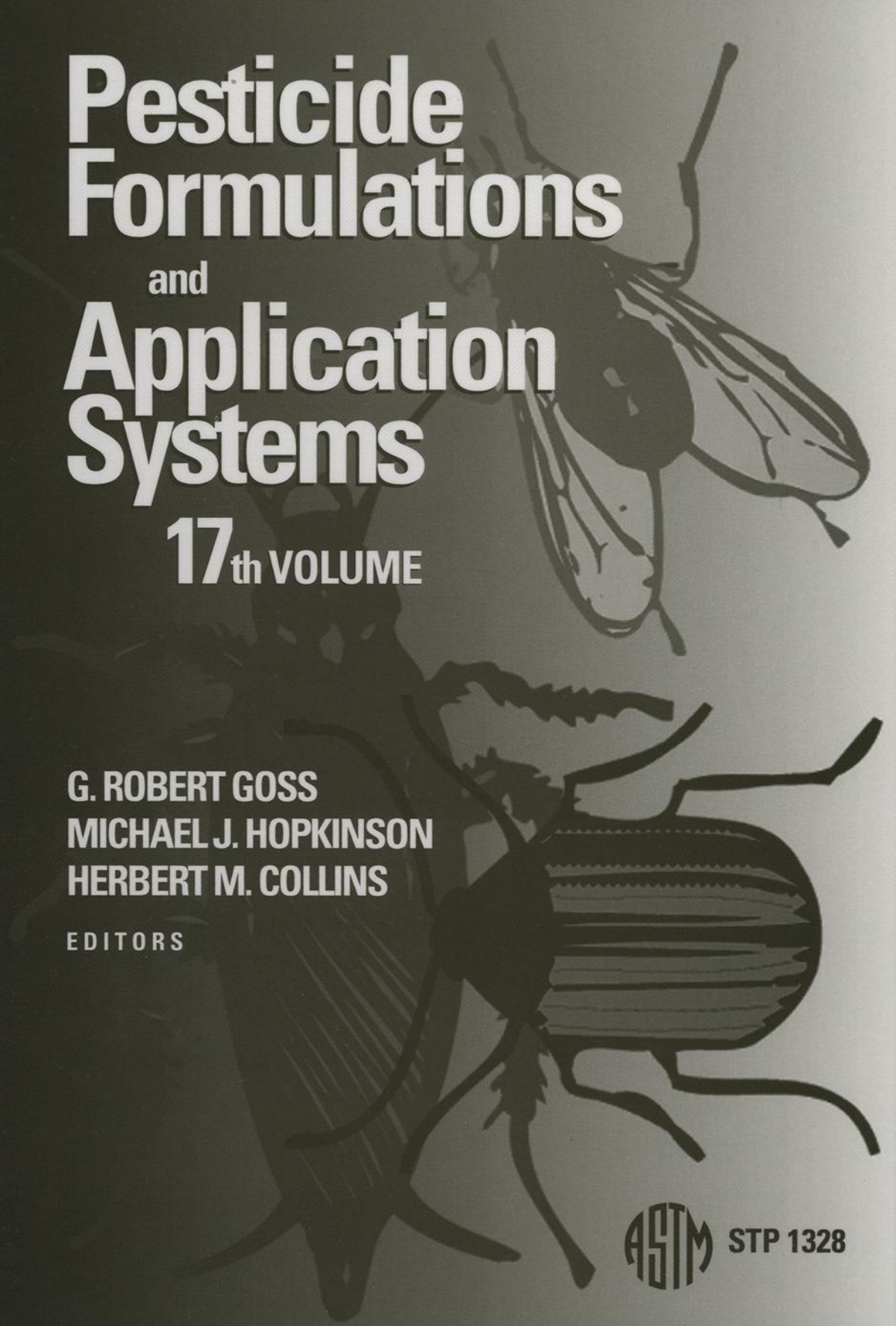


Pesticide Formulations



and

Application Systems

17th VOLUME

G. ROBERT GOSS
MICHAEL J. HOPKINSON
HERBERT M. COLLINS

EDITORS



STP 1328

STP 1328

***Pesticide Formulations and
Application Systems:
17th Volume***

*G. Robert Goss, Michael J. Hopkinson,
and Herbert M. Collins, Editors*

ASTM Publication Code Number (PCN):
04-013280-48



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

Printed in the U.S.A.

ISBN: 0-8031-2469-4
ISSN: 1040-1695
PCN: 04-013280-48

Copyright © 1997 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: 508-750-8400; online: <http://www.copyright.com/>.

Peer Review Policy

Each paper published in this volume was evaluated by two peer reviewers and at least one of the editors. 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 printed "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 these peer reviewers. The ASTM Committee on Publications acknowledges with appreciation their dedication and contribution of time and effort on behalf of ASTM.

Foreword

This publication, *Pesticide Formulations and Application Systems: 17th Volume*, contains papers presented at the symposium on Pesticide Formulations and Application Systems: The Changing Face of Agricultural Delivery Systems, held on 29–30 October 1996 in New Orleans, Louisiana. The symposium was sponsored by ASTM Committee E-35 on Pesticides. G. Robert Goss of Oil-Dri Corporation in Vernon Hills, Illinois; Michael J. Hopkinson of Ciba-Geigy Corporation in Greensboro, North Carolina; and John D. Nalewaja of North Dakota State University in Fargo, North Dakota presided as symposium co-chairmen. G. Robert Goss, Michael J. Hopkinson, and Herbert M. Collins of Stepan Company in Winder, Georgia are editors of the resulting publication.

Contents

Overview—G. R. GOSS, M. J. HOPKINSON, AND H. M. COLLINS ix

FORMULATION TECHNOLOGY

FORMULATION PREPARATION

New Developments in the Regulation of Pesticide Inert Ingredients in the United States—K. B. LEIFER 5

Development of Emulsifiable Concentrate Formulations Using Experimental Design Software—B. J. BUTLER 11

Oxo-Alcohol Acetates: A New Family of Inerts for Agricultural Chemical Use—P. D. FRISCH 23

CHEMICAL FORMULATIONS

Water in Oil Microemulsion Aerosol Systems for Insecticidal Compositions—K. S. NARAYANAN, M. KAMINSKY, D. JON, AND R. M. IANNIELLO 39

Trifluralin 10% Granular Formulation Prepared on Biodac® and Clay for the Control of Annual Ryegrass, Giant Foxtail and Carpet Weed—H. ROSS, B. OMILINSKY, A. D. LINDSAY, D. CREECH, J. GLATZHOFFER, AND B. TICKES 49

Stable Formulation of Easy Hydrolyzing Actives Based on Specialty Silicas Shown on Malathion as a Modelling Substance—R. OELMÜLLER AND A. MÜLLER 53

BIOLOGICAL FORMULATIONS

Targeted Delivery of Pesticides from Matricap™ Compositions—R. LEVY, M. A. NICHOLS, AND W. R. OPP 63

Liquid Formulations of Non-Spore Forming Microorganisms—T. J. WACEK 94

New Paradigms in Formulating Mycoinsecticides—S. T. JARONSKI 99

APPLICATION TECHNOLOGY

- Comparison of Droplet Spectra of Fluorescent Tracers Commonly Used to Measure Pesticide Deposition and Drift**—R. A. DOWNER, L. M. KIRCHNER, F. R. HALL, AND B. L. BISHOP 115
- Effect of Shielding Spray Boom on Spray Deposition**—H. E. OZKAN, A. MIRALLES, C. SINFORT, H. ZHU, D. L. REICHARD, AND R. D. FOX 129
- Effect of Surface Charge/Particle Size of a Latex Particle on Transport Through Soil**—F. N. KEENEY, K. P. STEELE, AND G. A. VON WALD 143

REVIEWS

- A Review of the Measurement of Wettability for Agricultural Applications**—N. R. PALLAS 165
- A Review of Surfactants Used in Novel Agricultural Applications**—R. S. TANN 187

SURFACE ACTIVE AGENTS/ADJUVANTS

BASIC CHEMISTRY

- Hydrolytic Stability of Phosphate Ester Surfactants**—D. G. ANDERSON, W. J. EBERLE, AND D. R. STUBBS 201
- Foam Control in Trisiloxane Alkoxylate Systems**—G. A. POLICELLO AND K. KOCZO 217
- Why Organosilicone Adjuvants Spread**—R. M. HILL AND R. F. BUROW 226

EFFICACY

- Solid Adjuvant Systems—Formulations, Stability and Efficacy**—K. S. NARAYANAN AND M. TALLON 241
- Dry Concentrate (DC) Spray Adjuvants**—J. R. ROBERTS, A. K. UNDERWOOD, A. CLARK, R. E. MACK, J. M. THOMAS, AND G. C. VOLGAS 257
- Lipophilic Chemistry Affects Surfactant Phytotoxicity and Enhancement of Herbicide Efficacy**—F. A. MANTHEY, E. F. SZELEZNIAK, AND J. D. NALEWAJA 267
- Linear Alcohol Ethoxylates Affect Glyphosate and Fluazifop-P Deposits**—J. D. NALEWAJA AND R. MATYSIAK 277
- MON-37532 Phytotoxicity is Affected by Surfactant and Ammonium Nitrate**—Z. WOZNICA, J. D. NALEWAJA, AND E. SZELEZNIAK 287

Measuring Proton Extrusion from Cell Membranes of Barley Calli to Evaluate Surfactant Phytotoxicity—F. A. MANTHEY, L. S. DAHLEEN, J. D. NALEWAJA, AND J. D. DAVIDSON	298
Triton X-45: A Unique Effect on Growth Regulator Sorption by and Penetration of Isolated Plant Cuticles—R. G. FADER AND M. J. BUKOVAC	310
Author Index	327
Subject Index	329

Overview

This book is the seventeenth in a continuing forum on one aspect of pesticide science. Specifically, this forum addresses pesticide formulations and application systems. Formulation and application of active ingredients is closely intertwined.

In this area of pesticide science, active ingredients are already of proven efficacy. The formulator is concerned about preparing the active ingredient for application. The applicator is concerned about how to deliver a formulated product to the target. Often, between formulation and application, other ingredients are added to aid efficacy. These are loosely called adjuvants. Pesticide regulations, of course, play an integral part in all these areas.

This book addresses nearly all the areas of pesticide formulations and applications. The first chapter, titled Formulation Technology gives examples of state-of-the-art development in preparing actual formulations. There are sub-sections for formulation preparation, chemical formulations, and biological formulations.

The Formulation Preparation section contains papers on the regulation of inert ingredients (Leifer), experimental design of formulation experiments (Butler), and the use of certain inert ingredients (Frisch).

Actual formulations can come in many forms. The Chemical Formulations section addresses several. There are papers on granules (Ross et al.), solid powders (Oelmüller and Müller), and even aerosols (Narayanan et al.).

While today, chemicals are the primary weapons against pests, biological agents are being increasingly used. The last section in this first chapter is on biological formulations. Levy et al. discusses the controlled release of biologically derived agents (*Bacillus* spp). Both Wacek and Jaronski describe the delivery of live organisms to the target.

Application Technology is the second chapter. Two papers (Downer et al. and Ozkan et al.) address spray deposition from hydraulic nozzles. While not exactly application technology, the paper by Keeney et al. describes the movement of particles through soil once applied.

One of the functions of this forum is education. Formulations and applications scientists come from across the United States, and to some extent the world, to share this knowledge. The third chapter is a review section. Papers review aspects of surface active agents, both their use (Tann) and property measurement (Pallas).

Finally, the last chapter, Surface Active Agents/Adjuvants describes surfactant basic properties and their effects on active ingredient efficacy. Hydrolytic stability (Anderson et al.), foam control (Policello and Koczko), and the mechanism of efficient organosilicane spreading (Hill and Burow) is discussed in the first section.

As described in the second paragraph of this forward, adjuvants can play an important role in the efficacy of a formulation. These are usually added as tank mixes immediately prior to application.

Recent advances in the use of solid adjuvant formulations are introduced by Roberts et al. and Narayanan and Tallon.

The balance of the papers introduce a wealth of factual information about adjuvant effects on several basic chemicals by several different methods. Three papers by Manthey et al. ("Lipophilic. . ."), Nalewaja and Matysiak, and Nalewaja et al. deal with herbicide efficacy. Contained are some of the first scanning electron micrographs of the effects of surfactants on droplet deposition. The paper by Mathey et al. ("Measuring. . .") gives a novel laboratory

method for predicting adjuvant efficacy. Fader and Bukovac confirm that even small differences in surfactant chemistry can alter formulation properties.

This volume advances our knowledge of many facets of pesticide formulation and application science. It is only one of several and hopefully one of more to come. As long as we live, chemistry will affect our lives. This forum, in its own small way, helps provide a safer environment for humanity, by delivering pesticides in a more efficient and safe manner.

G. Robert Goss

Symposium Co-Chairman.

Michael J. Hopkinson

Symposium Co-Chairman.

Herbert M. Collins

Symposium Co-Chairman.

ISBN 0-8031-2469-4