

PICOGRAM

And Abstracts

AMERICAN CHEMICAL SOCIETY

Division of Agrochemicals

228th ACS National Meeting

August 22 – 26, 2004, Philadelphia, PA

Fall 2004



Issue No. 67

www.agrochemical.org

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Programming

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HOSPITALITY COMMITTEE REPORT

One-thousand six hundred fifty dollars were donated by eight companies in support of the coffee lounge in Anaheim. The sponsors, named below and on the poster we displayed at the AGRO desk area, are to be thanked again for their generosity.

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On Tuesday evening we once again joined the Ag & Food Division for an exquisite joint Gala, this time at the Disneyland Hotel. All members, speakers, spouses and assorted guests enjoyed exotic food, fun, drinks and door prizes. Revelers were reported sighted in the falls pools and Hook's Nook long after the formal benediction of the Social Hour was past. Thanks for your continued support and participation -- we can't have fun without you.

SOCIAL CO-CHAIRS - Al Barefoot & Jeff Jenkins
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Welcome to the City of Brotherly Love – Philadelphia!!

As we gather this Fall in the city where our Founding Fathers laid the framework for what was to become these United States of America, let us REFLECT on the dedication and self-sacrifice that so many of our predecessors have given for our ability to meet for this the 228th National Meeting of the American Chemical Society. Dedicated peoples throughout the world have and continue to give of themselves not for glory or gold, but for the betterment of mankind. Let us hope and pledge that we shall follow in their footsteps to improve the lives of all people through the advancement of our sciences.

The Agrochemical Division continues to feel the effects of its Maturity as many consolidations continue in the industrial sector. As we mature, we are finding New Growth and Opportunities with affiliated disciplines, which are eager and enthusiastic in pursuing alliances with our division. One of our main goals is to act as a catalyst for discussion and dissemination of research and ideas in the agrochemical arena. This reach must serve the needs of our members and the scientific community. The Agrochemical Division also has the responsibility to inform and educate our communities.

Over the past year, we have extended our efforts toward support and participation in Regional Meetings and in Local Sections throughout the USA. We have strengthened our support and cooperation with Affiliated Groups here in the USA and Globally. Our hope is that we can continue these efforts and act as a resource to them.

Just as we thought our programming might decline, Allan Felsot and his wonderfully talented Symposium Chairs have managed to create a diverse program consisting of 160 papers and posters. The program includes symposia on many current issues including: Innovative Products and Technologies and their Impact on Nutrient Use; Pesticidal Activity from Lab to Greenhouse to Field; Agrochemical Residues and Metabolism, Agrochemicals in Watershed-Scale Water Quality Assessment; Perchlorate Contamination and Remediation; Metals Contamination in Agricultural Products and Soils.

(Continued Next Page)



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One symposium asked the question: Is Organic Food Healthier Than Conventional Food? Another symposium takes a look at the “other side” of scientific understanding: Synthesis: Good Ideas That Never Made It To Products. We are again delighted to have excellent participation in the Agrochemical Education Awards Program for Graduate Student Travel. This continues to be a great opportunity to support our future agrochemical scientists, and we sincerely appreciate the participation of each of the graduate students. Also, we continue our special programming with a Workshop of Trace Metal Analysis in Fertilizer.

The Agrochemical Division’s most prestigious award, The International Award For Research In Agrochemicals, will be presented to Dr. John M. Clark on Monday morning. The symposium in honor of Dr. Clark is most appropriately titled: The Yin and Yang of Pesticide Toxicology. The symposium will take a look at the many challenges and advances in the field of pesticide toxicology as well as prospects for the future. The Sterling B. Hendricks Memorial Lectureship Award will again be sponsored by the US Department of Agriculture – Agricultural Research Service. The award and lectures are being presented as a part of the Agricultural and Food Division programming this year. Please check your program for the date and time and plan to attend.

Everyone is WELCOME to come to the Agrochemical Division Annual Combined Governance Meeting which will be held on Sunday evening starting at 5 PM. Also, everyone is invited to the Agrochemical Social which will be held on Tuesday evening starting at 6 PM. Check the program or at our Hospitality Table for the location of these events.

Lastly, “A Heartfelt Thank You” to all of the Officers, the Executive Committee and the Committee Chairs for all of your efforts on behalf of the Agrochemical Division. I would be remiss in not noting some special efforts this past year. A Gold Star to Drs. Willa Garner and Nancy Ragsdale for their EXTRA efforts in getting the Agrochemical Division Procedures Manual completed! Also, a special Thank You Gold Star to our PICOGRAM Editor, Dr. Laura McConnell for putting out an excellent Newsletter and WEB site (often in spite of the last minute receipt of many of our news articles). This past year as Chair has been a special privilege and pleasure for me. I thank each and every member for this opportunity!

The Agrochemical Division with its diverse membership can continue to “RING TRUE” as a resource to the scientific community and to the general public. Each member can make a positive difference in his or her local community, as well as on a regional or even the national level. If you are not already involved in the AGRO Division consider this “your opportunity”. We can use your expertise! Again Thank You, and Now let us “Go Forth” and continue these efforts!

Sincerely, Rodney M Bennett, AGRO Chair 2004

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INTERNATIONAL AWARD
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Dr. John Marshall Clark, Ph.D., is a professor of environmental toxicology and chemistry in the Department of Veterinary & Animal Science at the University of Massachusetts in Amherst. He is the director of the Massachusetts Pesticide Analysis Laboratory and an adjunct professor in the Molecular and Cell Biology, Environmental Toxicology & Risk Assessment, and Plant Biology Programs. He has made numerous contributions to the study of agrochemicals and has been an active member of the Agrochemical Division of ACS for 28 years. He also is a member of the Environmental Chemistry and Chemical Toxicology Divisions of ACS. Dr. Clark's research has contributed substantially to the basic understanding of pesticide mode of action, resistance mechanisms and management, and environmental fate and exposure assessment. He has published over 150 research and review articles and edited six symposium books.

John has extensively studied the manner in which neurotoxic pesticides affect both target and non-target organisms, including long term investigations focused on alternative modes of action of the pyrethroid insecticides. This research has established that CS-syndrome pyrethroids, in addition to their action at voltage-sensitive sodium channels, also modify the kinetics of voltage-sensitive calcium channels at presynaptic nerve terminals, evoking neurotransmission. Recent investigations have begun the evaluation of mixtures of pyrethroids in terms of their agonistic and antagonistic effects at these target sites. This unique action of only some pyrethroids will have a substantial impact on their characterization using FQPA criteria.

He has also made many contributions to the elucidation of resistance mechanisms of insects. John is one of the pioneers in the implementation of molecular techniques (e.g., Bi-PASA, minisequencing, SISAR, RT-PCR, etc.) as practical genotyping tools for monitoring resistance in field populations.

Dr. Clark has directed the Massachusetts Pesticide Analysis Laboratory since 1984 and, in addition to FIFRA/FQPA enforcement aspects, has conducted research that addresses critical concerns that occur as urbanization encroaches on agricultural areas. His analytical research group has contributed new methodology for pesticide analysis and identification of active metabolites, means to detect and evaluate chemical trespass following the application of pest control agents, and the critical evaluation of recreational exposures following application of turfgrass chemicals using combined environmental residue, dosimetry and biomonitoring approaches.

John has been active in various other professional societies (SOT, SFN, SETAC), serves on four editorial boards of scientific journals, and has served on many grant review panels (NIH, EPA, NSF, USDA). He is currently a member of the scientific program committee for the 11th IUPAC International Congress of Pesticide Chemistry, Kobe, Japan 2006.



Laboratories

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Worker Exposure
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Confined Crop Rotation
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Sediment Toxicity Studies
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Shellfish Residue Studies
Terrestrial Organisms

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2004



STERLING B. HENDRICKS MEMORIAL LECTURESHIP AWARD



Dr. Robert L. Buchanan's career accomplishments have significantly impacted the chemical science of agriculture through the advancement of food science as well as the protection of public health. He has been a strong manager and leader in his work assignments and scientific field, impacting on the policies of regulatory agencies related to microbial food safety. Dr. Buchanan's primary contributions to food chemistry involve his research on thermal resistance of foodborne pathogens, irradiation of pathogens, and mathematical modeling of pathogen behavior. His work to develop quantitative risk assessment methodology and mathematical means for modeling the behavior of foodborne pathogens has become the guideline of today's Pathogen Modeling Program worldwide. This technology is the basis of practical strategies for controlling foodborne pathogens in agricultural commodities in addition to scientific advice to regulatory agencies and industry on microbiological food safety issues and policies. This technology is becoming the basis for risk assessment policies for regulatory agencies and food industries worldwide.

Following completion of his Ph.D. in Food Science at Rutgers University and post-doctoral training in food science/mycotoxicology at the University of Georgia, Dr. Buchanan became a member of the faculty in the Department of Nutrition and Food Sciences at Drexel University. After leaving Drexel, he took a position as Supervisory Microbiologist with the Agricultural Research Service (ARS)/USDA Eastern Regional Research Center (ERRC). Since holding that position, he has served as Deputy Administrator of the Food Safety Inspection Service/USDA and as a research microbiologist at the ARS/USDA ERRC. Currently Dr. Buchanan is Senior Science Advisor for the Center for Food Safety and Applied Nutrition (CFSAN) of the Food & Drug Administration (FDA) where he also is Director of the CFSAN Office of Science.

Dr. Buchanan's work has resulted in over 150 research publications and over 140 abstracts involving presentations at meetings. In his present role as Lead Scientist for the President's Food Safety Initiative, he has led the development of FDA research programs. The research he has fostered has resulted in understanding the origin and subsequently control of contamination by a number of microorganisms in vegetables, fruits and fruit juices. The FDA issued guidelines based on these efforts for the protection, handling, processing and marketing of these agricultural commodities. States have implemented Good Agricultural Practices and Good Manufacturing Practices related to the research produced under Dr. Buchanan's leadership as a manager and director. For his many contributions to his field, Dr. Buchanan is recognized as an outstanding chemist.

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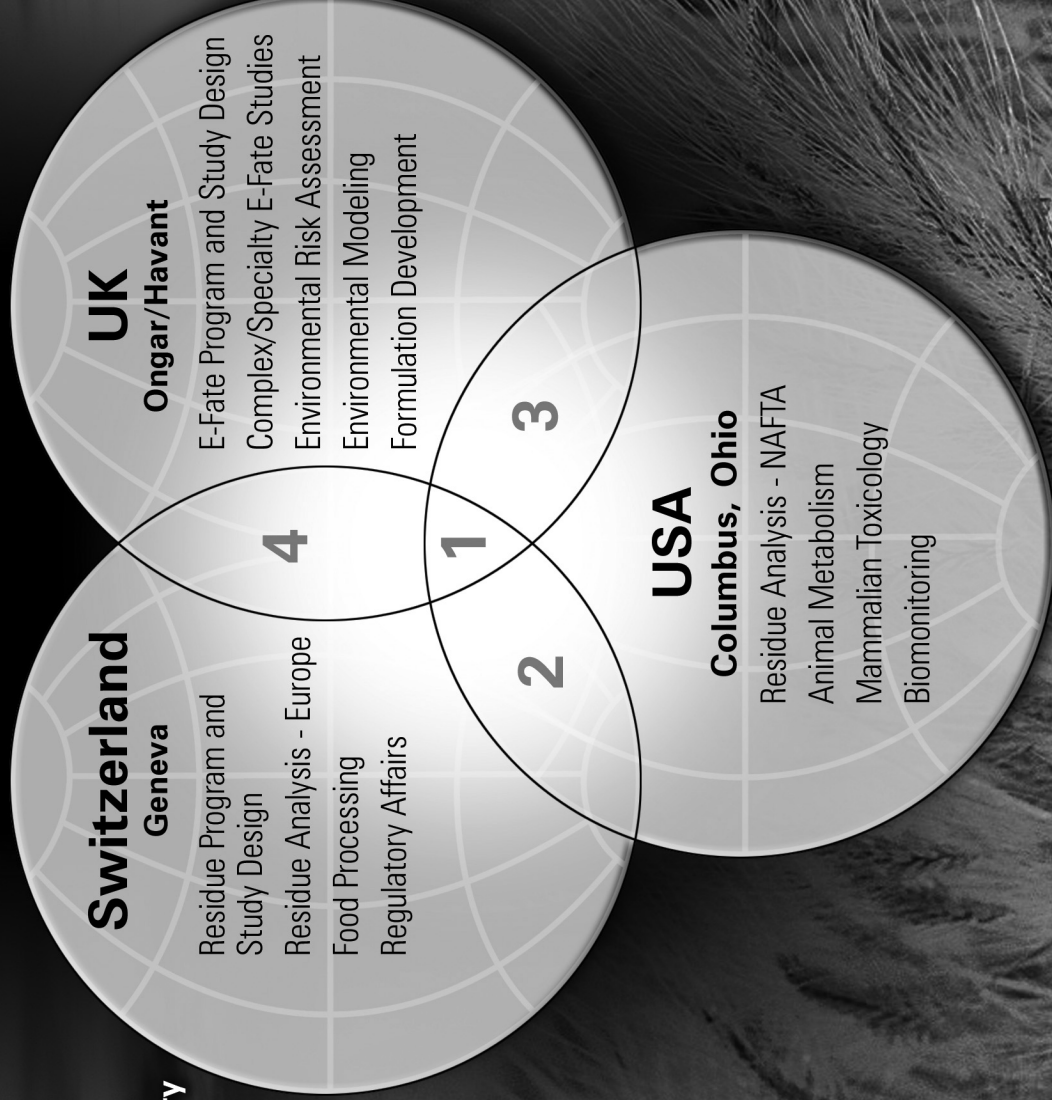
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Capabilities in Common

- 1 Program Management
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- 2 Product Characterization
Residue Method ILV
- 3 Plant Metabolism
- 4 Tier Summary Production
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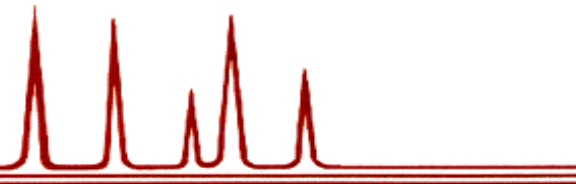
Thirteen graduate students have been awarded AGRO Division travel grants to present their research poster at the ACS National Meeting in Philadelphia. The top three posters will be displayed at the Agrochemical Division's Social Mixer where the first place winner will receive an additional \$500 award.

O. Bawardi	The metabolism of Fenthion in fish. O. Bawardi, B. Furnes, D. Schlenk University of California Riverside, Department of Environmental Science, Riverside, CA.
D. D. Brame	Influence of grassed buffers on agrichemical movement to ground water. D. D. Brame, R. F. Spalding. Agronomy Dept., University of Nebraska, Lincoln, NE.
Q. Cheng	Perchlorate exposure in mammals through drinking water. Q. Cheng, L. Perlmutter, P. N. Smith, S. T. McMurry, T. A. Anderson. . Texas Tech Univ., The Institute of Environmental and Human Health, PO Box 41163, Lubbock, TX.
B. W. Clark	Development of subacute bioassays for the assessment of transgenic corn (<i>Zea mays</i>) expressing the Bt protein. B. W. Clark, J. R. Coats. Department of Entomology, Iowa State University, Ames, IA.
J. J. Doherty	Conversion of triadimefon to triadimenol in turfgrass. J. J. Doherty, R. N. Edwards, R. A. Putnam, J. M. Clark. Environ. Toxicology and Risk Assessment Program, Department of Public Health, University of Massachusetts, Amherst, MA
C. L. Friedman	Degradation of chloroacetanilide herbicides by anodic Fenton treatment. C. L. Friedman, A. T. Lemley Graduate Field of Environmental Toxicology, Cornell University, TXA, 239 MVR Hall, Ithaca, NY
R. K. Frisbie	Actions of λ-cyhalothrin isomers on voltage sensitive calcium channels at rat brain presynaptic nerve terminals. R. K. Frisbie, S. B. Symington, J. M. Clark Molecular and Cellular Biology Program, Dept. Entomology; Univ. of Mass., Amherst, MA.
D. A. Goldade	In-vitro metabolism of the avicide 3-chloro-4-methylaniline hydrochloride in hepatic and renal cellular preparations. D. A. Goldade, J. D. Tessari, J. J. Johnston Dept. of Radiological and Environ. Health Sci, Colorado State Univ., Fort Collins, CO
K. L. Henderson	Mass balance of ^{14}C-metolachlor in a phytoremediation system. K. L. Henderson, J. B. Belden, J. R. Coats. Dept. of Entomology, Iowa State Univ., Ames, IA.
M. L. Hladik	Removal of chloroacetamide herbicides and neutral degradates during simulated drinking water treatment. M. L. Hladik, E. J. Bouwer, A. L. Roberts. Dept. of Geography and Environmental Engineering, Johns Hopkins University, Baltimore, MD
H. J. Kim	Serial invasive signal amplification reaction for the genotyping permethrin-resistant (kdr-type) head lice, <i>Pediculus capitis</i>. H. J. Kim, S. B. Symington, S. H. Lee, J. M. Clark. Molecular and Cellular Biology Program, Dept. of Entomology, Univ. of Massachusetts, Amherst, MA
P. Kulshrestha	Detection of residues of tetracycline antibiotics in soil fertilized with manure and wastewater using Enzyme Linked Immunosorbent Assay (ELISA) and high performance Liquid Chromatography with electrospray ionization Tandem Mass Spectrometry (LC/MS/MS): Correlation between results of screening and confirmatory tests. P. Kulshrestha, R. F. Giese Jr. Dept. of Chemistry, Natural Science Complex, The State University of New York, Buffalo, NY
K. S. Yoon	Improved artificial rearing apparatus for the human head louse allows the determination of resistance to formulated pediculicides and repellency. K. S. Yoon, J. P. Strycharz, J. M. Clark. School of Public Health and Health Sciences, Univ. of Massachusetts, Amherst, MA

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2. An abstract of 150 words (submit directly to <http://oasys.acs.org/oasys.htm>); this short abstract will be printed in the Agrochemicals Division biannual publication, PICROGRAM.

MAIL OR FAX THIS SIGNED APPLICATION, & FAX OR EMAIL EXTENDED ABSTRACT TO:

Dr. Allan Felsot, Washington State University, FEQL, 2710 University Dr., Richland, WA 99352

(Phone: 509-372-7365; Fax: 509-372-7460; email: afelsot@tricity.wsu.edu)

****Deadline for submittal of application materials: November 1, 2004.**

NOTE: Two awards will be made based on the merits of the submitted applications. Applicants not winning the awards will be invited to present their research in the Young Scientist's Recognition Symposium and will be eligible to receive a small travel grant.

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Analytical Chemistry:	Method development and validation, ILV, clinical sample analysis, analysis of agrochemicals and metabolites in soil, water, air, crops and animal tissues.
Field Studies Design and Analytical Phase:	Terrestrial and aquatic dissipation, rotational crops, nature and magnitude of residues in crops, lysimetry and small plot dissipation studies utilizing radiolabels. Volatility and Flux determination.
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CALL FOR NOMINATIONS

2005 STERLING B. HENDRICKS MEMORIAL LECTURESHIP


The Agricultural Research Service (ARS), USDA's primary research agency, is seeking nominations for the 2004 **Sterling B. Hendricks Memorial Lectureship**. This Lectureship was established in 1981 by ARS to honor the memory of Sterling B. Hendricks and to recognize scientists who have made outstanding contributions to the chemical science of agriculture. Dr. Hendricks contributed to many diverse scientific disciplines, including soil science, mineralogy, agronomy, plant physiology, geology, and chemistry. He is most frequently remembered for discovering phytochrome, the light-activated molecule that regulates many plant processes.

Nominees may be outstanding, senior scientists in industry, universities, or government positions. Current ARS employees are not eligible. Nominations may be made by sending (1) a letter explaining the nominee's contributions to chemistry and agriculture and (2) a current curriculum vitae to:

Kim Kaplan, Lecture Coordinator
 ARS Information Office
 Room 1-2253, Mail Stop # 5128
 5601 Sunnyside Ave.
 Beltsville, MD 20705
 kaplan@ars.usda.gov

The deadline for nominations is November 4, 2004.

The Lecture, on a scientific topic, trend or policy issue of the lecturer's choice, will be presented at the American Chemical Society Fall Meeting (Washington, DC, August 28 - September 1, 2005). The Division of Agricultural & Food Chemistry and the Division of Agrochemicals cosponsor the lecture, and it will be held in a joint session of these divisions. The award includes an honorarium of \$2,000, a bronze medallion, and expenses to attend the meeting.

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<p>Contact: EN-CAS Analytical Laboratories 2359 Farrington Pt. Drive Winston-Salem, NC 27107 Ph: (336) 785-3252 Fx: (336) 785-3262 E-Mail: tballard@en-cas.com</p>	<p>Capabilities in Both Modern & Classical Methodology & Instrumentation</p> <ul style="list-style-type: none"> ■ LC/MS/MS -- GC/MS ■ GC / FPD, N-P, EC, FID ■ HPLC / UV, Electrochemical, Fluorescence, Conductivity, Post-Column Derivatization ■ Robotics / Automation 	



CALL FOR APPLICANTS AGROCHEMICAL EDUCATION AWARDS

SUPPORT FOR GRADUATE STUDENT POSTER PRESENTATIONS AT THE 2005 FALL MEETING

The Division of Agrochemicals has established an endowment fund that will be used to promote an understanding of the role of chemistry in agriculture as embraced in the following areas related to pest management chemistry: synthesis, metabolism, regulatory, biotechnology, delivery, risk assessment, resistance, residues, mode of action, and fate/behavior. To address this mission, awards will be made through the Division's Education Committee.

Proposals are sought for the 2005 awards. Graduate students will be awarded up to \$600 each to help defray costs of attendance to give poster or oral presentations at the ACS 2005 Fall Meeting, which will be held August 28 - September 1, 2005, in Washington, DC. Posters will be displayed in a special section of the Division of Agrochemicals' poster session as well as the ACS Sci-Mix. A winner and two runners up will be selected for display at the Division's Social. The winner will receive an additional cash award of \$500. The subject of the presentation should fall within the areas listed in the introductory sentence. **To apply, a graduate student should submit the following, to be received no later than May 1, 2005:**

1. An abstract formatted according to the directions given on the ACS website. Be sure to include name (of applicant), address, and e-mail address.
2. A 2-page extended abstract giving more detail of the research/presentation.
3. A letter of nomination from the faculty advisor.

Please submit the above electronically with the three items as attachments in either Word or Word Perfect to Dr. John J. Johnston at john.j.johnston@aphis.usda.gov. If there are any questions, please contact Dr. Johnston at USDA/APHIS/National Wildlife Research Center, 4101 LaPorte Ave., Fort Collins, CO 80521, (970)-266-6082. Abstracts will be reviewed by the Education Committee and submitters notified of their selection status in May 2005.

AWARDS COMMITTEE REPORT

Professor John Clark, Department of Entomology, University of Massachusetts, will receive the International Award for Research in Agrochemicals at the 2004 Fall Meeting of the ACS in Philadelphia, PA. The award is sponsored by DuPont Crop Protection, Wilmington, DE. Dr. Clark was nominated by Ralph Mumma for his research on insecticide modes of action and insecticide resistance. The Award Symposium has been organized by Dr. Mumma around Dr. Clark's career research contributions.

Awards Committee balloting in 2004 produced two International Award winners selected for 2005. Dr. Robert I. Krieger, Department of Entomological Sciences, University of California, Riverside will be honored at the Spring Meeting in San Diego, CA. The Award is sponsored by BASF Corporation. An Award Symposium in his honor to highlight his contributions to understand and minimize exposures and risks in the use of pesticides will be organized by nominators Nancy Ragsdale and James Seiber.

At the Fall Meeting in Washington, D.C., the International Award will be presented to Professor Janice Chambers, Mississippi State University for her work on mammalian toxicity of organophosphorus pesticides and other neurotoxicants. Dr. Chambers was nominated by Ernest Hodgson. The Award will be sponsored by DuPont Crop Protection.

The AGRO Division is grateful for the continuing support of the sponsors of our International awards, BASF Corporation and DuPont Crop Protection.

The Awards Committee is accepting new awards nominations for the International Award for Research in Agrochemicals and for the Division Fellow Award. The nomination forms for both are found in the PICOGRAM. Please consider nominating a deserving colleague. The deadline for the International Award is December 31, and for the Fellow Award is May 31 each year.

Respectfully submitted

James N. Seiber, Chair, AGRO Awards Committee, May 21, 2004

NOTES FROM THE PROGRAM CHAIR

ALLAN FELSOT

Philadelphia, the “City of Brotherly Love”, is our venue for the 228th national meetings of the American Chemical Society. Adopted home of Ben Franklin, perhaps America’s first Renaissance Man, the city is also known as the birthplace of the American Philosophical Society where endeavors scientific could be debated. It is fitting therefore that AGRO, a Division noted for its highly interdisciplinary and integrated subject matter, has in store a wall-to-wall program that should titillate every scientific interest.

We kick off the week on Sunday with morning and afternoon symposia organized by John Lyga and George Theodoridis of FMC. The morning symposium, **Translation of Pesticidal Activity from Lab to Greenhouse to Field**, is followed in the afternoon with **Synthesis of Agrochemicals: Good Ideas that Never Made It to Products**. The afternoon will end with a stimulating panel discussion that will encourage you to tell your own story of involvement with product failures and successes.

On Monday morning, you are invited to honor Dr. John Clark (University of Massachusetts) as this year’s winner of **DuPont Crop Protection’s International Award for Research in Agrochemicals**. John is our Renaissance Man, having successfully conducted research ranging from biochemical genetics and toxicology to environmental chemistry. A morning and afternoon symposium called **The Yin and Yang of Pesticide Toxicology** has been organized in John’s honor by past award winner Dr. Ralph Mumma (Penn State emeritus). The morning symposium will focus on mode of action research, and the afternoon will tackle research in insect resistance and environmental toxicology.

AGRO will maintain its reputation of offering provocative and controversial topics on Monday with the all day symposium, **Is Organic Food Healthier Than Conventional Food?** Joe Rosen (Rutgers Univ.) has pulled together 13 speakers who will probe the current myths and truths surrounding the production and marketing of certified organic food. Topics will address a range of pesticide, sanitary, and environmental quality issues in addition to examining some of the social aspects behind the promotion of organic foods.

Tuesday morning kicks off with a full day symposium, **Perchlorate Contamination and Remediation in Agricultural Products and Soils**, that FERT subdivision members Peter Kane (Purdue University), Wayne Robarge (North Carolina State University), and Bill Hall (IMC Global) organized. This symposium follows a very successful perchlorate symposium in Anaheim but goes one step further with a strong emphasis on analytical methods and remediation as well as an overview of health issues.

Tuesday will also be a day of eclectic science with a plethora of topics covered in a **General Papers** session in the morning and the **General Posters** session in the afternoon. One hour prior to the start of our morning session, the USDA-sponsored **Sterling Hendricks Memorial Lecture Award** will be presented in a symposium organized by the Division of Agricultural and Food Chemistry.

Posters submitted for the **Agrochemical Education Awards for Graduate Student Travel** will be displayed simultaneously with the **General Poster** submissions at the Pennsylvania Convention Center. Many thanks are due to John Johnston (USDA) for organizing the student competition. Most of the AGRO posters will also be displayed with other ACS Division’s posters on Monday evening at the Convention Center in the traditional free beer and popcorn bash known as **Sci-Mix**. Among our combined 50 general papers and posters, you will find the cosmos of subject areas represented by AGRO.

Wednesday morning dawns with the standing symposium on **Agrochemical Residues and Metabolism** that is organized by David Smith (USDA), Teresa Wehner (Merial), and John Johnston (USDA). The symposium will continue in the afternoon. Meanwhile, a full day symposium organized by Peter Kane (Purdue), Wayne Robarge (NC State), and Bill Hall (IMC) titled **Metals Contamination in Agricultural Products and Soils: Methodology, Monitoring, Regulation, and Remediation**, delves into a controversial topic with a focus ranging from hazard assessment to analytical issues.

The one-and-a-half day symposium, **Agrochemicals and Watershed-Scale Modeling: Solutions for Water Quality Management**, starts Wednesday afternoon with a subject session called **Watersheds and Resource Conservation: CEAP and SWAT**. Symposium organizers Don Wauchope (USDA), Bill Hall (IMC), and Al Barefoot (DuPont Crop Protection) continue their sessions all day on Thursday with the subject focused on **Innovations in Watershed-Scale Water Quality Assessment**.

Thursday morning unfolds with the start of the all-day symposium, **Innovative Products, Practices and Technologies Impacting Nutrient Use and Laboratory Analysis in the 21st Century**. Organizers Bill Hall and Wayne Robarge have put together two informative sessions on the cutting edge in nutrient technologies.

Finally, analytical enthusiasts will be able to hone their skills by attending the **Trace Metal Analysis in Fertilizer Workshop**. Organizers Peter Kane, Bill Hall, and Wayne Robarge have pulled together experts in metals analysis to deliver very practical sessions on Thursday morning and afternoon.

The conclusion of the Philly meeting will end my tenure as AGRO Program Chair and begin my role as Division Chair. I plan to remain an activist and lend a hand to programming under the able leadership of our next Program Chair, Don Wauchope. AGRO remains the most interdisciplinary Division of ACS and by far has the most provocative programming covering academic, industrial, and regulatory science. I could not have organized anything without you volunteering to organize symposia and your contributions of papers to the meeting. I hope you will continue to stay involved in our professional scientific society.

Program Summary

Program	Sun	Mon	Tues	Wed	Thur
Translation of Pesticidal Activity from Lab to Greenhouse to Field	AM				
Synthesis of Agrochemicals: Good Ideas that Never Made It to Products	PM				
AGRO Business Meeting	PM				
International Award for Research in Agrochemicals: The Yin and Yang of Pesticide Toxicology--A Symposium in Honor of John M. Clark (Sponsor: DuPont Crop Protection)		AM PM			
Is Organic Food Healthier Than Conventional Food?		AM PM			
Sci-Mix		PM			
Perchlorate Contamination and Remediation in Agricultural Products and Soils			AM PM		
General Papers			AM		
General Posters			PM		
Agrochemical Education Awards for Graduate Student Travel			PM		
AGRO Social			PM		
Agrochemical Residues and Metabolism				AM PM	
Metals Contamination in Agricultural Products and Soils: Methodology, Monitoring, Regulation, and Remediation				AM PM	
Agrochemicals and Watershed-Scale Modeling: Solutions for Water Quality Management				PM	AM PM
Innovative Products, Practices and Technologies Impacting Nutrient Use and Laboratory Analysis in the 21st Century					AM PM
Trace Metal Analysis in Fertilizer Workshop					AM PM



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AGRO CALL FOR PAPERS



2005 ACS NATIONAL MEETINGS
SAN DIEGO, CA MARCH 13-17
WASHINGTON, DC AUGUST 28-SEPTEMBER 1

Listed below are symposia and other program sessions that are at various stages of consideration by the Division of Agrochemicals for the meetings in 2005. Some are ideas that have been tossed out; others already have an Organizer.

It's hard to believe it but the ACS On-line Abstract Submittal System (OASYS) will open for the **San Diego meeting** in just a few months! Want to contribute a paper? Have your own idea about a symposium you would like to see happen? If you have an idea for the AGRO programs for 2005--or beyond, for that matter--please contact us. We are always looking for symposia ideas. Now is a good time to start organizing a topical symposium for 2005 or 2006, especially one likely to be a good candidate for publication as a book or in an appropriate ACS journal. Questions or suggestions regarding current or future programming are welcome and should be directed to:

Don Wauchope, AGRO Program Chair - 2005

USDA-Agricultural Research Service, POB 946, 2316 Rainwater Rd., Tifton, GA 31794, (229) 386-3892, don@tifton.usda.gov

SAN DIEGO: 229TH NATIONAL MEETING, MARCH 13-17, 2005

- NATIONAL/REGIONAL AIR MONITORING PROGRAMS IMPACTING AGRICULTURE. **FERT** Subdivision—contact Bill Hall wlhall@imcglobal.com
- ORGANIC FARMING AND NUTRIENTS – PRODUCTIVITY, VALUE, AND FOOD SAFETY (JOINT WITH AGFD). **FERT** Subdivision—contact Bill Hall wlhall@imcglobal.com
- INNOVATIVE TECHNOLOGIES FOR PRODUCTION & ANALYSIS OF SPECIALTY FERTILIZERS & PESTICIDES (JOINT WITH AGRO). **FERT** Subdivision—contact Bill Hall wlhall@imcglobal.com
- ANTIOXIDANTS IN FOOD--RELATIONSHIP TO AGRONOMIC PRACTICES AND PESTS; METHODS OF ANALYSIS. Organizers: Jim Seiber jseiber@pw.usda.gov; Allan Felsot afelsot@tricity.wsu.edu
- RISK ASSESSMENT. Idea under development--perhaps focused on rural families and actual measurements of exposure. Allan Felsot (afelsot@tricity.wsu.edu) and Rich Fenske (University of Washington; rfenske@u.washington.edu).
- YOUNG SCIENTISTS RESEARCH RECOGNITION AWARD SYMPOSIUM. Contact Allan Felsot (afelsot@tricity.wsu.edu)
- ACS INTERNATIONAL AWARD FOR RESEARCH IN AGROCHEMICALS (SPONSORSHIP BY BASF CORPORATION)—Symposium Honoring Dr. Robert Krieger (UC-Riverside). Organizers: Nancy Ragsdale (nnr@ars.usda.gov) and Jim Seiber (jseiber@pw.usda.gov)
- PHYTOPHTHORA: PHYSIOLOGY, ECOLOGY, AND CONTROL. Suggested by Nancy Ragsdale (nnr@ars.usda.gov)
- OTHER PROPOSED SYMPOSIA SEEKING ORGANIZERS & PARTICIPANTS:
- THE ROLE OF INTEGRATED CHEMICAL MANAGEMENT IN IPM: ANTAGONISMS, SYNERGISMS (POTENTIATION), & RESISTANCE MANAGEMENT
- FORESTRY PEST CONTROL & MANAGEMENT CHEMICALS
- BIOTECHNOLOGY'S NEXT GENERATION OF CROP PROTECTION CHARACTERS

WASHINGTON: 230TH NATIONAL MEETING, AUG. 28 – SEPT. 1, 2005

(note the regulatory emphasis; we expect strong attendance by regulatory chemists)

- ASSESSING EFFECTIVENESS OF AGRICULTURAL BMPS ON NUTRIENT INPUTS, YIELDS AND THE ENVIRONMENT. **FERT** Subdivision—contact Bill Hall wlhall@imcglobal.com
- WATER QUALITY PROTECTION AT THE WATERSHED SCALE: MONITORING & TRADING, ARE THEY WORKING? (JOINT WITH ENV). **FERT** Subdivision—contact Bill Hall wlhall@imcglobal.com
- NEW NUTRIENT & SOIL AMENDMENT PRODUCTS IMPACTING AGRICULTURAL PRODUCTION & THE ENVIRONMENT. **FERT** Subdivision—contact Bill Hall wlhall@imcglobal.com
- HOMELAND SECURITY & AGRICULTURE: MANAGING AGRICULTURAL INPUTS AND ASSURING FOOD SAFETY (JOINT WITH AGFD). **FERT** Subdivision—contact Bill Hall wlhall@imcglobal.com
- HARMONIZATION ISSUES IN REGULATION: SCIENCE & GLOBAL POLITICS
- PEST MANAGEMENT BY GOVERNMENT AGENCIES (Especially on government lands)
- PUBLIC HEALTH PEST CONTROL ISSUES
- MANAGEMENT OF CONTAMINANTS IN PUBLIC WATER SUPPLIES: METALS, MICROBIALS, AGROCHEMICALS
- AGROCHEMICAL TECHNOLOGY: WHAT WILL BE THE STATE OF THE ART IN 2015?
- AGROCHEMICAL RESEARCH, EXTENSION & EDUCATION: WHO WILL TRAIN THE NEXT GENERATION? WHO WILL CONDUCT THE RESEARCH? WHO WILL FUND?
- METABOLOMICS (contact Will Ridley, william.p.ridley@monsanto.com, or Jim Seiber, jseiber@pw.usda.gov)
- REGULATORY AND IPM ISSUES WITH AGROCHEMICAL MIXTURE APPLICATIONS
- TEN-YEAR RETROSPECTIVE ON FQPA AND CONSUMER EXPOSURE
- CHILDREN’S HEALTH AND PESTICIDES
- CHANGES IN PESTICIDE USE PROFILES
- STIMULATION OF PEST MANAGEMENT STRATEGIC PLANS
- EMISSIONS FROM AGRICULTURAL FACILITIES AND EFFECTS ON ADJACENT ECOSYSTEMS
- PEST CONTROL/AG ISSUES IN NATIVE AMERICAN TRIBAL AREAS

BEYOND 2005: Atlanta and San Francisco

Suggestions have been raised for “Pest Control in Sports Turf” and “The Future of Pest Control in Minor-use Crops” (especially fruits and nuts)

We are open to additional ideas and looking for interest in any of the above--and someone taking responsibility for those with no Organizer listed. Obviously we do not lack for potential programming!

A LONG-RANGE PLANNING RETREAT FOR THE AGRO DIVISION?

DON WAUCHOPE, VICE CHAIRMAN (don@tifton.usda.gov)

The Division of Agrochemicals is due for a concentrated study of its future. ACS Divisions exist to develop the programs of the national meetings. Thus, AGRO's job is to provide a venue where the latest research--the science behind agrochemicals technology--is reported. It is clear, however, that the Division is getting smaller and older and the amount of research to report is decreasing. I cannot imagine anything that would turn this trend around. We all know the reasons for this: the pesticide and fertilizer industries are mature, aggregating, integrating, globalizing and increasingly doing their R & D research in-house without the assistance of university or government researchers or consultants. The latter have been negatively criticized if they work in this contentious area.

I don't mean to be totally gloomy. Outside the major-company R & D players (who grow increasingly cautious in publishing research and protective of proprietary information), chemical research in this field has some small but active bright spots: environmental fate and behavior of pesticides and fertilizers driven by regulatory needs, research on alternatives to pesticides (excuse me, crop protection chemicals) some continued academic momentum on metabolism and modes of action and weed dynamics, etc. Our recent programming at the national meetings has been diverse and interesting and well attended (though the audiences are smaller than they used to be). Allan Felsot tells me we are recently getting more papers, but whether this is just a blip or a stable trend remains to be seen.

There are major societal and regulatory and environmental concerns still to be addressed by agrochemical science. Such issues demand a clear-eyed look at our future as a Division. Several proposals have surfaced in recent years: go to one meeting a year; merge with AGFD Division; work with ENV and AGFD to carve a new Division at the nexus between food, resources and biotech?

I mentioned at the Business meeting last year that it was suggested to me at the ACS Leadership Conference that a Divisional leadership retreat for a few days might be the best way to concentrate our attention on this question and propose some paths into the future. I posted a question to the ACS leadership listserv about this and several Division officers replied that they had had really excellent success with this. Someone also has made the excellent suggestion that we actively encourage younger members of the Division to participate.

Let's think about this. I would like to hear your opinion of the idea and/or suggestions. I will summarize any reactions you send me at the Business Meeting in Philadelphia.

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FERTILIZER & SOIL CHEMISTRY NEWS

We have begun to rebuild FERT membership through the help of an ACS mini-grant. We have initiated a new member campaign with a goal of 300 subdivision members by the end of 2004. Our efforts to date include a presence at the 2003 Environmental Quality and Agriculture Conference, the 2004 Metals Forum III and Midwest AOAC as well as the 2004 Southern and National Fertilizer Control Officials meetings. We also plan to be at AOAC in St. Louis in September and the Agronomy Society meetings in November. Our goals are to:

- Create broader FERT identity by including agronomy, environmental and analytical chemistry into programs
- Deliver content by developing relevant programming, training and timely communications to members
- Extend the identity and message by FERT sponsorships and participation in non-ACS scientific meetings

We are developing strong programming and planning in advance for future ACS meetings. The infusion of broader program content and new speakers will bring ideas, energy, and responsiveness to our programs and the division. In the future we will work with AGRO, AGFD, ENVIRO, ANYL, and other divisions in cooperative program efforts. At Anaheim FERT presented a strong perchlorate related symposium; the first spring programming in FERT history! Our Philadelphia programming includes the following topics.

- Agrochemicals & Watershed-scale Modeling: Solutions for Water Quality Management (Programmed with AGRO)
- Innovative Products, Practices & Technologies Impacting Nutrient Use In The 21st Century
- Trace Metals Contamination In Agricultural Products & Soils: Methodology, Monitoring & Regulation (A methodology & spectroscopy workshop is planned in conjunction with this symposium)
- Perchlorate Contamination In Agricultural Inputs: Methodology, Monitoring, & Remediation

Future subdivision activities and program topics are listed below.

229th - San Diego, CA, March 13-17, 2005

- National/Regional Air Monitoring Programs Impacting Agriculture
- Organic Farming and Nutrients – Productivity, Value, and Food Safety (Joint with AGFD)
- Innovative Technologies for Production & Analysis of Specialty Fertilizers & Pesticides (Joint with AGRO)

230th - Washington, DC, August 28 - September 1, 2005

- Assessing Effectiveness Of Agricultural BMPs On Nutrient Inputs, Yields And The Environment
- Water Quality Protection at the Watershed Scale: Monitoring & Trading, Are They Working? (Joint with ENV)
- New Nutrient & Soil Amendment Products Impacting Agricultural Production & the Environment
- Homeland Security & Agriculture: Managing Agricultural Inputs and Assuring Food Safety (Joint with AGFD)

231st - Atlanta, GA, March 26-30, 2006 and Beyond

- Agriculture and Nutrient Recycling Technology – Efficiency, Necessity and Economics
- U.S. Fertilizer Production – Challenges of Operating in a Global Marketplace
- Mineral Nutrition And Plant Disease – Interactions And Effects
- Agriculture and Adjacent Ecosystems - Can Both Be Protected? (Joint with ENV)
- New Techniques and Instrumentation Used In Fertilizer and Soil Analysis (Joint with ANYL)

Take part in the revitalization of FERT division by joining our division and attending upcoming programs. Please let me, or any FERT officer listed below know how we can be more responsive to your needs.

Bill Hall

Subdivision Chair

wllhall@imcglobal.com

Phone: 864-428-7161

Wayne Robarge

Chair Elect & Program Chair

wayne_robarge@ncsu.edu

919-515-1454

Bill Herz

Vice Chair

wcherz@tfi.org

202-515-2706

Herb McKinnon

Secretary

hmackin1@tampabay.rr.com

813-989-2267

Sincerely,

Bill Hall

FERT subdivision chair 2003-2004



CALL FOR PAPERS



ANTIOXIDANTS IN FOOD--RELATIONSHIP TO AGRONOMIC PRACTICES AND PESTS; METHODS OF ANALYSIS

229th ACS National Meeting, San Diego, CA, March 13-17, 2005
Division of Agrochemicals

Abstract Submission Deadline – November 28, 2004

We are seeking papers for a symposium that will explore how all agronomic practices, including pest control, fertilization, soil and water management, and crop variety affect the production of phytochemicals designated as beneficial for human health. Many of these chemicals are classified as antioxidants. The agronomic management practices are expected to run the gamut of certified organic, sustainable, and conventional production. In addition to information on how the levels of beneficial phytochemicals vary in relation to agronomic practices, we are also interested in methods of analysis and experimental design. Please consider submitting a paper for this unique symposium.

For more information contact Allan Felsot, Washington State University (afelsot@tricity.wsu.edu) or Jim Seiber, USDA-ARS Albany, CA (jseiber@pw.usda.gov).

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Julie E. Eble, Ph.D., CEO and President

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CALL FOR PAPERS

Organic Farming and Nutrients – Productivity, Value, and Food Safety (Joint with AGFD)

Abstract Submission Deadline – November 28, 2004

229th ACS National Meeting, San Diego, CA, March 13-17, 2005

Sponsored by the Fertilizer and Soils Subsection of the Agrochemicals Division

Organizers: Dr. Wayne Robarge, North Carolina State University, Raleigh, NC
Mr. Bill Hall, IMC Global, Mulberry, FL
Mr. Bill Herz, The Fertilizer Institute, Washington, D.C.

Purpose of Symposium: To explore the research and experience gained from large scale organic farming practices. This will not only include university and independent research, but also experience of actual producers complying with the USDA National Organics Program. Areas to be explored include the varying materials approved for organic farming inputs, practices and management techniques in use, yield and quality comparisons and the economic considerations of supplying, growing, marketing and using foods grown following the NOP guidelines. Additionally food safety is a concern of everyone; the positive and negative implications of producing, buying, consuming and exporting organic foods will be discussed. The future of organic goods as well as the inputs to their production will be examined.

Possible Topics (although not limited to the following):

- **Understanding and complying with the (NOP) National Organics Program**
- **Examining the list of approved organic inputs for quality, value, and safety**
- **Research comparing long term yields and economics of small and large scale operations**
- **Management practices and recycling – how to make the most of what we have**
- **How to assure the quality and safety of organically grown foods**

An ACS Symposium Series publication of the same title will be pursued. To facilitate the timely publication of the symposium proceedings, contributors are requested to provide manuscripts by March, 2005.

For additional information contact the organizers:

Wayne Robarge Department of Soil Science, North Carolina State University
PO Box 7619 Raleigh, NC 27695-7619
Phone: (919) 515-1454; Email: wayne_robarge@ncsu.edu

Bill Hall IMC Global Operations
3095 County Rd, Mulberry, FL 33860
Phone: (863) 428-7161; Email: whall@imcglobal.com

Bill Herz TFI
Union Center Plaza
820 First Street, N.E. Suite 430
Washington, D.C. 20002
Phone: (202)-515-2706; Email: wcherz@tfi.org

CALL FOR PAPERS

Innovative Technologies for Production & Analysis of Specialty Fertilizers & Pesticides (Joint with AGRO)

Abstract Submission Deadline – November 28, 2004

229th ACS National Meeting, San Diego, CA, March 13-17, 2005

Sponsored by the Fertilizer and Soils Subsection of the Agrochemicals Division

Organizers: Bill Hall, IMC Global, Mulberry, FL
Wayne Robarge, North Carolina State University, Raleigh, NC
Bill Herz, The Fertilizer Institute, Washington D.C.

Purpose of Symposium: To provide a forum for the exchange of innovative technologies that will allow more efficient and better use of specialty fertilizers and crop protection products such as those used for home lawns, gardens, golf courses and horticulture. Products may include slow release or enhanced efficiency fertilizers as well as recycled nutrients and innovative fertilizer pesticide combination products that positively impact growth, nutrient utilization and pest control. These materials may also be more efficient in terms of controlling unintended nutrient and AI releases to the environment. Other management, application or regulatory measures may be explored for their usefulness in maximizing efficiency while minimizing environmental effects. New production and process advancements resulting in improvements in nutrient delivery or pesticide manufacture will also be addressed.

Possible Topics (although not limited to the following):

- New Controlled or Designed Release Fertilizer Materials
- New Methodologies that Might Prove to be more Efficient, Faster, Precise and Less Expensive
- Products or Practices Enhancing Nutrient or AI Efficiency or Minimizing Environmental Risks
- Production or Process Advances Resulting in Technological Advancements Within the Industry
- Use of Recycled Nutrients to Conserve Natural Resources and Minimize Waste
- Improved Management/Application Practices Optimizing Nutrient Utilization or Minimizing AI Use

An ACS Symposium Series publication of the same title will be pursued. To facilitate the timely publication of the symposium proceedings, contributors are requested to provide manuscripts by February 20, 2005.

For additional information contact the organizers:

Bill Hall IMC Global Operations
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Wayne Robarge Department of Soil Science, North Carolina State University
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Phone: (202)-515-2706; Email: wcherz@tfi.org

CALL FOR PAPERS

AGRICULTURE AND AIR MONITORING: INVESTIGATING TECHNOLOGIES FOR MEASUREMENT AND RESEARCH

Abstract Submission Deadline – November 28, 2004

229th ACS National Meeting, San Diego, CA, March 13-17, 2005

Sponsored by the Fertilizer and Soils Subsection of the Agrochemicals Division

Organizers: Dr. Wayne Robarge, North Carolina State University, Raleigh, NC
Mr. Bill Hall, IMC Global, Mulberry, FL
Ms. Karen Harlan, NADP Central Analytical Laboratory, Champaign, IL

Purpose of Symposium: Air quality issues relating to agricultural activity are at the forefront of many federal and state regulatory agendas. The goal of the symposium is to facilitate open discussion regarding development of accurate and reproducible analytical techniques for sampling and analysis of nutrients and contaminants in air. These discussions will include air emissions from animal feeding operations as well as ambient air and atmospheric deposition of analytes impacting agriculture and the environment.

Possible Topics (although not limited to the following):

- *Current Air Monitoring Programs*
- *Techniques for Monitoring Air Emissions from Lagoons and Confined Feeding Operations*
- *Impacts of Atmospheric Deposition of Nutrients and Contaminants on Watersheds and Models*
- *Techniques for Determination of Analytes from Air Particulate and Deposition Sampling*
- *Analytical Methods Including Discussions of Criteria for Selecting Limits of Quantitation*
- *Sample Analysis and Interpretation of Data*
- *Air Monitoring of Emissions from Manure and Fertilizers Applied to Agricultural Fields*
- *Regulatory Programs and Use of Data in Risk Assessment*

An ACS Symposium Series publication of the same title will be pursued. To facilitate the timely publication of the symposium proceedings, contributors are requested to provide manuscripts by March, 2005.

For additional information contact the organizers:

Wayne Robarge Department of Soil Science, North Carolina State University
PO Box 7619 Raleigh, NC 27695-7619
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2204 Griffith Dr
Champaign, IL 61820-7405



International Union of Pure and Applied Chemistry

A member of the International Council of Scientific Unions

Advisory Committee on Crop Protection Chemistry

The International Union of Pure and Applied Chemistry, IUPAC, is probably best known for its work in pure chemistry regarding atomic weights and nomenclature. However, IUPAC also sponsors efforts in applied chemistry, including a number of workgroups affiliated with the Division of Chemistry and the Environment. The Advisory Committee on Crop Protection Chemistry is one such workgroup, which is comprised of around 20 internationally recognized experts from academia, industry, and government. The Committee provides unbiased and authoritative views on the behavior and potential impacts of agrochemicals in the environment through its projects and technology transfer activities.

Through its projects, the Committee critically examines globally relevant issues related to environmental assessment of agrochemicals. Ongoing projects include:

- Bioavailability of Xenobiotics in the Soil Environment
- Genetically Modified Crop Cultivation and Impact on the Environment
- Spray Drift: Assessment and Mitigation
- Global Availability of Information on Agrochemicals
- Methods for Setting Interim MRLs for Minor-Consumption Crops
- A Critical Compendium of Pesticide Physical Chemistry Data
- Simplified Methods and Tools for Ecological Risk Assessment of Pesticides
- Glossary of Terms Related to Pesticide Chemistry (revision and update)

If you are interested in participating in an ongoing or proposed project, please visit the IUPAC project web page for further details and project leader contact information:

<http://www.iupac.org/divisions/VI/cp6.html>

IUPAC is very interested in receiving additional proposals for projects related to crop protection chemistry, and anyone may submit a proposal for a project. You may visit the IUPAC project web site for details:

<http://www.iupac.org/projects/index.html>

Project reports include formal recommendations or definitions and are published in *Pure and Applied Chemistry* (PAC) and other international journals. Recently completed reports include:

- D. Hamilton et al. "Pesticide Residues in Food: Acute Dietary Exposure." *Pest Manag. Sci.* 2004, 60:311-339.
- A. Ambrus et al. "Significance of Impurities in the Safety Evaluation of Crop Protection Products." *PAC*, 2003, 75:937-973.

First Announcement

International Workshop on Crop Protection Chemistry in Latin America

February 14-17, 2005

San José, Costa Rica

Invitation

This workshop is designed to address contemporary and emerging issues related to harmonized approaches for environmental assessment and regulation, and is the 6th in a series sponsored by the International Union of Pure and Applied Chemistry (IUPAC) since 1988. Organization is being shared also with the University of Costa Rica and Costa Rica Ministry of Agriculture, and co-sponsorship has been arranged with CropLife Latin America and the local industry association.

Crop protection chemistry is at a critical juncture in Latin America. The use of agrochemicals for crop protection purposes has increased significantly in recent years, and the region now is one of the most important areas for agricultural production and export to world markets. At the same time, research and regulatory interests for sustainable agricultural production and a high level of environmental protection have increased. There is clearly a need to identify and prioritize the key regional issues related to crop protection chemistry and environmental protection, and also to exchange ideas and information regarding harmonized approaches for the scientific evaluation and regulation of crop protection chemistry.

An invitation is extended to all interested scientists to come to beautiful Costa Rica and join experts from across Latin America and from around the world in the important deliberations being planned.

Scientific Program

The program for the meeting will include invited lectures, submitted posters, and discussions with simultaneous English/Spanish translation for all oral sessions. Key scientific topics include:

- Environmental fate and impacts
- Analysis and monitoring of pesticide residues
- Risk assessment and mitigation
- Regulations and standards, including food residues and maximum residue limits
- Product quality criteria and specifications

Social Program

Following the scientific program, a day of touring and local agricultural visits will be available to workshop participants.

Further Information

For further information please contact program chairs Ken Racke (email: kracke@dow.com) or Elizabeth Carazo (email: ecarazo@cariari.ucr.ac.cr) or visit the workshop web site:

<http://www.iupac.org/symposia/2005/crop-protection-chemistry/index.html>

ANNOUNCEMENT & CALL FOR POSTERS

INTERNATIONAL CONFERENCE ON PESTICIDE APPLICATION FOR DRIFT MANAGEMENT

**Waikoloa, Hawaii
October 27-29, 2004**

This international forum will bring together leaders in research and technology, as well as educators, manufacturers and governmental regulators from Europe, North America, Australasia and other continents. Scientists, industry leaders, educators, and regulators will share the most current knowledge related to pesticide spray drift, concerns for human health and the environment, meteorological factors, product stewardship, adjuvant chemistry, drift reduction technology, computer modeling and best management practices. The conference goal is to provide the state of the art in spray drift knowledge and to close the conference with two distinct workshops focusing on drift models from the U.S., Australasia, Canada, U.K. and Germany, as well as to initiate working groups to develop globally harmonized core educational spray drift principles and best management practices for 1) aerial, 2) airblast, and 3) ground application equipment. The conference will encompass discussions related to agriculture, urban areas, aquatic sites, vector abatement, and forestry. The energy generated from the international networking will result in activities that continue well beyond the close of the meeting.

For more information about the conference and its sponsors, registration, hotel reservations, and presenting a poster, visit the web site <http://pep.wsu.edu/Drift04/>.

MINUTES FROM THE AGROCHEMICAL DIVISION COMBINED GOVERNANCE MEETING

**ACS 227th ACS National Meeting – Anaheim, CA
Sunday, March 28, 2004 - 5:00 PM
Chair, Agrochemicals Division - Rodney Bennett**

Program Planning

Rod Bennett called the meeting to order at 5:10 pm. Members in attendance introduced themselves, and Rod passed around a sign up sheet for the AGRO desk. The sign-up sheet is retained in the archives. We need volunteers to represent AGRO, answer questions about the division, sell books, and seek new members. Rod distributed copies of an AGRO “Reference and Training” notebook that he prepared to organize documents on Agrochemicals Division governance. Rod noted that he submitted nominations for ChemLuminary Division and Regional awards this year and called our attention to the initiative grants that can be up to \$5000 for one grant or \$7500 for two. The meeting continued with a discussion of programming.

Anaheim Update - Allan Felsot

There are 29 posters in the program and 120 papers in 4 symposia and two general sessions. The numbers compare favorably with last year when around 100 papers were on the New Orleans and New York meeting programs. For comparison, there are 140 papers in the Environmental division program and 161 in Ag and Food. Two other symposia of interest are: Chemistry and Safety of Acrylamide in Food (AGFD), and Natural Products for Pest Management (AGFD). Environmental Chemistry designated three AGRO symposia of interest:

Agrochemical Issues in Urban Environment, Perchlorate Uptake in Plants, and Pesticide Risk Assessment: Conceptual to Quantitative Exposure Model. The Women Chemist’s Committee and Younger Chemist’s Committee cross-listed the Young Scientist Research Recognition Award Symposium. ACS is enforcing balanced programming at meetings, and Allan has distributed symposia over the entire meeting.

Philadelphia Program - Allan Felsot & Bill Hall

Abstract deadlines: May 3 – authors’ deadline in OASYS; May 12 – symposium organizers; May 19 – Allan’s deadline. On his return, Allan will begin working on the Philadelphia program and will send notices to the list serve to request papers. There are 12 subject symposia planned.

Standing Sessions include: Agrochemical Education Award Posters, General Posters, General Papers, Sci-Mix and the Sterling Hendricks Memorial Lectureship Award which is co-sponsored with AGFD. The International Award for Research in Agrochemicals (sponsored by DuPont Crop Protection) will honor John Clark. The symposium has the theme: “The Yin and Yang of Pesticide Toxicology.” There are 18 invited papers already on the agenda.

Other subject symposia:

Is Organic Food Better for You than Conventional Food?; Agrochemical Residues & Metabolism; Degradation & Metabolic Fate of New Crop Protection & Animal Health Products; Agrochemicals & Watershed-Scale Modeling: Solutions for Water Quality Management, Synthesis of Agrochemicals: Good Ideas that Never Made It to Products; Translation of Pesticidal Activity from Lab to Greenhouse to Field, Agriculture and Air Monitoring: Investigating Technologies for Measurement and Research; Metals Contamination in Agricultural Products and Soils: Methodology, Monitoring, Regulation, and Remediation; Innovative Products, Practices and Technologies Impacting Nutrient Use and Laboratory Analysis in the 21st Century; Mineral Nutrition and Plant Diseases--Interactions and Effects

The Academic Employment Initiative is a pilot program sponsored by ACS President Chuck Casey and the Graduate Education Advisory Board with the objective of providing an opportunity for academic employers to “pre-interview” and speak one-to-one with prospective faculty position applicants. The definition has been broadened to include people looking for academic positions – could be post-docs and recent graduates. Participants would submit a poster designated ‘AEI’ to a Division and it would automatically be assigned to a special section of Sci-Mix. The Program starts with the Philadelphia meeting.

Bill Hall noted that there is more FERT programming at Philadelphia than at any fall program in the last 5 years. M&E has a rule for the number of posters - limited to 10% of total papers. Agro makes \$600 per session available to symposium organizers for travel and

registration expenses. Additional funding is possible if approved by the officers.

Beyond 2004, Allan Felsot, Bill Hall, Don Wauchope
Ideas for 2005 – send to Don Wauchope, copy in Allan Felsot

Proposed symposia for San Diego, Spring, 2005:

Antioxidants in Food--Relationship to Agronomic Practices and Pests; Methods of Analysis

Organizers: Jim Seiber (USDA); Allan Felsot (Washington State University);

“Risk Assessment” (idea under development--perhaps focused on rural families; actual measurements of exposure) Rich Fenske (University of Washington) Young Scientists Research Recognition Award Symposium;

International Award--BASF Sponsorship;

Phytophthora: Physiology, Ecology, and Control;

The role of Integrated Chemical Management in IPM: Antagonisms, Synergisms (Potentiation), & Resistance Management;

Forestry Pest Control & Management Chemicals

Biotechnology's Next Generation of Crop Protection Characters;

FERT Proposals for San Diego:

Modeling & Risk Assessment--Tools for Managing Agricultural Inputs & Food Safety;

Organic Farming & Nutrients--Productivity, Value & Food Safety;

Innovative Technologies for Production and Analysis of Specialty Fertilizers & Pesticides;

Proposed Symposia for Washington, DC:

Harmonization Issues in Regulation: Science & Global Politics;

Pest Management by Government Agencies;

Public Health Pest Control Issues;

Management of Contaminants in Public Water Supplies: Metals, Microbials, Agrochemicals;

Agrochemical Technology: What Will Be the State of the Art in 2015?;

Agrochemical Research, Extension & Education: Who will train the next generation? Who will conduct the research? Who will fund?-- Bill Hall, Don Wauchope; Ten year retrospective on FQPA - Dan Stout, EPA NERL;

Harmonization issues in regulation of Crop Protection Products – Rod Bennett, Al Barefoot;

Agrochemicals Technology: What will be the state of the art in 2015? - Allan Felsot, Al Barefoot;

FERT Proposals for Washington:

Assessing Effectiveness of Agricultural BMPs on Yields & the Environment;

TMDLs & Plant Nutrients--Monitoring & Trading, Are They Working?;

Agriculture & Adjacent Ecosystems--Can They Both Be Protected?;

New Nutrient & Soil Amendment Products Impacting Agricultural Production & the Environment;

Long-range Programming:

Metabolomics (metabolic profiling), high field NMR, mass spec, altered metabolite profiles due to disease control (Will Ridley & Jim Seiber);

Mixtures: Toxicology and Risk assessment;

Formulation Issues (Adjuvants, etc.);

Stimulation of Pest Mgt. Strategic Plans;

Pest Control in Military Establishments/Areas;

Environmental impacts of agriculture – emissions from ag operations, particulate matter, effects on adjacent ecosystems;

Pest Control/Ag Issues by Tribes;

Alternatives to repellants, vector control;

Issues in Turf Management.

IUPAC Cooperative Activities - Ken Racke

Workshop 2005

2006 International Congress of Pesticide Chemistry will be sponsored by the Pesticide Society of Japan. Ken is looking for people to help with workshops and session leaders.

2010 International Congress of Pesticide Chemistry Ken would like to see the conference return to the US and will need a specific proposal by fall 2005. Previous experience showed importance of having good support from ACS. There was discussion of potential costs and the need for very intense effort and willingness, but we agreed that it is worth pursuing a proposal. Ken agreed to chair committee to prepare proposal. Jeanette Van Emon and Don Wauchope volunteered to assist with preparation of the proposal, which will include a venue and tentative budget by August 2005. Don suggested Washington DC in June 2010, which will give increased likelihood of having government agencies participate.

Advisory Committee on Crop Protection chemistry places emphasis on recommendations and projects and evaluations of different areas. See website for additional information on projects – www.iupac.org/divisions/VI/cp6.html. IUPAC also sponsors regional workshops and Ken provided information on a workshop on crop protection chemistry in Latin America during 2005.

Future Special Conference Committee - John Clark

Pan Pacific – both books are on track for submittal. Next Pan Pacific would be 2008 and would be a collaboration with both the Japanese Pesticide Society and the Chinese Pesticide Society. ACS involvement in planning would be highly desirable. ACS might be willing to help with a smaller conference. Barry and Rod volunteered to write

a letter proposing ACS support for a medium sized conference. Without ACS support we are not committing to a Pan Pacific conference in 2008. The Pan Pacific Conference could be brought into the ACS Pacific Chemistry Conference. Since special conferences have greater appeal, this isn't preferred, but could be the choice since we need ACS involvement.

Long Range Program Planning - Herb Nigg, Dave Barnekow, Rod Bennett

Biotechnology Secretariat plans 4 years ahead, and it would be useful for us to look farther ahead. The new directions initiative grants from DAC could be used to help. Will Ridley and Jim Seiber agreed to look into long range programming with the Biotech Secretariat. Don Baker agreed to work on organizing AGRO programming at the Western regional meeting. Allan proposed occasional symposia focusing on a pest complex such as Phytophthora physiology, ecology, and control. John Clark volunteered to work on chemical management in IPM.

Executive Committee Reports

Secretary's Report -Aldos Barefoot

The minutes of the fall 2003 annual meeting were reviewed by the officers and delivered to the Picogram editor for publication. Candidates for office were notified of election results, and elected officers were certified to ACS. The annual report was prepared and reviewed by officers and submitted to the ACS before the March 15 deadline.

Treasurer's Report - Terry Spittler

Consolidation within the agrochemical industry continues to contribute to our membership decline as fewer companies are represented. Travel resources and opportunities are also declining in academia and government agencies. In spite of declining AGRO membership, the division programming and financial support remain viable. We are noticing a strong following from other disciplines attending specific symposia, and are reorienting our recruiting efforts to attract more multi-disciplinary chemists.

Several years ago, we implemented controls on our traditional social and program expenditures to keep them within the scope of our income. This eliminated the need to sell capital assets in the recently depressed market to meet operating obligations: we are benefiting fully from the investment appreciation now taking place. Annual support continues to be strong from our core of patrons, and our book royalties remain above \$8000/yr.

Although we have a large educational endowment directed towards our educational and outreach programs,

we do not maintain separate operations and endowment reserves. We fund all of our established and optional functions from current income so as to maximize the amount in our working investment pool. In effect, our current management strategy maintains active programming, social and recruitment efforts without depleting our reserves in unsettled times.

Fertilizer Subdivision Report - Bill Hall & Herb MacKinnon

In addition to more programming this year than in recent years, the FERT sub-division sponsored an Environmental Quality and Agriculture Conference. Many members have returned to the roll due to a membership drive that raised the visibility of the sub-division. There are now about 250 members, but FERT needs additional active members to maintain the level of programming. The Florida and California Pesticide Workshops could offer a venue for advertising FERT.

Councilor's Report - Barry Cross, Joel Coats, Nancy Ragsdale, Judd Nelson

At the end of 2003 the Society expects a net deficit of \$3.1 million, which is \$1.9 million more than the approved budget. There were substantial shortfalls in advertising revenue, investment income and print subscription revenue.

The Committee on Economic and Professional Affairs (CEPA) reported that ACS members are having to cope with a record high 3.5% unemployment rate for chemists. A career publication "Foreign Born Guide for Chemical Professionals" has been revised with a new chapter on post 9/11 immigration guidance. M&E reported that the New York Meeting attracted 14,351 attendees. Overlapping and competing programming remains a problem and some individuals have submitted a paper to multiple Divisions. A task force will review this issue. In keeping with the objective of the National Meeting Long Range Financial Plan, M&E and the ACS BOD approved raising the advanced registration fee to \$285 for 2004. Membership Affairs reported a decline of 1% membership in the ACS in 2004. ACS is in discussions with American Society of Chemical Engineers on activities that can be combined. A merger is not under consideration.

At the Anaheim Meeting there are three petitions under consideration:

1. Petition for Electronic Balloting for Councilors, and Alternates from Local Sections and Divisions.
2. Petition to change the Division Annual Report Deadline. The deadline would be moved forward to not later than Feb 15 rather than March 15.

3. Petition for Membership Requirements for Teachers. The amendment would allow membership to those “fully certified, licensed, or otherwise qualified as a pre college teacher of chemistry or an allied science plus 3 years of employment as a chemistry teacher”.

The Agrochemicals Division supports all three petitions.

Membership Committee - Randy Weintraub & Chris Peterson

Randy and Chris propose to poll members to see if we are serving the members’ needs. Last year they sent letters to 90 students inviting them to meetings. Don Baker proposed looking for international members since much of industry is moving out of the United States. Allan Felsot will check into SETAC recruiting practices. Rod moved that we hold a retreat at an ACS center to investigate ways to find new members and broaden the appeal of the Agrochemicals Division. Bill Hall seconded the motion which passed unanimously. Don Wauchope will work on the idea and report at Philadelphia.

Publications Committee - Laura McConnell

The PICOGRAM was successfully published this spring with 5 half-page ads and 6 full-page ads. Information on the AG-LIST and advertising in the PICOGRAM was included on the back cover. Thanks to Terry Spittler, AGRO is using a new printing company (The Printing Center, Cornell, NY) for the PICOGRAM instead of ACS. We will now be able to see proofs prior to printing. We have now also included the entire AGRO program in the PICOGRAM with titles and authors in front of the abstracts for the convenience of our members. Lists of previous award winners, previous Division Chairs, and lists of AGRO books were omitted to make room for the program. Laura would like help with the website. If there is an individual who would like to take over this task, please get in touch with Laura. A special thank you goes out to Allan Felsot for proofing the PICOGRAM prior to submission to the printers.

Jim Seiber reported that there has been an explosion in the number of manuscripts submitted to the Journal of Agricultural and Food Chemistry as well as an increase in the number of pages published. The principal growth is in the Ag and Food area, while agrochemicals has remained stable. The electronic system has made submission easier. Willis Wheeler is the associate editor for the agrochemicals area. The need for reviewers is at a crisis point. Jim has placed advertisements for reviewers at the AGRO table. Symposia can be published if they do not qualify for publication as a book. The journal is trying to attract papers in metabolomics, proteomics and genetic materials.

Awards Committee - Jim Seiber

Jim Seiber has taken over the chairmanship of the Awards Committee from Joel Coats. Jim thanked Joel for 9 years of service as chair and for preparing the report for the Picogram. Steve Duke will receive the International award at the Spring 2004 meeting, John Clark at the Fall 2004 meeting. The committee is reviewing nominations for 2005. There was discussion of whether to continue the current practice of granting two awards each year. There are two sponsors of the award (DuPont and BASF), and both companies appear committed to their sponsorship. Jim asked us to consider three questions: 1) should the award be granted once or twice during each year; 2) should we give the award in a broader area of research than agrochemicals; and 3) should the company name be associated with the award. Jim was asked to discuss the award with the sponsoring companies and return with a report at the Philadelphia meeting. Rod suggested that we find a way to recognize sponsors. The executive committee agreed to write letters to the sponsors thanking them for support.

Finance Committee - Barry Cross

Last April there was concern expressed that there were significant losses in the Education Fund and we should consider a more conservative portfolio. At that time we were poised for an economic recovery and the potential for gains far outweighed the potential for losses, therefore no changes in fund allocation were adopted. We have now enjoyed a sustained year of economic and stock price growth and the Education Fund has nicely recovered its valuation. Now we face the situation where stocks are now well valued but can grow further with more economic growth. Our strategy should therefore be to begin now to transfer a percentage of our stock (suggested 10% now) into interest bearing securities such as inflation tagged treasuries. T. Rowe Price Spectrum Fund is a conservative investment vehicle and serves us well in good and bad economic cycles and should remain our vehicle for “near cash” investment. Income continues to decline from membership, the number of benefactors, and book royalties, but this has been offset by the Division’s recently adopted cost saving measures and will be further helped by increased funding from the ACS to Divisions. Barry moved that the Finance committee talk to its investment advisor, restate our goals and restructure gains of the Educational Endowment Fund. Bill Hall seconded the motion.

Hospitality Committee - David Smith, Jeff Jenkins

Eight companies donated to support of the coffee lounge in Anaheim. On Tuesday evening we will once again

join the Ag & Food Division for a joint social. All members, speakers and spouses are invited. The social will be held at Disneyland Hotel, Garden Terrace Room, Tuesday, March 29, 6-8 pm.

Nominating Committee - Jeanette Van Emon (2005 election); Rodney Bennett (2006 election) Balloting back on track for election by next meeting. Jeanette needs names for executive committee.

Public Relations Committee - Jeff Jenkins
Dr. Stephen Duke's International Award for Research in Agrochemicals has been noted in a public relations notice sent to five news organizations.

Education Committee - John Johnston
Young Scientists Research Recognition Award & Symposium:
There were five applications (12 in 2003) for the award. First Place went to Wei Zheng, University of California-Riverside; Advisor: Scott Yates (USDA). The Runner-Up was Keri Henderson, Iowa State University; Advisor: Joel Coats.
Next Competition: San Diego, Spring 2005
Deadline for receipt of applications: November 1, 2004

By-Laws Committee - Don Baker
Don is working to resolve discrepancies between by-laws and procedures. Any by-law changes should reflect what we actually do. Changes in by-laws must be sent to M&E before the annual meeting.

Committee on Patron Relations - Luis Ruzo
We have not yet received all the contributions from donors that we expect. There are only four contributors this year and contributions are down from previous years. Luis is working on a few other patrons.

E-mail Communications System - Tim Ballard & Terry Spittler set up the system using the ACS grant. There are about 1000 names on the list. Tim gets 2-3 dozen error messages after each e-mailing. Allan agreed to review the addresses and compare to those on the membership list. Al will provide FERT list to Bill Hall to correct email addresses.

Previous Business
Procedures Manual - Nancy Ragsdale
The manual is slowly coming to completion. An ad hoc review group met just prior to the business meeting. Nancy needs input from a few other people involved. Don can do preliminary review of concurrence between the by-laws and manual.

New Business
Regional Meetings - Rod will look for participants and encourage increased participation at regional and local section meetings.
National Chemistry Week - Rod participated in program for teachers and noted that we could use a specific program on agrochemicals for teachers. Don Baker is involved in science demonstrations in schools. Will Ridley can provide information for schools.
Projector - Terry Spittler proposed we purchase a projector for use by Agrochemicals Division. Allan Felsot seconded the motion. During discussion it was noted that the projector should be used only for Agrochemicals Division business. The motion carried. The Secretary was asked to select and purchase a projector.

Rod Bennett adjourned the meeting at 10:28 pm.

Respectfully submitted,
Aldos Barefoot, Secretary

COUNCILOR REPORT, ANAHEIM

At the Council meeting in Anaheim the Council selected F. Sherwood Rowland and Isiah M. Warner as candidates for 2005 President Elect. They join E. Ann Nalley who was certified as a petition candidate.

As of March 30 2004, 14,141 registrants attended the ACS Spring National Meeting. Council voted to set member dues for 2005 at the fully escalated rate of \$123.00. Membership of the ACS was 159,332 as of the year ending 2003. This represents a 1% decline in membership; however, the number of student members increased by 3.7% and the number of recent graduates increased by 50%. Council voted to dissolve the probationary Division of Laboratory Automation.

Three petitions on Electronic Balloting, changing Division Annual Report Deadline and Membership Requirements for Teachers were received and will be considered for action at the ACS Philadelphia Meeting. There were detailed presentations regarding ACS partnership with AIChE. There was strong support from the Council to develop an alliance that should benefit the membership of both societies.

Respectfully Submitted,
Barrington Cross and Joel Coats
Councilors Agro Division
May 16, 2004

*BYLAWS OF THE DIVISION OF AGROCHEMICALS of the AMERICAN CHEMICAL SOCIETY

Bylaw I. Name and Objects

Section 1. The name of this organization shall be the Division of Agrochemicals (hereinafter referred to as "the Division") of the AMERICAN CHEMICAL SOCIETY (hereinafter referred to as "the SOCIETY").

Section 2. The objects of the Division shall be to bring together persons particularly interested in agrochemicals, to consider all scientific aspects of chemistry relevant to the control of pests of agricultural or public health significance and to other methods for enhancing or modifying agricultural productivity, to develop and improve the professional stature of chemists with these interests, and to render whatever service it may to the scientific and lay communities on the topic of agrochemicals.

Bylaw II. Members and Affiliates

Section 1. Membership in the Division shall be open to all members of the SOCIETY. Application for membership shall be made in writing to the Secretary of the Division and shall be accompanied by one year's dues.

*Effective Approved, as amended, by the Committee on Constitution and Bylaws, acting for the Council of the American Chemical Society.

Section 2. A National Affiliate of the SOCIETY may apply to the Secretary to become a National Affiliate of the Division. Provided that Division dues established for National Affiliates are paid, a National Affiliate shall have all the privileges of membership in the Division except those of voting for or holding an elective position of the Division, voting on articles of incorporation or bylaws of the Division, or serving as a voting member of its Executive Committee.

Section 3. The Division may accept Division Affiliates who are not members or National Affiliates of the SOCIETY but who wish to participate in the activities of the Division. Such affiliates shall be entitled to all the privileges of membership in the Division save those withheld by the Bylaws of the SOCIETY.

Section 4. Members may resign their membership in the Division by submitting their resignation, in writing, to the Secretary during the year for which their dues are paid.

Section 5. The name of any member of the Division who is in arrears in payment of dues by as much as two years shall be stricken from the rolls. A member dropped for nonpayment of dues may be reinstated upon payment of arrearages.

Section 6. Affiliates shall retain affiliate status only so long as payment is made of Division dues. An affiliate's name is to be stricken from the rolls as soon as the affiliate is in arrears in the payment of dues.

Section 7. The anniversary date of Division members and National Affiliates of the Division shall coincide with their anniversary dates in the SOCIETY.

Bylaw III. Officers and Councilors

Section 1. The officers of the Division shall be a Chair, a Chair-Elect, a Vice-Chair, a Secretary, and a Treasurer. The Chair-Elect shall automatically succeed to the office of Chair upon expiration of the latter's term of office or if this office becomes vacant. The Vice-Chair shall automatically succeed to the office of Chair-Elect upon expiration of the latter's term of office or if this office becomes vacant. The offices of Secretary and of Treasurer may be held by one individual. Only MEMBERS are eligible to hold elective positions.

Section 2. The duties of the Chair shall be to preside at meetings of the Executive Committee, to carry into effect the decisions and recommendations of the Committee, to preside at stated meetings of the Division, and to appoint all committees except as otherwise provided.

Section 3. The duties of the Chair-Elect shall be to serve in the absence of the Chair of the Division and to act as Chair of the Program Committee.

Section 4. The duties of the Vice-Chair shall be to serve in the absence of the Chair-Elect and to act as Assistant Chair of the Program Committee, with particular emphasis on planning and developing technical programs.

Section 5. The duties of the Secretary shall be to keep minutes of all meetings of the Division and of the Executive Committee; to keep a roll of Division members and affiliates and to submit the same annually to the Executive Director of the SOCIETY for verification as provided in the Bylaws of the ~~national~~ SOCIETY; to conduct the business correspondence of the Division as assigned to the Secretary by the Chair or by the Executive Committee; to prepare and submit an annual report of Division activities to the SOCIETY as required in the SOCIETY's Bylaws; to perform such other duties as may, from time to time, be assigned ~~him~~ by the Chair or Executive Committee, or required by the SOCIETY's Bylaws. The Secretary shall send to each member, at least two weeks before the regular meetings of the Division, abstracts of papers to be presented at said meetings.

Section 6. The Treasurer shall act as custodian of the funds of the Division, collect dues and other revenues, and pay the bills of the Division after the same have been authorized by the Executive Committee. The Treasurer shall maintain accurate records of receipts and disbursements and shall submit a report of the financial condition of the Division at the annual meeting of the Division. The Treasurer shall furnish a surety bond, the premium for which shall be paid from Division funds.

Section 7. Councilors and Alternate Councilors shall represent the Division on the Council of the SOCIETY as provided in the Constitution and Bylaws of the SOCIETY.

Section 8. The Division shall have an Executive Committee, which shall consist of the officers of the Division, the Immediate Past Chair of the Division, and the Chairs, the Chairs-Elect, Councilors and Alternate Councilors, Vice-Chairs, and Immediate Past Chairs of Subdivisions, if any, and fifteen (15) Members-at-Large. The Chair of the Division shall serve as Chair of the Executive Committee.

Section 9. The officers of the Division other than the Chair and the Chair-Elect, Division Councilors and Alternate Councilors, shall be elected by mail ballot as described elsewhere in these bylaws.

Section 10. At the annual meeting of the Division, the Executive Committee shall appoint a Nominating Committee consisting of at least three members, one of whom shall be the Immediate Past Chair of the Division, who shall serve as Chair of this Committee. This Committee shall nominate two candidates for the office of Vice-Chair, and at least ten (10) candidates for the positions as Members-at-Large to be filled on the Executive Committee. This Committee shall nominate candidates for each of the following offices to be filled: Councilor, Alternate Councilor, Secretary, and Treasurer. This Committee shall submit a report in writing to the Chair of the Division for preparation of the ballot to be mailed to the membership. Additional nominations may be made in writing by any group of at least five members and presented to the Chair of the Division not less than three months prior to the fall meeting.

Section 11. Officers and Members-at-Large shall be elected by the members and Division Affiliates of the Division. Only members of the Division may vote for Councilors and Alternate Councilors. The Secretary or other designated officer of the Division shall prepare an election ballot on which shall appear the names in order chosen by lot of all candidates nominated and found willing to serve. In all Division balloting conducted by mail, the ballot voted shall be sealed, without voter identification, in a special ballot envelope. The special ballot envelope, bearing no voter

identification, shall be enclosed in a larger envelope upon which—or within which, on a separate slip—shall be hand-inscribed the name of the member voting; the larger envelope shall then be sealed and forwarded to the Chair of the Tellers Committee. The Tellers shall count the ballots thus received, using the list of members provided by the Secretary to verify the eligibility of all those voting. Any ballot envelope not validated by the voter's accompanying hand-inscribed name shall be rejected. The Secretary shall set and announce in advance of the balloting the interval during which ballots must be received to be counted; this interval shall not be less than four nor more than seven weeks following the ballot mailing. The Tellers Committee, appointed by the Chair of the Division, shall be responsible for counting all valid ballots received within the interval and shall certify the results to the Secretary, who shall in turn certify the results to the SOCIETY, the elected officers, and the Division. Elections are to be by plurality, should there be more than two candidates for an office. Resolution of a tie vote shall be made by the Executive Committee.

Section 12. The Chair, the Chair-Elect, the Vice-Chair, the Secretary, and the Treasurer of the Division shall serve for one year or until their successors are elected.

Section 13. The terms of office of the Members-at-Large of the Executive Committee shall be three years. Five Members-at-Large shall be elected each year.

Section 14. The terms of Councilors and Alternate Councilors and all officers excluding the Chair, Chair-Elect, and Vice-Chair, shall begin on January 1 following their election. The terms for Chair, Chair-Elect, and Vice-Chair shall begin at the conclusion of the fall meeting of the SOCIETY.

Section 15. Vacancies in offices other than Chair and Chair-Elect shall be filled by the Executive Committee. Incumbents so selected shall serve until the next regular election.

Bylaw IV. Councilors

The Division shall have Councilors and Alternate Councilors whose terms of office shall be three years. Alternate Councilors shall serve only for specific meetings of the Council when a Councilor is not able to attend.

Bylaw V. Committees

Section 1. There shall be a Program Committee, consisting of three or more members, one of whom shall be the Chair-Elect of the Division, who shall serve as Chair of the Committee. A second member of the Committee shall be the Vice-Chair. The Program Committee shall have the entire responsibility for organizing the program of papers for all Division meetings. It shall work cooperatively with other Divisions of the SOCIETY and other bodies in planning joint sessions and symposia of mutual and timely interest.

Section 2. There shall be a Membership Committee of three or more members. This Committee shall aggressively promote membership in the Division by members of the SOCIETY.

Section 3. There shall be a Finance Committee of two or more members. This Committee shall audit the accounts of the Treasurer prior to the business meeting of the Division and report its findings at the annual meeting. This Committee shall advise the Executive Committee on financial resources.

Section 4. There shall be an Awards Committee of at least six members. This Committee shall maintain and develop the Division and International Awards Programs.

Section 5. There shall be a Hospitality Committee of at least two members. This Committee will direct social events in coordination with other committees and maintain a hospitality table at Division meetings.

Section 6. There shall be a Publication Committee of at least three members. This Committee shall be responsible for publication of the Division newsletter, *PICOGRAM*, and other Division publications.

Section 7. Special committees may be appointed to consider, conduct, and report upon such special matters as may be delegated to them.

Section 8. Except where otherwise provided, committee appointments shall be made by the Chair, with the advice and approval of the Executive Committee.

Bylaw VI. Dues

Section 1. Members of the Division shall pay annual dues, the exact amount to be decided by the Executive Committee. Dues are payable in advance. Members who have been granted emeritus status by the SOCIETY and who are interested in the work of the Division shall be granted all privileges of Division membership without the payment of annual dues.

Section 2. Affiliates shall pay annual dues of \$2.00 more than members except that Division Affiliates who are regularly matriculated students specializing in a chemical science shall pay annual dues of an amount to be decided by the Executive Committee.

Bylaw VII. Subdivisions

Section 1. Composition. The Division may sponsor Subdivisions devoted to specialized fields within the area of Division interest. Membership in the Division shall be a requirement for membership in a Subdivision.

Section 2. Formation. Formation or discontinuance of a Subdivision shall be at the discretion of the Executive Committee of the Division. Steps to initiate a Subdivision may be made by petition of a group of Division members to the Executive Committee or by the action of the Executive Committee. The scope of the activities of any Subdivision shall be defined by the Executive Committee.

Section 3. Officers. Upon approval of the formation of a Subdivision, the Executive Committee of the Division shall appoint a Chair, Chair-Elect, Vice-Chair, and Secretary for the Subdivision. The Chair-Elect shall assume the office of Chair after one year. In succeeding years the Subdivision shall elect at the annual meeting a Chair-Elect and a Secretary. The Chair, a Chair-Elect, and Secretary shall constitute a Steering Committee for the Subdivision. This Steering Committee shall report through the Chair of the Subdivision and be responsible to the Executive Committee of the Division, of which Subdivision Chairs shall be members *ex officio*.

Section 4. Funds. The necessary expenses for each Subdivision shall be authorized by the Executive Committee of the Division from Division funds and shall be paid by the Treasurer of the Division upon the usual authentication.

Bylaw VIII. Meetings

Section 1. There shall be a meeting of the Division at each national meeting of the SOCIETY unless the Executive Committee votes otherwise, provided the requirements for a minimum number of meetings as specified in the SOCIETY Bylaws shall be met.

Section 2. The annual meeting of the Division shall be held at the fall meeting of the SOCIETY. Division business requiring vote of the membership shall be conducted only at this meeting, except as provided elsewhere in these bylaws. However, voting by the membership may be conducted by mail or as directed by the Executive Committee.

Section 3. Special meetings of the Division may be called by the Executive Committee, provided notice is given to the membership in writing or by publication in *Chemical & Engineering News* at least two months in advance. Special meetings may not be held within one month before or after a national meeting.

Section 4. Fifteen (15) members of the Division shall constitute a quorum for the conduct of business.

Section 5. The fee for registration at any special meeting shall be decided by the Executive Committee in accordance with the Bylaws of the SOCIETY.

Section 6. The rules of order in the conduct of Division meetings not specifically provided in these bylaws or in the SOCIETY's documents shall be the most recent edition of *Robert's Rules of Order, Newly Revised*.

Bylaw IX. Papers

Section 1. The Program Committee may approve or reject papers submitted for presentation before any meeting of the Division.

Section 2. The rules for papers presented before meetings of the SOCIETY as outlined in the Bylaws and Regulations of the SOCIETY shall govern the Division.

Bylaw X. Amendments

Section 1. These bylaws may be amended at any annual meeting of the Division by a two-thirds (2/3) vote of the members present. All amendments shall be submitted in writing to the Secretary at least sixty (60) days prior to the meeting. Upon approval of the Executive Committee, the Secretary shall send the text of the proposed amendment to the members of the Division at least thirty (30) days prior to the annual meeting.

Section 2. Amendments shall become effective upon approval by the Committee on Constitution and Bylaws, acting for the Council, unless a later date is specified.

Bylaw XI. Dissolution

Upon the dissolution of the Division, any assets of the Division remaining thereafter shall be conveyed to such organization then existent as is dedicated to objects similar to those of the Division and the AMERICAN CHEMICAL SOCIETY, or to the AMERICAN CHEMICAL SOCIETY, so long as whichever organization is selected by the governing body of the Division at the time of dissolution shall be exempt under Section 501(c)(3) of the Internal Revenue Code of 1954 as amended or under such successor provision of the Code as may be in effect at the time of the Division's dissolution.

American Chemical Society
DIVISION OF AGROCHEMICALS
ABSTRACTS

228th ACS National Meeting
Philadelphia, PA, August 22-26, 2004

A. S. Felsot, *Program Chair*

Symposia Location: Courtyard Marriot
Poster Session: Pennsylvania Convention Center

OTHER SYMPOSIA OF INTEREST:

Advances in Microbial Food Safety (see *AGFD*, Tue, Wed, Thu)

Lipid Oxidation and Antioxidants: Chemistry, Methodologies, and Health Effects (see *AGFD*, Sun, Mon)

A Systems Biology Approach to Hormone Active Agents in the Environment (see *TOXI*, Tue)

Emerging Applications of Accelerator Mass Spectrometry to Toxicology and Pharmacokinetics (see *TOXI*, Sun)

Opportunities for Analytical Chemists in the Pharmaceutical Industry (see *ANYL*, Tue)

Environmental Aspects of Pharmaceuticals and Personal Care Products (see *ENVR*, Wed, Thu)

Environmental Fate and Treatment of Persistent Halogenated Compounds (see *ENVR*, Mon, Tue, Wed)

PCBs in Freshwater and Marine Sediments: Transport, Transformation and Treatment (see *ENVR*, Sun, Mon)

AGFD Award for the Advancement of Agricultural and Food Chemistry (see *AGFD*, Tue)

SOCIAL EVENT:

Social Hour: Tue

BUSINESS MEETING: Sun

SUNDAY MORNING

Section A

Translation of Pesticidal Activity from Lab to Greenhouse to Field

J. W. Lyga and G. Theodoridis, *Organizers*

9:00 — Introductory Remarks.

9:10 —**1.** Synthesis and antifungal activity of novel substituted pyridopyrimidinones and quinazolinones: The discovery of proquinazid, a new and potent powdery mildew control agent. **T. P. Selby**, C. G. Sternberg, J. F.

Bereznak, R. A. Coats, E. A. Marshall

9:40 —**2.** Crocacins A and D – novel natural products as leads for agrochemicals. **P. J. Crowley**, I. H. Aspinall, K. Gillen, C. R. A. Godfrey, I. M. Devillers, G. R. Munns, J. Phillips, O. A. Sageot, J. Swanborough, R. Viner, P. A. Worthington, J. Williams

10:10 — Intermission.

10:30 —**3.** Thiamethoxan: A neonicotinoid precursor converted to clothianidin in insects and plants. **P. Jeschke**, R. Nauen

11:00 —**4.** Interaction of fipronil and its analogs with GABA receptors. **Y. Ozoe**, J. G. Scott

11:30 —**5.** New termiticides necessitate changes in efficacy testing: A case study of fipronil. **C. J. Peterson**, T. L. Wagner, T. G. Shelton, J. E. Mulrooney

SUNDAY AFTERNOON

Section A

Synthesis of Agrochemicals: Good Ideas that Never Made It to Products

J. W. Lyga and G. Theodoridis, *Organizers*

1:30 — Introductory Remarks.

1:35 —**6.** Fungicidal properties of acivicin and its derivatives. **A. C. O'Sullivan**, M. R. Dobler, H. G. Brunner, P. Chemla

2:05 —**7.** 2-Acylimino-3-phenylthiazolines: A new family of bleaching herbicides. **Y. Sanemitsu**, S. Kawamura, S. Hashimoto, T. Nagatomi, Y. Yamada

2:35 —**8.** Discovery of insecticidal cyanine dyes. **R. N. Henrie II**, T. G. Cullen, B. J. Dugan, Y. L. Zhang, Y. Deng, S. Simpson, B. Black, F. Schuler

3:05 — Intermission.

3:20 —9. Aphicidal N-hydroxy and N-amino benzimidazoles. **S. D. Crawford**, B. J. Dugan, R. N. Henrie II, W. H. Yeager, Z. M. Elshenawy, H. R. Wendt, J. W. Lyga, J. A. Argentine, D. M. Roush, F. J. Zawacki, S. W. Szczepanski

3:50 —10. Panel Discussion: Challenges in pesticide translation from lab to greenhouse to field. **B. Black**

MONDAY MORNING

Section A

International Award for Research in Agrochemicals: The Yin and Yang of Pesticide Toxicology--A Symposium in Honor of John M. Clark

Mode of Action

Cosponsored with DuPont Crop Protection

R. O. Mumma, *Organizer, Presiding*

8:30 — Introduction and Award Presentation.

8:40 —11. Challenges and future of pesticide toxicology. **J. M. Clark**

9:05 —12. Model of the voltage-gated sodium channel in relation to the action process of pyrethroids. **F. Matsumura**

9:30 —13. Isoform-dependent effects of pyrethroids on mammalian sodium channels. **D. M. Soderlund**

9:55 —14. Mode of action of nonfungicidal anti-blast chemicals. **I. Yamaguchi**

10:20 —15. Insecticide symptom phenotyping: Lessons learned from "Toxicology of Insecticides". **J. A. Argentine**

10:45 —16. *Tribolium* genomics: Sleuthing for novel targets. **R. W. Beeman**, S. J. Brown, M. D. Lorenzen, Y. Park

11:10 —17. Paramecium behavior and insights into insecticide activity. **J. Van Houten**

11:35 —18. Comparative action of cismethrin and deltamethrin on voltage-sensitive calcium channels associated with mammalian presynaptic nerve terminals. **S. B. Symington**, J. M. Clark

Section B

Is Organic Food Healthier Than Conventional Food?

J. D. Rosen, *Organizer, Presiding*

8:30 — Introduction: Why have we asked the question?

8:45 —19. The risks from pesticides on food: Synthetic vs. organic--can we really know? **C. F. Chaisson**

9:10 —20. Are synthetic pesticide residues in food a danger to human health? **M. F. Hare**

9:35 —21. Is the content of disease-reducing phytochemicals influenced by certified organic crop production practices? **A. S. Felsot**

10:00 — Intermission.

10:15 —22. Is organic food more nutritious? **R. Kava**

10:40 —23. Do organic animal husbandry practices make beef and dairy products safer? **G. C. Smith**, J. D. Tatum, J. N. Sofos, K. E. Belk, J. A. Scanga

11:05 —24. Is organic farming better for the environment? **A. Avery**

11:30 —25. Is genetically-modified food unsafe? **C. S. Prakash**

MONDAY AFTERNOON

Section A

International Award for Research in Agrochemicals: The Yin and Yang of Pesticide Toxicology--A Symposium in Honor of John M. Clark

Insect Resistance and Management; Environmental Toxicology

Cosponsored with DuPont Crop Protection

R. O. Mumma, *Organizer, Presiding*

1:20 — Introductory Remarks.

1:25 —26. Evolutionary plasticity of monooxygenase mediated insecticide resistance. **J. G. Scott**, S. Kasai

1:50 —27. Role of esterases in insect resistance to insecticides. **K. Y. Zhu**

2:15 —28. Mass spectral approach to identify an inducible cytochrome P450 in Colorado Potato Beetle (CPB). **J. Nelson**, J. R. Gao, J. M. Clark

2:40 —29. Management of head lice resistance to pyrethroids. **S. H. Lee**, J. M. Clark, K. S. Yoon, J. R. Gao, S. B. Symington

3:05 — Intermission.

3:20 —30. Fate of monoterpenoid insecticides in the environment. **J. R. Coats**, J. A. Grodnitzky, J. B. Belden, D. Hu

3:45 —31. Insecticide exposure in the MPTP-treated C57 mouse model of Parkinson's disease. **J. R. Bloomquist**

4:10 —32. Mitogen activated protein kinases as targets for endocrine disrupting pesticides. **D. M. Tessier**

4:35 —33. Mitigating golfer exposure to turfgrass pesticides.
R. A. Putnam, J. M. Clark

Section B

Is Organic Food Healthier Than Conventional Food?

J. D. Rosen, *Organizer*

A. S. Felsot, *Presiding*

1:30 — Introductory Remarks.

1:35 —34. Does irradiated food pose a health risk? **D. W. Thayer**

2:00 —35. The ACB's (alkylcyclobutanones) of food irradiation. **C. H. Sommers**

2:25 —36. Does "Consumer Reports" publish accurate information on organic food issues? **J. D. Rosen**

3:00 — Intermission.

3:15 —37. Is the media covering organic food issues fairly? **A. Avery**

3:40 —38. Who is funding the organic-only food movement? **D. Martosko**

4:05 —39. Are free-range chickens microbiologically safer? **J. S. Bailey**, D. E. Cosby

4:30 —40. Safety of natural foods compared to conventional foods: What are the risks? **J. W. Finley**

MONDAY EVENING

Section A

Sci-Mix

A. S. Felsot, *Organizer*

8:00 - 10:00

61-73, 80-81, 84, 88, 97, 103-104. See subsequent listings.

TUESDAY MORNING

Section A

Perchlorate Contamination and Remediation in Agricultural Products and Soils

P. F. Kane, W. Robarge, and B. Hall, *Organizers*

8:30 — Introductory Remarks.

8:35 —41. The perchlorate debate: Political or scientific correctness? **J. Long**

9:00 —42. Perchlorate in the environment: The epidemiological studies find no adverse outcome. **S. H. Lamm**, C. Goebel

9:25 —43. Perchlorate dose-response relationship and the likelihood of effects at environmentally relevant levels.
R. C. Pleus

9:50 —44. Rapid determination of perchlorate anion in foods by ion chromatography-tandem mass spectrometry. **A. J. Krynetsky**, R. A. Niemann, D. A. Nortrup

10:15 — Intermission.

10:30 —45. Ion chromatographic determination of perchlorate in crops by on-line enrichment and conductivity detection. **R. A. Niemann**, A. J. Krynetsky, D. A. Nortrup

10:55 —46. A production method for the analysis of perchlorate by ion chromatography/mass spectrometry. J. Mathew, J. Gandhi, J. Zweigenbaum, **J. Hedrick**

11:20 —47. Accelerated solvent extraction (ASE) and ion chromatography-mass spectrometry (IC-MS) for the determination of perchlorate in solid samples. **B. E. Richter**, R. Slingsby, D. Later, S. E. Henderson

Section B

General Paper, Oral

A. S. Felsot, *Organizer*

9:05 — Introductory Remarks.

9:10 —48. A new mixed-mode weak cation-exchange SPE Sorbent for the LC-MS determination of paraquat and other quaternary ammonium compounds. **M. S. Young**, K. M. Jenkins

9:35 —49. Latest developments in the "quick, easy, cheap, effective, rugged, and safe" (QuEChERS) method for chemical residues in food. **S. J. Lehotay**, K. Mastovska

10:00 —50. Assessing risk of genomic damage in crops from pesticides. **D. W. Boerth**, E. Eder, J. R. Stanks

10:25 — Intermission.

10:40 —51. Non-uniformity in riparian buffer zone contaminant mitigation function: Role of critical areas in agrochemical export. **J. T. Angier**, G. W. McCarty, C. P. Rice, K. Bialek

11:05 —52. Synthesis and evaluation of algicidal analogs from a chromene amide in *Amyris texana*. **K. M. Meepagala**, K. K. Schrader, C. L. Burandt, S. O. Duke

11:30 —53. Application of optical properties of the vinyl-silsesquioxanes hybrid films for agriculture. X. Zhang, **L. Hu**, H. Ren, Y. Huang

TUESDAY AFTERNOON

Section A

Perchlorate Contamination and Remediation in Agricultural Products and Soils

P. F. Kane, W. Robarge, and B. Hall, *Organizers*

- 1:00** —**54.** Refinement of the IC perchlorate procedure for fertilizer materials containing high TDS. **W. P. Robarge**, G. Rameriz
- 1:25** —**55.** Selective ion exchange for perchlorate separation, recovery, and environmental forensics. **B. Gu**, H. Bao, J. Horita, G. M. Brown, N. C. Sturchio, J. F. Bohlke
- 1:50** —**56.** Photo-oxidation of chloride to perchlorate in the presence of titanium dioxide and nitrate. **G. Miller**, R. Kempley, G. Awadh, K. Richman
- 2:15** —**57.** mGCW in situ bioreactor technology for accelerated in situ removal of perchlorate and other nitrogenous compounds from soil and groundwater. **J. Mueller**, D. Hill, K. Bolanos-Shaw, A. Seech
- 2:40** — Intermission.
- 3:00** —**58.** From missiles to mitigation: Perchlorate treatment and remediation options. **T. E. T. Gillogly**
- 3:25** —**59.** EPA Perspective on Health Risks Posed by Perchlorate: Mode of Action for Hypothalamic-Pituitary-Thyroid (HPT) Disruption and Life Stage Concerns. **A. M. Jarabek**
- 3:50** —**60.** Panel discussion on the progress of the National Academy of Sciences' review of health impacts and EPA's establishment of an MCL for perchlorate. **W. L. Hall**, W. P. Robarge

Section B

Agrochemical Education Awards for Graduate Student Travel: Poster Presentations

J. J. Johnston, *Organizer*

2:00 - 4:00

- 61.** The metabolism of Fenthion in fish. **O. Bawardi**, B. Furnes, D. Schlenk
- 62.** Influence of grassed buffers on agrochemical movement to ground water. **D. D. Brame**, R. F. Spalding
- 63.** Perchlorate exposure in mammals through drinking water. **Q. Cheng**, L. Perlmutter, P. N. Smith, S. T. McMurry, **T. A. Anderson**
- 64.** Development of subacute bioassays for the assessment of transgenic corn (*Zea mays*) expressing the Bt protein. **B. W. Clark**, J. R. Coats

65. Conversion of triadimefon to triadimenol in turfgrass. **J. J. Doherty**, R. N. Edwards, R. A. Putnam, J. M. Clark

66. Degradation of chloroacetanilide herbicides by anodic Fenton treatment. **C. L. Friedman**, A. T. Lemley

67. Actions of λ -cyhalothrin isomers on voltage-sensitive calcium channels at rat brain presynaptic nerve terminals. **R. K. Frisbie**, S. B. Symington, J. M. Clark

68. In vitro metabolism of the avicide 3-chloro-4-methylaniline hydrochloride in hepatic and renal cellular preparations. **D. A. Goldade**, J. D. Tessari, J. J. Johnston

69. Mass balance of ¹⁴C-metolachlor in a phytoremediation system. **K. L. Henderson**, J. B. Belden, J. R. Coats

70. Removal of chloroacetamide herbicides and neutral degradates during simulated drinking water treatment. **M. L. Hladik**, E. J. Bouwer, A. L. Roberts

71. Serial invasive signal amplification reaction for the genotyping permethrin-resistant (kdr-type) head lice, *Pediculus capitis*. **H. J. Kim**, S. B. Symington, **S. H. Lee**, J. M. Clark

72. Detection of residues of tetracycline antibiotics in soil fertilized with manure and waste water using Enzyme Linked Immunosorbent Assay (ELISA) and high performance Liquid Chromatography with electrospray ionization Tandem Mass Spectrometry (LC/MS/MS): Correlation between results of screening and confirmatory tests. **P. Kulshrestha**, R. F. Giese Jr.

73. Improved artificial rearing apparatus for the human head louse allows the determination of resistance to formulated pediculicides and repellency. **K. S. Yoon**, **J. P. Strycharz**, J. M. Clark

Section C

General Posters

A. S. Felsot, *Organizer*

2:00 - 4:00

- 74.** Efficiency of microfertilizers' application in potato-growing. **T. E. Ostanaqulov**, A. T. Ostanaqulova, E. O. Otamurodov, X. Boymurodov
- 75.** Aerobic metabolism of chlorsulfuron in Spanish soil. **J. A. McMillan**, D. L. Ryan
- 76.** Fate of herbicides in the riparian buffer zone of a small first-order agricultural watershed. **K. Bialek**, J. Angier, K. Wilcox, G. W. McCarty, C. P. Rice
- 77.** Influence of subsurface drains on runoff of pesticides from Mississippi River alluvial soil of Southern Louisiana: Deep tillage needed. **L. M. Southwick**, B. C. Grigg, J. L. Fous
- 78.** Solar radiation, relative humidity, and soil water effects on

metolachlor volatilization. **L. L. McConnell**, J. H. Prueger, T. J. Gish, L. G. Mckee, J. L. Hatfield, W. P. Kustas

79. Sorption and desorption of Flumioxazin to soil, clay minerals, and ion-exchange resins. **W. K. Vencill**, J. A. Ferrell

80. The effect of natural organic matter for the degradation of chlorpyrifos-methyl in aqueous solutions. **X. Guo**, T. Wu, U. Jans

81. Role of reduced sulfur species in promoting the degradation of parathion and parathion-methyl in the environment. **T. Wu**, U. Jans

83. Degradation of chlorothalonil in irradiated water/sediment systems. **J. W. Kwon**, K. L. Armbrust

84. Comparison of PRZM-3 model predictions to prospective groundwater data for evaluating the movement of sulfentrazone and sulfentrazone 3-carboxylic acid into soil pore water and groundwater in rural Indiana. R. T. Morris, **J. C. Holihan**, T. L. Estes

85. Improvements to the Pesticide Root Zone Model (PRZM) for use in linked watershed modeling system. **J. M. Cheplick**

86. Watershed characterization for pesticide exposure assessment using GIS and remote sensing. M. Ball, **C. Holmes**, S. Kay, M. Matella

87. Watershed modeling by linking PRZM, RICEWQ, and RIVWQ. **A. M. Ritter**, W. M. Williams

88. Development of soy-based lithium grease. A. Adhvaryu, B. K. Sharma, **S. Z. Erhan**

89. Evaluations of *Myrothecium verrucaria* as a bioherbicide. **R. E. Hoagland**, H. K. Abbas, C. D. Boyette

90. Herbicidal 6-azolylmethyl-2-pyridinecarboxamides. **T. M. Stevenson**, C. M. Dubas-Cordery, M. Ruggeiro, K. M. Patel, E. M. Marshall, M. Luong, M. Lasut, B. Kamireddy, E. W. Reed

91. Phenylpyrazolopyridines, part 1: Promising herbicides for rice. **T. M. Stevenson**, B. A. Crouse, W. M. Murray, T. V. Thieu, T. Pappas

92. Phenylpyrazolopyridines, part 2: Broad spectrum herbicides. **T. M. Stevenson**, B. A. Crouse, T. P. Selby, B. K. Smith

93. o-Sulfamidobenzoylcyclohexanedione herbicides with a dual site of action. **T. M. Stevenson**, K. M. Patel, V. Wittenbach, W. Hanna, G. Armel

94. Isoxazolylheterocycles as fungicides and insecticides. **T. M. Stevenson**, B. A. Crouse

95. Role of bromine containing 4-thiazolidinones as potential antifungal agents. **D. R. K. Sandhar**

96. Synthesis and biological activity of thiazole substituted 3H-1,2,4-triazolin-3-one fungicides. **P. L. Sharpe**, T. P. Selby, G. M. Koether, J. P. Daub

97. Novel aphicides containing benzimidazole. **B. J. Dugan**, R. N. Henrie II, S. D. Crawford, S. W. Szczepanski, W. H. Yeager, Z. M. Elshenawy, H. R. Wendt, J. W. Lyga, J. A. Argentine, D. S. Rosen, F. J. Zawacki, B. Hu, R. K. Amaning

98. 4-Phenoxyimidazole insecticides and acaricides. **T. M. Stevenson**, T. P. Selby, T. V. Thieu, G. Seburyamo, D. L. Piotrowski, L. L. Geist

99. 4-Phenoxyimidazole insecticides. **T. M. Stevenson**, D. L. Piotrowski, R. Kucharczyk, F. Ali, C. Giffin

100. 4-Pyrazolopyrimidine insecticides and acaricides. **T. M. Stevenson**, T. V. Thieu, D. J. Robinson, D. L. Piotrowski, B. C. Stokes

101. Analysis of oxamyl in cotton gin trash by LC/MS/MS. **J. P. McClory**, R. M. Henze

102. Characterizing 3-chloro-p-toluidine hydrochloride on rough hulled rice and ethyl cellulose coated rice baits using high performance liquid chromatography. **R. S. Stahl**, C. A. Furcolow, J. C. Hurley, J. J. Johnston

103. Stability/availability of tetracycline in rabies vaccine baits. **J. J. Johnston**, T. M. Primus, T. Buettgenbach, M. J. Goodall, R. B. Chipman, D. Slate

104. Chiral pesticide analysis using HPLC with CD and fluorescence detection. **A. L. Jenkins**, W. A. Hedgepeth, R. A. Larsen

WEDNESDAY MORNING

Section A

Agrochemical Residues and Metabolism

T. A. Wehner and J. J. Johnston, *Organizers*
D. Smith, *Organizer, Presiding*

8:15 — Introductory Remarks.

8:20 — **105.** Ractopamine: Metabolism, tissues residues, and methods for analysis in livestock. **M. P. Turberg**, J. E. Dalidowicz, J. W. Moran, D. E. Kiehl, A. L. Donoho

9:15 — **106.** Tylosin: Mobility in a manure-soil matrix and dissipation in surface water. **K. L. Henderson**, T. A. Phillips, D. Hu, T. B. Moorman, J. R. Coats

9:40 — **107.** Influence of organic matter amendments on the persistence of endosulfan in soils. **I. I. Bashour**, R. M. Al-Hassan, N. S. Kawar

10:05 — Intermission.

10:20—108. Degradation of disulfoton, thiometon and phorate promoted by reduced sulfur species. **Q. Gan**, U. Jans

10:45—109. Development of analytical methods for environmental detection and quantification of the Bt protein from corn (*Zea mays*). **B. W. Clark**, J. R. Coats

11:10—110. Invertebrate digestive fluids for soil Bt protein extraction. **G. Shan**, R. A. Herman, J. Wolt, D. E. Weston, L. M. Mayer

11:35—111. Fate of the fumigant [¹⁴C] furfural in soil under anaerobic conditions. **M. F. Kovacs Jr.**, A. C. Katz, W. E. Gledhill, G. J. Burger, J. A. Norton

Section B

Metals Contamination in Agricultural Products and Soils: Methodology, Monitoring, Regulation, and Remediation

P. F. Kane, W. Robarge, and B. Hall, *Organizers*

9:00 — Introductory Remarks.

9:05—112. History and development of metals regulation in fertilizers. **W. L. Hall**

9:25—113. European regulation relating to cadmium in fertilizers. **I. Van Hauteghem**

9:50—114. Risk assessment for cadmium in phosphate fertilizers. **R. L. Chaney**, P. G. Reeves, J. A. Ryan

10:15 — Intermission.

10:40—115. Extraction of arsenic and lead from mineral fertilizer containing arsenopyrite and galena-hydroponic plant uptake and pH effects. **P. J. Eberhardt**

11:05—116. A generalized trace element mass balance model for cropland soils: Arsenic and cadmium. **A. C. Chang**, W. Chen, A. L. Yosef, S. Kim, M. Khosravifard

11:30—117. Producing a product-specific metals risk assessment for evaluation of As in fertilizer. **L. Shull**, M. Jones, M. Bowland, L. Campe, D. Kmetzo

WEDNESDAY AFTERNOON

Section A

Agrochemical Residues and Metabolism

D. Smith and J. J. Johnston, *Organizers*

T. A. Wehner, *Organizer, Presiding*

1:00 — Introductory Remarks.

1:05—118. Metabolism of melengestrol acetate (MGA) in the bovine: Biological activity assessment of tissue residues and implications for human food safety. **D. A. Merritt**, E. M. Wilson, R. A. Martin, J. A. Hamrick, R. I.

Kalman, J. T. Minges, D. J. Russell, J. E. Guido, J. F. Boucher, J. W. Lauderdale

2:00—119. Determination of desmosterol concentration in a reference standard over time using cholesterol as an internal standard in a high performance liquid chromatography method. **R. S. Stahl**, C. A. Furcolow, M. J. Goodall, D. L. Griffin, J. J. Johnston

2:25—120. Use of analyte protectants to improve gas chromatographic analysis and quantitation of pesticide residues in biotic matrices. **K. Mastovska**, S. J. Lehotay

2:50 — Intermission.

3:10—121. The determination of antibiotic residues in animal tissues and honey; sample preparation for LC-MS analysis. **M. S. Young**, K. M. Jenkins

3:35—122. Metabolites of chlorphacinone in California ground squirrels, pocket gophers and mountain beavers. **T. M. Primus**, D. J. Kohler, B. A. Kimball, J. J. Johnston

4:00—123. Metabolism of methomyl in grapes. **D. L. Ryan**, W. T. Zimmerman, J. A. McMillan

4:25—124. Biotransformation of [¹⁴C]-phenylbutazone after oral or intravenous administration to cattle. **D. Smith**, J. K. Huwe, M. Lorentzsen, G. E. Harrington

Section B

Metals Contamination in Agricultural Products and Soils: Methodology, Monitoring, Regulation, and Remediation

P. F. Kane, W. Robarge, and B. Hall, *Organizers*

1:15—125. Rapid and accurate determination of total metals in fertilizers by ICP/MS after hotplate digestion with refluxing 10:1 HNO₃/HCl. **N. S. Bloom**

1:40—126. Digestion comparison of hotplate vs. microwave methods for fertilizer metals. **J. Bartos**, P. F. Kane

2:05—127. A case for contaminant control in trace metal analytical protocols: Covered vs. uncovered reaction beakers. **O. O. Offiah**, W. Bontoyan, P. J. Sweeney, K. McManus

2:30—128. Trace elements analysis in commercial fertilizer for California regulation. **M. Lee**, H. Welte, S. Kobata

2:55 — Intermission.

3:15—129. Preparing fertilizer materials for laboratory analysis of trace metal and nutrient analysis. **G. Latimer**

3:40—130. Using collaborative studies to define the detection limit for an analytical protocol: A proposal. **W. P.**

Robarge, C. Proctor

- 4:05** —**131.** Development and use of fertilizer reference materials to assess trace metals methodology. W. L. Hall, D. Averitt, **J. H. Falls**
- 4:30** —**132.** Survey of state and industry metals monitoring of US fertilizer materials. **W. C. Herz**, W. L. Hall, J. E. Gliksmann

Section C

Agrochemicals and Watershed-Scale Modeling: Solutions for Water Quality Management

Watersheds and Resource Conservation: CEAP and SWAT

R. D. Wauchope, B. Hall, and A. C. Barefoot, *Organizers*

- 1:30** — Introductory Remarks.
- 1:35** —**133.** P Index validation via monitored data and SWAT modeling. **T. L. Veith**, A. N. Sharpley, J. L. Weld
- 2:05** —**134.** Application of the Soil and Water Assessment Tool (SWAT) to assess environmental concentrations of an agricultural pesticide and the potential benefits of best management practices. **M. F. Winchell**, T. L. Estes, S. S. Alexander, R. Srinivasan
- 2:35** —**135.** Utilizing watershed-scale models for regulatory risk assessment. **C. D. Graff**, A. M. Sadeghi, C. J. Hapeman, A. Linda
- 3:05** — Intermission.
- 3:20** —**136.** Characterization of fate and transport of isoxaflutole, a soil-applied corn herbicide in surface water. **T. S. Ramanarayanan**, B. Narasimhan, R. Srinivasan
- 3:50** —**137.** Measuring environmental benefits of conservation practices: The Conservation Effects Assessment Project. **D. A. Bucks**, M. Wertz, S. Shafer
- 4:20** —**138.** Using USDA-Agricultural Research Service long-term watershed hydrology and water quality observations to estimate the quality of model predictions of the Conservation Effects Assessment Program (CEAP). **T. C. Strickland**, D. G. Sullivan, R. D. Wauchope, D. D. Bosch, T. T. Potter

THURSDAY MORNING

Section A

Agrochemicals and Watershed-Scale Modeling: Solutions for Water Quality Management

Innovations in Watershed-Scale Water Quality Assessment

R. D. Wauchope, B. Hall, and A. C. Barefoot, *Organizers*

- 9:00** — Introductory Remarks.

- 9:05** —**139.** Comparison of regulatory estimates of drinking water concentrations with monitoring data. **R. L. Jones**

- 9:35** —**140.** Estimating pesticide concentrations in U.S. streams from watershed characteristics and pesticide properties. **C. G. Crawford**, R. J. Gilliom

- 10:05** —**141.** Comparison of EPA model calculated drinking water exposure estimates with monitoring results from surface drinking water supplies. **S. H. Jackson**, P. Hendley, M. H. Russell, R. L. Jones, N. Poletika, D. I. Gustafson

- 10:35** — Intermission.

- 10:50** —**142.** Modeling the drinking water exposure component for the organophosphate pesticide cumulative risk assessment. **N. C. Thurman**, K. Costello

- 11:20** —**143.** Turf pesticide and fertilizer impacts on watersheds: Monitoring and modeling case studies in a TMDL and water criteria context. **S. Z. Cohen**, S. S. Reid, Q. Ma

Section B

Innovative Products, Practices and Technologies Impacting Nutrient Use and Laboratory Analysis in the 21st Century

B. Hall and W. Robarge, *Organizers*

J. B. Sartain, *Presiding*

- 8:30** — Introductory Remarks.

- 8:35** —**144.** Fertilizer efficiency: An appropriate agricultural environmental indicator? **T. W. Bruulsema**, P. E. Fixen, C. S. Snyder

- 9:00** —**145.** Use of anion exchange membranes to characterize positional availability of soil phosphorus. **J. L. Kovar**, P. D. Schroeder, W. M. Jarrell

- 9:25** —**146.** Phosphorus and potassium leaching under contrasting residential landscapes established on a sandy soil. **J. L. Cisar**, J. E. Erickson, J. E. Snyder, J. C. Volin

- 9:50** —**147.** A new polymer coating for increasing phosphorus use efficiency and reducing environmental impact. **L. Murphy**, J. L. Sanders

- 10:15** — Intermission.

- 10:30** —**148.** Recovery of nutrients from phosphate fertilizer manufacturing process: Cleaning and recycling gypsum pond water. **V. V. Astley**

- 10:55** —**149.** Development of sustainable fertilizer with positive local and global impacts. **D. Day**, J. W. Lee, D. Reicosky

11:20 —150. ESN® controlled-release nitrogen for enhanced nitrogen efficiency and improved environmental safety. **A. D. Blaylock**, R. D. Dowbenko, J. Kaufmann, G. D. Binford, R. Islam

Section C

Trace Metal Analysis in Fertilizer Workshop

P. F. Kane, B. Hall, and W. Robarge, *Organizers*

9:00 — Introduction.

9:10 — Workshop.

THURSDAY AFTERNOON

Section A

Agrochemicals and Watershed-Scale Modeling: Solutions for Water Quality Management

Innovations in Watershed-Scale Water Quality Assessment

R. D. Wauchope, B. Hall, and A. C. Barefoot, *Organizers*

1:00 — Introductory Remarks.

1:05 —151. Fractal-based scaling and scale-invariant dispersion of peak concentrations of crop protection chemicals in rivers. **D. I. Gustafson**, K. Carr, C. Gustin, T. Green, R. L. Jones, J. Kreuger, P. R. Richards, B. Roepke

1:35 —152. The persistence of metolachlor breakdown products in a riparian buffer system. **C. P. Rice**, K. Bialek, J. T. Angier, G. McCarty

2:05 —153. Watershed modeling linking PRZM with RIVWQ. **J. M. Cheplick**, A. M. Ritter, W. M. Williams, N. J. Snyder

2:35 —154. A watershed tracer method for development of a multi-compound daily concentration model. **W. Chen**

Section B

Innovative Products, Practices and Technologies Impacting Nutrient Use and Laboratory Analysis in the 21st Century

B. Hall and W. Robarge, *Organizers*

1:00 —155. Stabilized nitrogen: Improving nitrogen's efficiency. **A. R. Sutton**, T. J. Healey

1:25 —156. Development of Nurea®, a low cost extended release fertilizer designed for specialty and agricultural applications. **S. Simon**, T. Pursell

1:50 —157. Microchip fertilizer technology for enhanced efficiency and eco-safe purposes. **R. Hartmann**

2:15 — Intermission.

3:00 —158. GreenEdge®: An innovative bio-based slow release fertilizer. **A. Varshovi**

3:25 —159. Development and testing of a laboratory method for determination of nutrient release from slow release fertilizers. **W. L. Hall**, J. B. Sartain

3:50 —160. Development and correlation of soil incubation studies measuring nutrient release. **J. B. Sartain**, R. C. Littell, E. W. Hopwood

Section C

Trace Metal Analysis in Fertilizer Workshop

P. F. Kane, B. Hall, and W. Robarge, *Organizers*

1:00 — Introduction.

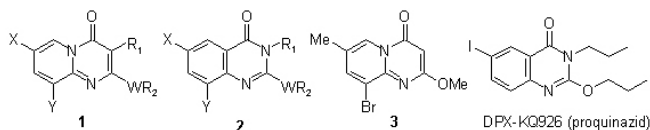
1:10 — Workshop.

DIVISION OF AGROCHEMICALS

1. Synthesis and antifungal activity of novel substituted pyridopyrimidinones and quinazolinones: The discovery of proquinazid, a new and potent powdery mildew control agent

Thomas P. Selby, Charlene G. Sternberg, James F. Berezna, Reed A. Coats, and Eric A. Marshall, DuPont Crop Protection, Stine-Haskell Research Center, P.O. Box 30, Newark, DE 19714, thomas.p.selby@usa.dupont.com

Substituted pyrido[1,2-a]pyrimidin-4-ones of formula 1 and quinazolinones of formula 2 (where W is a heteroatom - preferably oxygen) represent a new class of antifungal agents possessing high activity against powdery mildew strains of fungi. Discovered by random screening, lead compound 3 showed interesting but very weak powdery mildew activity at a high rate of application. A substantial optimization effort followed with more active analogs of formulae 1 and 2 uncovered. Many analogs were extremely active when applied foliar applied pre-infection, as protectants, at very low concentrations (<0.5 ppm). Although non-toxic to powdery mildew cells on the leaf surface, these compounds prevent plant penetration by the pathogen via potent inhibition of appressorial formation during the infection process. These compounds were effective against a variety of powdery mildew strains but our biological evaluations focused on wheat powdery mildew. Although pyridopyrimidinones and quinazolinones were very active in lab tests, only quinazolinones showed excellent greenhouse to field activity translation. Optimum levels of activity were obtained for DPX-KQ926, which gave outstanding mildew control in field tests on cereals, grapes and other crops at rates of application as low as 25 g/ha in some cases. DPX-KQ926 was superior to commercial standards and provided excellent residual control as a protectant. Commercial development of DPX-KQ926 (proquinazid) was subsequently pursued. This paper will focus the discovery of proquinazid with an emphasis on synthesis, structure-activity relationships and the challenge of overcoming greenhouse to field activity translation hurdles for analogs of this unique class of fungicidally active heterocycles.



2. Crocacin A and D – novel natural products as leads for agrochemicals

Patrick J Crowley, Ian H Aspinall, Kevin Gillen, Christopher R. A. Godfrey, Ingrid M. Devillers, Gordon R. Munns, Janet Phillips, Olivia Anabelle Sageot, Joe Swanborough, Russell Viner, Paul A. Worthington, and John Williams, Syngenta, Jealott's Hill International Research Centre, Bracknell, Berkshire, RG42 6EY NA, United Kingdom, Fax: 44 1344 413739, patrick.crowley@syngenta.com

The crocacin A and D are novel natural products that inhibit the electron transport chain at complex III in a beef heart mitochondrial respiration assay, and inhibit the growth of a range of plant pathogenic fungi in vitro and on plants. A short route to the synthesis of analogues of these unstable natural products was developed. A wide range of compounds were made in which the complex side chain was replaced by simple aromatic units, and many of them showed high activity in a mitochondrial beef heart respiration assay and some of these were active against plant pathogenic fungi of agricultural importance in glasshouse tests. In order to find compounds with greater stability than the natural crocacin, the photolabile Z-enamide was replaced with many different moieties, but none gave rise to improved fungicidal activity.

3. Thiamethoxan: A neonicotinoid precursor converted to clothianidin in insects and plants

Peter Jeschke, Research Global Chemistry Insecticides, Bayer CropScience AG, Building 6240, D-40789 Monheim, Germany, Fax: 49 (0) 2173 38-7452, peter.jeschke@bayercropscience.com, and Ralf Nauen, Research Global Biology Insecticides, Bayer CropScience AG

Neonicotinoids are insecticides acting agonistically on insect nicotinic acetylcholine receptors (nAChRs). They are active on commercially important Hemipteran pest species such as aphids, whiteflies and planthoppers, but also control Coleopteran and some Lepidopteran pests. Like the most prominent member of this class imidacloprid (IMI), all neonicotinoid insecticides bind with high affinity (150-values ~ 1nM) to [3H]IMI binding sites on insect nAChRs. One notable omission is thiamethoxan (THIAM), showing binding affinities up to 10,000-fold less potent than other neonicotinoids, using housefly head membrane preparations. Electrophysiological whole cell voltage clamp studies using neurons isolated from *H. virescens* central nerve cord showed no response to THIAM when applied at concentrations of 0.3 mM, although the symptomology of poisoning in orally and topically treated noctuid larvae suggest strong neurotoxicology. Other neonicotinoids like the non-cyclic clothianidin (CLOTHI) commercialized by Bayer CropScience AG and Sumitomo Chemical Takeda Agro as Poncho® and Dantotsu™, exhibit high activity as agonists on isolated neurons at concentrations as low as 30 nM. There was no obvious correlation between biological efficacy of THIAM against aphids and Lepidopterans and receptor affinity in electrophysiological and binding assays. Pharmacokinetic studies using the LC-MS/MS technique to analyze haemolymph samples taken from several pest species revealed that THIAM was rapidly metabolized to CLOTHI. CLOTHI shows high affinity to nAChRs in both binding assays and whole cell voltage clamp studies. When applied to cotton plants, THIAM was also quickly metabolized, with CLOTHI being the predominant neonicotinoid in plants briefly after application, as indicated by LC-MS/MS analyses. Interestingly, N-desmethyl THIAM was not significantly formed, neither in pest insects nor in cotton plants, although it was often mentioned as a possible metabolite, being nearly as active as IMI. In conclusion, our investigations show that THIAM is likely to be a neonicotinoid precursor for CLOTHI and not active by itself.

4. Interaction of fipronil and its analogs with GABA receptors

Yoshihisa Ozoe, Department of Life Science and Biotechnology, Shimane University, Matsue, Shimane 690-8504, Japan, Fax: 81-852-32-6092, ozoe-y@life.shimane-u.ac.jp, and Jeffrey G. Scott, Department of Entomology, Cornell University

Experiments were performed to see whether the site of action of the phenylpyrazole GABA antagonist insecticide fipronil is the same as that of other noncompetitive antagonists. First, we examined the interaction of fipronil and its analogs with the GABA receptor of the dieldrin-resistant strain of houseflies by the [3H]EBOB binding assay. Fipronil and three closely related analogues potentially inhibited the binding in both dieldrin-resistant and susceptible strains, whereas other 11 phenylpyrazoles showed lower inhibitory activities in the dieldrin-resistant strain than in the susceptible strain. The data indicate that fipronil might peculiarly bind to a site(s) or in a mode(s) different from those of other antagonists. Next, we investigated the effects of substituents of phenyltriazoles on the inhibition of [3H]EBOB binding to the GABA receptor. The favorable substituent for high activity was different from that of other antagonists, indicating that phenyltriazoles might bind to the antagonist site in a unique orientation.

5. New termiticides necessitate changes in efficacy testing: A case study of fipronil

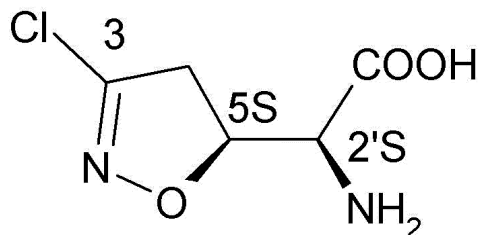
Chris J Peterson, Terence L. Wagner, Thomas G. Shelton, and Joe E. Mulrooney, Wood Products Insect Research Unit, USDA Forest Service, 201 Lincoln Green, Starkville, MS 39759, Fax: 662-325-6645, cjpeterson@fs.fed.us

The US Forest Service has been conducting efficacy testing of soil-applied termiticides and other products since the 1930s. With the emergence of delayed-acting, non-repellent (DANR) termiticides in the 1990s, deficiencies in testing protocol became apparent. For one DANR, fipronil, an "area effect" was observed in field trials, where control plots adjacent to treated plots experienced reduced termite incidence. It has been shown that DANR active ingredients are transferred from one termite to another, and this may be responsible for the area effect. An expanded test layout was developed where concentrations are separated by 50 feet from each other and from control plots. This layout appears to have solved the problem and has since been used for other products, for example chlorfenapyr. However, the expanded layout is costly, time consuming and land intensive. A laboratory test is necessary to determine which products require the expanded layout, and which may be placed in a conventional layout.

6. Fungicidal properties of acivicin and its derivatives

Anthony C. O'Sullivan, Markus R Dobler, Hans Georg Brunner, and Philippe Chemla, Research Synthesis, Syngenta, WRO-1060.6.40, Postfach 4002, Basel, Switzerland, Fax: 0041 61 323 8726, anthony.osullivan@syngenta.com

Acivicin is a fermentation product with antitumor activity isolated at Upjohn in 1973. The herbicidal activity was claimed by Rohm and Haas in 1985. We found it has interesting oomycete activity, and prepared analogs varying at positions 3, 5, 2', NH₂ and COOH. Acivicin inhibits glutaminases, so we tested known glutaminase-inhibitors, and glutamine derivatives with cysteine protease pharmacophores, some of which also showed interesting oomycete activity.



7. 2-Acylimino-3-phenylthiazolines: A new family of bleaching herbicides

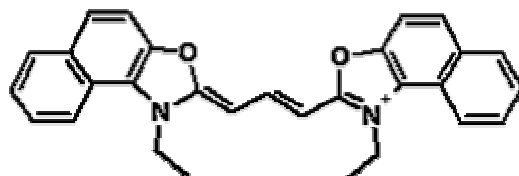
Yuzuru Sanemitsu, Shunichi Kawamura, Shunichi Hashimoto, Toshio Nagatomi, and Yoshimi Yamada, Agricultural Chemicals Research Laboratory, Sumitomo Chemical Co., Ltd, 2-1, Takatsukasa 4-Chome, Takarazuka, Hyogo 665-8555, Japan, Fax: 81(797)74-2129, sanemitsu@sc.sumitomo-chem.co.jp

While exploring certain synthetic development of various heterocycles, we happened to find out a weak herbicidal activity of ethoxycarbonyl-phenyl-isothioureia used as the synthetic intermediates, which showed bleaching symptoms. From the symptom and the similarity in the partial structure of well-known bleaching herbicides, this finding encouraged us to examine a systematic screening as a lead to new bleaching herbicides. Further optimizations of the herbicidal activity made us aware of increasing activity when the initial lead was converted into 2-acyliminothiazolines. In addition to this dramatic change structural optimization of 2-acyliminothiazolines led to the discovery of 2-difluoroacetyl-3-phenylthiazoline (S-3085) with cotton safety when applied preemergently. S-3085 was field tested as a cotton herbicide. However, commercial development was not pursued due to its narrow crop safety and low cost-efficiency. A summary of the discovery, synthesis, structure-activity-relationship and the mode of action of this class of herbicides will be discussed here.

8. Discovery of insecticidal cyanine dyes

Robert N. Henrie II, Thomas G. Cullen, Benjamin J. Dugan, Y. Larry Zhang, Yanli Deng, Sandra Simpson, Bruce Black, and Franz Schuler, Agricultural Products Group, FMC Corporation, P.O. Box 8, Princeton, NJ 08543-0008, Fax: 609-951-3835, robert_henrie@fmc.com

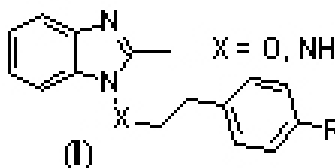
Inhibition of chitin synthase (CS, EC 2.4.1.16) is widely recognized as a largely untapped, intrinsically mammalian-safe, arthropodicidal mechanism of action. There are no known commercial insecticides that are *bona fide* inhibitors of CS, nor are there any in development to our knowledge. Certain classes of cyanine dyes (cf. generic and lead structure, below) were observed as hits in a high-throughput Lepidopteran (tobacco budworm, *Heliothis virescens*) chitin synthase assay. Optimization produced *in vivo*-active analogs; however, ultimately these were shown to be off-target. An overview of the chitin synthase project will be presented.



9. Aphicidal N-hydroxy and N-amino benzimidazoles

Scott D. Crawford¹, Benjamin J. Dugan¹, R. N. Henrie II¹, W. H. Yeager¹, Zeinab M. Elshenawy¹, Harvey R. Wendt¹, J. W. Lyga¹, Joseph A. Argentine¹, David M. Roush², Frank J. Zawacki¹, and Steven W. Szczepanski³. (1) Agricultural Products Group, FMC Corporation, P.O. Box 8, Princeton, NJ 08543, scott_crawford@fmc.com, (2) Agrochemical Products, FMC Corporation, (3) Cerus Corporation

Hydroxy and Amino benzimidazole derivatives (I) comprise a novel class of mitochondrial electron transport (METI) inhibitors with good activity against cotton aphid (*Aphis gossypii*). This presentation will cover the synthesis, SAR, biological activity, and ADMEET properties of this class of compounds.



10. Panel Discussion: Challenges in pesticide translation from lab to greenhouse to field

Bruce Black, FMC Corporation, Department of Discovery & Biochemistry, P.O. Box 8, Princeton, NJ 08543, Fax: 609-951-3330, bruce_black@fmc.com

The trials and tribulations of developing and commercializing a new bioactive product will be discussed from the perspective of challenges in translating laboratory results to greenhouse and field trials. A free ranging discussion of product failures and successes will be encouraged.

11. Challenges and future of pesticide toxicology

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Pesticide toxicologists are at the forefront of human endeavors that provide society with the food, fiber and health that it requires. We are among the first to adopt new technologies and regulatory controls to strengthen our basic and applied research approaches. Our research has pioneered the understanding of mechanisms of action, metabolism, resistance and environmental fate of xenobiotic compounds. So why do we spend so much effort explaining ourselves to others? A simple answer is that toxicology is the study of poisons, which are generally not well regarded by many. A second, more pervasive, problem is we accentuate the negative aspects of our science rather than the positive. We need to fundamentally change how we present our research to society and become much more proactive rather than reactive. The agrochemical industry has changed fundamentally and forever. We must embrace this change and use our scientific strengths to train the new generation of toxicologist who will be given the daunting but immensely rewarding task of feeding and protecting an ever increasing human population in an environment of decreasing resources. This will be our challenge and our future.

12. Model of the voltage-gated sodium channel in relation to the action process of pyrethroids

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An effort has been made to analyze the possible action process of pyrethroids on the sodium channel by utilizing the most recent information on the molecular topology (Chikara Sato et al., Nature 409, 1047, February 2001) and the structural changes of the sodium channel induced by batrachotoxin (Nora B. Cronin et al., J. Biol. Chem. 278, 10675, March 2003). According to this model the inner wall of the main sodium channel proper consists of four S5 and S6 segments that are surrounded by several side chambers that are connected to four each of extracellular and cytoplasmic openings. All of the sites of mutations so far found are located slightly below the center of S5 or S4 segments, indicating the functional importance of these sites. Mutations associated with Skdr, on the other hand, have been found to occur on the S4-S5 linkers that have been speculated to serve as the bridge between the main channel proteins and the outer structure, coordinating the movement of side chambers leading to the opening and closing of the cytoplasmic opening.

13. Isoform-dependent effects of pyrethroids on mammalian sodium channels

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Pyrethroid insecticides exert their neurotoxic effects principally by modifying the gating of voltage-sensitive sodium channels. In contrast to insects, which have sodium channels encoded by a single gene, mammalian sodium channels are products of a multigene family. Further sodium channel heterogeneity arises as a result of alternative exon usage and differential co-expression with auxiliary subunits. Are all mammalian sodium channel isoforms equally sensitive to pyrethroids? Do differences in isoform sensitivity contribute to the development of the T and CS intoxication syndromes produced by different structural classes of pyrethroids? Our research addresses these issues by evaluating the sensitivity of individual cloned sodium channel isoforms and subunit combinations expressed in *Xenopus* oocytes to an array of structurally diverse pyrethroids. The results of these studies identify surprising differences in the action of multiple compounds on a single isoform and in the relative sensitivity of different isoforms to a single pyrethroid. Our results will inform cumulative risk assessments for pyrethroids by the U.S. Environmental Protection Agency under the Food Quality Protection Act of 1996

14. Mode of action of nonfungicidal anti-blast chemicals

Isamu Yamaguchi, Environmental Plant Research Group, RIKEN Plant Science Center, 1-7-22 Suehiro, Tsurumi, Yokohama 230-0045, Japan, isyama@postman.riken.go.jp

While all modern pesticides are developed through extensive safety evaluation, there is a growing public concern about their effects on non-target organisms and the environment. Thus, there is a great deal of renewed interest in nonfungicidal disease controlling agents that are inherently specific to target plant pathogens. Two groups of nonfungicidal chemicals of rice blast, a serious rice disease in Japan, are available; melanin biosynthesis inhibitors (MBI and MBI-D) and plant activators or priming effectors, which induce host resistance against the pathogen's attack. Carpropamid, a novel MBI-D, inhibits scytalone dehydratase in the melanin biosynthesis pathway of *Magnaporthe grisea*, and probenazole induces systemic acquired resistance (SAR) in plants against *M. grisea*. No resistant pathogenic strains have emerged against probenazole in spite of its three decade use. Both chemical groups have high efficacy but low toxicity to non-target organisms. The molecular action and future prospects for related compounds will be discussed.

15. Insecticide symptom phenotyping: Lessons learned from "Toxicology of Insecticides"

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Intoxication symptoms often provide clues about the mode of action of insecticides. Most insecticides have distinct fingerprints, or phenotypes, of intoxication symptoms. We have developed a video library of symptom phenotypes using *Aphis gossypii* (cotton aphid) as a model to assist in our insecticide discovery efforts. The video library can, among other things, assist in determining new modes of action, quickly clarify if a compound analog is acting on a target site, and reveal activities of weak leads. Aphids were chosen as a model insect for symptom phenotyping for a number of reasons, including economic pest status. Aphids are normally sedentary, so movements are easy to discern and videotaping straightforward. Aphids also have distinct and repeatable reactions to stimuli such as being turned on the back, prodding, and light. Thirty distinct phenotypes have been described. While some symptoms are present in a number of insecticides, unique symptoms or distinctive combinations of symptoms usually are sufficient to establish a unique phenotype. The symptom phenotypes of the following insecticide standards have been characterized: neonicotinoids, flonicamid, GABA antagonists, GABA/Glutamine receptor agonists, octopamine agonists, carbamates, organophosphates, and cellular respiration inhibitors. The effects of time course and insecticide concentration on symptom phenotyping are also discussed.

16. *Tribolium* genomics: Sleuthing for novel targets

Richard W. Beeman¹, Susan J. Brown², Marce D. Lorenzen², and Yoonseong Park³. (1) USDA-ARS-Grain Marketing & Production Research Center, 1515 College Ave., Manhattan, KS 66502, beeman@gmprc.ksu.edu, (2) Division of Biology, Kansas State University, (3) Department of Entomology, Kansas State University *Tribolium castaneum* is one of the most sophisticated genetic model organisms among higher eukaryotes, and is a member of the largest and most species diverse of all eukaryotic orders, the Coleoptera. In 2003 the National Human Genome Research Institute assigned this beetle a high priority ranking for genome sequencing. The complete sequence will soon be read, assembled and annotated, providing the first overview of the entire genome of a polyphagous insect pest. *Tribolium* has a highly developed cryptonephridial system, and harbors a variety of protozoan parasites. The emerging genome sequence should provide a rich source of insight into the molecular biology of digestion, osmoregulation, immune response and other potential targets that could be perturbed for insect pest disruption and suppression. Preliminary sequence analysis has revealed nicotinic acetylcholine receptor subunits, acetylcholine esterase, voltage-gated sodium channels, neuropeptides and a neuropeptide receptor, serotonin receptors and numerous other genes potentially involved in metabolic resistance.

17. Paramecium behavior and insights into insecticide activity

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Paramecium has ciliary calcium channels that control ciliary calcium levels. Calcium determines the frequency of beating and transient reversal of beat, causing the cell to turn. These calcium channels and the lack of voltage gated sodium channels intrigued John Clark, who used *P. tetraurelia* to study the effects of deltamethrin on calcium channels without the complication of Na channels. Using behavioral mutants, which were shown by Kung not to turn and to have defective calcium channels, John showed that these mutants were resistant to deltamethrin. We worked with John in preliminary experiments to gather some electrophysiological evidence that deltamethrin in *P. tetraurelia* sustained calcium conductances, which led to cell death. Our collaboration has gone far beyond the preliminary stage, and I will talk briefly about our selection and partial characterization of a set of mutants resistant to deltamethrin as well as our parallel work on chemical sensing in this organism.

18. Comparative action of cismethrin and deltamethrin on voltage-sensitive calcium channels associated with mammalian presynaptic nerve terminals

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Presynaptic nerve terminals (synaptosomes) prepared from rat brain were used to evaluate the action of cismethrin and deltamethrin on voltage-sensitive calcium channels by measuring calcium influx and neurotransmitter release with multiple fluorescent endpoint assays. Both cismethrin and deltamethrin stimulated calcium influx in a stereospecific manner; however, they did so by different mechanisms. Only synaptosomes treated with deltamethrin resulted in subsequent enhanced neurotransmitter release, which was stereospecific, enhanced by depolarization, unaltered by tetrodotoxin, but blocked by ω -conotoxin MVIIIC. Electrophysiological experiments with Cav2.2 expressed in *Xenopus* oocytes validated the interaction of pyrethroids with this channel. Thus, cismethrin and deltamethrin elicit different actions at presynaptic nerve terminals and the modification of voltage-sensitive calcium channels by CS-syndrome pyrethroids is likely to modulate the rate of neurotransmitter release, a physiological response that is consistent with their observed acute neurotoxicity.

19. The risks from pesticides on food: Synthetic vs. organic--can we really know?

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The basis on which we assess risk from pesticide residues on foods is different for synthetically produced pesticides than it is for organic pesticides. This paper is a comparison of the hazard research requirements, risk assessment paradigms, expected safety standards and enforcement vigor brought to bear on both of these types of pesticides. The rigorous regulatory mandates focused on synthetic pesticides are juxtaposed to the mild and ambiguous standards of safety set for "natural methods". Regulatory scientists fret over the statistical confidence around the risk quantification calculated for synthetic pesticides. The state-of-the-science for organic pesticides seems to be stalled at the stage of definition of what is to be regulated. Given this disparity, can we really know which is safer?

20. Are synthetic pesticide residues in food a danger to human health?

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In the latest USDA Pesticide Data Program report containing data collected in 2002, 47% of fruits and vegetables, 15% of barley, 18% of

rice, and 15% of beef samples contained detectable residues of synthetic pesticides. Overall, 58% of all samples had no detectable residues, 19% contained one residue, and 23% contained more than one residue. Only 0.3% of samples exceeded tolerances and most residues were well below tolerance levels. Residue data from the Food and Drug Administration Center for Food Safety and Applied Nutrition monitoring program suggest a similar pattern of residue levels. In all, these residue estimates account for approximately 97% of the per capita food consumption for children aged 1-2 years, the most highly exposed age group. The most exhaustive and comprehensive analysis to date of dietary pesticide risk, EPA's Cumulative Risk Assessment for organophosphates, suggests that for most exposures and exposure group scenarios, risk is below levels of concern. These findings support data from numerous studies indicating that consumption of fruits and vegetables does not pose a public health threat. To the contrary, increased consumption of fruits and vegetables and the associated increased exposure to synthetic pesticides has been associated with measurable public health benefits.

21. Is the content of disease-reducing phytochemicals influenced by certified organic crop production practices?

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Antioxidant phytochemicals have a diversity of putative human health benefits including protection against cancer and heart disease among other ailments. At the same time, testing of high doses of isolated antioxidants in rodent diets using procedures similar to those used for pesticides also reveals potential for adverse health effects. Some antioxidants tests positive as tumorigens; phytoestrogens test positive in endocrine disrupter assays. Some research suggests that crops grown under certified organic crop production practices may have greater levels of antioxidants or other health-promoting phytochemicals than the crops grown under conventional practices. Other research shows contradictory results. If organic crop production practices are indeed associated with increased levels of antioxidants, then researchers need to formulate testable hypotheses that explain these observations. However, the first step in testing must be very strict definitions and control of what is organic production and what is conventional production. Second, isogenic lines of crops must be tested, preferably under the same meteorological conditions and in the same soil type. One hypothesis published recently is that greater pest pressure in organically grown crops may induce antioxidant production. However, organically produced crops do not necessarily suffer more pest damage than conventionally produced crops. Even if organically produced crops are shown to have higher levels of antioxidants than conventionally grown crops, individual dietary habits are much more likely to be the most important determinants of health.

22. Is organic food more nutritious?

Ruth Kava, The American Council on Science and Health, 1995 Broadway, New York, NY 10023, Kava@acsh.org
Purveyors of organic foods portray their products as being more "natural," and more nutritious and thus more healthful for humans than foods produced by conventional means. That many consumers believe such statements is attested to by the enormous growth of the market for organic foods, which by some accounts increased 40-fold in the United States between 1986 and 1996. The market has continued to grow by over 20% per year, in spite of the fact that organic foods are typically more expensive than comparable conventionally produced items. Numerous studies have attempted to determine if organic production methods do indeed confer a nutritional advantage. A variety of comparisons have been made, but because of the great variety of experimental designs and methods, there has been little consistency in the results reported. Even when some differences seem apparent, the validity of the results is dubious because of lack of complete information, small sample sizes, or lack of replication by other researchers. Some of these studies will be reviewed, and suggestions made for more appropriate means to examine this question. Consumers who pay a premium for foods they think will provide a health benefit should be informed about the validity of the benefits claimed for organic foods.

23. Do organic animal husbandry practices make beef and dairy products safer?

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USDA (2002) rules require that organic animal products be produced: (a) without use of pesticides, hormones, antibiotics, irradiation or bioengineering, (b) by farmers required to preserve soil, conserve water, enhance environmental quality and treat animals humanely, and (c) under inspection by USDA-accredited private companies and state agencies that certify companies as "organic." Federation of Animal Science Societies (2003) stressed that USDA's National Organic Program (NOP) for meat, milk and eggs "is a marketing program, not a food safety, nor food healthfulness program" and its "regulations do not address nutritional content of foods, food safety nor animal well-being." Food Marketing Institute (2004) identified as "top consumer food-related health concerns: (1) food-borne bacteria, (2) food poisoning, (3) Mad Cow Disease, (4) irradiated meats, (5) cloned animals, (6) meats/vegetables/fruits from foreign countries, and (7) genetically modified organisms. By definition, "organic" meat-animal products—but also "branded" meat-animal products—because of traceability components of programs generating them, can offer guarantees regarding items (4), (5), (6) and (7) but not for items (1), (2) or (3) of the FMI (2004) concerns. For example, FASS (2003) concluded there may be more risk associated with the use of organic foods due to their potential for introducing *Campylobacter* or other harmful microorganisms into the food chain. Three studies (Smith et al., 1994, 1997; Osborne, 1994) found no differences in violative residues of growth promotants, antibiotics, heavy metals, stress reducers, parasiticides or pesticides among "conventional," "natural" and "organic" beef. In conclusion, Federation of Animal Science Societies (2003) said while organic foods offer the consumer a choice, there is no evidence: (a) of nutritional difference between organic and conventionally produced meat, milk and eggs, or (b) that organic foods are any safer than conventional foods.

24. Is organic farming better for the environment?

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Organic farming has been advocated by many environmental organizations as better for the environment than non-organic farming methods. However, there is serious question whether this is actually so. Assessments of the environmental impacts of farming inputs disagree on this point. While some assessment methods indicate organic-approved inputs are more environmentally friendly, others suggest the opposite. However, non-organic farming methods have been rapidly evolving over the past decade with the approval and adoption of softer synthetic pesticides with low environmental impacts. The rapid adoption of crops improved via biotechnology has reduced the environmental impacts of non-organic farming systems even further. Any comparisons of organic and non-organic farming impacts need to account for these rapid and systemic changes. Finally, assessments of the environmental friendliness of any farming system need to consider the context in which these methods will be used, including land and organic fertilizer constraints. While the environmental burden may be low for a modest percentage of farmed area under organic constraints, large percentages of farmed area devoted to organic production increase the environmental impacts considerably.

25. Is genetically-modified food unsafe?

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Foods derived by bioengineering are as safe as conventional or organically-produced food. Safety of any food is inherent in the product and not contingent on how it is produced. When compared to traditional food, those foods enhanced through direct gene transfer technology undergo substantial safety testing and regulatory scrutiny prior to their commercial release. Every bioengineered crop prior to public release is subjected to detailed product safety evaluation including molecular characterizations, food and feed safety evaluation through animal

feeding studies, allergy testing and toxicity studies; compositional analysis; nutritional assessments; and environmental safety assessments. It must also be recognized that bioengineered crops undergo relatively minor and precise modification in contrast to major unknown genomic modifications with traditional hybridization or mutation breeding techniques. Cumulatively such crops have been grown on 300 million ha in the past eight years in more than a dozen countries. Thousands of food products contain biotech ingredients, and the absence of any evidence of harm to human or animal health by the consumption of bioengineered food is a testimony that such foods are safe.

26. Evolutionary plasticity of monooxygenase mediated insecticide resistance

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Cytochrome P450 monooxygenases are an important metabolic system for the detoxification of xenobiotics, and are thus one of the major mechanisms by which insects evolve insecticide resistance. However, little is known about the evolutionary constraints of this resistance mechanism. We investigated the genetics of resistance in a strain of house fly (NG98) from Georgia, USA that had evolved 4,000-fold resistance to the permethrin, and compared this to other permethrin resistant strains from the USA and Japan. Resistance in NG98 was due to monooxygenase-mediated resistance on autosomes 1, 2 and 5, and *kdr* on autosome 3. These results indicate the genes which evolve to produce monooxygenase-mediated resistance to permethrin are variable between populations, and that the P450 monooxygenases have some degree of plasticity in response to selection. Monooxygenase-mediated resistance appears to evolve using different P450s, and possibly different regulatory signals controlling P450 expression, even in strains selected with the same insecticide.

27. Role of esterases in insect resistance to insecticides

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Esterases play an important role in conferring or contributing to insecticide resistance in insects and other arthropods. They are conventionally classified into three types. The A-esterases are not inhibited by organophosphates but degrade these insecticides as their substrates. The B-esterases are readily inhibited by organophosphates, whereas the C-esterases do not interact with organophosphates. The most common esterases involved in insecticide resistance in insects are the B-esterases, including carboxylesterases and acetylcholinesterase. Carboxylesterases confer insecticide resistance by sequestering and/or hydrolyzing various insecticides including organophosphates, carbamates and pyrethroids. In contrast, acetylcholinesterase confers resistance by reducing its sensitivity to inhibition by organophosphates and carbamates or increasing its gene expression that compensates for the function of inhibited acetylcholinesterase in insect nervous system.

28. Mass spectral approach to identify an inducible cytochrome P450 in Colorado Potato Beetle (CPB)

Judd Nelson, Department of Entomology, University of Maryland, College Park, MD 20742, Fax: 301-314-9290, jn5@umail.umd.edu, Jian Rong Gao, Department of Veterinary and Animal Sciences, University of Massachusetts, and John Marshall Clark, Department of Veterinary and Animal Science, University of Massachusetts

An important mechanism of resistance to abamectin in CPB is enhanced oxidative metabolism. Oxidative metabolism can be induced in CPB with dexamethasone and can also be inhibited with synergists like piperonyl butoxide. Fat body microsomal fractions prepared from CPB that were either induced with dexamethasone or not induced, and the proteins were differentially labeled with ICAT (isotope coded affinity tag) reagents. Capillary LC-MS/MS analyses of tryptic digests have allowed us to tentatively identify CYP3A4 as an ICAT labeled

cytochrome P450 in CPB. This result is interesting because of the structural and metabolic similarities between abamectin and erythromycin- both products of *Streptomyces* species.

29. Management of head lice resistance to pyrethroids

Si Hyeock Lee¹, John Marshall Clark², Kyong Sup Yoon², Jian Rong Gao², and Steven B. Symington². (1) School of Agricultural Biotechnology, Seoul National University, Room 6120, Building #200, San 56-1 Sillim-dong, Gwanak-gu, Seoul, 151-742, South Korea, Fax: 82-2-873-2319, shlee22@snu.ac.kr, (2) Department of Veterinary and Animal Science, University of Massachusetts

Head louse resistance to permethrin and pyrethrum is prevalent worldwide. Permethrin-resistant head lice are significantly more tolerant to knockdown and are cross-resistant to DDT, indicating the involvement of a *kdr*-type resistance mechanism as a major factor. Sequence analysis of the full-length cDNA fragments of voltage-sensitive sodium channel α -subunit gene from permethrin-resistant head louse populations has identified three mutations (M815I, T917I, and L920F). All these mutations appear to exist *en bloc* as a haplotype and to have functional significances in resistance. We have developed DNA-diagnostic protocols, including serial invasive signal amplification reaction (SISAR) and real-time PCR amplification of specific allele (rtPASA) for the detection of the conserved point mutations resulting in knockdown resistance. A sound resistance management strategy based on efficient DNA-based genotyping techniques will greatly expand the lifespan of the valuable and effective pediculicides, such as permethrin, and ensure safe control of pediculosis.

30. Fate of monoterpenoid insecticides in the environment

Joel R Coats, J. A. Grodnitzky, J.B. Belden, and Dingfei Hu, Department of Entomology, Iowa State University, Ames, IA 50011, Fax: 515-294-4757, jcoats@iastate.edu

Monoterpenes from essential oils of plants are highly selective insecticides with commercial uses in several markets. Because of their simple 10-carbon structures, they are considered to be very biodegradable, although very little data is available to support that assumption. Two tritium-labeled (³H) monoterpenoids have been utilized in studies of degradation in soil, water, and a plant. Laboratory experiments on the degradation of thymol and phenylethyl propionate in soil and water were conducted to assess their dissipation over time and degradation products formed.

31. Insecticide exposure in the MPTP-treated C57 mouse model of Parkinson's disease

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Neurochemical changes in C57BL6 mice were investigated following three doses of permethrin or chlorpyrifos given over a two week period, with analysis of dopaminergic biomarkers at varying times after the last treatment. In striatal synaptosomes prepared from treated mice, permethrin significantly increased dopamine uptake at low doses (1.5 mg/kg). Moreover, there was a correlation between dopamine uptake, transporter protein expression in Western blots, and binding of GBR12935, a radioligand that labels the dopamine transporter. A similar low-dose upregulation of the synaptic protein alpha-synuclein was also observed, although it had a more rapid onset and disappeared quickly. This upregulation is significant because this protein is a major component of the proteinaceous fibrillary tangles (Lewy bodies) observed in Parkinson's disease. At high doses of permethrin (200 mg/kg) or chlorpyrifos (100 mg/kg), dopamine uptake was significantly decreased, which correlated with elevated cellular stress, as measured by a mitochondrial complex 1 assay. Combination treatments with permethrin, chlorpyrifos, and the parkinsonian toxin MPTP showed enhanced effects when biomarkers were analyzed 4 weeks post-treatment, and they were consistent with neurodegeneration. Overall, the results demonstrate insecticide-induced neurochemical changes that may be related to the development of Parkinson's disease.

32. Mitogen activated protein kinases as targets for endocrine disrupting pesticides

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Diverse pesticides have been implicated as endocrine disrupters with effects on hormonally regulated physiological processes, including cancers of hormonally regulated tissues. The IC50s for these compounds at hormone receptors are typically four to five orders of magnitude higher than for the native hormone, suggesting that the receptors may not be the principle sites of action resulting in endocrine disruption. The mitogen activated protein kinases (MAPKs) are an evolutionarily conserved group of signaling proteins that regulate cellular growth, proliferation, differentiation, and stress responses, and are also represented among oncogenes and tumor suppressor genes. The MAPK signaling pathways exhibit cross-talk with hormonal signaling. For example, the oncogene product erbB-2 is a receptor tyrosine kinase that interacts with androgen receptor (AR) signaling via the ERK1/2 MAP kinase pathway. Therefore MAP kinase activation represents a potential mechanism of action for endocrine disrupting chemicals in relationship to hormonal carcinogenesis. In the LNCaP prostate cancer cell line, the pesticides o,p-DDT, beta-HCH and vinclozolin activated kinase activity, in particular the erbB-2 and ERK1/2 MAP kinases. This was associated with an increase in AR activation and expression of PSA, an AR-regulated protein. Therefore, these pesticides appear to activate key hormonal regulators with demonstrable effects on cellular function.

33. Mitigating golfer exposure to turfgrass pesticides

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Golfer activity on treated turf offers a unique opportunity to measure and model pesticide exposure in that all golfers more-or-less engage in the same behavior. Early efforts to estimate exposure focused on the collection of environmental residues (dislodgeable foliar and volatile residues) and the use of default transfer and penetration factors. This approach resulted in a highly useful screening tool to eliminate from further study any exposure scenarios that were deemed safe using US EPA Hazard Quotient values. Recent efforts have utilized dosimetry (residues on cotton suits, gloves, and air samplers) and biomonitoring (urinary metabolites) in conjunction with environmental monitoring to determine transfer and penetration factors in over 100 rounds of golf. Exposure estimates made using dosimetry and biomonitoring data are significantly less (2- to 16-fold) than previous estimates made using environmental residues. Combining all three techniques provided a means for developing an accurate golfer exposure model.

34. Does irradiated food pose a health risk?

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Irradiation of foods offers a means to help ensure that foodborne pathogens do not reach the consumer. The nutrients and wholesomeness of irradiated foods have been studied extensively. If all pork were to be irradiated the loss of thiamin to the American diet would not exceed 4%. Radiolytic products are produced in very small amounts and most of these are not unique to radiation processing. Neither short nor multigeneration feeding studies has produced evidence of toxicological effects in mammals due to the ingestion of irradiated foods. Nutritional, genetic, and toxicological studies of shelf-stable chicken meat sterilized by irradiation (46 to 68 kGy) were made. No evidence of genetic toxicity nor teratogenic effects was observed in mice, hamsters, rats, and rabbits. No treatment-related abnormalities or changes were observed in dogs, rats, or mice during multigeneration studies.

35. The ACB's (alkylcyclobutanones) of food irradiation

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Irradiation of foods for the purpose of improving microbiological safety, insect disinfestation, delay of ripening and sprouting has been an active area of research for over 45 years and has been approved by over 40 countries as a processing technology. Those approvals were made after extensive toxicological testing that included short-term genetic toxicology studies and long-term multi-generation feeding studies in animals that revealed no adverse effects, including cancer and birth defects, associated with consumption of irradiated foods. Hundreds of studies, including long-term studies in primates and short-term studies in humans have validated the safety of irradiated foods. Recently, however, it was claimed that 2-dodecylcyclobutanone (2-DCB), an alkylcyclobutanone that is found in trace quantities (ppm) in irradiated foods as a result of the radiolysis of palmitic acid, produced weak genotoxicity in a short-term DNA strand breakage test, the Comet Assay. Unfortunately, the Comet Assay has not been approved by regulatory agencies, and sometimes produces false positive results when cytotoxicity is induced. Some consumer groups have claimed results of those studies as proof that irradiated foods are both mutagenic and carcinogenic. In order to more accurately assess the genotoxicity of 2-DCB it was tested in the *Escherichia coli* TRP reverse and 5-fluorouracil forward mutagenicity tests, the *Salmonella* Mutagenicity Test, and the Yeast DEL Assay. 2-DCB did not induce mutations or chromosomal rearrangements in any of those assays, with or without exogenous metabolic activation. 2-DCB also failed to increase expression of the DNA damage inducible recA, dinD, umuDC and nfo genes in *E. coli*, with or without metabolic activation. The inability of 2-DCB to induce mutations, increase expression of DNA damage inducible genes, or cause genomic rearrangements in these short-term genetic toxicology tests calls into question the claims of 2-DCB's alleged genotoxic activity.

36. Does "Consumer Reports" publish accurate information on organic food issues?

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"Consumer Reports" has enjoyed a reputation for being an effective voice for consumer product safety. However, their advice on food safety and organic food issues has, in recent years, been more on the side of pro-organic food activists than sound science, an approach that has resulted in actually providing misinformation to the very people who depend on the magazine for unbiased reporting. This presentation will focus on "Consumer Reports" risk assessment errors in the Alar scare, their use of a toxicity index that has no scientific basis to compare the relative risks of pesticide-treated foods and the attempt to discourage consumers from purchasing irradiated meat. The latter is particularly appalling because the Center for Disease Control and Prevention has estimated that there would be at least 900,000 fewer cases of food poisoning (and 352 fewer deaths) annually if only 50% of the beef and poultry sold in the United States were irradiated.

37. Is the media covering organic food issues fairly?

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The media does a relatively poor job of covering organic food issues fairly. They mostly cover these issues in a manner sympathetic to organic and critical of non-organic. This is so for relatively fundamental reasons regarding the motives of many media outlets. Environmental activist groups and organic food advocates have capitalized on the media's need for controversy by making repeated claims of human health and environmental hazards from non-organic foods and farming methods. The general media have accepted these claims largely without question, resulting in non-organic foods being generally portrayed as posing lower health risks to consumers and fewer risks to the environment. In cases where organic foods have been revealed to

pose greater risks to consumers from fungal toxins, the media has chosen not to report on these cases. This is the case even with some scientific journals, such as Nature, which has failed to adequately referee papers making sweeping claims of organic superiority and has ignored the clear biases of the researchers making such claims.

38. Who is funding the organic-only food movement?

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Current campaigns attacking genetically modified organisms (GMOs) and other food technologies are typically organized by the same activist groups that promote organic-only diets. The two social movements have become so intertwined as to be nearly indistinguishable. One result is an unusual fundraising synergy, in which foundation donors and other financial backers make grants to anti-biotech campaigns that in turn promote organic food. Some pressure groups opposing GMOs, including a few engaged in illegal "direct action", are directly funded by organic food marketers. Activist spending on efforts to oppose biotech food, in excess of \$100 million annually, is fueling the global growth of the organic marketplace.

39. Are free-range chickens microbiologically safer?

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Many consumers assume that broiler chickens grown under traditional commercial conditions will be microbiologically inferior and have more *Salmonella* than free-range chickens which are usually less crowded and have access to outside spaces during grow-out. However, there is not much published information about the microbiological status of free-range chickens. The object of this study was to determine the prevalence of *Salmonella* on commercially grown free-range chickens. A total of 110 processed free-range chickens from 3 different commercial free-range chicken producers were sampled in lots of 10 per each of 11 replications for the presence of *Salmonella*. Carcasses were shipped by overnight freight on ice to our laboratory and traditional USDA cultural methods were used to sample for the presence of *Salmonella*. Overall, 6 of 11 (55%) lots and 27 of 110 (24.5%) of the carcasses were positive for *Salmonella*. No *Salmonella* were detected from 5 of the 11 lots and in one lot 100% all of the chickens were positive for *Salmonella*. Overall, the free-range chickens tested in this study had slightly higher levels of *Salmonella* than the 11% found in recent FSIS HACCP samples. The trends seen were very similar to those found in commercial integrated operations where a big variation from grower to grower and from lot to lot was observed. Consumers should not assume that just because chickens are grown under free-range conditions that they will have less *Salmonella* or other bacterial pathogens.

40. Safety of natural foods compared to conventional foods: What are the risks?

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Natural foods are perceived as safer and healthier because they do not have any pesticide residues, preservatives, colors, flavors, non-nutritive sweeteners or genetically modified ingredients. This paper will discuss the levels of residual pesticides and the use levels of additives from the perspective of their health risk to the consumer. The government has set limits of use or acceptable levels of residues. These levels will be compared to levels actually reported for various foods. The relative risks and benefits will be discussed based on the potential impact on human health.

41. The perchlorate debate: Political or scientific correctness?

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Perchlorate has been a safe therapeutic agent in the treatment of thyroid conditions for 50 years, and the State of California has gone on record to reassure the public that perchlorate has not been shown to cause cancer. How to explain, then, the misinformation that too frequently enters into the debate over the issue of perchlorate groundwater contamination? How does a chemically inert ion like perchlorate come under scrutiny under the same umbrella of concern as arsenic and asbestos, known carcinogens? How (and why) is the information published in the public media inconsistent with data presented in the peer-reviewed scientific literature? How is objective scientific data best reconciled with subjective risk assessment? An important related concern is “detection limit creep” – the movement toward environmental regulation to the limits of analytical detection, which now can approach sub-part per billion levels. The entire scientific community has a lot to lose if decisions pertaining to regulatory guidelines and mandates are not made on the basis of sound, carefully developed science.

42. Perchlorate in the environment: The epidemiological studies find no adverse outcome

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Perchlorate in drinking water and soil became a perceived human health concern following the 1997 assay sensitive to 4 µg/L and recognition that plants uptake perchlorate. Redlands (California) and Las Vegas (Nevada) have been studied for evidence of adverse human health effects. These studies, examining for fetal and neonatal thyroid effects (congenital hypothyroidism and altered levels of thyroid-related hormones) and on adults (thyroid diseases, including acquired hypothyroidism, and thyroid cancer) found no increase. An additional Las Vegas study found neither an increase in pediatric neurobehavioral diseases (autism or ADHD) nor a decrease in fourth-grade academic performance. Two studies (California and Arizona) reported an increased association between TSH and perchlorate in drinking water; however, further evaluation showed the findings to be artifacts of the study design and analysis. Human studies, including those in Chile at more than 100 µg/L, have demonstrated no adverse effects from current known levels of environmental perchlorate.

43. Perchlorate dose-response relationship and the likelihood of effects at environmentally relevant levels

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Salts of perchlorate are found naturally and have been used as fuel oxidizers for solid rocket engines and as a therapeutic agent for the treatment of thyrotoxicosis. Perchlorate has also been found as a contaminant in drinking water sources. The ability to reliably detect perchlorate at levels as low as 4 ppb in water has revealed widespread low-level environmental contamination from industrial and natural sources. Perchlorate has also been detected in produce grown with irrigation water or from some fertilizers that contain perchlorate. There exists a well-developed toxicological database for perchlorate in human subjects that provides valuable information from which to base a dose-response relationship. Human studies range from clinical studies, where low doses provide evidence of the threshold for the initial biochemical effect of perchlorate (competitive inhibitor of iodide uptake into the thyroid) to studies of therapeutic doses. A dose response assessment using human studies for perchlorate demonstrates that levels of perchlorate found in most drinking water or food sources are orders of magnitude below levels that would affect thyroid hormones, a precursor to potential adverse effects.

44. Rapid determination of perchlorate anion in foods by ion chromatography-tandem mass spectrometry

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A rapid, sensitive, and specific method was developed for the determination of perchlorate anion in lettuce, cantaloupe, bottled water, and in milk. Individual procedures, for each matrix, involved: extraction, filtration, followed by ion chromatography-tandem mass spectrometry (IC-MS/MS) determination. However, milk extracts underwent further cleanup using graphitized carbon solid phase extraction (SPE). The IC column used was a 4.6 mm x 75 mm Waters IC-Pak™ Anion HR column and the mobile phase consisted of 100 mM ammonium acetate in 50:50 (v/v) acetonitrile:water. A triple stage quadrupole mass spectrometer, equipped with electrospray ionization (ESI) in the negative ion mode, was used to determine perchlorate anion. An 18O₄-labeled perchlorate internal standard was used to correct for any matrix effects. The limit of quantitation (LOQ) was 1.0 ppb in lettuce, 2.0 ppb in cantaloupe, 0.50 µg/L in bottled water, and 3.0 µg/L in milk. Recoveries in fortified test portions ranged from 93-115 %.

45. Ion chromatographic determination of perchlorate in crops by on-line enrichment and conductivity detection

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An ion chromatography (IC) method that enriches anions in a short anion exchange column and transfers the contents by column switching to an analytical column for perchlorate separation and conductivity detection (CD) was developed for analysis of extracts prepared from lettuce and cantaloupe. Extracts were prepared from portions of chopped crop homogenate blended with diluted nitric acid. After vacuum filtration and volume measurement, a portion of extract was acidified further by addition of cation exchange resin in the hydrogen-ion form. Cleanup on a graphitized carbon column removed organic material while allowing perchlorate to pass through and be collected for IC-CD. Depending on the crop and native ionic strength, a 500-, 750-, or 1,000-µL aliquot was pushed through the precolumn, which replaced the injection loop, followed by a water wash. The effect of solution ionic strength on limiting proportional enrichment in the precolumn will be discussed. Conductivity was measured after anion self-regenerating suppression of an hydroxide mobile phase modified with acetonitrile, and perchlorate peak area was linearly calibrated (R²>0.999) to five standard levels between 2.5 and 50 ng contained in 50-500-µL loadings. Limit of quantitation was 10 ppb. Progress in extending the method to carrots and tomatoes will be reported. In addition, statistical analysis of determination by IC-CD versus IC-tandem mass spectrometry (MS/MS) with an isotope-labeled perchlorate internal standard will be presented.

46. A production method for the analysis of perchlorate by ion chromatography/mass spectrometry

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A production method for the determination of perchlorate anion at sub ppb levels using ion chromatography/mass spectrometry (IC/MS) is described. The method uses an ion chromatograph equipped with an ion suppression column and a single quadrupole mass spectrometer. The IC/MS method follows the quality control guidelines of EPA Method 314 methodology originally developed for IC with conductivity detection at the single ppb range [1]. Key to the method is the switching of the ion suppression column prior to the elution of the perchlorate. Single ion monitoring at m/z 99 and 101 is employed. The IC/MS method is not affected by the addition of the interference matrix described in Method 314 on perchlorate recoveries throughout the measurable range. Typical recoveries are 90%–105% at the 0.5 and 1-ppb level in synthetic drinking and waste waters with the method detection limit (MDL) less than 100 ppt. Similar recoveries for extractions from vegetable materials are also observed.

47. Accelerated solvent extraction (ASE) and ion chromatography-mass spectrometry (IC-MS) for the determination of perchlorate in solid samples

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The widespread presence of perchlorate in soils, water and vegetation has received increased attention by scientists, regulatory agencies and the general public. The need for new analytical methodology to detect perchlorate at sub ppb levels is apparent. Accelerated Solvent Extraction (ASE) is an extraction technique that uses organic or aqueous based solvents for fast and efficient extractions. ASE fulfills the requirements of Method 3545A for the extraction of organic contaminants from solid waste samples. However, aqueous solvent systems are widely used in ASE, and this allows the extraction of very polar compounds. This presentation will center on the use of ASE as an extraction method prior to perchlorate determination using ion chromatography (IC) with mass spectrometry for detection. We have investigated the recovery of perchlorate from soils and vegetable samples. Vegetation extracts generally require a clean up step prior to analysis. We explored various in-line clean up procedures to remove interferences for the IC analysis. In this procedure, samples can be extracted using ASE, and no further sample manipulation is necessary other than volume adjustment. We will discuss ASE precision and accuracy results for the determination of perchlorate from these sample types and how the various operating parameters affect analyte recovery.

48. A new mixed-mode weak cation-exchange SPE Sorbent for the LC-MS determination of paraquat and other quaternary ammonium compounds

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Solid-phase extraction (SPE) for paraquat and diquat has been accomplished using reversed/phase with an ion-pairing reagent or strong cation exchange. Each of these options has drawbacks when LC/MS is considered for the subsequent analysis; the high ionic-strength or ion-pair eluents employed with the traditional modes of SPE are not fully compatible with LC/MS. Therefore, a new type of SPE sorbent is under investigation for the extraction of quaternary ammonium compounds. This is a mixed-mode sorbent that incorporates a weak cation-exchanger bound to a polymeric reversed-phase particle. No concentrated salts, acids or bases and no ion-pairing reagents are required for the analysis. Instead, the analytes are eluted with a mildly acidic eluent that is entirely compatible with LC/MS and is easily removed by evaporation. In this presentation, we will evaluate this new SPE sorbent for the sub-ppb LC/MS determination of paraquat and related compounds in surface water and in other matrices.

49. Latest developments in the “quick, easy, cheap, effective, rugged, and safe” (QuEChERS) method for chemical residues in food

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In 2003, the so-called “quick, easy, cheap, effective, rugged, and safe” (QuEChERS) method was introduced for the analysis of pesticide residues in fruits and vegetables. The original method was developed using only gas chromatography/mass spectrometry (GC/MS) to detect pesticide analytes in nonfatty matrices. Unique features of the highly streamlined approach are that it employs magnesium sulfate to induce partitioning of water from acetonitrile extracts, which attain high recoveries of even polar analytes, and that cleanup is done by dispersive solid-phase extraction, in which an aliquot of the extract is

mixed with sorbent in a small tube to remove many matrix co-extractives. Since that time, the method has been validated using GC/MS and liquid chromatography (LC)/MS-MS for more than 200 pesticides in fruits and vegetables, and optimizations have been made via buffering to improve results for problematic pesticides (e.g. captan, folpet, chlorothalonil). The QuEChERS approach has now been evaluated for pesticides in fatty foods, such as milk and eggs, and work is progressing to adapt it for the multiclass, multiresidue analysis of veterinary drugs in animal-derived foods. An interlaboratory method validation of the buffered QuEChERS method has also been conducted for nonfatty foods, and preliminary results will be presented.

50. Assessing risk of genomic damage in crops from pesticides

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Pesticides are important to insure crop viability. Contact of crop plants with active pesticide is of sufficient duration to allow attack on the genetic material of the plant by the pesticide or its metabolites. Oxidative stress from pesticides may also manifest itself by DNA adduct formation. Such assaults may be among the several factors responsible for reported stress or damage to particular crops although attack may involve other biochemical systems. A substantial number of pesticides are halogenated organic compounds or are electrophilic agents which, in general, have been shown to be genotoxic and mutagenic. Evidence is presented for adduct formation from diverse crop plants treated with a variety of pesticides. DNA extracted from crop plants has been subjected to ³²P post-labeling studies showing elevated levels of adducts. In vitro studies with mononucleotides have been carried out to identify adduct formation. Theoretical modeling studies have been used to develop models for predicting DNA interactions with pesticide molecules.

51. Non-uniformity in riparian buffer zone contaminant mitigation function: Role of critical areas in agrochemical export

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Modeling riparian buffer mitigation function requires case studies where validation can be performed and model parameters optimized. The capacity for riparian buffers to remove agrochemicals from surface and ground water is limited by the least effective portions of riparian ecosystems. Assumption of uniformity in riparian mitigation function leads to inaccurate assessment of remediation capacity of these ecosystems and inadequate models. A first-order agricultural watershed in Maryland was studied to evaluate spatial and temporal variability in riparian zone function. Most annual stream nitrate load originated in a small portion of the riparian zone; the rest of the riparian zone contributed little nitrate to the stream. Small (3-8m²) foci of groundwater discharge to the surface created secondary channels that accounted for about 35% of nitrate exported from this watershed. The metolachlor degradation product MESA, which was primarily transported to the surface by groundwater, exhibited similar delivery patterns within the same discharge zones. These “critical areas” of disproportionate agrochemical delivery should be included in evaluations of riparian function, to enhance the viability of models. Preferential flow appeared to account for location of critical areas. Improved riparian models can include assessment of pesticide delivery patterns, with nitrate perhaps serving as a surrogate for MESA.

52. Synthesis and evaluation of algicidal analogs from a chromene amide in *Amyris texana*

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A chromene amide was isolated from the ethyl acetate extracts from the stems of *Amyris texana*. These extracts showed selective toxicity towards the 2-methylisoborneol-producing blue-green alga *Oscillatoria perornata* compared to the green alga *Selenastrum capricornutum*. The naturally occurring chromene amide showed selective algicidal activity towards *O. perornata* with a lowest-complete-inhibition concentration (LCIC) of 10 μM and a LCIC of 100 μM for *S. capricornutum*. A series of analogs of chromene derivatives were synthesized to produce more selective and water-soluble compounds against *O. perornata*. The structure activity study indicated the amide moiety is not essential for algicidal activity. The optimal algicidal activity was observed in the analogs containing a 2-C side-chain length with isopropyl moiety in the amine group.

53. Application of optical properties of the vinyl-silsesquioxanes hybrid films for agriculture

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Vinyl-silsesquioxanes (VS) derived from hydrolytic condensation of vinyltrimethoxysilane (VMS) and modified with tetraethoxysilane (TEOS) (VST) were prepared by sol-gel process. The Ormosil thin films based on VS and VST (f-VS and f-VST) were coated on glass by the dip-coating method. The VS structural characteristics and the morphology were characterized, by Fourier transform infrared (FTIR) and a scanning probe microscope (SPM) device. The optical behavior of the films was studied by a UV-VIS-NIR scanning spectrophotometer (SSP). The f-VS films showed the largest UVR absorbs in a range of 200-300 nm wave length. The average transmittance of the coatings within 400-700 nm band can be increased up to more than 90%. The effects of TEOS contents on the optical properties and their applications in agriculture were discussed. The hybrid film with 20% TEOS fraction had the optimum antireflectivity, and can be used as antireflective coating in the sun-beam gathering of green house.

54. Refinement of the IC perchlorate procedure for fertilizer materials containing high TDS

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Several years ago, a joint effort between the U.S. Environmental Protection Agency, the fertilizer industry (The Fertilizer Institute), and representatives from academia resulted in the development of an approved analytical protocol for detection and quantification of perchlorate in fertilizer source materials and fertilizer blends (EPA/600/R-01/026). While implementation of this protocol has proved generally successful since its release, the accurate detection of perchlorate in a high solids matrix such as fertilizer continues to prove difficult. In this paper, continuing efforts to refine the protocol and delineate guidelines for reporting realistic detection limits, optimizing instrument performance and to avoid potential interferences (false positives) are presented. Over reliance on dilution to avoid interference from the high salt background in fertilizers can easily lead to unrealistic detection limits or reporting of perchlorate contents that are systemically biased high. Over dilution of the sample matrix also increases the susceptibility to reporting false positives due to interferences.

55. Selective ion exchange for perchlorate separation, recovery, and environmental forensics

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Selective ion exchange is essential for separation and removal of trace

levels of perchlorate (ClO_4^-) from Chilean salt deposits or contaminated water containing orders of magnitude higher concentrations of sulfate, chloride, and nitrate. We recently developed a new class of bifunctional anion exchange resins for efficient sorption and removal of perchlorate. A new resin regeneration technique was also developed for recovering sorbed perchlorate; a nearly 100% recovery of perchlorate could be achieved by washing with as little as ~2 bed volumes of the $\text{FeCl}_3\text{-HCl}$ regenerant solution. These new techniques allowed for the isolation and recovery of perchlorate from nitrate deposits for isotopic identification. We found that perchlorate derived from Atacama soils has a unique oxygen isotope signature: large positive ^{17}O anomalies (+4.2‰ to +9.6‰) in comparison with no ^{17}O anomalies in man-made perchlorates. This ^{17}O anomaly thus provides a powerful tool for the forensics of perchlorate in nature.

56. Photo-oxidation of chloride to perchlorate in the presence of titanium dioxide and nitrate

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Naturally occurring perchlorate has been observed in playa areas of the western United States, in nitrate deposits from northern Chile, and has also been observed at low concentrations in surface and groundwater in the southwestern United States, distant from industrial sources. Studies were conducted to determine if perchlorate could be formed when dry chloride salts were exposed to ultraviolet light in the presence of titanium dioxide and nitrate, both of which are known to generate hydroxyl radical. Production of perchlorate was observed and varied with the conditions used; for example, 59 days of UV-B irradiation of 8 mg of chloride in the presence of 200 mg of titanium dioxide on a Petri dish resulted in the production of 260 ng/plate of perchlorate. Perchlorate formation was also observed when 440 mg of nitrate was irradiated in the presence of 20 mg of chloride. Although the sodium nitrate used for these studies was found to be contaminated with perchlorate, significant increases in perchlorate were observed (from 1800 ng/plate to 2500 ng/plate) following 59 days of irradiation. Additionally, a limited number of desert soils were analyzed by ion chromatography to determine if perchlorate was present. Concentrations varied from non-detectable to 16 ng/gm of soil. Because desert soils have previously been shown to also generate hydroxyl radical under irradiation, these results suggest a natural source of perchlorate in the arid regions of the southwestern United States.

57. mGCW in situ bioreactor technology for accelerated in situ removal of perchlorate and other nitrogenous compounds from soil and groundwater

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Microbiologically enhanced vertical groundwater circulation well (mGCW) technology uniquely combines vertical groundwater circulation wells with in situ bioreactors (US patent 5,910,245). By design, circulating groundwater transports dissolved contaminants to the centralized well/bioreactor core wherein they are treated/removed. Bacterial productivity around an mGCW system typically increases 10- to 10,000-fold. Aided by physical in situ mixing and vertical flushing, mGCW systems can yield fast and effective treatment/containment under a variety of field conditions. We recently modified this technology to create anaerobic mGCW systems supported by controlled-release carbon plus reduced metal (EHC Technology). The integration of mGCW + EHC technologies yields highly anaerobic (-550 mV Eh) conditions in situ, and can accelerate the bioremediation of aquifers containing perchlorate and other nitrogenous compounds. Multiple in-well bioreactor configurations can be accommodated (packed bed, fluidized bed, and tangential-flow type) using a variety of biosupport matrices (i.e., AQUAMEND). The bioreactors can be located: a) inside the well below, b) in an annulus space between the well casing and a larger diameter outer casing, or c) above ground in a contained area. Pumps are used to control flow rate and bioreactor residence time to

provide the appropriate kinetic relationship between a particular reactor type, contaminant, and design configuration.

58. From missiles to mitigation: Perchlorate treatment and remediation options

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Perchlorate is an endocrine disrupting compound (EDC) as it inhibits thyroid function. Its carcinogenic, neurodevelopmental, reproductive, and immunotoxic effects are of serious concern. As perchlorate may be dispersed throughout groundwater, detected in the vadose zone, or concentrated in a "hot spot", multiple approaches are suitable (and necessary) for an economical treatment solution to address this concern. Pump-and-treat technologies are often necessary for dealing with today's water supply. In-situ treatment is attractive for "tomorrow's" water and some site remediation. Excavation and treatment or surface soil treatments are frequently employed to deal with mitigating the source. Consequently, the selection of the most appropriate technology or combination of technologies is dependent on understanding the problem, site-specific issues and treatment goals. The objective of this presentation is to discuss: What are the current treatment options? How are some of the treatment options being applied? Which treatment options may be available in the future?

59. EPA Perspective on Health Risks Posed by Perchlorate: Mode of Action for Hypothalamic-Pituitary-Thyroid (HPT) Disruption and Life Stage Concerns

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Characterization of health and ecological effects of endocrine disruption is an area of active research in the US EPA. Contamination of the environment with perchlorate has focused attention on potential effects of impaired thyroid function. Thyroid hormones are essential to maintain physiological function of most tissues at all life stages and are critical for the proper neurological development of the fetus and newborn. Toxicological sequelae of HPT disruption include neurodevelopmental deficits and thyroid neoplasia. EPA has developed a conceptual model of disruption of the HPT axis as the mode of action (MOA) leading to these adverse effects for use in its risk assessments. This model facilitates interpretation and integration of diverse data across epidemiological screening studies in newborns, human clinical studies, guideline toxicological testing studies such as the developmental neurotoxicity (DNT) study, and ecological screens. This presentation focuses on the development of the conceptual model of HPT axis disruption, and its application as the MOA for perchlorate toxicity.

60. Panel discussion on the progress of the National Academy of Sciences' review of health impacts and EPA's establishment of an MCL for perchlorate

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the answers to the seven questions posed to it by Dr. Paul Gillman, the scientific community continues debate on specific science issues associated with water and agriculture. The discussion will be focused on how policy and decisions regarding regulation and science will affect the agricultural community. Questions will include what role should each of us take in finding a safe and amicable solution to the complex questions facing the agricultural community and the public in general.

61. The metabolism of fenthion in fish

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Sulfoxides of thioether organophosphate pesticides are generally more

toxic when compared to their parent compounds. However, few studies have examined the enantioselectivity of sulfoxide formation in biota.

The objective of this study is to examine the enantioselectivity of sulfoxidation in the thioether pesticide, fenthion, in various fish species (rainbow trout, hybrid striped bass, tilapia). The sulfoxides were measured using normal phase high performance liquid chromatography with a chiral column and detected by ultra violet light at 254nm. Preliminary in vitro data in striped bass has indicated that the (+) sulfoxides are formed in approximately 65% enantiomeric excess. It is believed that the enzymes responsible for sulfoxidation are cytochrome P450s and flavin-containing monooxygenases (FMOs). The P450 inhibitor lubrol was used to determine the amount of sulfoxide formed by FMO and P450 systems. Preliminary data has indicated that in striped bass P450 is responsible for 74% of sulfoxide formation.

62. Influence of grassed buffers on agrochemical movement to ground water

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Two buffers were studied to determine if percolation through grassed buffers leads to increased loading of agrichemicals to ground water. At Buffer I, peak nitrate-N concentration in runoff samples, lysimeter samples (1.2 m and 2.4 m), and shallow ground water samples (7 m) were 12.9 mg L⁻¹, 12.3 mg L⁻¹, and 32.1 mg L⁻¹, respectively. Atrazine (<0.05 to 0.1 µg L⁻¹) was only in the upslope, shallow well. Tensiometers (1.2 m and 2.4 m) suggested water percolates through the unsaturated zone; however tracers were not detected in the lysimeters. A clay lens at 1.2 m may retard pesticides. At Buffer II, nitrate-N and triazine concentrations in multilevel samplers (0.6 m to 10.7 m) ranged from <0.01 to 14.5 mg L⁻¹ and from <0.05 to 2.5 µg L⁻¹, respectively. No other pesticides were detected. There was no evidence of significant downward transport of agrichemicals through the buffers compared to the cultivated fields.

63. Perchlorate exposure in mammals through drinking water

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We developed a method for perchlorate analysis in plasma and tissues in which the detection limits for perchlorate in plasma and tissues were 13.7 ppb and 23.2 ppb, respectively, and the perchlorate recovery from spiked samples was consistent and reproducible (83.6 ± 0.6%). Evaluation of perchlorate exposure in large mammals, such as cattle, was conducted by monitoring cows on a site with access to a perchlorate-contaminated spring (concentration approximately 25 ppb) for 14 weeks during spring 2003. Monitoring data showed that perchlorate was only detected (15 ppb and 22 ppb) in one cow on consecutive sampling points during the study, but no perchlorate was detected in any of the tissue samples collected from these cows. A perchlorate distribution study was also conducted in laboratory animals (voles). Voles were administered perchlorate (250 ppm) through drinking water for 4 or 8 hours. Perchlorate was found to be excreted primarily through the urine with the average recovery of 4- and 8- hour exposure groups of 47% and 88%, respectively. Comparatively, little perchlorate was observed in blood, liver, kidney, thyroid, and feces.

64. Development of subacute bioassays for the assessment of transgenic corn (*Zea mays*) expressing the Bt protein

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In the last six years, the use of transgenic crops expressing Bt (*Bacillus thuringiensis*) delta-endotoxins has increased substantially, but assessment of ecological risks from plant-produced Bt suffers from a lack of studies that examine soil biota in an ecologically relevant manner. The goal of the current study is to develop assays that simulate exposure in the agroecosystem and incorporate chronic endpoints. Four bioassays were performed using invertebrate

decomposers fed transgenic plant material from two varieties of Bt 11 and their isolines, and two varieties of Mon 810 and their isolines. In a 28-day test, no differences between corn types were observed in survival or population growth of springtails (*Folsomia candida*). In a 21-day survival and growth test with juvenile earthworms (*Eisenia fetida*), no differences between corn types were observed. Survival and growth of juvenile pillbugs (*Armadillidium* sp.) were measured in a 49-day test. Individuals fed Bt 11 had a significantly greater percentage weight increase than those fed its isolate. Results of a current survival and growth test with juvenile sowbugs (*Porcelio scaber*) will be reported. Attempts are made to correlate nutritional content of the food types to the observed results.

65. Conversion of triadimefon to triadimenol in turfgrass

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Triadimefon is rapidly metabolized to the more mobile triadimenol in soil. Triadimenol poses a greater threat to groundwater than triadimefon due to its increased water solubility, half-life, mammalian toxicity, and lower Koc value. Two studies were performed to monitor these compounds in a turfgrass system. The first study monitored the conversion of triadimefon to triadimenol in turfgrass leaves, thatch, roots, and soil over a period of 28 days. Triadimefon was completely converted to triadimenol in thatch within 7 days. The second study monitored the leaching of triadimenol over an entire year in a plot treated with triadimefon for three consecutive years. Triadimenol was still present in the soil at depths up to 6-8" depth 1 year after the last application. This finding indicates that triadimenol would be available in the soil column for redistribution during spring recharge.

66. Degradation of chloroacetanilide herbicides by anodic Fenton treatment

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Anodic Fenton treatment (AFT), an electrochemical oxidation process, was evaluated as a method for the degradation of chloroacetanilide herbicide wastewater solutions. Five herbicides (acetochlor, alachlor, butachlor, metolachlor, and propachlor) were chosen as representative chloroacetanilides. The degradation rate parameters of the herbicides were calculated from concentrations, determined by HPLC, in samples of effluent taken at different times throughout the treatment in conjunction with an established kinetic model. Treatment effluents were extracted and GC/MS was used to identify degradation products for metolachlor and acetochlor. Product formation was compared and related to parent compound structure. Hydroxyl radical modes of attack were hypothesized based on degradation rate parameters and products. The purpose of this study is to contribute to a compilation of data accurately describing the degradation of a wide array of pesticides by AFT in order to support the eventual use of AFT as a treatment in the field.

67. Actions of λ-cyhalothrin isomers on voltage-sensitive calcium channels at rat brain presynaptic nerve terminals

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Isolated rat brain presynaptic nerve terminals (synaptosomes) were used to evaluate the actions of λ-cyhalothrin isomers individually and in binary combinations on pharmacologically-isolated, voltage-sensitive calcium channels by measuring calcium influx, membrane depolarization, and neurotransmitter release in high-throughput fluorometric assays. The active isomer of λ-cyhalothrin (1R-cis-) and

the λ-cyhalothrin technical mixture (racemic 1R-cis- + 1S-cis-isomers) increase calcium influx, membrane depolarization and subsequent neurotransmitter release in a dose-dependent manner. The active isomer is more potent and efficacious than the technical mixture. The inactive isomer of λ-cyhalothrin (1S-cis-) had no effect on calcium influx, membrane depolarization or neurotransmitter release. In binary mixture experiments, the inactive isomer antagonized the effect of the active isomer and the technical mixture in all fluorometric assays. These results provide functional evidence that only the toxic 1R-isomer of λ-cyhalothrin elicits an agonistic action on voltage-sensitive calcium channels at the presynaptic nerve terminal but the 1S-isomer can antagonize its effect.

68. In vitro metabolism of the avicide 3-chloro-4-methylaniline hydrochloride in hepatic and renal cellular preparations

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The avicide 3-chloro-4-methylaniline hydrochloride (chloro-p-toluidine hydrochloride, CPTH, DRC-1339) is used to control pest bird species which damage agricultural crops. This chemical appears to pose minimal hazard to mammalian species (LD50s greater than 1000 mg/kg) while being extremely toxic to the target species (LD50 for starlings <10 mg/kg). While it is theorized that CPTH is a nephrotoxin, no definitive assessment of the mode of action has been performed. Previously published research indicated that renal deacetylase activity levels were higher in sensitive avian species than less sensitive species and might be the reason for observed difference in the level of toxic responses. To investigate this theory in-vitro metabolism experiments were performed and the resulting metabolites were identified and quantified. The primary metabolite observed during these experiments was 3-chloro-4-methylacetanilide. Additional suspected metabolic products include a hydroxyl metabolite of the acetanilide. Deacetylase activity was found to proceed at a significantly faster rate in the renal mitochondrial fractions prepared from CPTH sensitive blackbirds and grackles than that of the less sensitive mallard. The data gathered during the experiments outlined above suggest that deacetylation may in fact be a factor in increasing the toxic response of CPTH.

69. Mass balance of ¹⁴C-metolachlor in a phytoremediation system

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The herbicide metolachlor has been implicated in point-source pollution at agrochemical dealerships in the Midwest. Prairie grasses have been used in filter strips and are also useful for phytoremediation, however little is known about the fate of contaminants and their metabolites within a grassed system. Effects of plant uptake on formation and fate of degradation products are not known. In this study, ¹⁴C-labeled metolachlor was added to closed systems to determine the fate of the parent compound and its metabolites in soil, plant, and air. Soil was treated with 25 mg/kg ¹⁴C-labeled herbicide and allowed to age 25 days. Four systems were then amended with a mixture of prairie grasses and four were unvegetated controls. ¹⁴C-CO₂ and volatile ¹⁴C-organic metabolites were collected throughout the 97-day study. Soil and plant materials were evaluated for radioactivity and identity of metabolites was determined. Vegetation significantly reduced concentrations of metolachlor in soil, compared to controls. There was no difference in mineralization between vegetated and control systems, therefore plant uptake appears to be important in the remediation of metolachlor; 7.2% of total applied ¹⁴C-label was taken up by the grasses in the 97-day study.

70. Removal of chloroacetamide herbicides and neutral degradates during simulated drinking water treatment

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Recent work reveals the prevalence of chloroacetamide herbicides (acetochlor, alachlor, dimethenamid and metolachlor) and 17 neutral degradates in raw drinking water samples obtained in the Midwestern United States. Their ubiquity raises questions about the fate of herbicide degradates during water treatment processes. This study explored the efficiency of coagulation/flocculation (alum and ferric chloride) and oxidation (chlorine and ozone) processes for removal of the compounds in question from an amended surface water. Coagulation/flocculation produced little to no removal (<10%) of the parent herbicides or the neutral degradates. Chlorination was able to entirely remove compounds that no longer contained the acetamide functional group for degradates of acetochlor, alachlor and metolachlor; compounds that retained the acetamide functional group had low removal efficiencies (0-16%). Dimethenamid and its deschloro degradate also demonstrated good removal efficiencies (84 and 96%, respectively) during chlorination. Ozonation proved more effective than chlorination, yielding removals of 60-100% for all parent herbicides and degradates. Product analysis was undertaken in the case of reaction of dimethenamid and one neutral degradate with aqueous chlorine. A single product in this case, involving addition of a chlorine to the thienyl ring, was obtained. This by-product of drinking water chlorination has not been previously reported.

71. Serial invasive signal amplification reaction for the genotyping permethrin-resistant (kdr-type) head lice, *Pediculus capitis*

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Permethrin resistance in the human head louse, *Pediculus capitis*, has been reported in worldwide, and found associated with the knockdown phenotype and cross-resistance to DDT and the pyrethrins. Recently, three point mutations, M827I, T929I and L932F in the voltage-sensitive sodium channel α -subunit gene, have been determined to be associated with permethrin resistance as a resistant haplotype (kdr-type). We have optimized a serial invasive signal amplification reaction (SISAR) protocol for the detection of these mutations using PCR amplified DNA fragments. SISAR distinguished all genotypes, including heterozygotes, with high accuracy in a heterogeneous head louse population from Texas. Using SISAR, resistance-conferring mutations are detected in a high throughput format, facilitating the efficient monitoring of permethrin resistance allele frequency in field populations.

72. Detection of residues of tetracycline antibiotics in soil fertilized with manure and waste water using Enzyme Linked Immunosorbent Assay (ELISA) and high performance Liquid Chromatography with electrospray ionization Tandem Mass Spectrometry (LC/MS/MS): Correlation between results of screening and confirmatory tests

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Residues of tetracycline group of antibiotics were quantified in wastewater from a sewage treatment plant and in soil fertilized with manure from animals receiving these antibiotics as feed additives, therapeutics, and growth promoters using tetracycline class specific enzyme linked immunosorbent assay (ELISA). The results from ELISA analysis were confirmed and quantified using Liquid Chromatography with Electrospray Ionization Tandem Mass Spectrometry (LC/MS/MS).

The degradation of chlortetracycline (initial concentration of 5.0 ppm) in soil fertilized with manure and grown with and without corn plants was followed using ELISA and LC/MS/MS to measure the decline in the chlortetracycline concentrations. Low levels of chlortetracycline residues (0.5 to 1.0 ppm) remained detectable in soils for up to 5 months. The correlation between the chlortetracycline concentrations determined by ELISA and LC/MS/MS methods was 0.81. It was observed that the degradation of chlortetracycline followed first order degradation kinetics and its half-life was greater in the soil planted with corn than the soil in which the corn plants were not grown. Total tetracycline residues analyzed by ELISA in the influent and effluent wastewater samples were determined to contain trace levels of tetracycline, oxytetracycline and chlortetracycline residues by LC/MS/MS. A correlation of 0.91 was achieved between the results of these methods. Tetracycline concentrations as high as 1250 $\mu\text{g}/\text{Kg}$ (0 – 10 cm soil depth) and as low as 11 $\mu\text{g}/\text{Kg}$ (40 – 50 cm soil depth) were detected using ELISA in soil fertilized with swine manure sampled from a farm. A correlation of 0.97 was achieved between the tetracycline concentrations determined by ELISA and LC/MS/MS methods. ELISA proved to be a cost-effective alternative analytical method for conducting environmental fate and transport studies necessary to understand the behavior of tetracycline residues in the agricultural fields.

73. Improved artificial rearing apparatus for the human head louse allows the determination of resistance to formulated pediculicides and repellency

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The human head louse, *Pediculus capitis* (De Geer), is an ectoparasitic insect that causes pediculosis, the most prevalent infestation of humans in the United States (U.S.) and in other developed countries. An improved artificial rearing apparatus enabled us to maintain large-scale rearing of pediculicide-susceptible and -resistant populations of human head lice, which allowed establishment of an in situ mortality bioassay using formulation-treated hair tufts on an artificial "scalp" membrane for semi-clinical validation of formulated product efficacy. N,N-diethyl-m-toluamide (DEET) treatment elicited 96.7 and 86.7% repellency (1 and 24 hr after treatment, respectively), indicating that DEET was a competent repellent against head lice and can serve as a standard repellent for comparison with other candidate compounds. Percent repellency values of farnesol, elemol, α -cubebene and piperonal were 60.0, 56.7, 46.7 and 96.7% (1 hr after treatment, respectively) and 53.3, 46.7, 36.7 and 36.7% (24 hr after treatment, respectively).

74. Efficiency of microfertilizers' application in potato-growing

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A study of how microfertilizers influence productivity and assimilation of microelements has been carried out with "Zarafshan" potato. The experiment was conducted on a typical gray-land soil of the Urgut area with a total nitrogen content of 0.082% and phosphorus content of 0.2%. Nitrogen, phosphorus and potassium were also applied to the ground at a rate of 0.1% at the beginning of the experiment. The microelements were applied to the ground as a solution. Each variable was replicated four times. The content of microelements were determined by emission spectral analysis, and definition of the mobile forms of manganese, copper and zinc in solution extracts were carried out using a "Saturn" spectrophotometer with a two-beam circuit. Of eight microelements (Li, B, Cr, Mn, Cu, Zn, Mo, I) tested in a background fertilizer with NPK of 120:90:60, boron and manganese were the most effective in enhancing productivity of "Zarafshan" potato. The application of boron and manganese increased potato productivity by 15-18%. Potato productivity was maximally affected by applications of microfertilizers during crop formation.

75. Aerobic metabolism of chlorsulfuron in Spanish soil

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The metabolism of ^{14}C -chlorsulfuron was investigated in a Spanish loamy soil (pH 8.3, 2.1 % OM) using both phenyl and triazine radiolabelled material. Test substance was applied at a rate of 0.2 mg ai g^{-1} soil to 10 g soil samples maintained in darkness at 20°C and 75% moisture capacity. Moist air was passed over the samples and through alkali solutions to trap volatile acidic metabolites. Samples harvested from 0-120 days, were extracted and analyzed by reverse phase HPLC. Measurement of unextractable residues and evolved carbon dioxide verified good material balance. Major transformation products were confirmed by LC/MS. The two predominate mechanisms for the degradation of chlorsulfuron in aerobic soil were: cleavage of the sulfonylurea bridge and O-demethylation of the triazine ring with further metabolism to triazine ring opened products. Approximately 6% and 2% of the phenyl- and triazine-radiolabelled test substances, respectively, mineralized to $^{14}\text{CO}_2$ by 120 days.

76. Fate of herbicides in the riparian buffer zone of a small first-order agricultural watershed

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The effectiveness of a riparian buffer in removing herbicides, atrazine and metolachlor, applied to an agricultural field was studied. The riparian system under study contains a first-order stream that receives ground water and surface runoff from the field. We monitored the fate of parent herbicides and their degradation products to determine the ability of the riparian buffer to remove these agrochemicals from the environment. Ground water that moves through the field/riparian buffer system exfiltrates at different rates in various zones of the buffer. For this study we selected sites within the buffer characterized by fast, moderate or slow upwelling of ground water, and measured the concentration of herbicides and their degradation products in the surface and ground water at different depth within the soil profile. The majority of monitored compounds were removed in the riparian buffer more effectively following transport through the slow upwelling zone. The buffer was less effective in removing metolachlor degradation products, especially metolachlor-ethanosulfonic acid (metolachlor-ESA). An especially high discharge of metolachlor-ESA to the surface was observed in fast upwelling zones within the riparian buffer. These fast upwelling zones may limit the effectiveness of a riparian buffer in remediation of agricultural contamination.

77. Influence of subsurface drains on runoff of pesticides from Mississippi River alluvial soil of Southern Louisiana: Deep tillage needed

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Runoff volume and loss of atrazine and metolachlor from 0.21 ha plots on Commerce silt loam with subsurface drains 1 m deep were not statistically different from runoff from plots without such drains. Concentrations of the herbicides in runoff as a function of time after application, and relations between runoff concentrations and corresponding soil concentrations were not different between the subsurface drain and no-drain treatments. These findings are contrary to previous reports of subsurface drainage impacts on the same soil. The primary cause of the differing results appears to be tillage management. Previous drainage management studies on this same soil were routinely deep chiseled, while our study was conducted under minimum tillage management. For this alluvial soil, the success of

subsurface drainage in reducing runoff in an earlier study was apparently related to routine (every other year) deep tillage of the plots. In our work on Commerce silt loam soil using minimum tillage management, subsurface drains do not effectively reduce runoff volume or losses of common soil-applied herbicides.

78. Solar radiation, relative humidity, and soil water effects on metolachlor volatilization

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Pesticide volatilization is a significant loss pathway that may have a detrimental impact on surrounding environments. This five-year study was designed to evaluate the impact of meteorological variables and surface soil water on volatilization losses of the pre-emergent herbicide metolachlor. Herbicide vapor concentrations were measured after application using polyurethane foam plugs at five heights above the soil surface. Volatilization fluxes were computed using pesticide concentration profiles with a flux gradient technique using corresponding eddy covariance measurements. The highest flux rates were found during years with wet soil conditions combined with high temperatures and intense solar radiation, especially in 2001 where a maximum flux rate of 1500 ng $\text{m}^{-2} \text{s}^{-1}$ was observed. Cumulative volatilization losses across years varied from 5 to 25% of applied active ingredient, with over 90% of losses occurring the first 72 hours. Results suggest that at conditions >20% soil water content, metolachlor volatilization losses can increase exponentially.

79. Sorption and desorption of Flumioxazin to soil, clay minerals, and ion-exchange resins

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Flumioxazin adsorption kinetics was described using a Greenville sandy clay loam soil. Adsorption kinetics experiments showed that 72% of total herbicide was absorbed after 1 hour of continuous shaking and continued to increase to 78% after 72 hours. Flumioxazin adsorption was then tested on seven commonly occurring soils throughout the southern United States. Adsorption isotherms for all soils had K_f values that ranged from 8.8 to 0.4, with the many occurring near 1.5. Soil organic matter content was the parameter most highly correlated with flumioxazin adsorption ($r^2 = 0.95$, $p < 0.001$). Sorption to clay minerals had K_f values ranging from 50 for bentonite to 4.7 for kaolinite. However, normalizing K_f for sorbent surface area revealed that aluminum hydroxide (gibbsite) possessed the greatest flumioxazin sorption. Sorption to anionic exchange resin (K_f 676) was greater than cationic exchange resin (K_f 42). Molecular model calculations were performed to elucidate why sorption was greater to anionic exchangers. These calculations indicated that a region of dense electronegativity exists on the 3-dione moiety of the molecule. This occurrence would lead to greater flumioxazin sorption by positively charged surface sites. Desorption isotherms from soil exhibited no effect of hysteresis. Desorption from clay minerals was very rapid and flumioxazin in solution was undetectable after the third desorption step. From these data it was concluded that flumioxazin can become readily available in soil solution with the addition of increased soil water content.

80. The effect of natural organic matter for the degradation of chlorpyrifos-methyl in aqueous solutions

Xiaofen Guo¹, Tong Wu², and Urs Jans². (1) Department of Chemistry, City College of CUNY, Convent Ave @ 138th St, New York, NY 10031, xiaofenguo@hotmail.com, (2) Chemistry Department, City College of CUNY

The effect of natural organic matter for the degradation of chlorpyrifos-methyl in aqueous hydrogen sulfide solution has been investigated. The kinetics of chlorpyrifos-methyl disappearance are first order in chlorpyrifos-methyl. Natural organic matter (NOM) has been shown to

increase the degradation rate of chlorpyrifos-methyl in aqueous solution containing hydrogen sulfide. Pseudo-first-order reaction rate constants were proportional to NOM concentrations. The degradation of chlorpyrifos-methyl in aqueous hydrogen sulfide solution containing NOM is strongly pH dependent, with rates increasing with increasing pH.

81. Role of reduced sulfur species in promoting the degradation of parathion and parathion-methyl in the environment

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agriculture. The exposure of these chemicals may be at high risk for adverse health effects. Recent studies have shown that organophosphate chemicals are consistently present in the air, rain and surface waters, suggesting a long environmental half-life. It is also reported that high concentrations of reduced sulfur species can occur under anaerobic conditions. Reduced sulfur species are good nucleophiles and reductants that can possibly undergo reactions with organophosphates. The kinetics of the reactions of parathion and parathion-methyl with reduced sulfur nucleophiles (e.g., bisulfide, polysulfide, thiophenolate) are determined using well-defined aqueous solutions over a pH range from 5 to 9. The determined second-order rate constants for the reactions of the two insecticides with bisulfide are significantly larger than that for hydrogen sulfide. Polysulfides react about 30 times faster than bisulfide. The experiments indicate that inorganic reduced sulfur species (e.g., bisulfide, polysulfides) present at environmentally relevant concentrations may represent an important sink for organophosphates in coastal marine environment. The mechanistic investigation of this reaction indicates that the nucleophilic attack by bisulfide at phosphorothionate esters occurs at the carbon atom of the alkoxy group rather than at the central phosphorus atom.

83. Degradation of chlorothalonil in irradiated water/sediment systems

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Many pollutants in aquatic systems will associate with sediment and their fate in such systems is important to assess potential biological impacts. Water/sediment systems incorporating simulated sunlight were designed to simulate shallow water conditions. Experiments were run in the light and dark simultaneously for 30 days in both creek and pond sediment systems. Hydrolysis and photolysis were also conducted in distilled-deionized water to support the results of water/sediment degradation experiments. The recoveries for chlorothalonil and hydroxychlorothalonil were 90% and 84% from creek sediment and 86% and 78% from pond sediment. The half-lives of chlorothalonil by hydrolysis and photolysis in distilled-deionized water were 47.8 days ($r^2=0.9286$) and 2.4 days ($r^2=0.9924$), respectively. More than 85% of the applied chlorothalonil in both water/sediment systems dissipated within 1 day from the water phase under light conditions. In contrast, 32-40% of the applied chemical remained in the water at day 1 in the dark. Approximately 3-6% and 10-16% of the applied chlorothalonil were found in sediments under light conditions at day 1 and in the dark at day 2, respectively, which are the highest amounts observed during the experimental period. The levels subsequently decreased rapidly, indicating that sediment is not a major sink for chlorothalonil in aquatic systems. Hydroxychlorothalonil, a major degradation product/metabolite, was detected only in the dark systems and ranged in concentration from 0.003-0.016 $\mu\text{g ml}^{-1}$. The total recoveries (water + sediment) under light conditions at day 1 were just 15-17% versus 68-79% in the dark, suggesting that photodegradation is likely important to the dissipation of chlorothalonil in aqueous environments.

84. Comparison of PRZM-3 model predictions to prospective groundwater data for evaluating the movement of sulfentrazone and sulfentrazone 3-carboxylic acid into soil pore water and groundwater in rural Indiana

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FMC Corporation has conducted three prospective groundwater studies in support of the registration for sulfentrazone, an FMC herbicide. Sulfentrazone was applied at the proposed label rate for the pre-emergent control of weeds in soybean fields along with a conservative tracer, potassium bromide. The modeling of sulfentrazone and its metabolite, sulfentrazone 3-carboxylic acid was performed using PRZM 3.12. The input parameters for PRZM were selected based upon a wealth of laboratory and site-specific soil and weather data that was available and were calibrated against observed bromide field data. The selection process for choosing input parameters and the comparison of the PRZM outputs to the observed field data will be presented.

85. Improvements to the Pesticide Root Zone Model (PRZM) for use in linked watershed modeling system

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To improve watershed modeling based on the linked models Pesticide Root Zone Model (PRZM) - Pond Water Quality Model (PONDWQ) - Riverine Water Quality Model (RIVWQ), several enhancements were made to the PRZM model. First, a new sub-lateral flow routine was developed to more closely represent tile drainage. Next, the ET routine was changed to allow the use of FAO irrigation and drainage paper 56 based technology. Finally, a known inaccuracy in the calculation of the antecedent moisture condition used for calculating the curve number in the PRZM was corrected. In addition to these changes several other enhancements will be discussed.

86. Watershed characterization for pesticide exposure assessment using GIS and remote sensing

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The use of landscape level information in pesticide exposure assessment provides additional information regarding the potential exposure to surface water from agricultural applications. Spatial data providing information on land cover, crop type & location, surface water location, elevation & slope, soil characteristics, and precipitation can all be combined in a Geographic Information System (GIS) to generate spatially distributed exposure estimation within or between watersheds. The use of remotely sensed information (satellite and aerial imagery) can also be incorporated to refine the land cover information and provide highly detailed information about crop variability, agricultural buffers, riparian zones, etc. The hydrologic network contained within a watershed can be efficiently examined using functionality already in place with the network data structure contained in a GIS. This poster will present several examples of different approaches for the spatial characterization of watersheds from the perspective of surface water and agriculture, at both the national scale (national ranking for vulnerability) and the local scale (detailed analyses of a single watershed). A discussion on publicly available and custom data sets will also be presented.

87. Watershed modeling by linking PRZM, RICEWQ, and RIVWQ

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The field-scale Pesticide Root Zone Model (PRZM) and the Rice Water Quality Model (RICEWQ: Pesticide Runoff Model for Rice Crops) were linked with a Riverine Water Quality Model (RIVWQ) for modeling a watershed with a high density of rice agriculture. The PRZM model was used to simulate the runoff from non-rice land use within the watershed. RICEWQ was used to simulate water drained from rice paddies or water that overflowed the rice paddies during storm events. The watershed stream network was set up as a series of links and nodes in the RIVWQ model. The predicted flow from the model was compared with the flows measured at a USGS gauging station in the watershed.

88. Development of soy-based lithium grease

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Seed oil is a potential replacement for mineral oil as a base fluid for making grease. The advantages of using products based on seed oils are their eco-friendly and non-toxic nature. This work focuses on the development of soy oil-based lithium grease using a variety of fatty acid component to obtain the thickener (metal soap) structure. It has been observed that the physical and chemical properties of grease are largely based on the soap thickener fiber microstructure. A transmission electron microscope methodology was developed to study the nature and structure of soap dispersoid in grease matrix. Tribochemical and oxidation studies were designed and the data obtained show excellent anti wear/friction and oxidation properties of soy-based greases.

89. Evaluations of *Myrothecium verrucaria* as a bioherbicide

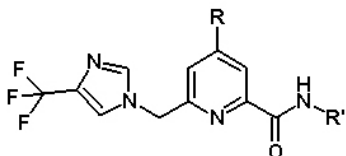
Robert E. Hoagland¹, Hamed K. Abbas², and C. Douglas Boyette¹.
 (1) Southern Weed Science Research Unit, USDA-ARS, P.O. Box 350, Stoneville, MS 38776, Fax: 662-686-5422, rhoagland@ars.usda.gov,
 (2) Crop Genetics and Production Research Unit, USDA, ARS

Bioherbicides are phytopathogenic microorganisms or microbial compounds that possess phytotoxic properties useful for weed control. *Myrothecium verrucaria* (Alb. & Schwein.) Ditmar: Fr. is a fungus with bioherbicidal activity against several weed species. We previously found that liquid culture preparations or spores could control kudzu [*Pueraria lobata* (Willd.) Ohwi], reedvine (*Brunnichia ovata*), hemp sesbania (*Sesbania exalta*) and sicklepod (*Senna obtusifolia*), and that a synergistic interaction occurred when the fungus was combined with the herbicide glyphosate. Several *M. verrucaria* sectors were discovered on culture plates that exhibited 35-100% control of kudzu seedlings when applied with a 12-hr dew period. Without dew, these sectors gave no control. However, in the absence of dew, the efficacy of some sectors was enhanced by application with a surfactant (Silwet L-77) or corn oil. Growing the fungus on a solid substrate (rice grains) showed that ground fungal-rice material, applied as a soil drench, effectively controlled kudzu seedlings (8 to 10 leaf stage), and that cell-free preparations reduced younger kudzu plant growth by 90-96%. Fungal formulations in wheat flour-water mixtures (2x10⁷ spores/g) provided a high level of kudzu seedling control when incorporated into soil prior to planting. Results indicate utility of this organism as a soil-incorporated bioherbicide and suggest that a phytotoxic factor exists in cell-free extracts.

90. Herbicidal 6-azolylmethyl-2-pyridinecarboxamides

Thomas M. Stevenson, Christina M. Dubas-Corderly, Marc Ruggeiro, Kanu M. Patel, Eric M Marshall, Maitram Luong, Michael Lasut, Balreddy Kamireddy, and Earl W. Reed, DuPont Crop Protection, Stine-Haskell Research Center, P.O. Box 30, Newark, DE 19714, Fax: 302-366-5738, Thomas.M.Stevenson@usa.dupont.com

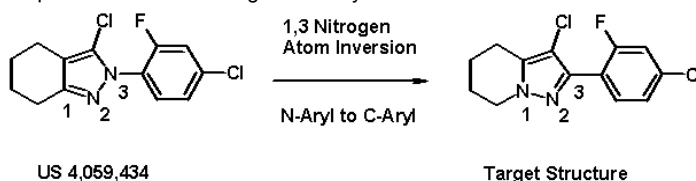
Over the last decade much effort has been invested in herbicide research directed toward inhibition of carotenoid biosynthesis at the phytoene desaturase step. Many of the active compounds resulting from this effort contain m-trifluoromethylphenoxy groups. At DuPont we have found that azolylmethyl groups substituted with trifluoromethyls are good replacements for this functionality. This led us to make 6-azolylmethyl-2-pyridinecarboxamides as potential herbicides. This poster will describe the synthesis and biological evaluation of these compounds.



91. Phenylpyrazolopyridines, part 1: Promising herbicides for rice

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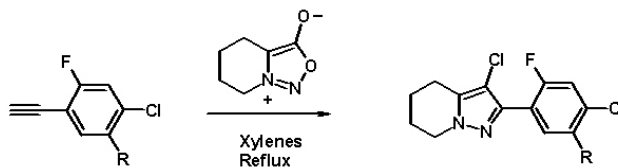
We have been studying the effects on biological activity of inverting the nitrogen atoms in the pharmacophores of heterocycles containing hydrazone linkages. Previously, we found that the biological activity of pyrazoline insecticides was not effected by a 1, 3-inversion of the pyrazoline nitrogens. To extend this study to a class of herbicidal pyrazole inhibitors of protoporphyrin IX oxygenase, we needed to synthesize the pyrazolopyridine target structure shown below. This represents the nitrogen atom inverted analog of the representative compound from U.S. patent 4,059,434, which had been a lead compound at DuPont. We were able to synthesize the target compounds by using sydnone cycloadditions with acetylenes. They proved to be potent herbicides with excellent activity and utility in rice. In this poster we will present the chemistry used to make these compounds and their biological activity.



92. Phenylpyrazolopyridines, part 2: Broad spectrum herbicides

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In a companion poster we reported that protoporphyrinogen IX oxidase (PROTOX) inhibiting phenyl pyrazolopyridines with 2,4-disubstitution were promising herbicides. We have extended this work to 2,4,5-trisubstituted phenyl pyrazolopyridines. These compounds have even broader herbicidal activity with potential utility in corn, soybeans, and cereals. The synthesis of these compounds is also based on sydnone cycloadditions. Introduction of the 5-substituents was accomplished by a variety of novel methods outlined in this poster.

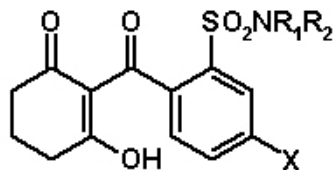


93. o-Sulfamidobenzoylcyclohexanedione herbicides with a dual site of action

Thomas M. Stevenson, Kanu M. Patel, Vern Wittenbach, Wayne Hanna, and Gregory Armel, DuPont Crop Protection, Stine-Haskell Research Center, P.O. Box 30, Newark, DE 19714, Fax: 302-366-5738, Thomas.M.Stevenson@usa.dupont.com

In the 1980's and 1990's a great deal of research was done in the area of "triketone" herbicides. These compounds exert their herbicidal activity by inhibiting the enzyme p-hydroxy phenylpyruvate dioxygenase. The result of this inhibition is that the plants are deprived of the products from the carotenoid biosynthesis pathway. Treated plants show bleaching symptomology. We became interested in synthesizing "triketone" compounds with an o-sulfamido group since DuPont has a lot of experience in the synthesis of sulfonamides containing esters and acids from many years of work in the sulfonylurea herbicides. However when we made and tested these compounds it turned out that they were active herbicides, but did not exhibit bleaching symptomology. In fact these compounds showed inhibition of both p-

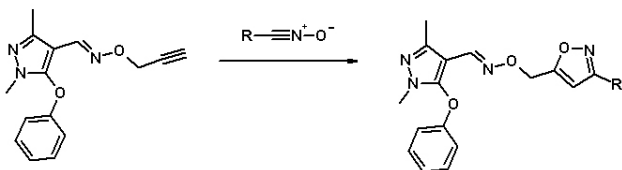
hydroxy phenylpyruvate dioxygenase and acetolactate synthase, the site of action of sulfonylureas. In this poster we will describe the synthesis, biology and biochemistry of these interesting herbicides.



94. Isoxazolylheterocycles as fungicides and insecticides

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During the past 15 years a wide variety of heterocyclic compounds have been found which can inhibit mitochondrial electron transport at Complex I. These compounds share common features that include a nitrogen heterocycle, a linking chain and a lipophilic group. In the case of most of the patents in this area, the lipophilic portion of the molecule did not include heterocyclic residues. We carried out a program of attaching propargyl and allyl groups to these heterocycles and then doing nitrile oxide cycloadditions to give isoxazoles and isoxazolines. These compounds were potent insecticides and fungicides. In this poster we will outline the chemistry and biological activity of these isoxazolyl heterocycles.



95. Role of bromine containing 4-thiazolidinones as potential antifungal agents

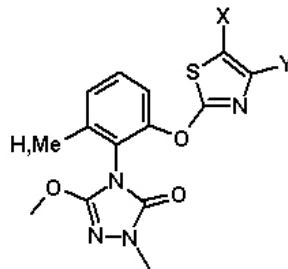
Dr Randeep K. Sandhar, Department of Chemistry, Bhutta College Of Engineering & Technology, 379-E Bhai Randhir Singh Nagar, Ludhiana141012 NA, India, Fax: 0091-161-2462966, sandharandeep@rediffmail.com

Refluxing benzal-4-bromoaniline or its C-phenyl derivatives (I-VIII) with thioglycolic acid in equimolar ratio resulted in the formation of 2-phenyl-3-(4-bromophenyl)-4-thiazolidinone (Ia), 2-(4-chlorophenyl)-3-(4-bromophenyl)-4-thiazolidinone (IIa), 2-(4-hydroxyphenyl)-3-(4-bromophenyl)-4-thiazolidinone (IIIa), 2-(4-methoxyphenyl)-3-(4-bromophenyl)-4-thiazolidinone (IVa), 2-(3,4-dimethoxy phenyl)-3-(4-bromophenyl)-4-thiazolidinone (Va), 2-(3,4,5-trimethoxyphenyl)-3-(4-bromophenyl)-4-thiazolidinone (VIa), 2-(3-methoxy-4-hydroxyphenyl)-3-(4-bromophenyl)-4-thiazolidinone (VIIa) and 2-(3-ethoxy-4-hydroxyphenyl)-3-(4-bromophenyl)-4-thiazolidinone (VIIIa). The compounds have been characterized on the basis of IR studies showing characteristic peak for the carbonyl group. The synthesized compounds have been screened for their antifungal activity against five pathogenic fungi viz *Alternaria alternata*, *Fusarium oxysporum*, *Colletotrichum capsici*, *Myrothecium roridum* and *Ustilago tritici*. 4-Thiazolidinones have been found to be more potent than their parent compounds in general and *F. oxysporum* and *M. roridum* in particular. The best compound of the present study has been found to be VIIa, with ED50 value of 170 ppm against *M. roridum*. It's concluded that the presence of bromine in C-phenyl ring and sulfur facilitates the antifungal potential of synthesized 4-thiazolidinones. These compounds can be further exploited for their use in agriculture.

96. Synthesis and biological activity of thiazole substituted 3H-1,2,4-triazolin-3-one fungicides

Paula L. Sharpe, Thomas P. Selby, Gerard M. Koether, and John P. Daub, DuPont Crop Protection, Stine-Haskell Research Center, P. O. Box 30, Newark, DE 19714, Fax: 302-366-5738, Paula.L.sharpe-1@usa.dupont.com

Fungicides based on the natural product strobilurin A have become successful commercial products. At DuPont we have found that triazolinones can replace the natural methoxy acrylate pharmacophore. In this poster we will describe the synthesis of triazolinone strobilurin analogues with thiazole side chains. We will also present data on the structure activity relationships of these compounds as well as their fungicidal evaluation.

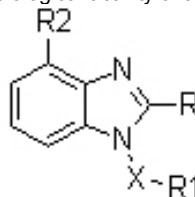


X, Y = alkyl, aryl, halo, etc.

97. Novel aphicides containing benzimidazole

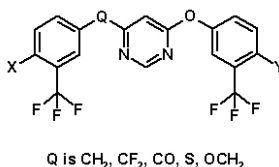
Benjamin J. Dugan¹, Robert N. Henrie II¹, Scott D. Crawford¹, Steven W. Szczepanski², Walter H. Yeager¹, Zeinab M. Elshenawy¹, Harvey R. Wendt¹, John W. Lyga³, Joseph A. Argentine¹, David S. Rosen⁴, Frank J. Zawacki¹, Bolun Hu¹, and Rene K. Amaning¹. (1) Agricultural Products Group, FMC Corporation, P.O. Box 8, Princeton, NJ 08543, Fax: 609-951-3330, benjamin_dugan@fmc.com, (2) Cerus Corporation, (3) Department of Discovery Research, Agricultural Products Group, FMC Corporation, (4) Agricultural Products Group, Chemistry Dept, FMC Corporation

Compounds that act by inhibition of mitochondrial electron transport (METI) are known, effective acaricides. METI active geranylbenzimidazole derivatives also exhibited aphid activity. Bioisosteric replacement of the geranyl moiety produced analogs with activity against cotton aphid (*Aphis gossypii*). The preparation and biological activity of the benzimidazoles will be presented.



98. 4-Phenoxy pyrimidine insecticides and acaricides

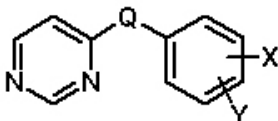
Thomas M. Stevenson, Thomas P. Selby, Tho V. Thieu, Gilles Seburyamo, Donna L. Piotrowski, and Lora L. Geist, DuPont Crop Protection, Stine-Haskell Research Center, P.O. Box 30, Newark, DE 19714, Fax: 302-366-5738, Thomas.M.Stevenson@usa.dupont.com 4,6-Bis(aryloxy)pyrimidine insecticides have extremely good activity on many species of mites. We became interested in this area because we had earlier shown that in phenoxy pyrimidine herbicides, that replacement of a phenoxy group with either a benzyl or benzoyl substituent gave compounds which retained much of the biological activity and had better environmental properties. We then undertook the synthesis of compounds containing a variety of novel replacements for one of the oxygen linkers in these molecules as shown in the structure below. This poster will outline the various synthetic methods we used to synthesize these compounds as well as results from biological evaluations.



99. 4-Phenoxy pyrimidine insecticides

Thomas M. Stevenson, Donna L. Piotrowski, Roman Kucharczyk, Farah Ali, and Christine Giffin, DuPont Crop Protection, Stine-Haskell Research Center, P.O. Box 30, Newark, DE 19714, Fax: 302-366-5738, Thomas.M.Stevenson@usa.dupont.com

4,6-Bis(aryloxy)pyrimidine insecticides have extremely good activity on many species of mites. In connection with a project designed to replace one of these aryloxy groups with an azolylmethyl group we attempted a halogen metal exchange of a 4-aryloxy-6-iodopyrimidine with n-BuLi. On quenching of the mixture with dimethylformamide we only obtained the 4-aryloxy pyrimidine and no aldehyde. Unexpectedly, the compound showed potent activity on corn planthopper and none of the acaricidal activity of the parent structures. We followed this serendipitous result by an analoging program using a variety of different phenols and spacers. This poster will describe the synthesis of these compounds as well as results from biological screening.

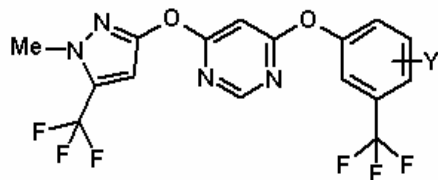


Q = O, OCH₂, CF₂,
S, Direct Bond, CO

100. 4-Pyrazolyloxy pyrimidine insecticides and acaricides

Thomas M. Stevenson, Tho V. Thieu, Darius J. Robinson, Donna L. Piotrowski, and Berlin C. Stokes, DuPont Crop Protection, Stine-Haskell Research Center, P.O. Box 30, Newark, DE 19714, Fax: 302-366-5738, Thomas.M.Stevenson@usa.dupont.com

4,6-Bis(aryloxy)pyrimidine insecticides have been shown to possess excellent acaricidal activity and activity on some insect species. Key to this activity is the presence of a m-trifluoromethyl group on each of the two aryl rings. We were drawn to replace one or both of the phenoxy groups with trifluoromethylpyrazolyloxy groups in hopes of lowering the lipophilicity of these compounds and extending the activity to sucking insects such as aphids and plant hoppers. Synthesis of the compounds and biological evaluation revealed that keeping one of the m-trifluoromethylphenoxy groups is essential for good activity. However, introduction of one pyrazolyloxy group did lead to compounds with improved activity on sucking insects. This poster will outline the synthetic approaches we used to make the desired compounds as well as their biological activity.



101. Analysis of oxamyl in cotton gin trash by LC/MS/MS

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Enforcement methods have been developed for carbamate pesticides utilizing liquid chromatography (LC) with post column derivatization and fluorescence detection. Recently mutiresidue methods have been developed for carbamates using LC/MS/MS. The sample cleanup described in this method provides conditions to analyze difficult matrices like cotton gin trash. The sample is extracted with ethyl acetate. Sample cleanup utilized EnviCarb solid phase extraction (SPE), followed by a normal phase Si SPE. Oxamyl was retained on the Si SPE column, and the column was washed to remove impurities. Analysis was performed by LC/MS/MS in negative ion mode with an electrospray ionization source. The mean percent recovery of oxamyl from 12 freshly fortified control cotton gin trash samples was 101% with a relative standard deviation of 12%. This method should be applicable

to other carbamates in addition to oxamyl.

102. Characterizing 3-chloro-p-toluidine hydrochloride on rough hulled rice and ethyl cellulose coated rice baits using high performance liquid chromatography

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Methods were developed to extract and quantify the avicide 3-chloro-p-toluidine hydrochloride (CPT HCl) from rough hulled rice and ethyl cellulose coated rice baits using high performance liquid chromatography. The mobile phase used in the methylcellulose coated rice matrix method was an acetonitrile/phosphate buffer (60:40) at pH 8 while the rough hulled rice bait matrix method used an acetonitrile/phosphate (70:30) buffer at pH 2. Increased sensitivity was observed for CPT HCl at the higher pH, while there was a faster elution time at the lower pH. The two methods provide flexibility in characterizing different bait formulations in an ongoing pesticide formulation improvement program.

103. Stability/availability of tetracycline in rabies vaccine baits

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Tetracycline is widely used as a biomarker for bait consumption by wildlife; tetracycline is incorporated into bones and teeth and may be detected by fluorescence microscopy several weeks post consumption. In 2003, the US Department of Agriculture distributed approximately 10 million oral rabies vaccine baits containing tetracycline to control the spread of wildlife-vectored rabies to humans, pets and livestock. To estimate the percent of target species consuming the baits, raccoons and skunks were collected in baited areas and teeth were analyzed for the presence of the biomarker. Several incidences of low biomarker detection rates prompted an investigation of the stability of the biomarker in the baits. Baits were collected at several points along the manufacturing and distribution chain. Baits were analyzed for free and polymer bound tetracycline and epitetracycline. The results indicated that a portion of the tetracycline was converted to the less active isomer, epitetracycline. Additionally, significant quantities of both compounds were trapped in the polymer formulation. The results of this study suggest that approximately half of the target quantity of tetracycline was available for absorption. This situation could contribute to the low biomarker detection rates and suggests that formulation modification should be considered.

104. Chiral pesticide analysis using HPLC with CD and fluorescence detection

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Pesticides are of concern because they bioaccumulate through the food chain to top predators, including people, and have endocrine-disrupting or other toxic properties. Almost 25% of all pesticides are chiral molecules, most of which are manufactured as a 50/50 mixture of the two enantiomers. Recent developments have forced the agrochemical industry to consider enantioselectivity. For example, the (R) enantiomer of dichlorprop kills the weeds, while the (S) enantiomer is inactive. Enantiomeric agrochemicals will cost less to produce, require smaller quantities and cause less environmental damage. Synthesis of pure enantiomers can be more profitable because the patents of the racemic compounds eventually expire. To make more accurate determinations of chiral pesticides, it is necessary to understand the effects of their enantiomers. Jasco offers the only commercially available CD detector for HPLC. This paper will demonstrate detection of the enantiomers of selected chiral pesticides using HPLC with fluorescence and CD detectors.

105. Ractopamine: Metabolism, tissues residues, and methods for analysis in livestock

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Ractopamine hydrochloride (HCl) is a phenethanolamine drug approved for use in swine and cattle to improve feed efficiency and increase the yield of lean meat. In order to gain approval as a feed additive, ractopamine HCl was the subject of extensive food safety testing in both livestock and laboratory animals. This presentation will review the metabolic fate and tissue residues of ractopamine HCl in swine and cattle. Studies employing [¹⁴C] ractopamine HCl were used to determine the magnitude of total residues and nature of the metabolites present in edible tissues. Metabolites were isolated and identified using mass spectrometry and NMR. A focus of the presentation will be a review of residue depletion studies conducted in swine to determine the appropriate marker residue and target tissue, and kinetics of residue depletion from edible tissues upon withdrawal from treatment. The very low tissue residues of ractopamine present in edible tissues necessitated the development and validation of highly sensitive chromatographic methods employing electrochemical and fluorescence detection. The regulatory tissue residue analytical methods and control strategies needed to monitor use of the product will also be reviewed.

106. Tylosin: Mobility in a manure-soil matrix and dissipation in surface water

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Tylosin is a veterinary antibiotic commonly used as a livestock feed additive for growth promotion and disease prevention. Tylosin enters the environment via application of manure to soil. Little is known about the fate of tylosin in a manure-soil matrix. In this study, the mobility of tylosin was investigated using intact soil columns treated with swine manure at 5 mg/kg tylosin. Following a rain event, leachate was examined for tylosin using ELISA and LC/MS/MS. 0.8 ng/mL total tylosin was detected in leachate, with tylosin isomers A and D comprising 22% and 65%. Over 80% of total tylosin applied to soil columns was tylosin A, thus indicating differential mobility and/or persistence of tylosin D. To evaluate dissipation in surface water, dilute pond water was fortified to 10 ng/mL tylosin. The tylosin solutions received treatments of 0.1% manure solution and vegetation, alone and in combination. Solutions receiving manure treatments had a significant decrease in tylosin concentration beginning at day 4; this decrease could be due to increased microbial degradation or binding of tylosin to organic matter. Vegetation did not have a significant effect on dissipation during the 24-day test, however trends indicate a possible effect beyond day 24.

107. Influence of organic matter amendments on the persistence of endosulfan in soils

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Endosulfan is an organochlorine, non-systemic insecticide and acaricide with contact and stomach action. It is used against a wide range of sucking and chewing insect pests. A laboratory pot experiment was conducted to study the effect of amending soil with four different sources of organic matter, namely poultry by-product meal, poultry manure, dairy manure, and municipal solid waste compost. The organic amendments were cured, dried, ground (<1 mm) and thoroughly mixed with a Lebanese calcareous soil at a rate of 2 % and placed in plastic pots. Endosulfan was added at the rate of 20 mg/kg to each pot. The pots were kept at room temperature and the moisture level was maintained near field capacity. One hundred-gram soil subsamples were collected from every pot at days 1, 8, 15, 22, 29, 43 and 57 for the measurement of endosulfan isomers. Endosulfan was extracted from

the soil samples with acetone. The supernatant was filtered through anhydrous sodium sulphate; 5-mL aliquots were diluted to 25 mL with hexane and mixed well. Two sub-samples from the filtrates were analyzed for α and β -endosulfan isomers by gas chromatography. The half-life of (-endosulfan in the poultry by-product meal treatment was about 15 days compared to about 22 days in the other treatments. The half-life of (-endosulfan was about 22 days in the poultry by-product meal, 57 days in the municipal solid waste compost, and the extrapolated half-life was about 115 days for the other three treatments.

108. Degradation of disulfoton, thiometon and phorate promoted by reduced sulfur species

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Organophosphates are among the most widely used insecticides in the United States. Organophosphorus pesticides present in the surface water may associate with the particles and become the part of the sediment phase. Anoxic condition in sediment gives rise to the reduced sulfur species, which are good nucleophiles and can react with the pesticides. The primary purpose of this research was to determine the role of reduced sulfur species in promoting the degradation of disulfoton, thiometon, phorate. The influence of substituents and the structural difference on the reaction mechanism and the reaction rates was expected. Hydrolysis and degradation promoted by reduced sulfur species of phorate are much faster than disulfoton and thiometon. While polysulfide and thiophenol had important influence on the degradation of phorate, hydrogen sulfide did not show the actual promotion for the degradation of phorate. The reaction rate order of the degradation of phorate promoted by the sulfur species is polysulfide >> thiophenol > hydrogen sulfide. The reactions of thiometon with reduced sulfur species are much faster than disulfoton. This difference might result from the steric hindrance. There existed much difference between the hydrolysis and the degradation of the pesticides promoted by the reduced species. The presence of the reduced sulfur species may retard the hydrolysis of the pesticides.

109. Development of analytical methods for environmental detection and quantification of the Bt protein from corn (Zea mays)

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The use of *Bacillus thuringiensis* (Bt) proteins, expressed in transgenic plants, has increased substantially in agroecosystems. As a result, concerns have been raised regarding the safety of these toxic proteins in the environment. Constructing an ecological risk assessment requires quantitative environmental exposure data, but this is severely limited by the lack of accurate and sensitive analytical methods to quantify Bt proteins in soil. Current chemical methods do not yield toxin measurements that correlate well with the levels detected by bioassay. The overall goal of this project is to develop and optimize analytical methods that will allow accurate and sensitive quantification of Bt proteins in natural environmental matrices, and lay the groundwork for measurement of other toxic proteins in the future. The approaches discussed are: 1) evaluation of solvent/buffer systems for high extraction efficiencies, and the evaluation of solvent-extracted protein for analysis by immunoassay, and 2) use of bead-based immunoassay techniques to enhance extraction of the protein from soil. Multiple organic solvents and combinations were examined and soil extraction efficiencies were measured using ELISA.

110. Invertebrate digestive fluids for soil Bt protein extraction

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Since the debut of genetically modified (GM) crops two decades ago, the potential risk to ecosystems has been a concern of various stakeholders. Risk assessments requiring a measure of GM protein

persistence in soil have been hampered by the lack of efficient and quantitative detection methods due to low extractability of *Bacillus thuringiensis* (Bt) proteins from soil. Insect bioassay has been the only available method capable of measuring a reasonable fraction of active Bt protein in soil, but this approach is imprecise and requires considerable effort to obtain quantitative results. Given that deposit-feeding invertebrates must have the biochemical tools necessary to extract nutritionally important soil or sediment-bound proteins, we have been exploring the digestive fluid of deposit feeders as a potential *in vitro* extractant for Bt proteins. We have developed an efficient, biomimetic extraction procedure using an artificial worm gut fluid. Coupled with a rapid and sensitive immunoassay, it for the first time allows the conduct of efficient, accurate and quantitative risk assessments for Bt proteins based on persistence in soils. Commercial GM proteins (Cry1Ab, Cry1Ac, Cry1F) in a variety of soils were investigated in terms of extraction efficiency and the correlation between data from this method and insect bioassays.

111. Fate of the fumigant [¹⁴C] furfural in soil under anaerobic conditions

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Furfural, Generally Recognized as Safe (GRAS) as a food flavorant, has also been used with significant environmental benefits as a new and effective crop protection agent to control nematodes, fungi, and weeds. Furfural was rapidly metabolized via transient metabolites to CO₂ in 4 soil types at various temperatures in an earlier aerobic soil metabolism study. The current study reports the metabolic pathway and fate of furfural in the same 4 soils under anaerobic conditions. Furfural was studied under anaerobic conditions at 20° and 10°C for 180 days in 4 soils (2.1-11.7% organic matter) at application rates of 150 mg/kg (600 lbs active/acre). Furfural disappeared from all soils within 11 days with a calculated half-life of 1-3 days compared to 0.6 hours-1.2 days under aerobic conditions with a slower rate of mineralization to CO₂. Extractable soil metabolites progressively decreased from 51% to <6% of applied radioactivity over a period of 7 to 180 days. Metabolites, primarily found in the soil aqueous phase, were initially characterized by HPLC/RAM as furfural alcohol and/or 2-furoic acid and by day 28 as a mixture of propionic and acetic acids. Characterization and quantification of bound residues will also be discussed.

112. History and development of metals regulation in fertilizers

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Although the issue of metal contaminants in fertilizer materials gained national attention in 1999, the fertilizer industry was working to address the issue of trace metals in fertilizers much earlier. In 1993 EPA published the 503 biosolids rules for meals. Also in 1993 the Fertilizer Institute (TFI) formed a taskforce to assess risks associated with metals in fertilizers. In 1995 Steven J. Van Kauwenbergh published a survey of metals ore deposits around the world. This brought to light differences in the metal levels of phosphate ores. At that time Japan, Europe, and Canada had regulations or guidelines regarding metals levels in fertilizers. Currently 8 states have regulatory limits for some trace metals. Over 20 others are monitoring metals of products in their states. AAPFCO (Association of American Plant Food Control Officials) recently adopted standards that can be used by states to assure safe levels of trace metals in fertilizer materials.

113. European regulation relating to cadmium in fertilizers

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Unintentional cadmium content in mineral fertilizers is a concern for the European Community, in particular for Austria, Finland and Sweden who, since their accession to the Community, were allowed to restrict

the placing on the market of EC-fertilizers with a cadmium content above their national threshold. The Commission committed itself in 1998 to produce limit values and a method to determine the cadmium content in fertilizers. A risk assessment program was conducted in the different Member States. Several options to stabilize the rate of accumulation of cadmium in agricultural soils in Europe were considered. Meanwhile a mandate was given to the European Centre for Normalisation, CEN TC260 – Task Force cadmium, to develop a method. The method proposed uses nitric acid extraction and determination with optical ICP or AAS flame. Finally a new regulation including a European threshold relating to cadmium in fertilizers was agreed upon in March 2004.

114. Risk assessment for cadmium in phosphate fertilizers

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Cadmium induced renal tubular dysfunction occurred where subsistence rice farmers produced their lifetime dietary rice on Zn-mine waste contaminated soils in Japan and other Asian countries. Research has shown that polished rice Cd is greatly increased while grain Zn is not increased; and that rice grain is usually deficient in Fe and Zn for humans. These dietary deficiencies promote Cd absorption 10-20-fold compared to diets with adequate Fe and Zn supply. Analysis of exposed Japanese populations has shown a threshold in urinary Cd before tubular dysfunction began, indicating that claims of dietary Cd disease in Europe are not valid. The potential for fertilizer-Cd to enter crops and diets indicates very low chance that fertilizers will cause human Cd disease compared to previous reports on this topic. Philosophically, the extremely high Cd phosphate ores should be avoided or treated to remove Cd in production of phosphate fertilizers or feed ingredients.

115. Extraction of arsenic and lead from mineral fertilizer containing arsenopyrite and galena- hydroponic plant uptake and pH effects

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A sulfuric acid solution at pH 2.3 is shown to remove about half the arsenic from arsenopyrite contained in a mineral micronutrient based fertilizer. Only 1.8% of the lead was removed from the galena as a result of the extraction. After extraction, adjusting the pH to 4.22 reduced the extracted arsenic levels by 99.9%. Lead was reduced by 85.3%. The precipitation of arsenic as pH increases prevents plant uptake of arsenic since most plants grow at pH levels above 4.22. Plant uptake and removal data will be presented.

116. A generalized trace element mass balance model for cropland soils: Arsenic and cadmium

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A mass balance computational model is developed to assess trace element transformations in the root zone of irrigated cropland that receives routine P fertilizer and micronutrient applications. Cropland soils in California receive typically contain 7.7 and 0.22 mg kg⁻¹ of As and Cd, respectively and receive 30 and 13 g ha⁻¹ yr⁻¹ of As and Cd inputs, respectively through application of P fertilizers and irrigation water. The total As and Cd content of the cropland soils receiving simulated fertilizer inputs for 100 years will change from 7.7 to 7.6 and 0.22 to 0.35 mg kg⁻¹, respectively. Uncertainties, estimated by the Monte Carlo simulations, show that 95% confidence intervals of the estimated total As and Cd of soils vary from 7.2 to 8.2 mg kg⁻¹ and 0.25 to 0.5 mg kg⁻¹, respectively. A Windows-based version of the model has been developed for site- and case-specific assessments of trace element accumulation in soils.

117. Producing a product-specific metals risk assessment for evaluation of As in fertilizer

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For more than a decade, the health and environmental implications of the presence of various non-nutrient inorganic substances (e.g., arsenic, cadmium) in commercial fertilizers has attracted the interest of a wide range of government agencies and non-government organizations. Several human health risk assessments have been prepared for the purpose of evaluating baseline risks associated with measured concentrations in fertilizer and establishing health protective, risk-based practical standards for industrial and regulatory risk management. The fact that these standards are not product specific and are intended for broad application to fertilizer products anywhere in the U.S. presents a number of scientific, regulatory and industrial compliance challenges. Arsenic, a trace constituent in both phosphate and certain micronutrient fertilizers, poses certain toxicological and risk assessment complications, some of which indicate the need for product-specific risk assessment in evaluating the nature and magnitude of potential health protectiveness.

118. Metabolism of melengestrol acetate (MGA) in the bovine: Biological activity assessment of tissue residues and implications for human food safety

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Melengestrol acetate (MGA) is an orally active progestational steroid used as a feed additive in beef heifers. MGA was highly metabolized in the bovine and in women and rabbits. To characterize the nature of MGA-related residues in edible bovine tissues, metabolites were generated using in vitro test systems. The structures of three monohydroxy- and one dihydroxy metabolite of MGA were determined. The relative abilities of MGA and these metabolites to act as agonists for the human progesterone, glucocorticoid, androgen, and estrogen receptors were then determined using in vitro reporter gene assays. These data support the interpretation that MGA and its metabolites are classified principally as progestogens with secondary glucocorticoid activity. Given the greatly reduced activities of the metabolites versus MGA, the biologic activity of MGA can be attributed primarily to parent MGA and the contribution of the metabolites to biological activity can be largely discounted.

119. Determination of desmosterol concentration in a reference standard over time using cholesterol as an internal standard in a high performance liquid chromatography method

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Desmosterol [(3 β)-Cholesta-5,24-dien-3-ol] is being evaluated as an infertility agent in a number of wildlife species at the United States Department of Agriculture/Animal Plant Health Inspection Service/Wildlife Services/National Wildlife Research Center. To support this effort, we developed a high performance liquid chromatography method to quantify desmosterol in plasma samples. A problem we encountered was the degradation of the desmosterol standard over time. Limited availability required that we develop an approach that would allow us to quantify the desmosterol in the standard over a standard-lot life cycle. We modified the original method to add cholesterol as an internal standard when preparing the desmosterol standards. This approach has proven to be robust and allowed us to

operate within the constraints imposed by a limited standard supply.

120. Use of analyte protectants to improve gas chromatographic analysis and quantitation of pesticide residues in biotic matrices

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Analyte protectants are compounds that strongly interact with active sites in the gas chromatographic (GC) system, thus decreasing degradation and/or adsorption of co-injected analytes. Therefore, the application of analyte protectants can minimize losses of susceptible analytes and significantly improve their peak shapes (due to reduction of peak tailing). When added to both sample extracts and matrix-free standards, analyte protectants can induce an even response enhancement in both instances, resulting in effective equalization of the matrix-induced response enhancement effect. As compared to matrix-matched standardization, this approach offers a more convenient solution to the problems associated with calibration in routine GC analysis of pesticide residues in diverse samples. We evaluated various compounds and found a mixture of 3-O-ethylglycerol, gulonolactone, and sorbitol to be one of the most effective combinations for the volatility range of GC-amenable pesticides. Not only did the addition of these analyte protectants effectively compensate for the matrix-induced response enhancement, it also improved intensity and peak shape of those pesticides susceptible to losses and peak tailing, thus decreasing their detection limits. Moreover, they also minimized the matrix-induced diminishment effect, resulting in improved ruggedness and, consequently, reduced need for frequent GC system maintenance.

121. The determination of antibiotic residues in animal tissues and honey; sample preparation for LC-MS analysis

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There is increasing worldwide interest in the presence of antibiotic and other veterinary agricultural residues in meat and seafood products. Although the determination of these residues is closely related to crop analysis for pesticides, in many cases much lower quantitation limits are required. Usually, for both pesticide residue analysis and veterinary residue analysis, analytical requirements are dictated by toxicological concerns; the desired LOQ is related to the allowed maximum residue levels of properly registered and properly used agrochemicals. However, there is significant concern about nonregulated and illegal use of certain antibiotics for livestock agriculture and for fish farming. In these cases, there is no permissible residue limit; the presence of any such residues is evidence of criminal activity. In this presentation, we will discuss SPE strategies prior to tandem LC/MS analysis for sub-ppb determination of chloramphenicol, nitrofurantoin antibiotic metabolites, and other related substances in animal tissues and in honey.

122. Metabolites of chlorophacinone in California ground squirrels, pocket gophers and mountain beavers

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Chlorophacinone is an anticoagulant used in formulated products to control populations of such pest species as California ground squirrels, pocket gophers and mountain beavers. To assess the potential secondary hazard to scavengers, the residues of chlorophacinone in the carcasses must be determined and a risk assessment completed. The residues in liver and whole body tissue samples are typically determined by ion-pairing reversed-phase high performance liquid chromatography (HPLC) after liquid extraction of the sample combined with a solid phase extraction (SPE) clean-up procedure. All samples were determined with the addition of diphacinone as a surrogate. In addition to the analyte, several metabolites were detected. Since the identification of these metabolites could not be confirmed by HPLC with ultraviolet detection the samples were also analyzed by HPLC/mass

spectrometry (HPLC/MS) with atmospheric pressure chemical ionization and an ion trap detector. The chromatographic system was modified from an ion-pairing system with an inorganic buffer to one that was more compatible to HPLC/MS. Extracts were analyzed in full scan mode, as well as, with MS/MS to confirm the presence of chlorophacinone and to identify the metabolites of chlorophacinone. Hydroxy metabolites were observed and identified in all three pest species.

123. Metabolism of methomyl in grapes

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The metabolic fate of methomyl (S-methyl N-[methylcarbamoyloxy]thioacetimidate) in grapes (*Vitis vinifera*) was examined. Vines were treated with [$^{14}\text{C}/^{13}\text{C}$]methomyl at 1000 g ai/ha at a late stage in berry development. Berries and foliage were sampled at 0, 2, 4, 7 and 14 days, extracted and analyzed for methomyl and its metabolites. Methomyl was readily metabolized in the grape berry and foliage. The primary pathway involved the displacement of the S-methyl moiety of methomyl by glutathione, which in turn was metabolized to thiolactic acid and thioglucose derivatives. Other pathways involved hydrolysis of the carbamate ester, hydroxylation of the methylamino moiety and the isomerization of methomyl to its E-isomer, followed by the formation of acetonitrile via a proposed Beckmann type rearrangement. Ultimately, methomyl and its metabolites were degraded to ^{14}C -carbon dioxide or incorporated into natural plant constituents such as glucose and other sugars. Techniques used to isolate and identify metabolites by LC/MS will be discussed.

124. Biotransformation of [^{14}C]-phenylbutazone after oral or intravenous administration to cattle

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Phenylbutazone (PBZ) is a non-steroidal anti-inflammatory agent that is sometimes used in an off-label manner by livestock producers. No withdrawal period has been established for phenylbutazone and no marker compound or tissue exists for PBZ in cattle. The objective of this study was to identify PBZ metabolites in cattle and to determine the identity of PBZ related residues in tissues. Urine samples were filtered, chromatographed, and metabolites analyzed by quadrupole time-of-flight MS. Tissue residues were extracted prior to analysis. Parent phenylbutazone was the major excretory product in cattle urine. Two ring-hydroxylated (phenolic) and three metabolites hydroxylated on the butyl alkyl group were detected as were three metabolites containing dual sites of oxidation. An O-glucuronide of a mono-hydroxylated metabolite and a C-glucuronide of parent PBZ were excreted in the urine. Approximately 20 and 30% of the liver and kidney residues, respectively, were non-extractable radiocarbon; phenylbutazone was present in the extracts.

125. Rapid and accurate determination of total metals in fertilizers by ICP/MS after hotplate digestion with refluxing 10:1 HNO₃/HCl

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To best assure product quality, the agrochemical industry requires a simple, inexpensive, and accurate means of assaying the trace metals content of fertilizers. We developed a digestion procedure, which takes only 3-4 hours to perform, allowing a single technician to prepare 100 samples for analysis in a day. One gram of the pulverized sample is weighed directly into a 40 mL borosilicate glass vial, and 10 mL of HNO₃ plus 1.0 mL of HCl are added. Into the mouth of each vial is placed a solid Teflon cone that serves as a reflux cap. The vials are placed in a hot-block, which is progressively warmed to 200°C over a period of one hour, and then allowed to reflux for two more hours. Upon cooling, the samples are diluted to 40 mL with deionized water and then centrifuged before analysis. The final solution is typically analyzed for trace metals by ICP/MS. In comparison with total bomb digestion using

HF plus aqua regia, and with INAA, this method recovered 95-105% of all 24 trace metals investigated, in 19 fertilizers. Excellent recoveries were obtained for traditionally difficult "crustal" elements (Be, Al, Sc, Cr, and La) and the volatile elements (Hg, Se and As).

126. Digestion comparison of hotplate vs. microwave methods for fertilizer metals

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A study was conducted to compare non-nutritive metal concentrations in commercial fertilizer and waste materials using common digestion techniques. EPA 3050B is a common laboratory method, since it only requires a hood and a hotplate. However, the acid strength of the final digest can be quite variable, potentially effecting results. EPA 3050B was modified to a hotblock digestion, to determine whether greater control over volumes and temperatures would influence results. EPA 3051A closed vessel microwave digests served as the reference, since it represents the greatest control over acid strength and digestion conditions. Digestates were analyzed by axial ICP-OES. Also, the effect of varying acid strength on metal recoveries was investigated.

127. A case for contaminant control in trace metal analytical protocols: Covered vs. uncovered reaction beakers

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Analysts in agricultural laboratories may use good house keeping and good judgment while performing analyses, but it is necessary to account for and document contaminants in the laboratory environment. The acceptable uncertainty in trace metal analysis may be compounded by the error resulting from improper lab hygiene. The question is how clean is your laboratory, and how effective are your anti-contamination strategies. Five different laboratory locations were sampled and quantified over two successive six month intervals and two successive three day periods to address these questions. Copper, Fe, Ni, and Zn show remarkable reduction between samples from open and closed reaction beakers. Arsenic, Cd, Co, Hg, Pb, Sb, and Se show some accumulation over a six month period but very little accumulation over a three day period with open beaker sampling. Contaminant control strategies translate to reduction in systemic error, reducing analytical noise and improving data quality.

128. Trace elements analysis in commercial fertilizer for California regulation

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Effective January 1, 2004, California Non-Nutritive Standards (Title 3, Sections 2302 and 2303) establish maximum concentrations of non-nutrient metals in inorganic commercial fertilizer and agricultural mineral products. The allowed levels of non-nutritive elements vary depending on labels. For example, a fertilizer containing P2O5 < 6% has the regulated levels of arsenic (10ppm), cadmium (20ppm) and lead (100ppm). The regulation cites the method 3050B or 3051A described in US EPA Publication SW-846 (Revision 3, December 1996) as testing methodology. Laboratory standard operating protocols (SOPs) have been developed to measure the performance of the method 3051A with atomic absorption spectrometry (AA). The protocols include measuring efficiencies of sample preparation, digestion, instrument performance, and method performance. Performance of the process and some historical results of ten trace elements (As, Cd, Pb, Co, Cu, Hg, Mo, Ni, Se, and Zn) in various commercial fertilizers are presented. A study is being conducted to determine sampling and method variability for three currently regulated trace elements in commercial fertilizer.

129. Preparing fertilizer materials for laboratory analysis of trace metal and nutrient analysis

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The Laboratory Services Committee of AAPFCO is preparing a quality control manual for preparing analytical samples, i.e., those ready for analysis, from received fertilizer materials. Discussion will center on theoretical and practical aspects of reducing the laboratory sample to the analytical sample and on quality assurance procedures, e.g., determining the effectiveness of riffles, necessary to reduce error and contamination to a minimum. Some comments will be made about handling difficult materials, e.g., compost. In addition the presentation will focus on the specific and unusual circumstances presented by attempting to analyze a contaminant introduced by a small portion of a blended fertilizer. Examples will include following a sample from sampling a bulk lot of material through the laboratory to the weighing of the final analytical portion used for analysis. The AAPFCO manual is a work-in-progress and has yet to be printed. The audience will be expected to join in the discussion.

130. Using collaborative studies to define the detection limit for an analytical protocol: A proposal

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The detection limit (DL) is an important parameter in characterizing an analytical protocol. We propose a simple method of estimating detection limit based on collaborative studies involving at least 5+ independent laboratories each measuring 5+ low-concentration materials. The method fits a curve as relative reproducibility's increases when concentration goes to zero. That concentration found below 33 1/3% is designated DL. A Tukey Jackknife standard error allows for assessing the fit. A function relating relative reproducibility's to concentration (the Horwitz curve) is extended to calculate an anticipated detection limit (ADL). The ADL is used as a point of comparison among individual reported DL to see where improvement in methodology is needed. If a measurement method's reported DL falls within a set factor (e.g. 2x ADL), the analytical protocol is deemed adequate.

131. Development and use of fertilizer reference materials to assess trace metals methodology

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An important factor in methods development, validation, and performance is reference materials. These materials must have qualities that assure their ability to assess analyst, method, and laboratory capabilities. Although several check sample programs are available to fertilizer chemists, their focus has been on nutrients. None of these programs were designed to include, measure, or assess contaminants such as trace metals. Through the continued work of organizations like AFPC, AAPFCO, and other industry sponsored programs, samples designed to assess analytical capabilities have been available to participants. However, new methods are needed and regulatory standards now require enforcement actions based on official monitoring data. This necessitates the need for certified reference materials applicable to the unique matrix found in fertilizers that also contain appropriate levels of trace metals. In cooperation with NIST the fertilizer community is producing a new multi-nutrient fertilizer SRM that will also have certified values for trace metals.

132. Survey of state and industry metals monitoring of US fertilizer materials

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IMC Global Operations, and **Joseph E. Gliksman**, IMC Phosphates

Several states have regulations, and conduct monitoring programs, for trace metals in fertilizers. Because these programs produce analytical data on products, there is now a significant independent database of information on metal levels in fertilizers. This information, gathered in a survey of states will be summarized. Producers also continue to monitor products for metals. By combining and/or comparing this data we can develop a robust picture of metals levels across a range of products and materials in the marketplace. This information can be used to predict compliance rates as well as the possibility of individual samples and products meeting regulatory standards. This information will be used to assess compliance rates based on regulatory standards already in place and the ability of products to meet proposed or future standards being proposed in the US and around the world.

133. P Index validation via monitored data and SWAT modeling

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Watershed-level nonpoint source phosphorus (P) loss can be measured through stream sampling. Accurate estimation of field-level P loss and relative contribution to watershed export of P is more complex. Simulation models can estimate losses at both field and watershed scales, but typically become data and expertise intensive as scale and predictive accuracy increase. Risk assessment indexes, such as the P-index, are less complex to use and can indicate P loss vulnerability based on source and transport-to-stream characteristics. A 39.5 ha mixed land use watershed was studied over four years. Measured watershed export of P was compared to watershed-level predictions from Soil and Water Assessment Tool (SWAT). Field-level predictions from SWAT were compared with P Index ratings for 22 fields. The P Index and SWAT categorized 73% of the fields similarly for risk to P loss, while all remaining fields except one were over or under predicted by one category.

134. Application of the Soil and Water Assessment Tool (SWAT) to assess environmental concentrations of an agricultural pesticide and the potential benefits of best management practices

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The Soil and Water Assessment Tool (SWAT) was used to develop a pollutant transport model to assess levels of diazinon in surface waters throughout the Feather River Watershed in California. The objectives were to describe the spatial distribution and frequency of elevated diazinon levels and to evaluate the potential benefits of agricultural best management practices. The best available elevation, land use, soils, hydrography, and pesticide application datasets were used to build the inputs to the model using a GIS interface. The model was calibrated using observed streamflow and in-stream diazinon monitoring data. Soil dissipation data were used to define the chemical environmental fate parameters. Model output was evaluated to identify river segments in the watershed with the greatest predicted environmental concentrations. The sub-basins with the most vulnerable orchards were determined by calculating the loading-rate from each sub-basin's orchard area. Additional model runs tested the effectiveness of best management practices in reducing the magnitude and frequency of elevated diazinon concentration episodes in the watershed. This analysis provides local decision-makers the opportunity to identify potential diazinon "hot-spots", decide upon the most effective mitigation strategies, and target local sub-basins that would most significantly benefit from implementation of best management practices.

135. Utilizing watershed-scale models for regulatory risk assessment

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Understanding the extent to which conservation practices implemented through programs such as EQIP, WRP, and CRP, reduce the risk of off-site agrochemical contamination, can be aided through the use of watershed-scale models such as SWAT and Ann-AGNIPS. These models can help 'map' a management action onto measurable endpoints. Management actions and their associated endpoints could include decisions to adjust field application of N and P according to nutrient uptake rates so as to reduce N and P concentrations at the edge of a field. The advantage to utilizing models is that they; allow for consideration of complex interactions across multiple variables; provide a framework to examine uncertainties in knowledge; and provide a scientific-based estimation of overall risk. Challenges to model-based risk assessment can be related to model availability and performance, as well as the time it takes to acquire necessary databases needed to study a specific risk.

136. Characterization of fate and transport of isoxaflutole, a soil-applied corn herbicide in surface water

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A conceptual model was developed to characterize the fate and transport of isoxaflutole residues to and in surface water. Soil and Water Assessment Tool (SWAT), a continuous daily time-step watershed model was used to simulate the processes identified in the conceptual model. Analytical data were available for a number of surface water bodies within the major product use area as a result of extensive and intensive residue monitoring since the time the product was registered for use in 1999. Detailed product use information at the zip-code level was obtained through dealer sales and grower surveys. The hydrologic and chemical transport results from the SWAT model were validated by comparison to available monitoring data from selected water bodies. Upon validation, the model was used to simulate the fate of isoxaflutole residues in the water bodies using long-term historical weather. The results from this were used to characterize the relative potential for exposure in wider range of water bodies within the use area.

137. Measuring environmental benefits of conservation practices: The Conservation Effects Assessment Project

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The 2002 Farm Bill substantially increased funding levels for existing conservation programs and established the Conservation Security Program (CSP). The Natural Resources Conservation Service (NRCS) and the Agricultural Research Service (ARS) have joined together, in collaboration with other USDA and Federal agencies, to initiate studies that will quantify the environmental benefits of conservation practices implemented through these programs. A national assessment is being implemented to track environmental benefits over time at the national scale. In selected regions of the country, watershed studies are being initiated to provide more in-depth assessments at a finer scale of resolution than is possible at the national level. In doing so, the watershed studies will advance the knowledge of how watershed scale assessments should be done and provide additional research findings and insights on the expected off-site effects of conservation practices. Annual reports will be published beginning in 2005 that document the

environmental benefits of conservation practices. A detailed description of the ARS watershed studies will be presented.

138. Using USDA-Agricultural Research Service long-term watershed hydrology and water quality observations to estimate the quality of model predictions of the Conservation Effects Assessment Program (CEAP)

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The CEAP program of the Natural Resources Conservation Service (NRCS) is an assessment, at a large-watershed scale, of the effectiveness of USDA's resource conservation programs in protecting water quality. Hydrologic/water quality models will be used to make these assessments. Several USDA-ARS research groups will 'ground truth' these assessments by developing estimates of the uncertainty of the model estimates. In this presentation we will describe an approach we are developing that takes advantage of the rich database of hydrologic and water quality data available from the Little River Watershed at Tifton, GA. The scientists and collaborators of the ARS Southeast Watershed Research Laboratory (SEWRL) are combining input data sets (e.g., soils, weather, soil conservation practices, agrochemicals use and land use) at higher resolution in both time and space than the national program, in order to estimate the sensitivity of prediction errors of the models being applied to the national-level assessment. Response differences in input data resolution and/or model selection will be used to estimate the confidence on predictions at those larger scales.

139. Comparison of regulatory estimates of drinking water concentrations with monitoring data

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Currently regulatory practice in the U.S. is to estimate potential concentrations in drinking water by using an Index Reservoir approach. This approach extrapolates results from modeling a single field with maximum application rates to watershed scale, based on a percent crop area estimate. Since 1998, Bayer and its predecessor companies have conducted drinking water monitoring studies with four different compounds. The results from the studies show that the Index Reservoir greatly overpredicts residues in surface water. The most important factor is the overestimation of use within a watershed. Other factors contributing to the overestimation of concentrations are the conservative procedures used to obtain input parameters and the simplified hydrology. A new procedure based on the USGS WARP model, being developed by a group of scientists from EPA, USGS, USDA, and Crop Life America, will provide more realistic estimates of concentrations of pesticides and their metabolites in drinking water.

140. Estimating pesticide concentrations in U.S. streams from watershed characteristics and pesticide properties

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Empirical regression models have been developed by the U.S. Geological Survey for estimating the concentration of atrazine in streams from pesticide-use intensity and various watershed characteristics. Separate models were developed to estimate the time-weighted annual mean and selected percentile concentrations (the 5th, 10th, 15th, 25th, 50th, 75th, 85th, 90th, and 95th). The models were developed from monitoring data collected at more than 100 streams throughout the United States as part of the U.S. Geological Survey's National Water-Quality Assessment (NAWQA) Program. Pesticide use in a watershed was the most significant explanatory variable, but several hydrologic and soil parameters were useful in explaining the variability in observed atrazine concentrations. The atrazine models have been extended to other pesticides by an adjustment factor that

incorporates pesticide properties. Predicted concentrations were nearly always within an order of magnitude of the measured concentrations, and the predicted percentile concentrations reasonably matched the actual distribution of the percentiles in most cases. The models can be used for human-health risk assessments by estimating concentrations of pesticides in streams used for drinking-water supply or designing monitoring programs for ecological risk assessments by identifying streams with concentrations exceeding a level of concern.

141. Comparison of EPA model calculated drinking water exposure estimates with monitoring results from surface drinking water supplies

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Crop-protection compounds are useful tools that enhance the quality of the food we enjoy. However, crop protection products can enter aquatic systems either by direct or indirect application. In order to better understand the possible frequency and magnitude of exposure to water resources, the regulatory community has developed a set of relatively simple models for estimating exposure to these water systems. The focus of the research was to compare how well the estimates of exposure to drinking water based on model calculations relate to actual monitoring data. Physical/chemical property data were entered in the EPA's exposure model FIRST. The predictions from FIRST were then compared to actual monitoring data from a USGS/EPA cooperative program that monitored for pesticides in surface drinking water supplies during 1999 and 2000. Results from this examination indicate the predictions from the model can over predict concentrations found in water by several orders of magnitude. Compound physical/chemical factors used as model input and other inputs such as crop area factors were examined to explain the difference between modeled and measured water concentrations.

142. Modeling the drinking water exposure component for the organophosphate pesticide cumulative risk assessment

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The Food Quality Protection Act requires EPA to consider multiple routes of exposure for pesticide groups having a common mechanism of action. For its first cumulative risk assessment, EPA had to develop methods to quantify possible drinking water exposure to organophosphate pesticides, EPA used the surface water models PRZM and EXAMS with a drinking water reservoir scenario to estimate a distribution of daily drinking water concentrations for multiple chemicals over several years. The approach simulated multiple fields in a watershed while accounting for likely co-occurrence of organophosphate pesticides in time and location. This provides a more realistic depiction of multiple chemical usage in a watershed, but does not fully account for location and assumes that treated fields are uniformly distributed throughout the watershed. This presentation describes the FQPA drinking water exposure modeling approach used in EPA's cumulative risk assessment and highlights future enhancements for improving this approach.

143. Turf pesticide and fertilizer impacts on watersheds: Monitoring and modeling case studies in a TMDL and water criteria context

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Assessment of potential or existing turf chemical impacts on a watershed requires a comparison of exposure - modeled or monitored concentrations - with reference points. The reference points can have highly varied derivations. EPA's ecoregional criteria for phosphorus consider overall ecosystem health, and they are so low that, in some areas, exceedances can be found in natural background areas. Total

Maximum Daily Loads (TMDLs) under the Clean Water Act are developed for specific contaminants of specific watersheds, and may either be based on ecosystem health, potential impacts to specific sensitive receptors, or limiting factors in the highest beneficial use of a water body. Formal and informal ambient and site-specific water quality criteria are analogous. The latter may focus on specific potentially sensitive receptors (amphibians, humans, endangered fish, etc.). Risk assessments, risk management programs, and monitoring programs for specific watersheds are usually submitted to county and local government agencies, but there is often review by state agencies and the U.S. Army Corps of Engineers. Case studies are presented about a total environmental risk assessment for a golf course in Utah and a multi-year, intensive, surface water and ground water monitoring program at a New York golf course. BMPs are derived for pesticides, nitrogen, and phosphorus.

144. Fertilizer efficiency: An appropriate agri-environmental indicator?

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More efficient use of fertilizers has been an economic and environmental goal for some time. However, efficiency is defined differently depending on whether the short or long term is in question. Current estimates of agronomic and recovery efficiency for N and P used in North American crop production vary considerably. Canada's National Agri-environmental Health Analysis and Reporting Program proposes indicators of risk of water contamination that are based on nutrient balance and efficiency indicators for nitrogen (N) and phosphorus (P). This presentation will review current efforts by industry and government in Canada and the United States to define appropriate indicators that accurately reflect the performance of the fertilizer industry and its contribution to resource use efficiency in agriculture.

145. Use of anion exchange membranes to characterize positional availability of soil phosphorus

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Our objective in this field study was to determine the relative distribution of bioavailable phosphorus (P) during the early part of the corn (*Zea mays* L.) growing season, following a surface band application of ammonium polyphosphate fertilizer at the time of planting. Bicarbonate-saturated exchange membranes were used to characterize P bioavailability. Treatments consisted of a control and 7.5-6.6-4.2 (mg kg⁻¹ N-P-K) or 30-6.6-4.2 liquid fertilizer dribbled (280 L ha⁻¹) on the soil surface 5 cm to the side of the seed row. In 2001, the highest concentration of bioavailable P was found nearly 8 cm below the soil surface, 43 days after application. Similar results were found from measurements in 2002 and 2003. Given that P diffusion in soil is a relatively slow process, the volume of fertilizer material applied and the porosity of the soil probably played a role in P movement.

146. Phosphorus and potassium leaching under contrasting residential landscapes established on a sandy soil

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Phosphorus (P) and potassium (K) use on residential landscapes is increasing with urbanization. Potential P and K losses via runoff and leaching are a concern. Landscape vegetation and maintenance protocols can influence nutrient losses. This study examined P and K leaching from contrasting residential landscape models: sandy soil-established St. Augustine grass (SA) and a mixed-species (MS) landscape. Fertilizers were applied to the SA monoculture bimonthly (February 1999 to April 2003); but only during establishment (February

1999 to December 2001) for the MS landscape. P and K runoff was negligible. Cumulative mean P leached was 37.8 kg ha⁻¹ on the MS treatment and 22.9 kg ha⁻¹ on the SA treatment. Cumulative mean K leached was 346 kg ha⁻¹ on the MS treatment and 185 kg ha⁻¹ on the SA treatment. Notably, leaching was severe during establishment and following intense precipitation, but the SA model minimized losses compared to the MS model.

147. A new polymer coating for increasing phosphorus use efficiency and reducing environmental impact

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The microenvironment surrounding a P fertilizer granule is subject to a series of primary and secondary reactions which substantially impact nutrient availability to plants. Influencing or controlling these reactions is of primary importance due to their impact on nutrient efficiency and resulting build up of P in soils which may contribute to non-point source pollution of waterways. It is well known that even under the best conditions only 5-25% (Mortvedt, 1994, Fertilizer Research) of fertilizer P is taken up by the crop during the first growing season. Thus the historical problem with the soil chemistry of P fertilizers has been the lack of availability due to fixation. This emphasizes the need to develop a P technology that is more efficient, produces greater crop responses and leaves less of an environmental footprint. An economical P coating of a newly patented chemistry has produced consistent effects on P uptake, crop yields, improved P-N.U.E. and reduced environmental footprint.

148. Recovery of nutrients from phosphate fertilizer manufacturing process: Cleaning and recycling gypsum pond water

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Phosphate plant pond or process water is an acidic mixture of ions. During extended periods of heavy rain or a plant shut down (e.g. Piney Point) this acidic water must be treated and discharged. Traditional methods have been double liming; however, this has several disadvantages. Large settling ponds are required and air stripping is often needed to reduce the ammonia emissions. We have developed a pre-treatment method that allows phosphate plant pond water to be treated using reverse osmosis. The advantages of our method are that large settling ponds are not required; upwards of 70% of the water can be discharged; the discharge water is of exceptionally high quality (exceeds Class III Groundwater Standards); up to 70% of the P₂O₅ in the water can be recovered as a non-scaling liquid and operating costs are lower than double liming. Our process is flexible and can be adapted to dilute or more concentrated pond water, typically found at an operating phosphoric acid plant.

149. Development of sustainable fertilizer with positive local and global impacts

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A project began in 2002 to investigate and demonstrate the methods of production at a continuous bench scale level and produce sufficient material for an initial evaluation of a potentially profitable method to sequester carbon dioxide. The novel process uses agricultural, forestry and waste biomass by extracting hydrogen using pyrolysis and reforming technologies conducted in a 50kg/hr pilot demonstration. The resulting experiments produced a novel enriched carbon sequestering fertilizer. A pyrolysis temperature profile was discovered that results in a carbon char with an affinity to sequester CO₂ through gas phase conversion with mixed hydrated ammonia within the pore structures of the carbon char. A bench scale project demonstrated a continuous process fluidized bed agglomerating process. The patent pending process is particularly applicable to fossil fuel combustion as it also

removes SO_x and NO_x, does not require energy intensive carbon dioxide separation and operates at ambient temperature and pressure. The method of sequestration uses existing farm/forest products, a power company and a farm fertilizer distribution infrastructure to deliver a fertilizer that has many long term soil restoration and crop production benefits. Up to seventy percent of the hydrogen produced can be used locally for fuel. The economic impacts of cycling local currency have been shown to increase job creation and regional wealth. The physical structure of the fertilizer's carbon material provides matrix for carrying and slowly dispensing adsorbed nutrients while sequestering the carbon for thousands of years. The global benefits from increasing rural job creation and soil restoration could reduce GHG buildup and social instability related to acquiring declining and limited fossil fuel reserves.

150. ESN® controlled-release nitrogen for enhanced nitrogen efficiency and improved environmental safety

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Controlled and slow-release fertilizers have been used in turf and horticultural crops for years but have been too expensive for major grain crops. Many slow-release products rely on uncontrolled biological processes to release nutrients. Agrium has developed an economical, polymer-coated controlled-release urea fertilizer, called ESN, for corn and other field crops. Nitrogen release from ESN is by temperature-controlled diffusion. Coupling N release with temperature, a primary factor in crop growth and N demand, allows the N supply to be more closely programmed to crop needs. University research shows controlled N release improves crop yield per unit of applied N and gives greater control over its fate. Studies demonstrate corn productivity can be maintained with about 70-80% of typical rates for traditional N fertilizers. Research also shows greater N recovery, reduced leaching losses, and reduced N₂O emissions with ESN. This paper will review findings from recent studies.

151. Fractal-based scaling and scale-invariant dispersion of peak concentrations of crop protection chemicals in rivers

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The pesticide registration process requires new methods in order to characterize peak concentrations in rivers beyond the edge-of-field scale. The complexity of current watershed-scale models inhibits their use, even though most exposure can occur only at this scale. We have explored the use of fractal-based approaches to account for such scaling effects. We found that log-log plots of maximum daily concentrations as a function of watershed area are linear with negative slope, consistent with expected fractal behaviour. The extrapolation of such plots down to smaller watersheds agrees with edge-of-field concentrations predicted using the Pesticide Root Zone Model (PRZM), when properly adjusted for use intensity. We have also defined a second useful property, "scale-invariant dispersion," in which concentrations are well described by an analytical solution to the convective-dispersion equation, regardless of scale. Both of these findings make it possible to incorporate the effect of scale directly into regulatory assessments.

152. The persistence of metolachlor breakdown products in a riparian buffer system

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The effectiveness of a riparian buffer in removing the herbicide metolachlor, as it moves through the system from an adjoining

agricultural field, was studied. The riparian system contains a first-order stream that receives groundwater and surface runoff from an active cornfield that is treated yearly with a pre-emergent mix of metolachlor and atrazine. The fate of the parent compound and its degradation products, metolachlor ethane sulfonic acid (MESA), metolachlor oxanilic acid (MEOA), and hydroxy metolachlor (OH-metolachlor) was followed over several years. Of the four products, MESA was detected in the highest concentration within the buffer zone (subsurface and exfiltrated groundwater, and stream water). MESA typically averaged 500 to 1000x higher in concentration than its parent (and most other pesticide products) in the buffer zone. Higher levels of MEOA were also observed. Seldom was OH-metolachlor observed in samples from the riparian system. This situation prevailed year round except for a 1-2 week period following spraying, when spikes in parent compound were observed in the stream. These spikes coincided with post-spraying rain events. There appears to be a particular persistence of MESA in this riparian ecosystem.

153. Watershed modeling linking PRZM with RIVWQ

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A relatively simple approach for simulating pesticide transport within watersheds was developed by linking the field-scale Pesticide Root Zone Model (PRZM) with RIVWQ, a water quality model for riverine environments. PRZM was used because of its standing as an exposure assessment tool by the U.S. Environmental Protection Agency's Office of Pesticide Programs and because of its flexibility in simulating soil properties, agronomic practices, and pesticide chemistry. RIVWQ was selected because of its ability to simulate variable flow and its ease of use relative to other models. Initial simulations resulted in streamflow predictions considerably shorter in duration than gauge measurements, thereby prompting innovations to address hydrologic attenuation and mass balance. Modifications to PRZM were made to account for sub-lateral flow, improve evapotranspiration, and correct programming errors for Curve Number dependency on soil moisture. Storage elements were included to attenuate water and chemical loadings to RIVWQ. Simulations addressed the distribution of agricultural fields, forests, and other land uses within several watersheds. This paper presents the detail used to represent the prototype systems and the comparison of model predictions to observed data.

154. A watershed tracer method for development of a multi-compound daily concentration model

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Water quality monitoring studies of streams and other surface water systems have accumulated a vast amount of concentration data for pesticides and other agricultural chemicals over the last two decades. Using these data to develop models is a desirable objective and will help to increase the understanding of factors controlling the environmental fate and transport of agricultural chemicals on watershed scales. However, most of these monitoring data sets are retrospective and many ancillary parameters such as specific product use, prevailing hydrological conditions, and agricultural practices in the watershed are not systematically recorded during the time of monitoring. Since these parameters are known to influence the frequency and magnitude of residue levels in surface water, mechanistic model development based on these data is often difficult. In this paper, a watershed tracer method combining the pesticide surface water mobility index (SWMI), historically surveyed product use, and readily available stream discharge data is proposed to overcome these shortfalls. A multi-compound time-series regression for predicting daily pesticide concentrations in watersheds is established. The time-series regression model is calibrated and validated independently using monitoring data obtained from Mid-West watersheds. Applications of the regression to lake/reservoir systems where water is relatively static are also discussed.

155. Stabilized nitrogen: Improving nitrogen's efficiency

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Nitrogen is the element that most often limits crop yields and profits. The benefits of nitrogen fertilization in pounds, bushels and dollars over the past 50 years have been most impressive. However a challenge remains to manage nitrogen fertilizer to achieve greater efficiency. A crop's nitrogen utilization can be improved by the use of "Best Management Practices" including nitrification and urease inhibitors. Research indicates that first-year crop uptake efficiencies can be significantly increased. This translates to higher yields and profits per pound of nitrogen applied. It also means an environmentally safer use of nitrogen fertilizer because less nitrogen is exposed to loss. No other nutrient offers greater benefits from wise use and management than nitrogen. Two methods are available to achieve this goal, enhanced nitrogen feeding and minimizing nitrogen loss.

156. Development of Nurea®, a low cost extended release fertilizer designed for specialty and agricultural applications

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The research and development of a patented low cost extended release fertilizer for use in the specialty and agricultural fertilizer markets is presented. Applied Chemical Technology, Muscle Shoals, Alabama developed a combination of known fertilizer materials with a lightweight absorbent material and a hydrogel. The absorbent material and the hydrogel are mixed with fertilizer materials in a fluid state. Absorption of the fertilizer and hydrogel occurs and is then granulated. Release of the absorbed fertilizer is delayed due to the presence of the hydrogel. Field trials have been performed on turfgrass and corn since 2001. Favorable results were obtained from these trials indicating reduced loss of nitrogen to the environment. These include a 2002 study that quantified a substantial reduction in nitrates leached from the test plot as compared to other nitrogen sources. Additional trials with Nurea® indicate equivalent yields in corn with 25% less nitrogen applied.

157. Microchip fertilizer technology for enhanced efficiency and eco-safe purposes

Richard Hartmann, Bi-En Corporation, 1827 SW Beaverton Hwy. Ste. 4, Portland, OR 97239, r.Hartmann@bi-encorp.com

Stabilized Enhanced Efficiency Controllable Release Calcium Cyanamide Compositions, Patent # US 6,576,035 B2 – June 10, 2003 is discussed. Calcium Cyanamide fertilizer, in micro amounts in compositions and methods with other nitrogen fertilizers, such as urea and manures, stabilize ionic compositions and enhance the effectiveness of calcium cyanamide and synergistically the others. The compositions are effective for enhanced reproductive and resistant plant growth, simultaneous to greater nutrient efficiency and thus eco-safer fertilizing, soil amending, metals stabilizing, and inhibition of odor and related human harmful organisms. The compositions are accurately site deliverable in granular and liquid formulations.

158. GreenEdge®: An innovative bio-based slow release fertilizer

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GreenTechnologies has developed a line of patent pending commercial slow release fertilizer products utilizing biosolids as a base material. These products have unique release mechanisms and the nutrients incorporated into the organic base produces a homogenous pellet with an immediate release followed by extended slow release of nutrients. These products are targeted primarily for turfgrass and ornamental markets and have been well received by the commercial and retail markets in Florida. Research projects in collaboration with regional universities have been conducted and are underway to establish efficacy and conduct a comparative evaluation to traditional commercial fertilizer products. Turfgrass field studies indicate a superior performance compared to other products tested. University research on efficacy will be presented.

159. Development and testing of a laboratory method for determination of nutrient release from slow release fertilizers

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There are many sources of slow release nutrients in today's marketplace. Application of a new technique to compare sources of slow release nitrogen, phosphate and potash materials gives a product release curve. This nutrient release profile is generated by accelerating the natural release mechanism of most commercial materials and analyzing the extract by traditional methods. Since nitrogen and phosphate are the nutrients most commonly named as causes of degradation water bodies in the US, these nutrients need the most effective characterization of release allowing for better management. The procedure will allow manufacturers and regulators to assess the impact of these nutrients, and make quick judgments of their claims and effectiveness. This information, in combination with other new material assessment techniques will allow correlation with active biological soil systems thus allowing a comparison of the accelerated laboratory release procedure with actual release in soil growing conditions.

160. Development and correlation of soil incubation studies measuring nutrient release

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The commercial development of slow-release fertilizer materials has been incremental and based on use of several unique technologies over the last fifty years. Each technology was addressed, as it was developed, in terms of the regulation and analysis of the specific material. Equipped with an effective method to evaluate a broad range of materials instead of a number of product-specific methods, regulators and the fertilizer industry can begin to monitor these materials efficiently in a laboratory setting. The history of the development of a method aimed at accomplishing this goal is described. Key components in the process were development of an accelerated laboratory procedure, development of a stable laboratory soil incubation method mimicking real-life biological conditions, and the correlation of the data from both new methods. The development of the soil incubation method and the correlation of data with laboratory methods is examined.

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