AGRO

Chemistry for and from Agriculture

American Chemical Society
233rd National Meeting and Exposition
March 25-29, 2007
Chicago, Illinois

PICOGRAM v. 72 and Abstracts

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Editor's Notes

Global change is not exclusive to the big Blue Ball. As you most certainly have noticed, the PICOGRAM has a different look. This is part of the global changes of which ARGO is undergoing. At this writing, we see an awaking - an inclusive atmosphere - a broadening of our interests and expectations and of our desire to understand the interactions of all things.

AGRO members have come together to focus on what joins us... to support and SUSTAIN our global community.

Enjoy the Meeting!

Cathleen J. Hapeman
PICOGRAM, Editor

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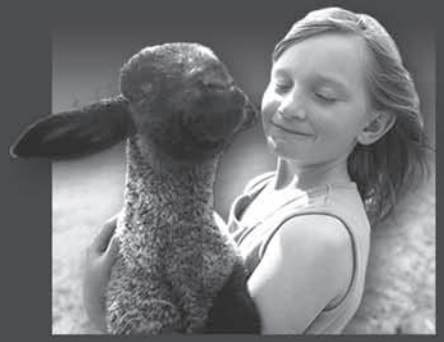
- Product Characterisation
- Regulatory Affairs



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Hospitality Committee Report

Coffee Lounge – San Francisco

Twelve noble sponsors contributed $2500 to keep us alert and responsive in this Fall's technical sessions. Laura et al. mounted a world-class slate of topics and speakers worthy of their support. Please take note of the sponsors and be sure to thank them for their generosity. Also, please consider encouraging your company to become a sponsor – there is no more appreciated gift than the gift of caffeine during our Technical Programming.

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On Tuesday evening at 6:00PM we had our Social Hour in the CLUB ROOM of the San Francisco Marriott. All members, speakers, and spouses enjoyed exotic food, fun, drinks and door prizes – well, if they did not it was their own fault. Look for even bigger and better things in Chicago!

SOCIAL CO-CHAIRS - Al Barefoot & Jeff Jenkins
COFFEE LOUNGE CO-CHAIRS - Terry Spittler & Liliana Schwartz

From the Chair's Desk

Laura L. McConnell

Chemists working in the realm of agricultural science are making important discoveries which will impact the quality of life for people all over the world. In the face of critical issues such as global warming, the need for renewable energy sources, and global population increases, international leaders are looking to agriculture for creative solutions for difficult problems. AGRO has emerged as an important source for the latest developments in agricultural science. Since our long range planning workshop in January 2006, a number of changes have been implemented to increase the value of AGRO activities to our members and to the scientific community at large. Ten specific priority actionable proposals were developed at the workshop. Below is an update on our substantial progress over the last year.

1. *Have Technical Program & Business Meeting only at Fall ACS National Meetings.*
   The AGRO leadership has voted to program at only one National Meeting per year, beginning in the 2008 (Philadelphia). This experiment will continue for three years and will be re-evaluated. This change will lead to a much larger AGRO program, will address the issue of limited travel budgets faced by many scientists, and will allow us to focus on alternative programming opportunities in addition to the National Meetings.

2. *Add workshops (training and goal-driven) to AGRO programming.*
   AGRO will be co-sponsoring the 4th Pan Pacific Conference on Pesticide Science, planned for June 2008 in Honolulu, HI with the Pesticide Science Society of Japan. This small conference will include a workshop on pesticide fate and risk models. Pan Pacific serves as our alternate programming activity for 2008. Al Barefoot and Joel Coats are leading this effort. For further information see page 29.

3. *Recreate the program planning structure of the Division to provide continuity and sustained outstanding scientific programs.*
   The program structure for AGRO has been expanded to provide consistent opportunities for scientists working in all areas of agricultural science to present their latest findings at our National Meeting Program. All major topics will be represented at each National Meeting while continuing to include special topic symposia on emerging issues and our awards symposia. An open program planning meeting will be held at each National Meeting to collect programming ideas (see page 27). Additional details on programming can be found on pages 23 through 41.

4. *Change the name of the Division to reflect more broadly its multidisciplinary focus.*
   As of yet, there is no consensus among the membership for a new Division name and major obstacles exist within ACS for a divisional name change. Therefore, most of the recent discussions have focused on simply redefining the meaning of AGRO to include all topics related to agriculture. John Johnston has suggested the new slogan, "Chemistry for and from Agriculture," which is on the cover of the more-streamlined PICOGRAM.

5. *Increase the Division's international participation, outreach, and visibility.*
   Rodney Bennett and Jason Sandahl have agreed to spearhead this effort. Participation by international scientists in AGRO has been strong this year. Thanks to the efforts of several AGRO members, Dr. Halima Traore, scientist from Mali, received a USDA Borlaug Fellowship. This funding supported her travel to the San Francisco ACS meeting and a six-week visit to a number of laboratories and conferences.

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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.
Exposure:	Cow and hen feeding studies, dislodgeable foliar and turf residues, mixer/loader and applicator dosimetry. Tobacco pyrolysis. Environmental monitoring (air and water).

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Website: www.ptrl-europe.de

Internet Home Page: www.ptrlwest.com

Good science, no surprises.

From the Chair's Desk
(continued)

6. *Include regulatory agencies in program planning.*
No specific initiatives have been implemented on this topic. However, discussions on this topic have increased awareness as to the importance for providing an open and welcoming forum for all scientists including the regulatory, industry, government and university arenas. AGRO seeks to serve these scientific communities by providing a forum for positive interaction leading to sound science solutions for problems related to agricultural science.

7. *Increase Travel Grants for Young Scientists/Students (including international).*
Opportunities to expand support for young scientists are still being explored.

8. *Involve students in program planning*.
A graduate student and post-doc box luncheon will be held in Chicago to kick off this new activity. Leaders within the student group of attendees will be sought to plan a student-led symposium in Boston or Philadelphia.

9. *Propose AGRO Division involvement in FAO/IAEA Infocris pesticide information web site.*
"Infocris" is a voluntary community website giving information on water pollutants including pesticides. Proposal is to offer cooperation by AGRO individuals to input information in exchange for AGRO attribution and links to our web site. Leader: Don Wauchope

10. *Webcasting of selected presentations from AGRO Meetings.*
Webcasting is a potentially powerful way to reach and service our members who do not attend meetings. A tech-savvy volunteer is needed to head this effort.

Strategic planning is an important component for the success of any organization. Changes can be painful, but the changes that have been made thus far have been positive in their effects. Continued planning is necessary to maintain momentum. Time spent at our business meetings is not adequate to envision activities 5 to 10 years from now. I suggest that another planning workshop be held some time in 2008. ACS has offered to assist us in facilitating this effort.

One further change which has been put into place this year is to combine the Banquet for the International Award for Agrochemicals with the AGRO Social Hour. The new event is called the AGRO Awards Social. It will be held on Tuesday evening at 6:00 – 8:30, and it is open to all AGRO members. The objectives are to: formally recognize our International Award winner in front of maximum number of AGRO members; to highlight our Young Scientist award winners; to provide an opportunity for younger members to meet and interact with our most distinguished scientists; and to have an enjoyable evening with friends.

I congratulate John Johnston on constructing a fine program for Chicago. The programming maintains our traditional focus on pesticides while expanding into new topics such as bioenergy, veterinary pharmaceuticals, and GIS. I thank all the symposium organizers for their hard work and dedication. Finally, I extend my sincerest thanks to all the people who continue to work for the success of AGRO. Your dedication and creativity is appreciated. We now look forward to Boston, Philadelphia, and beyond. *Onward and upward!*

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Awards Committee Report

Dr. Gerald T. Brooks, West Sussex, UK, Editor, Pest Science Management, will receive the International Award for Research in Agrochemicals at the Spring 2007 ACS Meeting in Chicago, IL for his research contributions in the study of the biochemical toxicology of insecticides. This award will be sponsored by DuPont Crop Protection. An award symposium has been organized by Dr. Derek W. Gammon.

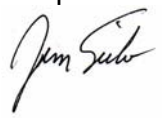
Dr. Frederick J. Perlak, Monsanto Company, St. Louis, MO will receive the International Award for Research in Agrochemicals at the Fall 2007 ACS Meeting in Boston, MA for his research contributions that led to the development of insect protected crops. This award will be sponsored by BASF Company. Dr. William P. Ridley will organize the award symposium.

Nominations for the 2008 International Award for Research in Agrochemicals are currently being solicited by the Awards Committee. Only one International Award will be presented in 2008. The Awards Committee is also accepting new award nominations for the Division Fellow Award. The nomination forms and criteria for both awards can be found in the *PICOGRAM* on pages 13 and 15, respectively. Please consider nominating a deserving colleague. The deadlines each year are December 31 for the International Award and May 31 for the Fellow Award.

USDA-ARS is seeking nominations for the 2008 Sterling B. Hendricks award. Deadline for nominations is November 6, 2007. Additional information can be found on page 17.

Congratulations to Drs. Brooks and Perlak!

Respectfully submitted,



James N. Seiber, Chair
Awards Committee

You Are Cordially Invited To The

AGRO DIVISION

Awards & Social

Meet with Friends Old and New

Celebrate the Winner
of the
International Award for
Research in Agrochemicals
Gerry Brooks

and the Winners
of the
Young Scientist Research Awards!

Gerry Brooks, the Editor-in-Chief, will speak to the great things that *Pest Management Science* is up to these days and to its exciting plans for future development. Take this opportunity to meet Gerry and the friendly members of the international editorial board and editorial staff from the London office.

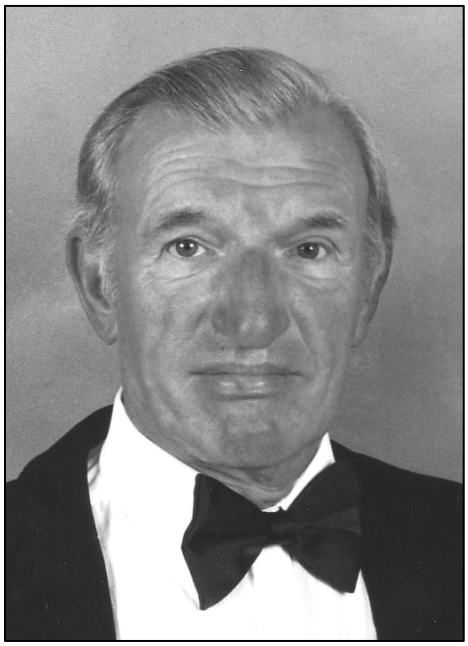
Fun, Food, Good Company, Door Prizes, and a Cash Bar
6:00 – 8:30 pm Tuesday, March 27th
Hyatt Chicago Grand B

ALL AGRO DIVISION MEMBERS, SPEAKERS AND THEIR GUESTS, SPOUSES/SOs, ARE INVITED TO JOIN US

The Division thanks *Pest Management Science (John Wiley & Sons LTD)*
For its cooperation and major sponsorship of the evening's festivities

ACS INTERNATIONAL AWARD FOR RESEARCH IN AGROCHEMICALS

Presented by the AGRO Division of ACS
Sponsored by DuPont Crop Protection



Dr. Gerald T. Brooks will receive the International Award for his work on insecticide biochemical toxicology and for his sustained contributions to the publication of agricultural research. Dr. Brooks received his BSc in Chemistry in 1953 and his PhD in 1956 from London University. In 1986 he was awarded a DSc, also from London University, for his studies on structure-activity relationships, the mode of action of insecticides, and insect growth regulators.

Dr. Brooks became a Civil Service Senior Research Fellow in the Biochemistry Department of the Pest Infestation Laboratory in Slough, UK in 1956. He became a Senior Scientific Officer in 1961 and served as the Principal Scientific Officer in Biochemistry Department from 1964 to 1969 and then at the Unit of Invertebrate Chemistry and Physiology of the former Agricultural Research Council (ARC, now incorporated into the Biotechnology and Biological Sciences Research Council) at the University of Sussex, where he was Senior Principal Scientific Officer; Head of ARC Insect Chemistry and Physiology Group at Sussex from 1982; and Honorary Reader of University of Sussex. Subsequent to his retirement in 1987, Dr. Brooks was a Visiting Research Fellow in the Biochemistry Department of Reading University, UK until 1991.

Dr. Brooks has been a Fellow of the Royal Society of Chemistry (RSC) since 1966 and was a member of the RSC's Agriculture Group Committee from 1989 to 1996. In 1981, he became a Fellow of the Institute of Biology and served as a Member of Council from 1985-1989. Dr. Brooks is an emeritus member of the Biochemical Society and the International Society for the Study of Xenobiotics; a member of the Pesticide Science Society of Japan and the British Toxicology Society; and a former member of the AGRO Division of ACS. He was also a member of the British Crop Protection Council from 1990 to 2002 and received the Distinguished Service Award of the Society of Chemical Industry in 2002.

Dr. Brooks has been a member of the Society of Chemical Industry (SCI) since 1969 and of the SCI Pesticides Group (now Pest Management Group) Committee from 1974. He has served on the *Pesticide Science* Editorial Board since 1976, as the Editorial Board Vice Chairman, as Editorial Board Chairman, and as Editor-in-Chief of the journal when it was renamed *Pest Management Science* in 2000. He is also a member of the International Advisory Board of Outlooks on Pest Management (Pesticide Outlook). Dr. Brooks has served as a member of editorial boards for other journals including *Pesticide Biochemistry and Physiology*; *Journal of Biochemical Toxicology*; *Journal of Environmental Health Science, B (Pesticides, Food Contaminants, and Agricultural Wastes)*; and *Agriculture, Ecosystems, and Environment*.

An all-day symposium to honor Dr. Brooks will be held on Tuesday, March 27.

PAST AWARDEES OF THE BURDICK AND JACKSON INTERNATIONAL AWARD

1969 Dr. John E. Casida, University of California, Berkley
1970 Dr. Richard D. O'Brien, Cornell University
1971 Dr. Robert L. Metcalf, University of Illinois
1972 Dr. Ralph L. Wain, Wye College, University of London, England
1973 Dr. Hubert Martin, British Crop Protection Council, England
1974 Dr. T. Roy Fukuto, University of California, Riverside
1975 Dr. Michael Elliot, Rothamsted Experiment Station, England
1976 Dr. Morton Beroza, USDA-ARS (retired)
1977 Dr. Francis A. Gunther, University of California, Riverside
1978 Dr. Julius J. Menn, Stauffer Chemical
1979 Mr. Milton S. Schecter, USDA (retired)
1980 Dr. Minuro Nakajima, Kyoto University, Kyoto, Japan
1981 Dr. Philip C. Kearney, USDA-ARS, Beltsville, Maryland
1982 Dr. Jack R. Plimmer, USDA-ARS, Beltsville, Maryland
1983 Dr. Karl Heinz Buechel, Bayer AG, Germany
1984 Dr. Jacques Jean Martel, Roussel Uclaf, Paris
1985 Dr. Junshi Miyamoto, Sumitomo Chemical Co., Japan
1986 Dr. James Tumlinson, USDA-ARS, Gainesville, Florida
1987 Dr. Fumio Matsumura, Michigan State University
1988 Dr. Ernest Hodgson, North Carolina State University
1989 Dr. Toshio Narahashi, Northwestern University
1990 Dr. David Schooley, University of Nevada, Reno
1991 Dr. Stuart Frear, USDA-ARS, Fargo, North Dakota

PAST WINNERS OF THE ACS INTERNATIONAL AWARD FOR RESEARCH IN AGROCHEMICALS

CO-SPONSORED BY BASF COMPANY AND DUPONT CROP PROTECTION

1992-F Dr. Bruce Hammock, University of California, Davis
1993-S Dr.Morifuso Eto, Kyushu University, Fuoka, Japan
1994-F Dr. Toshio Fujita, Kyoto University, Kyoto, Japan
1995-S Dr. Mohyee Eldefrawi, University of Maryland, Baltimore
1995-F Dr. Koji Nakanishi, Columbia University, New York
1996-S Dr. Günther Voss, Ciba, Basel, Switzerland
1996-F Dr. Klaus Naumann, Bayer, Leverkusen, Germany
1997-S Dr. Fritz Führ, Jülich, Germany
1997-F Dr. Izuru Yamamoto, University of Tokyo, Japan
1998-S Dr. George Levitt, DuPont, Wilmington, DE
1998-F Dr. Leslie Crombie, University of Nottingham, England
1999-S Dr. Don Baker, Zeneca, Richmond, CA
1999-F Dr. James Seiber, University of Nevada, Reno
2000-S Dr. George P. Georghiou, University of California, Riverside
2000-F Dr. Herbert B. Scher, Zeneca
2001-S Dr. Donald Crosby, University of California, Davis
2001-F Dr. Ralph Mumma, Pennsylvania State University
2002-S Dr. Keith Solomon, University of Guelph, Ontario, Canada
2002-F Dr. Marinus Los, American Cyanamid
2003-S Dr. Bob Hollingworth, Michigan State University
2003-F Dr. Hideo Ohkawa, Kobe University, Japan
2004-S Dr. Stephen Duke, USDA-ARS, Oxford, Mississippi
2004-F Dr. John Marshall Clark, University of Massachusetts
2005-S Dr. Robert Krieger, University of California, Riverside
2005-F Dr. Janice E. Chambers, Mississippi State University
2006-S Dr. Joel Coats, Iowa State University
2006-F Dr. Isamu Yamaguchi, Agricultural Chemicals Inspection Station, Tokyo Japan
2007-S Dr. Gerald T. Brooks, West Sussex, UK

CALL FOR NOMINATIONS
ACS INTERNATIONAL AWARD FOR RESEARCH IN AGROCHEMICALS

CO-SPONSORED BY BASF CORPORATION AND DUPONT CROP PROTECTION

I hereby nominate _____ as a candidate for this award.
(First) (Middle) (Last)

Complete the following for your candidate:

1. Birthplace Date of Birth Citizenship

2. Business Address:

3. **IMPORTANT** Please Attach:
   a. A **Curriculum Vitae** for your candidate which describes the individual's career data including, places and nature of employment, professional affiliations, honors received, and a list of publications and patents. Please provide 11 copies.
   b. A **description** (200 – 1000 words) of the reasons why your nominee should receive this award, stressing the individual's major accomplishments.
   c. Nominations often include one or two letters of support, but this is optional.

Submitted by: _____ Date: _____

Address: _____

Deadline: Nominations should be received by the committee chair by December 31 of each year. Balloting will be conducted in January/February and results will be announced at the spring meeting of ACS.

The nominating official(s) should be prepared to assist in organizing a symposium and dinner at the National ACS meeting in honor of the awardee.
Please, return this completed form to:

Dr. James Seiber
USDA-ARS, WRRC
800 Buchanan St.
Albany, CA 94710
510-559-5600 – phone
510-559-5963 – fax
jseiber@pw.usda.gov

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CALL FOR NOMINATIONS
AGRO Division Fellow Award

The Division has established the Fellow Award to recognize its members whose dedicated and enthusiastic service has kept the Division moving forward. Criteria shall be "continued and substantial contributions of time, talents, and service to the Division of Agrochemicals, ACS, and the agrochemical science over a period of at least six years."

Nominations include a letter, noting the contributions to the Division, and a current *curriculum vitae*. Contact the Awards Committee for further information.

Dr. James Seiber
USDA-ARS, WRRC
800 Buchanan St.
Albany, CA 94710
510-559-5600 – phone
510-559-5963 – fax
jseiber@pw.usda.gov

Deadline for submitting nominations is May 31 of each year.

PAST WINNERS OF THE AGRO DIVISION FELLOW AWARD

1971	Dr. Louis Lykken
	Dr. Tom H. (Bucky) Harris
	Dr. Herman Beckman (Posthumous)
1972	Mr. Wendell F. (Bud) Phillips
	Dr. Don G. Crosby
	Dr. Elvins Y. Spencer
1973	Mr. Roger C. Blinn
	Dr. Philip C. Kearney
	Dr. Julius J. Menn
1974	Dr. Morton Beroza
	Dr. James P. Minyard, Jr.
	Dr. Joe C. Street
1975	Dr. Hank F. Enos
	Dr. Maurice B. Green
	Dr. Charles H. Van Middelem
1976	Dr. Marguerite L. Leng
	Dr. Jack R. Plimmer
	Dr. Gerald G. Still
1977	Dr. Gustave K. (Bob) Kohn
1978	Dr. S. Kris Bandal
	Dr. Paul Hedin
1979	Dr. Rodney D. Moss
1980	Dr. G. Wayne Ivie
	Dr. John B. Siddall (Posthumous)
1981	Dr. Robert M. Hollingworth
	Dr. Gino J. Marco
1983	Dr. John Harvey, Jr.
1985	Mr. Henry Dishburger
	Dr. Richard C. Honeycutt
1986	Dr. Gunter (Jack) Zweig
1987	Dr. Willa Garner
1988	Dr. Jan Chambers
	Dr. James Seiber
1990	Dr. Joseph Fenyes
1991	Dr. Nancy N. Ragsdale
1992	Dr. Don Baker
	Dr. Joel Coats
	Dr. Guy Paulson
1993	Dr. Larry Ballantine
1994	Dr. James Heitz
	Dr. Ralph Mumma
	Dr. Willis Wheeler
1996	Dr. John Bourke
1998	Dr. Hank Cutler
	Mr. Paul Giesler
2000	Dr. Barry Cross
2001	Dr. Robert Hoagland
2003	Dr. Judd Nelson
2005	Dr. Rodney Bennett
2006	Dr. Terry Spittler

PAST AWARDEES OF THE STERLING B. HENDRICKS MEMORIAL LECTURSHIP

Sponsored by USDA-ARS and AGRO & AGFD Divisions

1981 Norman E. Borlaug, Nobel Laureate and Director of International Maize and Wheat Improvement Center, Mexico City

1982 Warren L. Butler, Professor of Biology and Past Chairman, Biology Department, University of California at San Diego

1983 Melvin Calvin, Nobel Laureate and University Professor of Chemistry, University of California at Berkeley

1984 Frederick Ausubel, Professor of Genetics, Harvard Medical School and Massachusetts General Hospital

1985 Alan Putnam, Professor, Department of Horticulture and Pesticide Research Center, Michigan State University

1986 Ralph Hardy, President, Boyce Thompson Institute for Plant Sciences, Cornell University, and Deputy Chairman, BioTechnica International

1987 Mary-Dell Chilton, Director of Biotechnology Research for Ciba-Geigy Corporation, Research Triangle Park, North Carolina

1988 Bruce N. Ames, Chairman, Department of Biochemistry, University of California at Berkeley

1989 Sanford A. Miller, University of Texas Health Science Center at San Antonio

1990 Roy L. Whistler, Emeritus Professor of Purdue University

1991 Peter S. Eagleson, Professor of Civil Engineering, Massachusetts Institute of Technology

1992 John E. Casida, Professor of Chemistry and Toxicology, University of California at Berkeley

1993 Philip H. Abelson, Deputy Editor, *Science*, and Scientific Advisor to AAAS

1994 Wendell L. Roelofs, Liberty Hyde Bailey Professor of Insect Biochemistry, Cornell University

1995 Winslow R. Briggs, Director Emeritus, Department of Plant Biology, Carnegie Institution of Washington

1996 Hugh D. Sisler, Professor Emeritus, Department of Plant Biology, University of Maryland

1997 Ernest Hodgson, Head, Department of Toxicology, North Carolina State University

1998 Martin Beroza, Chief, Organic Chemicals Synthesis Laboratory, Agricultural Research Service

1999 Bruce D. Hammock, Professor, Department of Entomology, University of California at Davis

2000 William S. Bowers, Professor, Department of Entomology and Chemical Ecology at the University of Arizona

2001 Malcolm Thompson, Research Chemist, USDA-ARS, Beltsville, Maryland (retired)

2002 Ervin E. Leiner, Professor Emeritus, Biochemistry Department, University of Minnesota

2003 Dr. Kriton Kleanthis Hatzios, VA Agricultural Experiment Station

2004 Dr. Robert L. Buchanan, Food & Drug Administration

2005 Dr. Donald Sparks, University of Delaware

2006 Dr. Stanley B. Prusiner, Institute for Neurodegenerative Diseases, University of California, San Francisco

CALL FOR NOMINATIONS
2008 STERLING B. HENDRICKS MEMORIAL LECTURESHIP

The Agricultural Research Service (ARS), USDA's primary research agency, is seeking nominations for the

2008 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.

The lecture should address a scientific topic, trend, or policy issue related to agriculture. Nominees may be outstanding, senior scientists in industry, universities, or government positions. Current ARS employees are not eligible.

The Award will be presented during the American Chemical Society National Meeting held in Philadelphia, PA on August 17-21, 2008 prior to the Lecture. (Giving the presentation is a requirement of the honor.) The Divisions of Agrochemicals and Agricultural & Food Chemistry co-sponsor the Lecture which will be held in a joint session of these divisions. The lectureship is presented at an AGFD symposium in even-numbered years and in an AGRO symposium in odd-numbered years. The award includes an honorarium of $2000, a bronze medallion, and expenses to attend the meeting.

To make a nominations send (1) a letter explaining the nominee's contributions to chemistry and agriculture and (2) a current curriculum vitae to:

Kim Kaplan, Lecture Coordinator
(301) 504-1637
at either
kaplan@ars.usda.gov
or
ARS Information Office
Room 1-2253, Mail Stop # 5128
5601 Sunnyside Ave
Beltsville, MD 20705

Electronic transmission is best; otherwise, use a carrier, such as FedEx.
The deadline for nominations is November 5, 2007 (COB, EST)

Changes in the AGRO Young Scientist Pre- and Post-Doctoral Research Awards

Sponsored by Dow AgroSciences

Following the Chicago meeting, the Young Scientist Pre- and Post-Doctoral Research Award will be undergoing changes as the AGRO Division moves to meeting at only Fall National ACS Meeting each year. The award name will be changed and will be opened to new investigators at research institutions, industries, and universities who have received their doctoral degrees within the last three years prior to the application deadline. Graduate students are invited to submit applications for the Education Awards for Graduate Student Travel.

For further information about the impending AGRO new investigator award, contact Dr. Allan Felsot at Washington State University (afelsot@tricity.wsu.edu) or visit the Division of Agrochemicals web site (http://membership.acs.org/a/agro/). Graduate students should direct their inquiries about the AGRO Education Awards to Dr. John Johnston at the USDA/National Wildlife Research Center, Fort Collins (john.j.johnston@aphis.usda.gov) (see page 21).

AGRO Young Scientist Pre- and Post-Doctoral Research Awards

Sponsored by Dow AgroSciences

The AGRO Division organizes an annual competition for the Young Scientist Pre- and Post-doctoral Research Awards. The purpose of the awards, which are open to both graduate students and post-doctoral research associates, is to recognize outstanding young agrochemical researchers and to encourage their participation in the Division. The 2007 awardees highlighted below will present their work during the annual Young Scientists Recognition Symposium at the 233rd ACS National Meetings in Chicago, IL. The symposium will also feature presentations by a total of 16 outstanding graduate students and post-doctoral associates and will begin on Sunday at 8:25 am in McCormick Place East, Room E267, Level 2.

The awards will be presented during The AGRO Awards Social on Tuesday evening. Awardees will receive a cash award, award plaques, and travel reimbursements to the Chicago meetings. All other presenters will receive a travel stipend from AGRO. The Agrochemicals Division would greatly appreciate your efforts to encourage students, post-doctoral research associates, and new investigators to apply for future award competitions sponsored by AGRO.

Kelsey Prihoda, is the *first-place winner of the 2007 Young Scientists Research Award* with her entry, "Development of methods to determine the aquatic fate and non-target effects of transgenic Bt proteins on aquatic invertebrates: Toward risk assessment." Kelsey conducted the research in the laboratory of Dr. Joel Coats at Iowa State University, Department of Entomology. Congratulations to Kelsey and Dr. Coats for being one of the first research teams to study the fate of Bt Cry1F protein in aquatic systems and its potential effects on aquatic midges.

Troy Anderson, *runner-up winner for 2007*, entered the paper, "Herbicide-induced hypoxic stress and hemoglobin gene regulation in an aquatic insect." Troy conducted his research in the laboratory of Dr. Kun Yan Zhu in the Department of Entomology at Kansas State University. Congratulations to Troy and Dr. Zhu for using a combination of genomics and physiological measurements to elucidate a putatively novel mechanism of atrazine sub-lethal effects in an aquatic insect larva.

SYMPOSIUM PARTICIPANTS

Lingshuang Cai
Iowa State University
Wan-Ru Chen
Georgia Institute of Technology
Yun Cheng
University of Florida
Lindsey Gereszek
Iowa State University
Elizabeth Hodges
University of Florida
Dingfei Hu
Iowa State University
Nicholas Johnson
Michigan State University
Brent Keller
Minot State University
Hirofumi Kosaki
Iowa State University
Christy Oliver
North Dakota State University
Gretchen Paluch
Iowa State University
Alejandro Perez-Jones
Oregon State University
Sukhendu Kumar Pramanik
Bidhan Chandra Krishi University
Robert Sulc
University of California, Irvine
Venkat Reddy Chinta Reddy
Iowa State University
Jing You
Southern Illinois University

AGRO Education Awards
2006 Fall ACS Meeting in San Francisco

Graduate Student Poster Presentations

The AGRO Division hosted a graduate student research poster competition at the 232nd National ACS Meeting in San Francisco, California on September 10-14, 2006. Fourteen students, representing six colleges, presented research findings on a wide range of agrochemical related topics including environmental fate of pesticides, pesticide exposure, new techniques for pesticide analysis, effects of pesticide on soil microflora, phytoremediation, and natural products as insect repellents.

All student presenters received a $600 travel grant plus ACS membership.
Additional cash awards were presented to:

Tim Goebel, Texas A&M (*First Prize Winner*)
Modification of polymer flocculants for removal of atrazine from water
Gretchen Schultz, Iowa State
Evaluation of essential oil mixtures for mosquito repellency
Sarah Landcaster, Texas A&M
Effects of pesticide programs for cotton on soil microbial activity

Graduate Student Research Poster Participants

Left to Right: Dingfei Hu (Iowa State), Vera Williams (Iowa State), Hirofumi Kosaki (Iowa State), Gretchen Shultz (Iowa State), Catherine Curan (U Washington), Kasandra King (U Washington), Kelsey Prihoda (Iowa State), Lindsey Gereszek (Iowa State), Sarah Landcaster (Texas A&M), James Keenan (U California – Riverside), Wesley Hunter (U California – Davis), Baohon Zhang (Texas A&M), Tim Goebel (Texas A&M), Amrith Gunasekara (U California – Davis)

Congratulations to all our student winners!

CALL FOR APPLICANTS
AGRO Education Awards

Support for Graduate Student Poster Presentations at the 2007 Fall ACS Meeting in Boston

The AGRO Division 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. Potential topics include 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 2007 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 2007 Fall Meeting, which will be held August 19 – 23, 2007 in Boston. Posters will be displayed in a special poster session of the ACS AGRO Division as well as at the ACS Sci-Mix. A winner and two runners up will be selected for display at the Division's Social. First, Second, and Third place winners will receive an additional cash award. 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 April 2, 2007:

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 two page extended abstract giving more detail of the research/presentation.

3. A letter of nomination from the faculty advisor.

Submit items 1, 2 to the ACS OASYS abstract submission website. Submit item 3 to as a Word or pdf file to Dr. John Johnston at john.j.johnston@aphis.usda.gov.

Direct questions to:
Dr. John J. Johnston
USDA/APHIS/National Wildlife Research Center,
4101 LaPorte Ave
Fort Collins, CO 80521
(970)-266-6082.

Abstracts will be reviewed by the Education Committee; submitters will be notified of their selection status in May 2007.

Analytical Chemistry

ILV
Residue Chemistry
FDA Multi-Residue Methods
Certification of Analysis
Sample Storage Stability
Dislodgeable Residue
Worker Exposure
Metabolite Characterization
Fumigant Residue Analysis
Methods Development

Product Chemistry

Certified Limits
Preliminary Analysis
Identity & Composition
Solubility Studies
Vapor Pressure
Octanol/Water Partition Coefficient
Product Storage Stability
Corrosion Characteristics
Physical Chemical Properties
Release Rate of Biocides

Plant Sciences and Field Research

Project Management
Worker Exposure
Dislodgeable Residues
Import Tolerance
Efficacy - Field & Greenhouse
Confined Crop Rotation
Magnitude of Residue
Soil Dissipation

Environmental Effects

Fish and Invertebrate Testing
Fish Bioconcentration
Marine & Fresh Water Organisms
Aquatic & Terrestrial Phytotoxicity
Sediment Toxicity Studies
Non-Target Insect Tests
Shellfish Residue Studies

Environmental Fate/Metabolism

Photodegradation
Hydrolysis
Aquatic/Soil Metabolism
Plant & Animal Metabolism
AD/DE & Leaching
Field Lysimeter Studies
Biodegradation

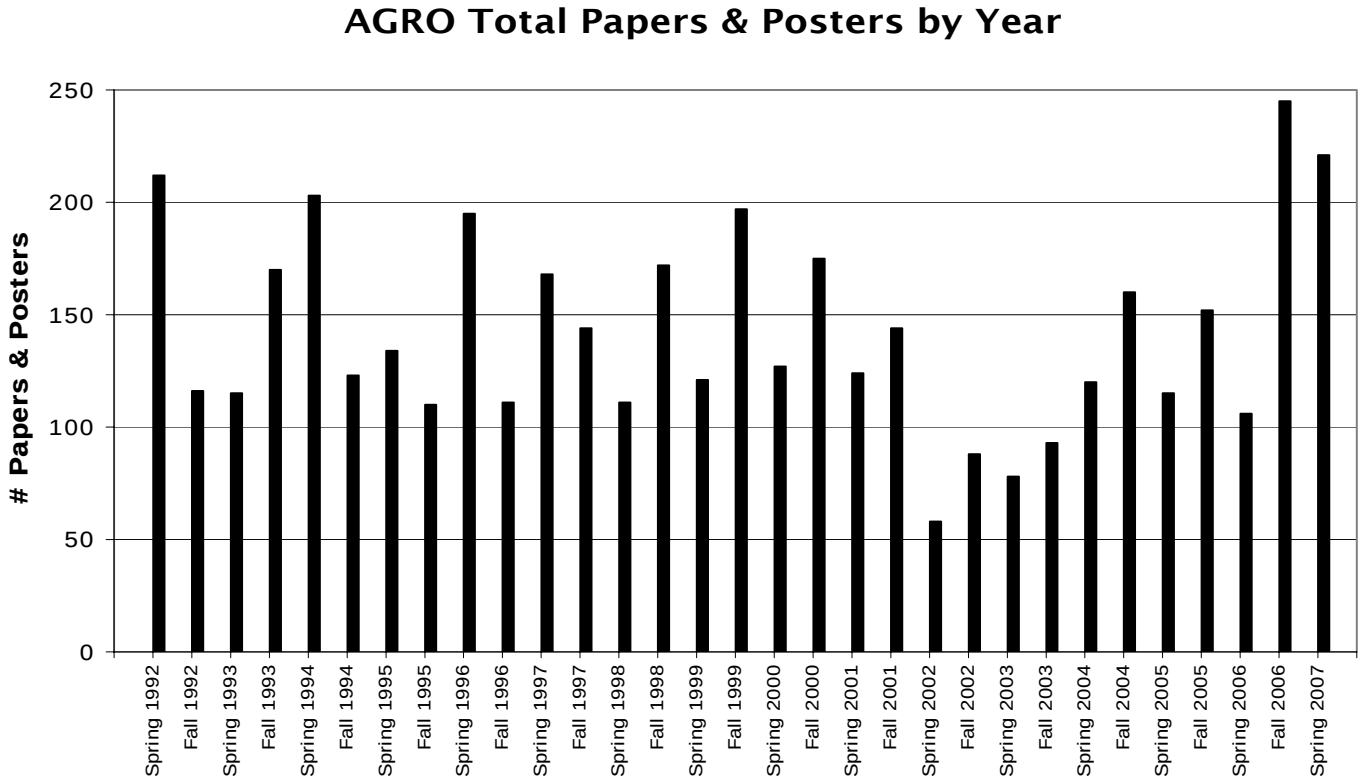
ABC Laboratories, Inc.
7200 E. ABC lane, Columbia,, MO 65202
Contact Del Koch, M.S. @ (573)-443-9003
Additional Information at: www.abclabs.com

Notes from the Program Chair

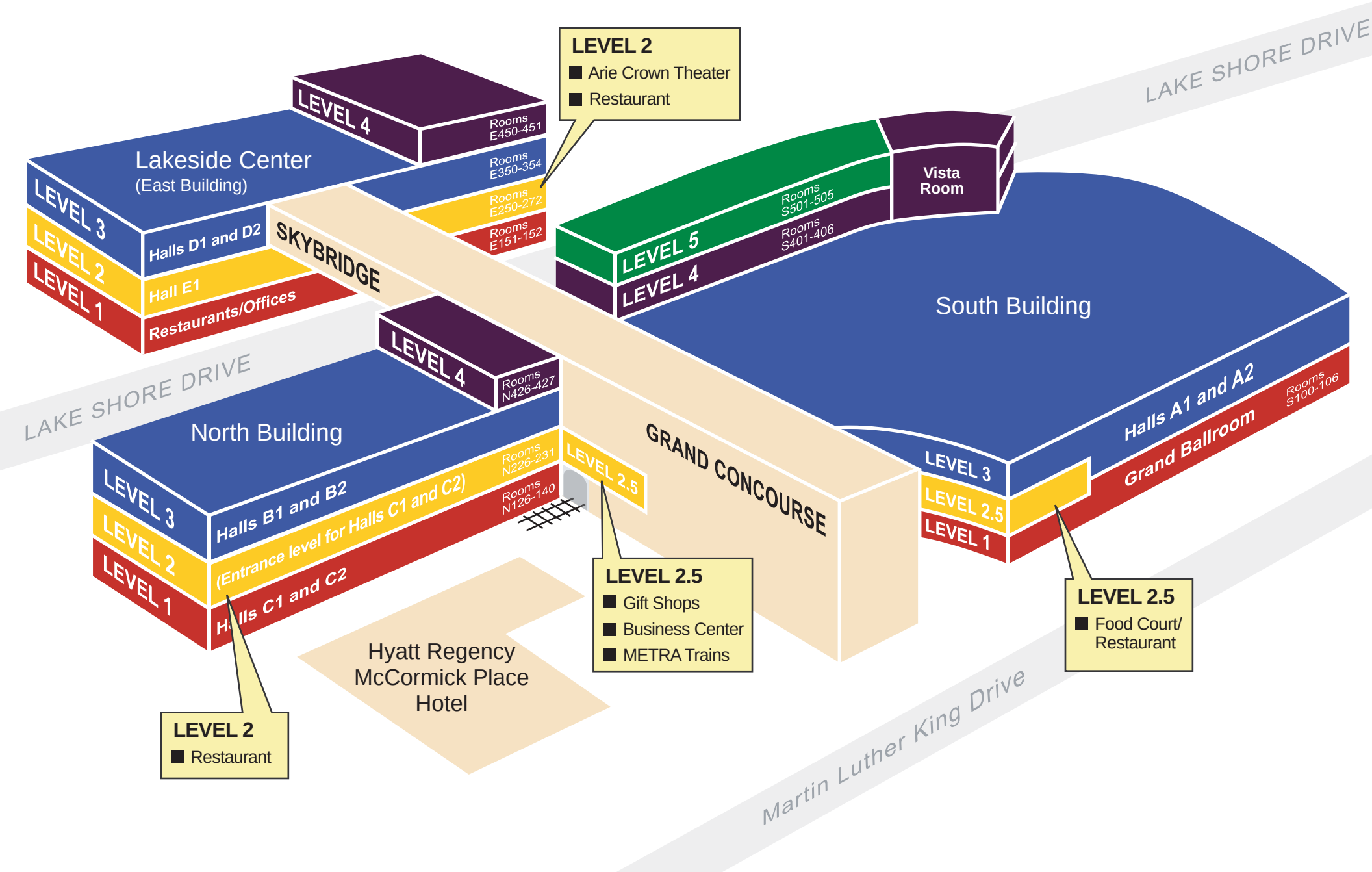
John J. Johnston

Programming for the 233rd National Meeting in Chicago compliments the AGRO Division's strategy to expand our areas of interest to include all areas of Agricultural Chemistry – chemistry for and from agriculture. Symposia included at this meeting address glyphosate resistance in crops and weeds; the fate of veterinary pharmaceuticals in the environment; spatial data analysis and GIS to estimate exposure to agrochemicals; development of agricultural biomass, biobased products, and biofuels; strategies for structural and residential pest management; sustainable, forest-pest management strategies; and agrochemical run-off and leaching management. Additionally, we will feature our young scientist research awards symposium, new developments and issues in agrochemical sciences symposium (a smorgasbord of agrochemical-related research), and a symposium to honor the lifetime achievements of the preeminent agrochemical scientist, Gerald T. Brooks.

At 221 presentations, our Chicago technical program represents the largest program that AGRO has ever sponsored in Chicago. Combined with the recent record-breaking AGRO program in San Francisco, the future of our division looks good. Our ability to expand into new relevant areas of interest and our commitment to student research appears to be reaping a bountiful harvest. Thanks to the dedicated and enthusiastic membership of the AGRO Division, our future looks bright!



McCormick Place
Overview



SPRING 2007 SCHEDULE

SYMPOSIUM OR SESSION	VENUE	Sun	Mon	Tue	Wed	Thu
Glyphosate Resistant Crops and Weeds	McCormick Place East Room E265, Level 2	AM PM	AM PM			
Young Scientist Pre- and Post Doctoral Research	McCormick Place East Room E267, Level 2	AM PM				
Veterinary Pharmaceuticals in the Environment	**SUNDAY:** McCormick Place East -- Room E266, Level 2 **MONDAY**: McCormick Place East -- Room E267, Level 2	PM	AM PM			
New Developments and Issues in Agrochemical Sciences	McCormick Place East Room E266, Level 2		PM			
Sci-Mix	Hyatt Regency Chicago -- Riverside Center		EVE			
AGRO Division Posters	McCormick Place East Room E354, Level 3			AM		
VENUE MOVES FROM EAST to SOUTH						
ACS International Award Symposium in honor of Gerald Brooks	McCormick Place South Room S105D, Level 1			AM PM		
Estimation of Environmental Exposure to Agrochemicals using Spatial Data Analysis & GIS	McCormick Place South Room S103B/C, Level 1			PM	AM PM	AM PM
Agricultural Biomass, Biobased Products, & Biofuels	McCormick Place South Room S103D, Level 1			PM	AM PM	AM PM
Recent Advances in Sustainable Household, Structural and Residential Pest Management	McCormick Place South Room S105D, Level 1				AM	
Sustainable Forest Pest Management	McCormick Place South Room S105D, Level 1				PM	
Pesticide Runoff/Leaching Mitigation by Riparian Buffers: Application of the REMM Model	McCormick Place South Room S105D, Level 1					AM

Some specific programming notes to keep in mind:

1. Our Venue: We move from McCormick Place East to McCormick Place South after the posters on Tuesday. Also, McCormick Place East is McCormick Place Lakeside.
2. The AGRO poster sessions will be held on Tuesday morning from 8:00 – 10:00 am. To encourage attendance at the poster session, we have postponed all other AGRO presentations until after the poster session.
3. The International Award Symposium will begin on Tuesday at 10:15 immediately following the AGRO poster session. Please support our International Award winner by attending Dr. Brook's address, "Fifty Years of Insect Toxicology".
4. The AGRO Awards Social will be held on Tuesday evening. This year's event promises to be our best ever - Don't miss out on this one.
5. Our AGRO future symposium ideas and symposium organizer information happy hour will be held on Wednesday afternoon, from 5:00 – 6:30 pm. This is a wonderful opportunity to participate in the future of AGRO programming which is the life blood of our division. Please share your ideas about the future symposia and find out more about being a symposium organizer. Refreshments will be served!

AGRO Program Committee Report

In response to initiatives developed at the AGRO Long Range Planning Workshop, the Program Committee of AGRO has been recreated with a specific goal:

> *"Establish a program planning structure for AGRO to provide continuity and sustained outstanding scientific program."*

The newly formed Program Committee is made up of the Division Officers, Executive Committee members, Standing members, Volunteer members, and a Long Range Program Coordinator to keep a continuous record of past and future programming. Some names are listed twice as they are serving in more than one category. If you have an interest in serving as a volunteer member of this committee, or if you would like more information on participating in AGRO programming, please contact Laura McConnell, Joe Massey, or one of the division officers.

Standing Programming and New Directions

A recent activity carried out by the committee was to establish a draft list of standing topic areas which reflect better the broader areas of agricultural research being addressed by AGRO.

- Environmental Fate, Transport, Risk Assessment and Modeling of Agriculturally-Related Chemicals
- Technological Advances and Applications in Agricultural Science: Nanotechnology, Genetically Modified Organisms, and Biocontrol Agents
- Development of Value-Added Products from Agricultural Crops and Byproducts
- Bioenergy and Biofuels from Agriculture
- Natural Products, Pheromones, and Chemical Signaling in Agriculture
- Human and Animal Health Protection: Veterinary Pharmaceuticals, Antimicrobials, Worker Protection Products
- Advances in Agrochemical Residue and Metabolism Chemistry
- Urban Agriculture – Turf, Ornamentals, Household Products, and Water Re-Use
- Developments in Integrated Pest Management and Resistance Management
- Soil and Nutrient Management for Sustainable Agriculture
- Agrochemical Toxicology and Mode of Action
- Residue and Metabolism Chemistry
- Synthesis of Bioactive Compounds
- Exposure and Exposure Assessment Modeling

These topics will be part of each AGRO program beginning in 2008 along with our normal awards, programming, and symposia to address ACS themes for each meeting and special topics of emerging or continuing interest.

If you have additional ideas for standing topics or programming that you would like to see included in AGRO, please contact one of the division officers or attend our Future AGRO Programming Discussion and Symposium Organizer Information meeting on Wednesday, March 28 at 5:00 pm.

Status of
Planned AGRO Programming & Outreach Activities
2007 – 2011

Activity/Event	Leader(s)	Status	Actions Required
234th ACS National Meeting August 19-23, 2007 Boston, Massachusetts	John Johnston	• See Call for Symposia & Papers, page 37	• Contact John if you are interested in organizing a symposium
4th Pan Pacific Conference on Pesticide Science June 1-4, 2008 Honolulu, Hawaii	Al Barefoot Joel Coats	• Organizing & Science Program Committees holding preliminary meetings • Pesticide Science Society of Japan will co-sponsor	• Committees are working on various aspects and securing sponsorships • AGRO to provide some financial support
236th ACS National Meeting August 17-21, 2008 Philadelphia, Pennsylvania	2007 Vice Chair	• Call for Symposia & Papers TBA in PICOGRAM vols. 73 & 74	• Contact the Vice-chair if you are interested in organizing a symposium
Activities beyond 2009			
AGRO Activity in Winter/Spring 2009	John Clark Ken Racke Others?	• Ideas/venue need to be discussed at March 2007 meeting	• Decide what specific activity AGRO will do
238th ACS National Meeting August 16-20, 2009 Washington, DC	2008 Vice Chair		
240th ACS National Meeting August 22-26, 2010 Boston, Massachusetts	2009 Vice Chair		
IUPAC Pesticide Congress Summer 2010 Melbourne, Australia		AGRO should exert a strong presence at this meeting. In the meantime, AGRO should decide whether to pursue a proposal to host the 2014 Pesticide Congress in the U.S.	
241st ACS National Meeting March 27-31, 2011 Anaheim, California	2010 Vice Chair		• Decide in 2010 if AGRO is returning to 2 national meetings per year
242nd ACS National Meeting August 28-September 1, 2001 Chicago, Illinois	2010 Vice Chair		

Open Meeting for All AGRO Members

AGRO Programming and Symposium Ideas & Organizer Information Meeting

Wednesday, March 28, 5:15 – 6:30 pm
McCormick Place East, Room E256

Hosted by
John J. Johnston and Laura L. McConnell

- Share your ideas about the future AGRO programming
- Learn more about organizing a symposium
- Let us know what topics are the most important to you

Refreshments will be served

AGRO Program Committee

John Johnston, 2007 Program Chair		John.J.Johnston@usda.gov
Joseph Massey, 2006 – 2010 Long Range Program Coordinator		jmassey@pss.msstate.edu
Division & Subdivision Officers		
Laura McConnell	Division Chair	mcconnel@ba.ars.usda.gov
	Vice Chair	
Bill Hall	Chair, FERT Subdivision	bill.hall@mosaicco.com
Terry Spittler	Treasurer	tds2@cornell.edu
Aldos Barefoot,	Secretary	Aldos.C.Barefoot@USA.dupont.com
Donald Wauchope	Immediate Past Chair	don.wauchope@tifton.usda.gov
Barry Cross	Councilor	barry.cross@worldnet.att.net
Standing Members		
Jim Seiber	Awards Committee Chair	jseiber@pw.usda.gov
Allan Felsot	Young Scientist Award Chair	afelsot@tricity.wsu.edu
John Johnston	Education Award Committee Chair	John.J.Johnston@usda.gov
John Clark	Special Conferences Chair	jclark@vasci.umass.edu
Cathleen Hapeman	Publication Committee Chair	hapemanc@ba.ars.usda.gov
Jason Sandahl	International Outreach Chair	Jason.Sandahl@usda.gov

Executive Committee Members			
Matthew Brooks	mwbrooks01@yahoo.com	Todd Anderson	todd.anderson@ttu.edu
Marty Kovacs	marty@toxcel.com	Cathleen Hapeman	hapemanc@ba.ars.usda.gov
Ann Lemley	atl2@cornell.edu	Patricia Rice	ricep@basf-corp.com
Teresa Wehner	teresa.wehner@merial.com	Luis Ruzo	l.ruzo@ptrlwest.com
Paul Zubkoff		Jeanette Van Emon	vanemon.jeanette@epamail.epa.gov

Volunteer Members 2006 – 2009			
Ellen Arthur	ellen.arthur@bayercropscience.com	Michael Meyer	mmeyer@usgs.gov
Ralph Mumma	rom1@psu.edu	Scott Yates	syates@ussl.ars.usda.gov

4th Pan Pacific Pesticide Conference

Waikiki Beach Marriott
Honolulu, Hawaii
June 1 – June 4, 2008

Crop and Public Health Protection Products
Science to Meet Consumer and Societal Needs

The AGRO Division of the American Chemical Society and the Pesticide Science Society of Japan are pleased to announce their co-sponsorship of the 4th Pan Pacific Pesticide Conference. The focus of this conference is research directed toward identification and resolution of issues related to discovery, selection, evaluation and use of pesticides intended for crop, public health, and environmental protection.

Session topics will include:

- Global trade issues
- Environmental issues
- Invasive Species
- New products and product discovery
- Mode of action
- Worker protection concerns
- Toxicology and metabolism
- Pesticide product characterization
- Process analytical technology
- Resistance to pesticides
- Residue analysis
- Government regulations and standards
- Applications of biotechnology

For further information:

Vernar Beatty
American Chemical Society
Office of Conference Management and Vendor Relations
202 872-4398

Organizing Committee Chairs:

Dr. Aldos Barefoot (aldos.c.barefoot@usa.dupont.com)
Dr. Koichi Yoneyama (yoneyama@cc.utsunomiya-u.ac.jp)

Program Committee Chairs:

Dr. Joel Coats (jcoats@iastate.edu)
Dr. Hiroshi Matsumoto (hmatsu@biol.tsukuba.ac.jp)

Abstracts can be submitted from October 5, 2007 to March 2, 2008

www.panpacificconference.org

AGRO 2007
CALL FOR SYMPOSIA & PAPERS

234th ACS National Meeting & Exposition
August 19-23, 2007
Boston, Massachusetts USA

The following symposia are planned for the ACS National Meeting in Boston 2007. Proposals for additional symposia are now being accepted. Please contact:

Dr. John Johnston, AGRO 2007 Program Chair
Chemistry Research Project
USDA/APHIS/WS/National Wildlife Research Center
4101 LaPorte Avenue
Fort Collins, CO 80521
john.j.johnston@aphis.usda.gov
970-266-6082; Fax: 970-266-6089

ACS International Award for Research in Agrochemicals Symposium will honor Dr. Frederick J. Perlak for his research contributions in the area of insect protected crops.

Sterling B. Hendricks Award Symposium
Organizer: J. J. Johnston, USDA/APHIS/WS/National Wildlife Research Center, 4101 LaPorte Avenue, Fort Collins, CO 80521, 970-266-6082, john.j.johnston@aphis.usda.gov

Agrochemical Education Awards For Graduate Student Travel: Research Poster Presentations
Organizer: J. J. Johnston, USDA/APHIS/WS/National Wildlife Research Center, 4101 LaPorte Avenue, Fort Collins, CO 80521, 970-266-6082, john.j.johnston@aphis.usda.gov

QSAR Reborn – A Symposium to Honor Phil Magee (co-sponsored by AGRO)
Organizers: John H. Block, College of Pharmacy, Oregon State University, Corvallis, OR 97331 541-737-5779, John.Block@oregonstate.edu; Robert Clark, Tripos Inc., 1699 S Hanley Rd Suite 303, 63144 St. Louis, MO, bclark@tripos.com (see page 33)

Agrochemical Residue & Metabolism Chemistry
Organizers: Teresa A. Wehner, Pharmacokinetics & Drug Metabolism, Merial Ltd, 631 Route 1 South, North Brunswick, NJ 08902, Teresa.Wehner@merial.com; J. J. Johnston, National Wildlife Research Center, U.S. Department of Agriculture/APHIS/WS, 4101 LaPorte Avenue, Fort Collins, CO 80521-2154, john.j.johnston@aphis.usda.gov; David Smith, Biosciences Research Laboratory, USDA-ARS, P.O. Box 5674, University Station, Fargo, ND 58105, smithd@fargo.ars.usda.gov (see page 34)

Immunochemistry Summit Meeting Series X
Organizers: Weilin L. Shelver, USDA-ARS, Biosciences Research Laboratory, 1605 Albrecht Boulevard, Fargo, ND 58105, 701-239-1425, shelverw@fargo.ars.usda.gov; Jeannette Van Emon, USEPA, 702-798-2154, vanemon.jeanette@epa.gov (see page 35)

Issues in Integrated Pest Management
Organizer: Ames Herbert, Tidewater AREC, 6321 Holland Road, Suffolk, VA 23437, 757-657-6450 ext 122, herbert@vt.edu; Susan Ratcliffe, North Central Region IPM Center, University of Illinois, Department of Crop Science, S-316 Turner Hall, 1102 S. Goodwin Avenue, Urbana, Illinois 61801, 217-333-9656, sratclif@uiuc.edu (see page 36)

Investigating Emissions of VOCs from Pesticide and Fumigant Applications: State of the Science and New Approaches to Protect Air Quality
Organizers: Laura L. McConnell, USDA-ARS, Beltsville, MD 20705, 301-504-6298, mcconnel@ba.ars.usda.gov; Peter G. Green, University of California, Davis, One Shields Avenue, Davis, CA 95616, 530-752-8581, pggreen@ucdavis.edu; Brian L. Bret, Dow AgroSciences, 909 Thoreau Court, Roseville, CA 95747, 916-780-7477, blbret@dow.com (see page 37)

Modern Chiral Agrochemicals: The Importance of Enantioselectivity in Fate & Effects
Organizer: Wayne Garrison, US EPA National Exposure Research Laboratory, 960 College Station Rd, Athens, GA 30605, 706-355-8219, garrison.wayne@epa.gov (see page 38)

Nanotechnology in Agriculture
Organizer: Norm Scott, Bio and Envir Engineering, 216 Riley-Robb, Cornell University, Ithaca, NY 14853, 607-255-4473, nrs5@cornell.edu (see page 39)

Rodenticides for the Protection of Public Health, Agriculture, and Natural Resources
Organizer: Thomas Primus, USDA/APHIS/WS/National Wildlife Research Center, 970-266-6065, thomas.m.primus@aphis.usda.gov (see page 40)

New Developments and Issues in Agrochemical Sciences General Oral Presentations and Posters
Organizer: John Johnston, USDA-National Wildlife Research Center, 4101 LaPorte Avenue, Fort Collins, CO 80521, 970-266-6082, john.j.johnston@aphis.usda.gov (see page 41)

AGRO 2008
CALL FOR SYMPOSIA & PAPERS

236th ACS National Meeting & Exposition
August 17-21, 2008
Philadelphia, Pennsylvania USA

The following symposia are planned for the ACS National Meeting 2008 in Philadelphia. Proposals for additional symposia are now being accepted. Please contact the Vice-Chair Elect (AGRO 2008 Program Chair) or Dr. John Johnston, AGRO 2007 Program Chair.

ACS International Award for Research in Agrochemicals (Nomination form on page 13)

Sterling B. Hendricks Award Symposium (Nomination form on page 15)

AGRO Awards for New Investigators (Additional information on page 18)
Organizer: Allan Felsot, Washington State University, 2710 University Drive, Richland, WA 99354, 509-372-7365, afelsot@tricity.wsu.edu

AGRO Education Awards For Graduate Student Travel:
Research Poster Presentations (See page 21)
Organizer: John J. Johnston, USDA/APHIS/WS/National Wildlife Research Center, 970-266-6082, john.j.johnston@aphis.usda.gov

Agrochemical Residue & Metabolism Chemistry
Organizers: Teresa A. Wehner, Merial Ltd; J. J. Johnston, USDA/APHIS/WS, 970-266-6082, john.j.johnston@aphis.usda.gov; David Smith, USDA-ARS, 701-239-1238, smithd@fargo.ars.usda.gov

Climatic Issues and Research: Impacts on Agriculture
Please contact AGRO Program Chair if you are interested in participating in this symposium

Energy Issues and Agriculture
Organizers: Cathleen Hapeman, USDA-ARS, Beltsville Agricultural Research Center, 301-504-6451, hapemanc@ba.ars.usda.gov; Joseph Massey, Mississippi State University, 662-325-4725, jmassey@pss.msstate.edu

Evaluation of Agriculturally-Related Chemicals
Impacts on Environmental, Animal, and Human Health
Organizers: Pamela Rice, USDA-ARS, 612-624-9210, pamrice@umn.edu; Todd Anderson, Texas Tech University, 806-885-4567, todd.anderson@tiehh.ttu.edu; Patricia Rice, BASF Corporation, 919-547-2668, patricia.rice@basf.com; Ellen Arthur, Bayer CropScience, 913-433-5328, ellen.arthur@bayercropscience.com

New Developments and Issues in Agrochemical Sciences (Gen. Presentations/Posters)
Organizer: 2008 Program Chair

Natural Products
Organizer: Paul Zubkoff, USEPA (retired), 113 West Queens Dr., Williamsburg, VA 23185, 757-229-4037, plzubkoff@msn.com

Co-Sponsored by AGRO in 2007
CALL FOR PAPERS

QSAR Reborn:
A Symposium in Memory of Dr. Phillip Magee

234th ACS National Meeting & Exposition
August 19-23, 2007
Boston, Massachusetts USA

Purpose of Symposium

This symposium will honor the late Dr. Phillip Magee, a pioneer in utilizing QSAR and the first president of the International QSAR and Modeling Society. Phil was one of the organizers of the International QSAR and Modeling Society and was its first president. While it is common to apply QSAR to bioactivities in humans, he showed its application to agrochemicals. After retiring from the Ortho Chemical Division of Standard Oil, Phil used QSAR to study transdermal properties of molecules. Until his stroke, Phil was utilizing both his knowledge of physical organic chemistry and QSAR descriptors to model bioactivities. This symposium will cover all work in the QSAR field.

Speakers who have developed QSAR methodologies and who apply them to solve problems are encouraged to contact symposium organizers.

Suggested Topics

- QSAR Descriptors
  - Physico-chemical, Topological, Quantum Mechanics, Geometrical/Stereochemical
- QSAR Techniques
  - 2D-QSAR, 3D-QSAR, Topological QSAR, Neural Networks, Classification Methods
- QSAR Applications
  - Drug Design, Agrochemical Design, Toxicities, Environmental Properties

For additional information contact the organizers

John H. Block, Oregon State University, john.block@oregonstate.edu
Robert Clark, Tripos, bclark@tripos.com

Abstracts should be submitted January 22 – April 2, 2007

AGRO 2007
CALL FOR PAPERS

Agrochemical Residue & Metabolism Chemistry

234th ACS National Meeting & Exposition
August 19-23, 2007
Boston, Massachusetts USA

Purpose of Symposium

To present a variety of research and new approaches associated with agrochemical residue, metabolism and environmental fate studies

Suggested Topics

- Determination of agrochemicals (herbicides, insecticides, fertilizers, pheromones, livestock drugs, etc.),
- Determination of metabolites and degradation products
- Approaches to improve method limits of detection, sample throughput, isolation, identification
- Agrochemical metabolism, environmental fate or field residue research

For additional information contact the organizers

John J. Johnston, USDA, National Wildlife Research Center
(970) 266-6082, john.j.johnston@aphis.usda.gov

David Smith, USDA-ARS, Biosciences Research Laboratory
(701) 239-1238, smithd@fargo.ars.usda.gov

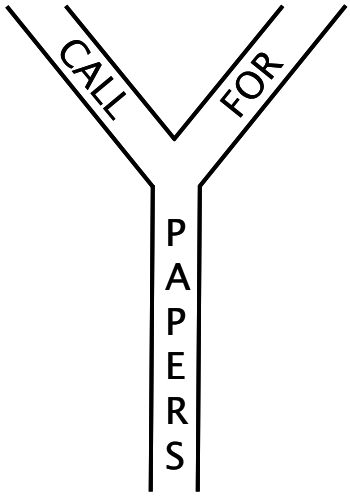
Teresa Wehner, Merial Ltd.
(732) 729-5713, teresa.wehner@merial.com

Abstracts should be submitted January 22 – April 2, 2007

AGRO 2007

Immunochemistry Summit Meeting Series X

234th ACS National Meeting & Exposition
August 19-23, 2007
Boston, Massachusetts USA



Purpose of Symposium

Advancements in microarray, microfluidic, and nanotechnologies are adding a new dimension to immunochemical methods. This symposium will examine these advancements for antibody-based and other receptor-based methods with applications for agrochemicals and the impact on food safety, agrochemical registration, environmental and biological monitoring, and homeland security.

Suggested Topics

- Current advances in immunochemical methods
- Applications to proteomics and metabolomics
- Case Studies
- Applications to food safety and homeland security
- Antibody mimics

For additional information contact the organizers

Jeanette M. Van Emon, USEPA, 702-798-2154
vanemon.jeanette@epa.gov

Weilin Shelver, USDA-ARS, 701-239-1425
shelverw@fargo.ars.usda.gov

Abstracts should be submitted January 22 – April 2, 2007

AGRO 2007
CALL FOR PAPERS

Issues in Integrated Pest Management

234th ACS National Meeting & Exposition
August 19-23, 2007
Boston, Massachusetts USA

Purpose of Symposium

Since its inception, integrated pest management (IPM) has developed economic thresholds to be used in conjunction with monitoring to determine the need for pest management. New issues and technologies continue to challenge broad implementation of IPM practices. This session will identify evolving pest management issues and the potential road blocks to IPM programming efforts in the future.

Suggested Topics

- IPM: Changing roles of organizations in the U.S.
- GMOs and the impact on pesticide usage
- GMOs fit into IPM programs
- Preparing the next generation for IPM roles in industry
- Impact of endangered species on IPM programming and adoption
- The PIPE: what does it do to enhance IPM

Oral presentations are by invitation only.
Poster submissions are open to all interested participants.

For additional information contact the organizers

Ames Herbert, Entomology Extension, Virginia Tech, 757-657-6450 ext 122, herbert@vt.edu

Susan T. Ratcliffe, North Central Region IPM Center, University of Illinois, 217-333-9656, sratclif@uiuc.edu

Abstracts should be submitted January 22 – April 2, 2007

AGRO 2007
CALL FOR PAPERS

Investigating Emissions of VOCs from Pesticide and Fumigant Applications: State of the Science and New Approaches to Protect Air Quality

234th ACS National Meeting & Exposition
August 19-23, 2007
Boston, Massachusetts USA

Purpose of Symposium

Provide an opportunity for scientists from industry, government, university and regulatory institutions to share their latest research findings with respect to measurement and modeling approaches for VOC emissions.

Suggested Topics

- Sampling and analytical methods for VOC detection in air
- Emission potential predictions for VOCs from pesticide and/or fumigants
- Modeling approaches for estimating VOC emissions
- Research on practices to reduce VOC emissions

For additional information contact the organizers

Laura L. McConnell, USDA-ARS
301-504-6298, mcconnel@ba.ars.usda.gov

Peter G. Green, Dept. Civil and Environmental Engineering
University of California, Davis
530-752-8581, pggreen@ucdavis.edu

Brian L. Bret, Dow AgroSciences
916-780-7477, blbret@dow.com

Abstracts should be submitted January 22 – April 2, 2007

AGRO 2007
CALL FOR PAPERS

Modern Chiral Agrochemicals:
The Importance of Enantioselectivity in Fate & Effects

234th ACS National Meeting & Exposition
August 19-23, 2007
Boston, Massachusetts USA

Purpose of Symposium

To discuss the impact of enantioselectivity on the fate and effects of current use chiral pesticides and other chiral agrochemicals

Suggested Topics

- Methods for separation and analysis of enantiomers in environmental samples
- Preparative methods for obtaining pure enantiomers from racemates
- Occurrence of chiral pesticides, veterinary drugs and their enantiomers in the environment, wildlife and humans
- Enantioselectivity in microbial degradation of chiral agrochemicals
- Effects of separate pesticide enantiomers on target and non-target organisms
- Risk assessment of chiral pesticides and other agrochemicals and their enantiomers
- Single- or enriched-enantiomer pesticides as a green chemistry measure

For additional information contact the organizers

Wayne Garrison, U.S. Environmental Protection Agency
(706) 355-8219, garrison.wayne@epa.gov

Jay Gan, University of California, Riverside
(909) 787-2712, jgan@ucr.edu

Ron Williams, Syngenta Crop Protection
(336) 632-7785, ron.williams@syngenta.com

Abstracts should be submitted January 22 – April 2, 2007

AGRO 2007
CALL FOR PAPERS

Nanotechnology Applications in Agriculture and Food Systems

234th ACS National Meeting & Exposition
August 19-23, 2007
Boston, Massachusetts USA

Purpose of Symposium

To address research, applications, and advances in nanotechnology for agricultural and food systems. Nanotechnology has the potential to revolutionize our food and agricultural systems and its impact through diagnosis and treatment of diseases, molecular modification, drug delivery, pathogen detection, control of processes, and energy efficiency and is perceived to be at just the beginning stages.

Suggested Topics

- Disease diagnosis
- Treatment delivery systems
- Drug delivery systems
- Molecular and cellular tools
- Identity preservation for plants and animal products
- Influence on plant/animal nutrition
- Nutrient uptake, utilization and modification
- Pathogen detection
- Environmental tracking
- Destroy targeted cells
- Social and ethical issues of the technology
- Environmental applications
- New materials
- Sensors
- Integrated sensing, monitoring and control
- Breeding plants and animal

For additional information contact the organizers

Norman Scott, Department of Biological and Environmental Engineering, Cornell University, 607-255-4473, nrs5@cornell.edu

Abstracts should be submitted January 22 – April 2, 2007

AGRO 2007
CALL FOR PAPERS

Rodenticides for the Protection of Public Health, Agriculture, and Natural Resources

234th ACS National Meeting & Exposition
August 19-23, 2007
Boston, Massachusetts USA

Purpose of Symposium

Anticoagulant rodenticides are used throughout the world to protect agricultural commodities from rodents, reduce the impact of rodents on natural resources such as endangered species, and minimize diseases vectored by rodents. Anticoagulants used as rodenticides include but are not limited to brodifacoum, bromadiolone, chlorophacinone, coumachlor, coumfuryl, coumatetryl, difenacoum, difethialone, diphacinone, flocoumafen, pindone, valone and warfarin. Oral presentations will present and discuss research and issues dealing with anticoagulants used as rodenticides.

Suggested Topics

- Management practices, strategies and uses
- Environmental impact, risk assessment, risk mitigation (primary and secondary hazard) and registration issues
- Chemistry including methods of analysis, degradation, and formulated product development
- Physiological response and metabolism
- Resistance

For additional information contact the organizers

Thomas M. Primus, USDA/APHIS/WS/National Wildlife Research Center
970-266-6065, thomas.m.primus@usda.aphis.gov

John D. Eisemann, USDA/APHIS/WS/National Wildlife Research Center
970-266-6158, john.d.eisemann@usda.aphis.gov

Abstracts should be submitted January 22 – April 2, 2007

AGRO 2007
CALL FOR PAPERS

New Developments and Issues in Agrochemical Sciences

234th ACS National Meeting & Exposition
August 19-23, 2007
Boston, Massachusetts USA

Purpose of Symposium

This symposium is open to all topics related to agricultural chemistry which are not pertinent to other symposia

Suggested Topics Include

- Formulation Chemistry
- Toxicology
- Mode of Action
- Computer Modeling
- Synthesis
- Environmental Fate
- Regulatory Science
- Organic Farming
- Agricultural Contaminants
- Environmental Quality
- Pest Attractants/Repellents
- Natural Products

For additional information contact

John J. Johnston
USDA/APHIS/WS/National Wildlife Research Center
4101 LaPorte Ave.
Fort Collins, CO 80521
970-266-6082
john.j.johnston@aphis.usda.gov

Abstracts should be submitted January 22 – April 2, 2007

Officers and Committees of the AGRO Division

AGRO DIVISION OFFICERS			
Division Chair			
Dr. Laura L. McConnell	(301) 504-6298	FAX: (301) 504-5048	mcconnel@ba.ars.usda.gov
Program Chair			
Dr. John J. Johnston	(970) 266-6082	FAX: (970) 266-6089	John.J.Johnston@aphis.usda.gov
Vice Chair			
Secretary			
Dr. Aldos C. Barefoot	(302) 451-5856	FAX: (302) 351-6656	aldos.c.barefoot@usa.dupont.com
Treasurer			
Dr. Terry Spittler	(315) 787-2283	FAX: (315) 787-2320	tds2@cornell.edu

EXECUTIVE COMMITTEE		
2005 – 2007	**2006 – 2008**	**2007 – 2009**
Dr. Matthew Brooks	Dr. Todd Anderson	
Dr. Marty Kovacs	Dr. Cathleen Hapeman	
Dr. Ann Lemley	Dr. Patricia Rice	
Dr. Teresa Wehner	Dr. Luis Ruzo	
Dr. Paul Zubkoff	Dr. Jeanette Van Emon	

COUNCILORS		
2004 – 2007	**2005 – 2008**	**2006 – 2009**
Dr. Barrington Cross	Dr. Joel Coats	Dr. Barrington Cross
Dr. Judd Nelson, Alternate	Dr. Nancy Ragsdale, Alternate	

Division Committees

FERT Program Committee			
Mr. William Hall, **Chair**	(863) 428-7161		bill.hall@mosaicco.com
Nominating Committee			
Dr. R. Donald Wauchope, **Chair**	(229) 386-3892	FAX: (229) 386-7215	don.wauchope@tifton.usda.gov
Dr. Allan Felsot	(509) 372-7365	FAX: (509) 372-7460	afelsot@tricity.wsu.edu
Dr. Rodney Bennett	(610) 878-6476	FAX: (610) 878-6475	rodney.bennett@cerexagri.com
Awards Committee			
Dr. James Seiber, **Chair**	(510) 559-5600		jseiber@pw.usda.gov
	Members		
Dr. John Casida	Dr. Robert Hollingworth		Dr. Willis Wheeler
Dr. Fritz Fuehr	Dr. Ralph Mumma		Dr. Izuru Yamamoto
Dr. Bruce Hammock	Dr. Nancy Ragsdale		
Dr. Ernest Hodgson	Dr. Jim Tumlinson		
Membership Committee			
Dr. Randy Weintraub, **Co-Chair**	(610) 878-6472	FAX: (610) 878-6475	Randy.weintraub@cerexagri.com
Dr. Christopher Peterson, **Co-Chair**	(662) 338-3104	FAX: (662) 338-3101	cjpeterson@fs.fed.us
Publications Committee			
Dr. Cathleen Hapeman, **Chair**	(301) 504-6451	FAX: (301) 504-5048	hapemanc@ba.ars.usda.gov
	Members		
Dr. Rodney Bennett	Dr. Laura McConnell		Dr. Terry Spittler
Dr. John Clark	Dr. Judd Nelson		
Finance Committee			
Dr. Barry Cross, **Chair**			bcross@weidel.com
Dr. Terry Spittler, **Ex Officio**	(814) 272-1039	FAX: (814) 272-1019	tds2@cornell.edu
	Members		
Dr. Don Baker	Dr. Ralph Mumma		
Dr. Willa Garner	Dr. Willis Wheeler		

Officers and Committees of the AGRO Division

(Continued)

Hospitality Committee			
Coffee Hour			
Dr. Terry Spittler	(315) 787-2283	FAX: (315) 787-2320	tds2@cornell.edu
Dr. Liliana Schwartz	(302) 451-5842	FAX: (302) 451-5943	Liliana.schwartz@usa.dupont.com
Social Hour			
Dr. Aldos Barefoot	(302) 451-5856	FAX: (302) 451-5941	aldos.c.barefoot@usa.dupont.com
Dr. Jeff Jenkins	(541) 737-5993	FAX: (541) 737-5001	Jeffrey.jenkins@orst.edu

Special Committees

Bylaws Committee			
Dr. Don Baker, **Chair**	(925) 254-108		
Committee on Patron Relations			
Dr. Luis Ruzo, **Chair**	(510) 741-3000	FAX: (510) 741-3030	l.ruzo@ptrlwest.com
Mr. Paul Giesler			
Future Special Conference Committee			
Dr. John M. Clark, **Chair**	(413) 545-1052		
Dr. Robert Hollingworth			
Public Relations Committee			
Dr. Jeff Jenkins, **Chair**	(541) 737-5993	FAX: (541) 737-5001	Jeffrey.jenkins@orst.edu
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Dr. Ann Lemley	Dr. James Seiber		
Education Committee			
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Dr. John Bourke, **Investment Coordinator**			
Dr. Allan S. Felsot, **Young Scientist Recognition Coordinator**	(509) 372-7365	FAX: (509) 372-7460	afelsot@tricity.wsu.edu
Members			
Dr. David Barnekow	Dr. J. Harold Falls		Dr. Judd O. Nelson
Dr. John M. Clark	Dr. Vincent Hebert		Dr. Jack R. Plimmer
Dr. Joel Coats	Dr. Ann Lemley		Dr. Nancy Ragsdale
Dr. Barry Cross	Dr. Glenn Miller		Dr. William Ridley

PROGRAM COMMITTEE LISTING

See page 28

Past Chairs of the Pesticide Chemistry/AGRO Division

1969	Donald G. Crosby	1982	Gino J. Marco	1995	Don Baker
1970	Elvins Y. Spencer	1983	G. Wayne Ivie	1996	Barry Cross
1971	Wendell Phillips	1984	Robert M. Hollingworth	1997	Willis Wheeler
1972	Philip C. Kearney	1985	John Harvey, Jr.	1998	Judd O. Nelson
1973	Roger C. Blinn	1986	Henry J. Dishburger	1999	Richard Honeycutt
1974	Charles H. Van Middelem	1987	James N. Seiber	2000	Ann Lemley
1975	Henry F. Enos	1988	Paul A. Hedin	2001	Jeffery Jenkins
1976	Julius J. Menn	1989	Gustave K. Kohn	2002	Terry Spittler
1977	James P. Minyard	1990	Willa Garner	2003	Jeanette Van Emon
1978	Gerald G. Still	1991	Guy Paulson	2004	Rodney Bennett
1979	S.K. Bandal	1992	Joel Coats	2005	Allan Felsot
1980	Jack R. Plimmer	1993	Larry Ballantine	2006	R. Donald Wauchope
1981	Marguerite L. Leng	1994	Nancy N. Ragsdale		

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Minutes from the AGRO Division Business Meeting

Long-Range Planning Committee Meeting
Program Planning Committee Meeting
Governance Meeting

232nd ACS National Meeting – San Francisco, California
Sunday, September 10, 2006, 5:00 – 9:45 pm
Don Wauchope – Chair

Note from Rodney Bennett, Acting Secretary: There were no specific motions in the Long Range or Program Planning Committee Meetings. Selected items were carried over to the Governance Meeting and voted on at that meeting.

LONG RANGE PLANNING COMMITTEE MEETING

Minutes of the Meeting

I. Call to Order – Don Wauchope at 5:00 pm

II. Introduction of Attendees

III. Name Change – Allan Felsot
Sent email asking if name of division should be changed. 28 respondents: 22 Yes, 6 No. The proposed names varied widely. Allan's proposed name was viewed by most respondees as being too broad. Some of the "No's" indicated that the name was not "Broad enough". Some liked the Old Name of Pesticide Chemistry.

Comments: John Johnston –Maybe we need to publicize and broaden the definition of Agrochemical Division. Highlight the public health protection area. Cathleen Hapeman agreed. John Clark - We need to think about the future members and students.

Allan will put the question on the election's ballot as to the need for a name change for the division. This will allow additional members to give their feedback, hopefully.

We should Review the Mission Statement. Don Wauchope, Laura McConnell, and Allan Felsot agreed to do the review. Long Range Planning Committee will review as well. In Canada, there was a problem with Public perception. It was suggested that we may want to add a subtitle. Use a current Industry Model. Re-define the division by the symposia that are being presented.

IV. Increase International Interactions
Helena K. Traore, from Mali, has been sponsored for this meeting for the Future of Pesticides in Agriculture Symposium. Jason Sandahl at FAS connected us with the Vorlog Fellowship, and she will be going to different areas across the country. Our biggest success: Large Books Table at the IUPAC in Kobe, Japan.

V. Travel Grants – John Johnston
There was not a lot of reward for bringing foreign students to the ACS National Meeting. Better return on investment if we go after new faculty or post-docs. Allan and John will address this issue when we move to one meeting per year. We have not had a great return on getting foreign students. How to attract foreign students that are working in the USA? Don Wauchope - difficulty getting foreign speakers for IUPAC to International Meetings. IUPAC - Outreach from Developed to Under-Developed countries. We could make a "Real" difference in these Under-Developed countries.

VI. Involving Students in Program Planning – Joel Coats
Keep moving forward on a youth movement. Develop symposium targeted at the youth and lead by younger chemists? Separate group of students or a student portion of the Planning Committee to include these students. If we have them on the Program Committee, how would they be selected?

Canadian Research Group only presented by students. Funding through their research plus graduate travel awards. Cary Henderson is working with Joel Coats on a symposium.

Laura McConnell suggested a graduate student luncheon. Have them come up with how they would like to set-up this symposium or a speaker. How would they prefer to have this? Have a Luncheon? Luncheon symposium for all of the graduate students at the next award session in Chicago. John Johnston indicated that they would be able to use the luncheon to expand to other senior graduate students. Don Wauchope will make this proposal at the AGRO Governance Meeting.

VII. FAO/WHO INFOCRIS – Don Wauchope
We have the AGRO Logo on the webpage. Compile information on specific chemicals. Professors to assign one of their students to compile this data. John Unsworth and his team review the data prior to putting this on the website. The database has a lot of

data to be filled-in and this can put people off. It is a good source. Please go look at this website.

VIII. Webcasting – Don Wauchope
This has a lot of potential but will take a lot of effort.

IX. New Business

- Ken Racke – Proposal for IUPAC. Helping sponsor a workshop in Beijing China. Talks by various people. Very catalytic in bringing a lot of people together. Strategically a good idea and could promote our Pan Ag Symposium.

- Laura McConnell and Terry Spittler went to a Strategic Plan Meeting. Two day meeting in DC with representatives from each of the divisions. One division was the test case for development of their strategic plan. What do we want to have next? Why? Ten to fifteen people were involved. Divisional structure. What is our next step for AGRO? John Clark – Programs have been good. How do we get people back into the rooms?

- Don Wauchope – Changing to One Meeting Per Year. What things will be different? Our Future ACS Symposia will be in the Fall of each year. We'll sponsor Regional and/or Workshops at other times of the year in place of the Spring meeting.

- Building Bridges to the ICIPE International Center for sponsorships in Nairobi and perhaps becoming a collaborator to the other Centers in the sub-African continent were proposed.

X. *Meeting Adjourned* – Don Wauchope at 6 pm

PROGRAM PLANNING COMMITTEE MEETING

Minutes of the Meeting

I. Call to Order – Laura McConnell at 6:00 pm

II. Goal
Laura is developing specific goals for the planning committee and is soliciting input from all members.

III. Members of the Committee
Will include Officers; Executive Committee; Volunteer Members.

IV. Long Range Program Coordinator(s)
Specific coordinators will be charged with providing input into selected topic areas.

V. One Objective of the Committee
Provide guidance and a structure for symposia at the ACS National Meetings as well as Workshops, Regional Meetings, Co-sponsored Meetings with other groups; Electronic Programming. Laura McConnell has developed some major topic areas to provide a "home" for topics that will continue into the future. We must have some set areas to which speakers can submit their proposals and topics.

VI. Conference Call
A conference call ~ 1 hour long was conducted with some interested committee members. This was very successful and will be continued in the future.

VII. Primary Themes
Themes are to be used at the National Meetings.

VIII. Plans for the Future
Plans need to be placed into the PICOGRAM and on the OASYS system earlier to allow a place and sufficient time to those who are interested in a specific topic.

IX. Major Topic Areas for National Meetings
People need to have a "HOME" for all of the major scientific areas within AGRO. Ten Major Areas that we offer at the National Meetings include:

1) Environmental Fate, Transport, Risk Assessment, and Modeling of Agriculturally-Related Chemicals;
2) Technological Advances and Applications in Ag Science;
3) Nano-technology, GMO, and Bio-control Agents;
4) Development of Value-Added Products from Agricultural Crops and Byproducts;
5) Bio-energy and Bio-fuels from Agriculture;
6) Natural Products, Pheromones, and Chemical Signaling in Agriculture;
7) Human and Animal Health Protection: Vet and New Products for Human Health and/or Worker Protection;
8) Advances in Agrochemical Residue Analysis and Metabolism Chemistry;
9) Urban Agriculture – Turf, Ornamentals Household Products and Water Re-Use;
10) Developments in Integrated Pest Management

X. Goals
Planning 5 years ahead. We need a champion for each of these topics. Volunteer members will need to be added above and beyond the executive committee. Program Chair to work with a group of people who have the contacts for each specialty.

XI. Programming – Laura McConnell
Programming thus far are the National Meetings for 2007. Pan Pacific in 2008. 236th National Meeting Aug 2008 Philadelphia. AGRO Workshop 2009. 238th ACS National Meeting in Washington, DC 2009, 240th ACS National Meeting in Boston 2010. IUPAC Pesticide Congress in Australia.

XII. Potential National Meeting Program
New Structure presented. We can easily fill-out 3 to 4 sessions at each meeting. Special Topics for each meeting. Open discussion meeting is being held at 5PM on Wednesday here in the Marriott. All are invited.

XIII. ACS 233rd National Meeting, Chicago, IL, March 25-29, 2007 – John Johnston

1) ACS International Award
2) Agricultural Biomass, Biofuels (co-sponsor with Fuels)
3) Drought Issues for Food Production (Grey)
4) Estimation of Environmental Exposure to Agrochemicals Using Spatial Data Analysis.
5) General Papers
6) New Dev and Issue in Agrochemical Sciences
7) Recent Advances in Sustainable
8) Sustainable Forest Per Management
9) Analytical Advancement in Nutrients

XIV. *ACS 234th National Meeting, Boston August 2007 – John Johnston*

1) International Award will honor Dr. Fredrick Perlak.
2) Advances and Application of QSAR in Agro Research – a symposium to honor Phil Magee. John Watt – Phil was at Ortho Division at Chevron; Robert Clark, COMP believed that this would be best placed in their Division. Equations. They would like to have some participation from AGRO. They would like to have this co-sponsored. (Phil and Doug in the past.) Physical Chemistry and Analytical Chemistry. He was approached at the last AGRO symposium to have this sponsored by COMP. QSAR Reborn is the preliminary title. Call for papers will be sent to John Johnston.
3) Chiral Pest and Animal Health Drugs.
4) Development in Integrated Pest Management
5) Nanotechnology in Agriculture

XV. Other Issues

- Agricultural Biomass Issues – Sustainable Energy (They are trying to get all these talks together.)
- Placement of the Sessions – Beverly Johnson is the one to talk with. Each program chair gets to request 3 other divisions to be close to. Multiple champions for each of these symposia.
- Get a draw for Philly. Any suggestions are solicited.

XVI. *Meeting Adjourned* –Laura McConnell at 7 pm

GOVERNANCE MEETING

Action Items from the Governance Meeting

I. *Motions and Outcomes*

Six Motions were made and All Passed. They were:

1) The minutes from the Spring 2006 Agrochemical Division Governance Meeting are accepted without modification. Motion passed.
2) The Treasurer's Report will be accepted without modification. Motion passed.
3) For the Spring 2006 AGRO social, the AGRO Social will be held separately from the Ag and Food Division, and the AGRO Officers and Executive Committee will pursue the Wiley Books sponsorship of a reception/social hour for International Award Winner, Dr. Brooks. Motion passed.
4) The Agrochemical Division will sponsor a Luncheon of the AGRO Graduate Students at the Spring 2006 ACS National Meeting. Any student that comes to the luncheon must have a sponsor. Motion passed.
5) Beginning with the 2008 ACS National Meeting, the Agrochemical Division will have Ten Standing Symposia Sessions and No General Papers Symposia. The Call for Papers will list only the Ten Standing Sessions with No General Sessions for the announcements for the 2008 meeting. Motion passed.
6) The ACS Agrochemical Division will become a co-sponsor of the IUPAC crop protection chemistry workshop planned for October 2007 and contribute a donation of $5000 to support travel of 2 or 3 invited lecturers from North America. The names of lecturers are to be selected and confirmed by the AGRO International Activities Committee in conjunction with the AGRO Program Committee. Motion passed.

II. *Committee / Individual Action Items:*

1) Items for the Strategic Planning Committee include: How to improve membership? How to continue to provide service to all members? How to attract New Members?
2) Laura McConnell will talk to Luis Ruzo to find a replacement for the Committee on Patron Relations.
3) Don Wauchope wanted to clarify the number of Executive Committee Members that were required to constitute a Quorum for the Agrochemical Governance Meeting.
4) AGRO International Activities Committee in conjunction with the AGRO Program Committee to help in selection of lecturers from North America to attend crop protection chemistry workshop through IUPAC.

Minutes of the Meeting

Call to Order – Don Wauchope, Chair at 8PM.

I. OLD BUSINESS and COMMITTEE REPORTS

Minutes of the Last Meeting were reviewed.

Chair-Elect, Laura McConnell, made a MOTION:"The minutes from the Spring 2006 Agrochemical Division Governance Meeting will be accepted without modification."

The motion was seconded by Anne Lemley.

The motion was put to a voice vote and unanimously Passed.

Treasurer's Report – Terry D Spittler, Treasurer

See PICOGRAM 72:52 (2007)

Chair-Elect, Laura McConnell, made a MOTION:"The Treasurer's Report will be accepted without modification."

The motion was seconded by Anne Lemley.

The motion was put to a voice vote and unanimously Passed.

Councilors' Reports – Barry Cross and Joel Coats

- The Chem Luminary Awards will be presented on September 12th, 2006.
- Our Finances and Investments are doing very well for the ACS.
- The ACS Committee on Meeting and Expositions (M&E) has decided to have computers provide in every room for speakers at the Chicago ACS National Meeting.
- M&E is looking into reducing the size of the Poster Session for Sci-Mix in the future.
- The new formula for the number of posters allowed to be presented at Sci-Mix from each division will be 15 Posters or 8% of the total number of Posters from the division (whichever is larger).
- Overseas Visas – In OASYS when you denote an overseas speaker, it will automatically send a letter to the speaker informing them of the requirements and inviting them to present.
- The average number of No-Shows for oral presentations at the ACS National Meetings is 15% currently. Some people never show up. ACS is collecting information on these individuals, and it is likely that they may not be allowed to participate in the future.
- Fewer people (892) are coming for jobs this year for the ACS National meeting. The number has been improving for the past several years, however. For the current ACS Fall National Meeting, 165 Jobs are available and 192 candidates are registered thus far.
- The Divisional Activity Committee (DAC) has proposed a new formula for financial allocations to the divisions. The formula will include: Specific Grants for Programs; A Base Allotment; A Poster Allotment; and An Allotment based on divisional membership in attendance at the ACS National Meetings. Also, there will be a doubling of the sum of money that multiple divisions can get, if they get co-sponsorships (either within or outside of ACS). USA and International co-sponsorships from other organizations is strongly encouraged. Some reduction of dues for Post Docs is being considered by Council. There is great interest from ACS in providing additional support for the Sustainability of the Environmental Chemistry concerns.

Membership Committee

Item for the Strategic Planning Committee include: How to improve membership? How to continue to provide service to all members? How to attract New Members?

Publications Committee – Cathleen Hapeman

- The PICOGRAM was very large this time. People followed the instructions this time! There were a lot of contributors this time.
- All the abstracts were edited. Symposium organizers and presenters should avoid adding multiple addresses for the same person in OASYS.
- The PICOGRAM had the same number of ads this time. There is a need to review the amount of money for adds in the PICOGRAM. Terry will review the costs as printing is the most cost.
- For the FALL Meeting, the announcement goes out in the Spring. The Spring PICOGRAM could be moved to an e-Mail edition or at least a non-bound version.
- If there are pictures to be included into the PICOGRAM, please watch the lighting. Dark pictures do not do well.
- Cathleen indicated that the PICOGRAM mailing went out the first week of August. The Bulk Mailings are often delayed.

ACS Books/*Oxford University Press Update* – Bob Hausman

- The traveling books shelves and books are available for outside meetings.
- Our AGRO books have had an increase in $1K in sales this year. Overall, there will be a profit for ACS Books this year.
- Pam Rice asked if there could be a Special Series for some books that can be made available electronically (PDF files). There is a lot of interest in having the symposia series available electronically. This is being brought to the forefront next year. The trend in books is to put the books on-line. Questions are coming in all the time. It is harder for the small publishers than for the large publishers.
- Author kits are now being sent on-line. No packets will be distributed by mail anymore. Production process is now by disk. The process is moving toward a solely electronic system. In 2007, accessibility kits will be available at the "chemistry.org" website.
- ACS and Oxford Books would like to encourage the division to display our books at more Regional Meetings and Symposia, as well as other professional association meetings in the USA and Internationally. This has been very successful for AGRO and ACS books in the past and an expansion in our efforts will be supported by ACS and Oxford Books.
- A link from the AGRO Division website to Oxford Books is critical. The Oxford Books website goes down frequently, and this is being reviewed. Persons purchasing books through the AGRO website link to Oxford Books will receive a 40% discount. We may want to advertise this more extensively on the AGRO website.
- ACS is sponsoring Book Signings at this meeting as "Meet and Greet the Authors!" At least once per year, ACS Books will make this a special event (posters, etc.) Recently, one book in the Carbohydrates Division was heavily supported by

one specific company that purchased 1600 books. This was the author and the company working in close collaboration. This may be an area of interest for AGRO.

AGRO Website Update - Allan Felsot

- A Flyer for the Pan Pacific Workshop has been added to the website. There will be a link on the AGRO website to the Pan Pacific Conference.
- Some job announcements are now being put onto the website.
- There is now a link to Agrochemical Information sites, such as a link to the INFOLINK and to Pesticide Management.
- We also are linked to Oxford Books through our site. (40% discount as mentioned earlier)

AGRO email: AG-LIST – Tim Ballard
Not everyone has signed up on the on-line directory. Not everyone is listed there. The email server information is listed on page 136 of the Fall 2006 PICOGRAM. Currently, 900 people are signed-up and on the Agro e-Mail server list.

Awards Committee
Jim Seiber's Report is in the PICOGRAM.

- The Spring 2007 International Award for Research in Agrochemicals will be presented to Dr. Gerald T. Brooks. Dr. Brooks is the Editor or Pest Science Management. The International Award is sponsored by DuPont Crop Protection. Derek Gammon will organize the award symposium.
- The Fall 2007 International Award will be presented to Dr. Frederick J. Perlak of Monsanto Company. William Ridley will organize the award symposium.
- The awards committee is continuing to accept nominations for all divisional awards.

Hospitality Committee – Terry Spittler

- The hospitality committee received $2400 for the coffee fund for the Fall 2006 meeting. See PICOGRAM 72:3 (2007)
- Wiley Publishing is interested in sponsoring a reception/ social hour for the International Award winner, Dr. Gerald T. Brooks (who is the Editor in Chief of Wiley) at the ACS Spring 2007 meeting in Chicago.
- Terry proposed that we NOT combine with the Ag and Food social as we typically do for the Spring meetings. Cathleen Hapeman made a MOTION: "For the Spring 2006 AGRO social, the AGRO Social will be held separately from the Ag and Food Division and the AGRO Officers and Executive Committee will pursue the Wiley Books sponsorship of a reception/social hour for International Award Winner, Dr. Brooks." Laura McConnell – Seconded the Motion. The Motion was Passed by unanimous voice vote.

Committee on Patron Relation – Luis Ruzo
Luis Ruzo has asked to be relieved of this duty. The Executive Committee asked that he find his own replacement. Laura McConnell will talk to Luis.

Nominating Committee – Allan Felsot
Two candidates for Vice Chair have been identified. We have a candidate for Secretary of the Division to replace Al Barefoot, who has indicated that he wishes to step down from this position. Allan is finalizing the slate of candidates for the Executive Committee. The ballots will be ready for distribution within the next month.

Public Relations – Jeff Jenkins
Press releases were prepared for Dr. Isamu Yamaguchi (AGRO International Award Winner) and Dr. Stanley B. Prusiner (Sterling Hendricks Award Winner). Articles were sent to the respective newspapers in their hometown area. Ms. Kim Kaplan of the US Department of Agriculture, Agricultural Research Service (the sponsor of the Sterling Hendricks Award) coordinates the public relations and articles for this award. Jeff noted that it was challenging to prepare a unique and appropriate press release for a Nobel Laureate (Stanley Kruzner). There have been numerous articles written about this outstanding individual. Our AGRO Public Relations has been effective and is getting out information on the AGRO Division and ARS.

Education Committee – John Johnston
Fourteen student participants were chosen for the Fall 2006 Student Awards program. The Student Poster sessions will be held from 1-5 PM in the Moscone Center and at the Sci-Mix on 8-10 PM on Monday night. John reminded everyone that the Students would be recognized at the AGRO Social on Tuesday evening and asked that AGRO members make time to talk to these folks and encourage their continued participation in the division.

Young Scientist Recognition Symposium – Allan Felsot
Feedback on Student Sponsored talk or symposium that had been discussed at the last Governance Meeting was very positive. Allan and John will act as mentors.

By-Laws Committee
Don Baker was unable to attend this meeting due to illness. Don Wauchope asked that there be a review of the number of Executive committee members that must be present at the Fall Governance Meeting (which will be the only meeting in the near future) to constitute a quorum. It was thought that having at least 10 persons in attendance would constitute a quorum.

Long Range Planning Committee (LRPC) - Don Wauchope

1) The LRPC will develop a set plan for long range planning
2) Have a Luncheon of the AGRO Graduate Students to foster higher participation from young current and potential members.

Don Wauchope presented a MOTION: "The Agrochemical Division will sponsor a Luncheon of the AGRO Graduate Students at the Spring 2006 ACS National Meeting. Any student that comes to the luncheon must have a sponsor." ; Laura McConnell – Second the motion. The Motion was Passed unanimously by voice vote.

Laura McConnell made a MOTION: – "Beginning with the 2008 ACS National Meeting, the Agrochemical Division will have Ten Standing Symposia Sessions and No General Papers Symposia. The Call for Papers will list only the Ten Standing Sessions with No General Sessions for the announcements for the 2008 meeting."; Cathleen Hapeman – Seconded the motion. There was a "Show Of Hands" vote of the eligible voting members present. The vote was: 16 Yes ; 2 Opposed. The Motion passed.

Pan-Pacific Conference – Joel Coats
Joel Coats and Aldos Barefoot are in the process of finalizing the program for the Pan-Pacific Conference. There was good representation of the Chinese groups at the recent IUPAC Pesticide Congress in Kobe, Japan. Handouts were prepared and distributed at the IUPAC Congress to promote the 2007 Pan-Pacific Conference. We are hopeful that the same high level of participation from the Asian groups will be seen for this meeting. The Organizing Committee for the Pan-Pacific Conference is meeting via conference calls frequently. Flyers announcing the meet are being distributed here at the ACS National meeting, as they were at IUPAC.

II. NEW BUSINESS – Don Wauchope

Ken Racke's Proposal
IUPAC will be sponsoring a workshop in Beijing. China University. Ken has proposed the following:

- TOPIC - Proposed co-sponsorship by AGRO of a crop protection chemistry workshop planned for China during 2007.

- BACKGROUND - The IUPAC Advisory Committee on Crop Protection Chemistry will be sponsoring a crop protection chemistry workshop in Beijing, China during October of 2007. The workshop will be locally co-sponsored by the Beijing Pesticide Science Society and will be held on the campus of the China Agricultural University. The chairman of the International Organizing Committee will be Dr. Ken Racke of IUPAC and the chairman of the Local Organizing Committee will be Prof. Shuren Jiang of China Agricultural University. The workshop will include lectures, posters, and discussion / demonstration sessions, and we anticipate 350-400 participants from China and the surrounding countries Asian countries along with invited international representatives. Major emphases will include issues related to regulation and product quality, environmental and worker safety assessment, and residues in food/international trade standards. This crop protection chemistry workshop will be the 7th in a series of regional workshops co-sponsored by IUPAC since 1988.

- PROPOSAL FOR AGRO – "AGRO Division to become a co-sponsor of the IUPAC crop protection chemistry workshop planned for October 2007 and contribute a donation of $5000 to support travel of 2 or 3 invited lecturers from North America (with names of lecturers to be selected and confirmed by the AGRO International Activities Committee)."

- POTENTIAL BENEFITS FOR AGRO
  1) Advance international visibility and influence of the Division and its programs
  2) Publicize and recruit participants for the 2008 Pan-Pacific Pesticide Conference
  3) By providing 2-3 lecturers, contribute to the education of the next generation of pesticide scientists in a region of growing international significance
  4) Listing of AGRO on the workshop web site and program as an official co-sponsor; 5) Create a forum for distribution of AGRO membership materials and book information.

Proposal as written in Ken's Letter to include Amendment to Motion: Must put International Committee to select candidates in conjunction with the Program Committee. Final MOTION was made by Don Wauchope: "The ACS Agrochemical Division will become a co-sponsor of the IUPAC crop protection chemistry workshop planned for October 2007 and contribute a donation of $5000 to support travel of 2 or 3 invited lecturers from North America. The names of lecturers are to be selected and confirmed by the AGRO International Activities Committee in conjunction with the AGRO Program Committee." Second – Cathleen Hapeman. The Motion was put to a "Show of Hands" vote of the eligible voting members present. The vote was: Yes – 14; No – 4. The Motion Passed.

Workshop Coordinator
The Agro Division is looking for a workshop coordinator to act as a part of the long range planning committee. Please contact Laura McConnell if you are interested in this position or if you would like to suggest an individual for this position. Young members of the Agro Division are encouraged to participate!

Website Information
Division officers' contact info web site (semi-secure). The Division is evaluating if any additional security measures should be taken. Suggestions should be forwarded to the division chair.

Booth at SETAC
Allan Felsot wants to setup a booth at SETAC. Kevin and Allan will man the booth. Books and Banners, etc. The request was granted by the Division Chair and was fully supported by the Executive Committee. Since this is in keeping with our normal divisional activities and is under the discretion of the chair, no specific motion was required.

Biopesticides
Paul Zubkoff reminded the group that biopesticides are going to be used on a greater scale in the future than they have been in the past. Many of these compounds are getting registered in a shorter timeline (2-3 years). Also registrations in the USA are being sought first in anticipation of registrations in foreign countries. They want a USA registration such that they can be accepted around the world. Paul suggested this as a Symposium and/or Workshop to be considered in the near future.

III. PASSING OF THE GAVEL
Current Chair, Don Wauchope passed the gavel to the New Chair, Laura McConnell.

New Chair, Laura McConnell saluted Don,
> "On behalf of the Division of Agrochemicals of ACS, we sincerely thank you, Don Wauchope, for your tireless efforts and outstanding accomplishments as Chair of the Division!"

All present at the meeting gave both Don and Laura a rousing Round of Applause!

Meeting Adjourned
Laura McConnell, Chair at 9:45 pm

Business Meeting minutes respectfully submitted,
Rodney M. Bennett

Treasurer's Report

AGRO Division

232nd ACS National Meeting & Exposition
September 10, 2006
San Francisco, California

	7/31/05	12/31/05	7/31/06
CHECKING ACCOUNT	$ 17,178	$ 22,493	$ 47,999
INVESTMENTS			
Spectrum Income (T. R. Price)	187,213	190,084	195,073
Prime Reserve (T. R. Price)	1,159	1,179	1,204
Educational Trust (JPMorgan)	466,712	439,101*	421,439**
ACS Investment Pool	21,012	22,605	23,175
TOTAL INVESTMENTS	**676,096**	**649,969**	**640,891**
TOTAL ASSETS	**693,274**	**672,462**	**688,890**

*$42,000 to checking 9/05; **$20,000 to checking 3/06

Terry D Spittler – Treasurer

Bylaws of the AGRO Division 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.

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 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 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.

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Julie E. Eble, Ph.D., CEO and Lab Director (x100)
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American Chemical Society
AGRO DIVISION
233rd ACS National Meeting
March 25-29, 2007
Chicago, Illinois
J. J. Johnston and L. L. McConnell, *Program Chairs*

PROGRAM

SOCIAL EVENTS

Graduate Student Luncheon
Tuesday 12:00 – 1:00 pm
McCormick Place South, Rm S403A
Invitation only; see page 7

AGRO Awards Social
Tuesday 6:00 – 8:30 pm
Hyatt Chicago Grand B
Members/Guests welcomed; see page 10

DIVISION MEETINGS

AGRO Business Meeting
Sunday 5:00 – 10:00 pm
Hyatt Chicago Columbus KL

AGRO Programming Discussion and Symposium Ideas & Organizer Meeting
McCormick Place East, Rm E256
Wednesday 5:15 – 6:00 pm
Details on page 5, 26-27

SUNDAY MORNING

Glyphosate-Resistant Crops and Weeds: Present and Future
Glyphosate-Resistant Crops and Their Economic Impacts
S. O. Duke, *Organizer*
S. Powles, *Organizer, Presiding*

Section A
McCormick Place East -- Rm E265, Level 2

8:30 —1. Glyphosate: A once-in-a-century herbicide. **S. O. Duke**, S. B. Powles

8:55 —2. Current and future glyphosate-resistant crops of Monsanto. **G. M. Dill Jr.**

9:20 —3. New multiple herbicide crop resistance and formulation technologies to augment the utility of glyphosate. **J. M. Green**, C. B. Hazel, D. R. Forney, L. M. Pugh

9:45 —4. Athenix technology for GRCs. **N. Duck**, B. VandeBerg, V. Heinrichs, L. Schouten, N. Carozzi, M. Koziel

10:10 — Intermission

10:25 —5. Grower perceptions and experiences with glyphosate-resistant weeds. **C. Foresman**, L. Glasgow

10:50 —6. Glufosinate-resistant crops. **J. Fischer**

11:15 —7. Economic impact of glyphosate-resistant crops. **L. P. Gianessi**

Young Scientist Pre- and Post-Doctoral Research Award Symposium
Cosponsored with WCC
A. S. Felsot, *Organizer, Presiding*

Section B
McCormick Place East -- Rm E267, Level 2

8:25 — Introductory Remarks

8:30 —8. Microwave-assisted synthesis of *N*-vanillylformamide. M. M. Bobylev, **B. D. Keller**

8:50 —9. Progress in synthesis and evaluation of potential nestmate recognition cues in the Argentine ant (*Linepithema humile*). **R. Sulc**, K. J. Shea, N. D. Tsutsui, M. Brandt, C. W. Torres, M. Lagrimas

9:10 —10. Development of new recyclable technologies for the production of biodiesel from soybean oil at room-temperature. **V. R. Chinta Reddy**, J. G. Verkade

9:30 —11. Bacterial degradation of toxaphene and DDT in laboratory microcosms and mesocosms. **Y. Cheng**, A. Ogram

9:50 —12. Effect of manganese and copper on the transformation of tetracycline antibiotics. **W -R. Chen**, C -H. Huang

10:10 — Intermission

10:25 —13. Fate and transport of biosolids-borne triclocarban. **E. A. Hodges**, G. A. O'Connor

10:45 —14. Environmental studies on the fate of pharma proteins produced in transgenic corns. **H. Kosaki**, J. Wolt, J. R. Coats

11:05 —15. Phototransformation of penoxsulam in aqueous methanol and acetonitrile. **S. K. Pramanik**, A. Bhattacharyya

11:25 —16. Laboratory evaluation of the environmental fate of two monoterpenoid insecticides: Thymol and phenethyl propionate. **D. Hu**, J. R. Coats

11:45 —17. *In vitro* reduction of sodium ^{36}Cl-chlorate in bovine ruminal fluid. **C. E. Oliver**, M. L. Bauer, J. S. Caton, R. C. Anderson, D. J. Smith

SUNDAY AFTERNOON

Glyphosate-Resistant Crops and Weeds: Present and Future
Evolved Glyphosate-Resistant Weeds and Weed Shifts

S. Powles, *Organizer*
S. O. Duke, *Organizer, Presiding*

Section A
McCormick Place East -- Rm E265, Level 2

1:30 — Introductory Remarks

1:35 —18. Glyphosate-resistant weeds in North America: The reasons and future implications for US agriculture. **J. W. Wilcut**, I. C. Burke

2:00 —19. Glyphosate-resistant weeds of South America: An overview. **M. M. Vila-Aiub**, R. A. Vidal

2:25 —20. Glyphosate-resistant weeds in Australia, Asia, Africa, and Europe. **S. B. Powles**, S. O. Duke

2:50 — Intermission.

3:05 —21. Evaluating an altered target-site variant of EPSPS for glyphosate resistance. **R. D. Sammons**, M. Alibhai, S. Flasinski, A. Boland, C. Kavanaugh, Y. Qi, J. You, S. Reiser

3:30 —22. Resistance to glyphosate from altered translocation patterns. **C. Preston**, A. M. Wakelin

3:55 —23. Weed species shifts in GRCs. **M. D. K. Owen**

Young Scientist Pre- and Post-Doctoral Research Award Symposium

Cosponsored with WCC
A. S. Felsot, *Organizer*

Section B
McCormick Place East -- Rm E267, Level 2

1:30 —24. Synthesized pheromone summons female sea lamprey into traps. **N. S. Johnson**, W. Li

1:50 —25. Mosquito repellents: Studies on natural product structure-activity. **G. E. Paluch**

2:10 —26. Solving the mystery of ladybug's noxious odor. **L. Cai**, J. A. Koziel, M. O'neal

2:30 —27. Conjugated linoleic acid: A potential insect control agent. **L. J. Gereszek**, J. R. Coats, D. C. Beitz

2:50 — Intermission

3:05 —28. Investigating the mechanisms of glyphosate resistance in *Lolium multiflorum*. **A. Perez-Jones**, N. Polge, J. Colquhoun, C. A. Mallory-Smith

3:25 —29. Chemical and biological availabilities of sediment-associated pyrethroid insecticides. **J. You**, S. Pehkonen, M. J. Lydy, D. P. Weston

3:45 —30. Herbicide-induced hypoxic stress and hemoglobin gene regulation in an aquatic insect. **T. D. Anderson**, K. Y. Zhu

4:05 —31. Development of methods to determine the aquatic fate and non-target effects of transgenic Bt proteins on aquatic invertebrates: Toward risk assessment. **K. R. Prihoda**, J. R. Coats

Veterinary Pharmaceuticals in the Environment
K. L. D. Henderson and J. R. Coats, *Organizers, Presiding*

Section C
McCormick Place East -- Rm E266, Level 2

1:30 — Introductory Remarks

1:35 —32. Fate of chlorate salts excreted from animals. **D. J. Smith**, C. E. Oliver, H. Hakk, R. C. Anderson, G. L. Larsen

2:00 —33. Mobility of a veterinary antibiotic tylosin in agricultural soil columns. **D. Hu**, K. L. Henderson, J. R. Coats

2:25 —34. Comparative biotransformation of fluoroquinolone antibiotics in matrices of agricultural relevance. **H. G. Wetzstein**, J. Schneider, W. Karl

2:50 — Intermission

3:05 —35. Abiotic transformation of tetracycline antibiotics in a natural surface water and in the presence of MnO_2. **K. F. Rubert IV**, C. J. Hedman, J. A. Pedersen

3:30 —36. Livestock hormones in the environment. **Y -W. Huang**, J. M. Bandeff

3:55 —37. CAFOs and emerging contaminants: Research by the USGS TOXICS Program. **D. W. Kolpin**, M. T. Meyer, L. B. Barber, E. T. Furlong, S. K. Haack, M. R. Burkhardt, J. L. Gray, K. A. Loftin

MONDAY MORNING

Glyphosate-Resistant Crops and Weeds: Present and Future
Resistance Management and IPM Aspects
S. O. Duke, *Organizer*
S. Powles, *Organizer, Presiding*

Section A
McCormick Place East -- Rm E265, Level 2

8:45 —38. Simulation modeling to aid in glyphosate-resistance management. **P. Neve**

9:10 —39. Sustainable use of glyphosate in North American cropping systems. **D. I. Gustafson**

9:35 —40. Sustaining glyphosate in South American cropping system. **P. J. Christoffoleti**, J. B. Galli, D. N. Ribeiro, B. A. B. Martins, M. S. Moreira

10:00 — Intermission

10:15 —41. Managing the risk of glyphosate resistance in Australian glyphosate-resistant cotton production systems. **J. Werth**, C. Preston, I. Taylor, G. Charles, G. Roberts, J. Baker

10:40 —42. Impacts of conservation crop production systems on soil and water resources: Glyphosate-resistant crops (GRCs) are part of the management toolbox. **M. A. Locke**, R. M. Zablotowicz, K. N. Reddy

11:05 —43. Disease control activities of glyphosate in glyphosate-resistant crops. **P. C. Feng**, P. M. Caldwell, G. J. Baley, F. C. Kohn

Veterinary Pharmaceuticals in the Environment
K. L. D. Henderson and J. R. Coats, *Organizers, Presiding*

Section B
McCormick Place East -- Rm E267, Level 2

8:20 —44. Environmental risk assessment of tylosin, narasin, and monensin. **A. N. Perkins**, R. D. Meyerhoff, A. Kelly, J. S. Teeter, S. D. Banks

8:45 —45. Risks of agricultural pharmaceuticals in surface waters and soil. **K. R. Solomon**, L. Lissemore, D. Hillis, P. K. Sibley

9:10 —46. Characterization of chlortetracycline-induced glutathione S-transferase to conjugate chloroacetanilide and chlorotriazine herbicides. **M. H. Farkas**, J. O. Berry, D. Aga

9:35 —47. Risk assessment considerations for veterinary medicines in aquatic ecosystems. **B. W. Brooks**, D. B. Huggett, R. A. Brain, G. T. Ankley

10:00 — Intermission

10:15 —48. Targets, effects and risks in aquatic plants exposed to veterinary antibiotics. R. A. Brain, **K. R. Solomon**, B. W. Brooks

10:40 —49. From laboratory results to field findings: Perception vs. reality on the effects of veterinary medicinal products (VMPs) toward non-target organisms. **Z. Yan**

11:05 —50. Risks from veterinary medicines in the environment to humans and ecosystems. **A. B. A. Boxall**

MONDAY AFTERNOON

Glyphosate-Resistant Crops and Weeds: Present and Future
Health and Environmental Aspects of Glyphosate-Resistant Crops

S. Powles, *Organizer*
S. O. Duke, *Organizer, Presiding*

Section A
McCormick Place East -- Rm E265, Level 2

1:35 — Introductory Remarks

1:40 —51. Pollen vs. seed movement: Gene migration from glyphosate-resistant crops. **C. A. Mallory-Smith**

2:10 —52. Fate of glyphosate in soil and the possibility of leaching to ground and surface waters. **O. K. Borggaard**, A. L. Gimsing

2:40 —53. Safety assessment of GR genes in food and feed. **W. F. Heydens**

3:10 — Intermission

3:25 —54. Assessing the environmental consequences of glyphosate-resistant weeds in the US. **G. C. Nelson**, J. G. Gardner, D. S. Bullock

3:55 —55. Comparison of environmental effects of glyphosate-resistant crops vs. what they replace in Europe. **G. A. Kleter**

4:25 —56. Glyphosate and hormesis: Environmental implications. **E. D. Velini**, E. Alves, M. C. Godoy, D. K. Meschede, S. O. Duke

4:55 — Panel Discussion

Veterinary Pharmaceuticals in the Environment

K. L. D. Henderson and J. R. Coats, *Organizers, Presiding*

Section B
McCormick Place East -- Rm E267, Level 2

1:30 —57. Evaluation of the fate of erythromycin A in aquaculture sediments. Y -H. Kim, **C. E. Cerniglia**

1:55 —58. Bioavailability of veterinary antibiotics in surface water. **K. L. D. Henderson**, T. B. Moorman, J. R. Coats

2:20 —59. Oxytetracycline at environmental interfaces studied by nonlinear optics. **P. L. Hayes**, J. M. Gibbs-Davis, M. J. Musorrafiti, A. L. Mifflin, K. A. Scheidt, F. M. Geiger

2:45 —60. Sorption, fate, and transport of endogenous steroid hormones in soils. **H. Hakk**, F. X. M. Casey, G. L. Larsen

3:10 — Intermission

3:25 —61. Sorption behaviors and binding mechanisms of ibuprofen with Al and Fe oxides and kaolinite. X. Huang, **G. D. Foster**

3:50 —62. Degradation and bioavailability of sulfamethazine in pond water microcosms. T. B. Moorman, **K. L. Henderson**, J. R. Coats

4:15 — Concluding Remarks

General AGRO Papers: New Developments and Issues in Agrochemical Sciences
J. J. Johnston, *Organizer, Presiding*

Section C
McCormick Place East -- Rm E266, Level 2

1:30 —63. Effect of nonionic surfactants on the oxidation of carbaryl by anodic Fenton treatment. **L. Kong**, A. T. Lemley

1:55 —64. Odorants from anaerobically-digested food waste and swine slurry. **H. Kim**, I. Lee, S -G. Hong

2:20 —65. Determination of pesticide levels in human urine using high pressure liquid chromatography-tandem mass spectroscopy. **J. E. Norrgran**, R. Bravo, P. A. Restrepo, R. D. Walker, D. B. Barr

2:45 —66. Method development for multiresidue pesticide extraction from natural and processed foods. **R. E. Hunter Jr.**

3:10 — Intermission

3:25 —67. Real-time detection of organophosphorus pesticides using carbon nanotube-based, field-effect transistor. **Y. Lei**, N. Liu, Q. Zhang, W. Chen, A. Mulchandani

3:50 —68. Topical insect repellent based on refined oil of *Nepeta cataria*. **Y. I. González**, D. L. Hallahan

4:15 —69. Uptake and translocation of residues into strawberry plants from ^{14}C-furfural treated soil. **M. F. Kovacs Jr.**, A. C. Katz, G. J. Burger, M. E. Dix, D. Teixeira

4:40 —70. Role of mineral phosphorus fertilization on corn (*Zea mays L.*) Cd upptake. **M. László**, B. S. Panwar, M. S. Greval

MONDAY EVENING

Sci-Mix
J. J. Johnston, *Organizer, Presiding*
8:00 - 10:00

Section A
Hyatt Regency Chicago -- Riverside Center

73, 75-76, 79-81, 85, 87, 93-94, 98, 100, 102-109. See subsequent listings.

POSTER SESSIONS

TUESDAY MORNING
8:00 - 10:00
J. J. Johnston, *Organizer, Presiding*
McCormick Place East -- Rm E354, Level 3

Estimation of Environmental Exposure to Agrochemicals Using Spatial Data Analysis and GIS

71. Using GIS data to discern sources for pesticide runoff contributions to the Choptank River watershed. **C. J. Hapeman**, W. D. Hively, M. Lang, L. L. McConnell, C. P. Rice, G. W. McCarty, T. R. Fisher, A. M. Sadeghi

72. Review of published studies on agricultural field buffer strip performance. **S. H. Jackson**, W. Chen, A. F. Rose, P. L. Havens, M. Thompson, T. S. Ramanarayanan, J. Hanzas, P. Hendle

73. Web based on-demand report and GIS data generation for a nationwide, potable-well monitoring program. A. C. Newcombe, **K. G. Peterson**

74. Framework for detailed endangered species determination development in support of pesticide product registration. **J. M. Giddings**, D. Howes, B. D. McGaughey

75. Tiered approach to the use of best available data on species locations in pesticide assessments on endangered species. **B. D. McGaughey**, D. Howes, K. H. Carr, A. T. Hall, S. Wall

76. FitoMarche: A tool to assess pesticide vulnerability maps and to estimate pesticide leaching in a stochastic way. **M. Balderacchi**, A. Di Guardo, M. Trevisan, C. Vischetti

77. Rural domestic well sensitivity: A case study for a shift from a pure hydrogeologic/detection analysis to a coupled hydrogeologic/detection/ contextual study construct. **P. Miller**, C. M. Harbourt, J. J. Prenger, P. Hendley

78. Using a combination of NASS cropping data and market research information to improve the spatial resolution of pesticide use estimates. **C. M. Holmes**, P. Hendley, J. Amos

79. GeoSTAC: Enabling efficient environmental assessments. **A. M. Wadley**, M. F. Winchell, C. M. Holmes, J. Amos, R. Srinivasan, D. J. Healy, P. L. Havens, D. A. Staats

80. GIS toolset to streamline pesticide exposure vulnerability analysis of community drinking water sources. **T. S. Ramanarayanan**, Z. Tang, R. Srinivasan, M. F. Winchell

81. Assessment of spatial exposure vulnerability using a watershed regression model. **Z. Tang**, T. Ramanarayanan

82. Measured impact of herbicide tolerant corn on occurrence of conventional corn herbicides in surface water. **K. H. Carr**, D. I. Gustafson

Agricultural Biomass, Biobased Products, and Biofuels

83. Near-critical hydrolysis of lignocellulosic biomass. **L. Ngo Tenlep**, D. E. Raynie

84. Amine hydroxy derivative of soybean oil as a lubricant additive. **B. K. Sharma**, A. Biswas, S. Z. Erhan

85. Direct production of bioethanol from raw starch by immobilized yeast cells surface engineered with amylolytic enzymes. **J - P. Chen**, K -W. Wu

86. Succinoylation and characterization of cellulose in ionic liquid. **C. F. Liu**, R. Sun, A. P. Zhang, J. L. Ren

87. Coumarin derivatives as novel antifungal seed treatments. **Y. V. Kuzmichev**, J. C. Laas, R. R. Pavlis, N. L. Brooker

88. Bioconversion and optimization of potato waste to lactic acid. **D. P. Adhikari**, E. Ashiamah-Finch, J. Furney, L. Kallestad, A. Frances, F -H. Chang

89. Fixed-bed, biodiesel-production technology. **P. Zhang**, J. Jarnefeld

90. Water solubilization of lignocellulosic biorenewables via derivatization with phosphite esters. **R. Oshel**, M. V. Nandakumar, S. Urgaonkar, D. G. Hendricker, J. G. Verkade

Glyphosate-Resistant Crops and Weeds

91. Low dose selection for glyphosate resistance in cross-pollinated *Lolium rigidum* vs. self-pollinated *Avena fatua*. R. Busi, **S. B. Powles**

92. Photosynthesis and respiration rate of *Lolium multiflorum* (Italian ryegrass) biotypes resistant to glyphosate. D. N. Ribeiro, **P. J. Christoffoleti**, R. De Prado, L. Vargas, R. Vivian, B. A. B. Martins

Sustainable Household, Structural, and Residential Pest Management

93. Biochemical and molecular characterization of bivalent anticholinesterases to the malarial mosquito. **T. D. Anderson**, D. C. Klorig, D. Wong, P. R. Carlier, J. R. Bloomquist

Sustainable Forest Pest Management

94. Winter detection of southern pine beetles using analytical georeferenced data. **W. E. Holmes**, A. E. Brown, Z. A. Parisa

Veterinary Pharmaceuticals in the Environment

95. Plant glutathione S-transferases as mediators of antibiotic detoxification. **M. H. Farkas**, D. Aga, J. O. Berry

96. Investigating the fate of the veterinary antibiotics monensin, lasalocid, and tylosin in agricultural systems. **S. A. Sassman**, L. S. Lee

97. Transformation of sulfamethazine by hydrous manganese oxides. **J. Gao**, J. A. Pedersen

New Developments in Agrochemical Sciences

98. Electrospray ionization mass spectroscopy shows speciation of phytate to be pH dependent. **L. Heighton**, W. F. Schmidt, C. P. Rice, R. L. Siefert

99. Antiviral activity of Keggin-type heteropoly compounds on tobacco plants. **S. Uskokovic-Markovic**, M. Todrovic, U. B. Mioc, B. Krstic, N. Dukic

100. Study on chemical character and activity of polysaccharides from several marine green alga collected in different localities and periods. **W. Mao**, H. Sun, X. Zang

101. Ecological efficiency of use of organo-mineral composts in agriculture. **S. B. Pardaev**

102. Dissipation of bromide ion following an in-furrow application to bare soil. **A. C. Newcombe**, R. Speth, T. Wiepke, N. Chamkasem, S. Chen

103. Human exposure to surface pesticide residues: Dislodgeable foliar residues and pilot studies to predict bioavailability. **Y. Li**, J. J. Keenan, M. M. Bigelow, Z. Chen, H. Vega, R. I. Krieger

104. Molecular modeling for screening of pesticide-nucleotide binding potentials. **D. W. Boerth**

105. Multiple-inlet plus intermittent rice irrigation increases rainfall capture and reduces non-point source runoff. **J. H. Massey**, M. C. Smith, A. B. Johnson

106. Runoff losses of three pesticides and a conservative tracer from warm-season turf using simulated rainfall. **P. A. Ampin**, J. H. Massey, B. R. Stewart, M. C. Smith, A. B. Johnson, R. P. Maiers, A. A. Andrews

107. Bioreporter-based chemical sensor of arsenic in agricultural samples. **D. L. Schroeder**, A. C. Nagel, B. D. Gross, T. S. Reed, B. Applegate, D. E. Nivens

108. Remote sensing of agricultural contaminants using biosensor networks over TCP/IP. **B. D. Gross**, T. S. Reed, A. Stoklosa, D. L. Schroeder, A. C. Nagel, B. Co, D. E. Nivens

109. Crystal and molecular structures of organophosphorus pesticides. **G. B. Hall**, **R. G. Baughman**

110. Influence of composts repared from tobacco wastes and phosphogypsum on the agrochemical properties of carbonate meadow soils of Zarafshan Valley. **T. K. Ortikov**, S. A. Khazratkulov

111. Cd, Ni, Pb, Se, and Hg bioaccumulation and phytoremediation characteristics of Crotalaria (*Crotalaria juncea L.*) under mineral nitrogen fertilization influence. **M. László**, M. S. Greval, B. S. Panwar

112. Triticale (*X Triticosecale W.*) Al, Cd, Co, Cr, Cu, Sr, Pb and Zn bioaccumulation in a long term field mineral fertilization experiment. **M. László**

113. Rye (*Secale cereale* L.) As, Cd, Hg, Ni, Pb, and Se phytotranslocation in a long-term field fertilization experiment. **M. László**

114. Phytoremediation aspects of Cd kinetics in Hungarian and Indian soils. **M. László**, B. S. Panwar, M. S. Greval

115. Impact of mineral NPK fertilization on wheat (*Triticum aestivum* L.) Cd, Hg, Ni, Pb, and Se translocation. **M. László**, M. S. Greval, B. S. Panwar

TUESDAY MORNING

Sustainable Resources: Science and Information Sources
Sponsored by CINF, Cosponsored with AGRO, FUEL, and SUST
B. Town, L. R. Solla, Samantha Swann, *Organizers, Presiding*

Hyatt Regency McCormick -- 12 B

8:30 — Introductory Remarks

8:35 — *CINF 55.* Designing a new industry for sustainability: Life cycle analysis for the emerging bioeconomy. B. E. Dale

9:15 — *CINF 56.* Emerging technologies for renewable materials in the UK and EU. J. Tomkinson, A. Hamer

9:45 — *CINF* 57. Biofuels: From an information perspective. K, Sands.

10:15 — *CINF 58.* Survey of information resources covering renewable fuels, chemicals and energy. S. Swann

10:45 — Discussion

International Award for Research in Agrochemicals Symposium in Honor of Gerald T. Brooks

Cosponsored with BASF Corporation
TUESDAY MORNING
D. W. Gammon and R. D. Wauchope, *Organizers, Presiding*
VENUE CHANGE: *McCormick Place South -- Rm S105D, Level 1*

First of two sessions

10:15 — Award Presentation

10:30 —116. 1956-2006: Fifty years of insect toxicology. **G. T. Brooks**

11:00 —117. Gerry Brooks' epoxide hydrolase: Thirty-five years to a pharmaceutical. **B. D. Hammock**

11:25 —118. Pyrethroid action at calcium channels: Neurotoxicological implications. **J. M. Clark**

TUESDAY AFTERNOON

Estimation of Environmental Exposure to Agrochemicals Using Spatial Data Analysis and Geographic Information Systems Groundwater
S. H. Jackson and P. Hendley, *Organizers*
R. J. Gilliom, *Organizer, Presiding*

Section A
McCormick Place South -- Rm S103B/C, Level 1

1:20 — Introductory Remarks. **R. J. Gilliom**.

1:30 —119. Hawaii's GIS-based screening tool for pesticide leaching assessment. **C. Ray**, F. Stenemo, R. Yost, S. Matsuda

1:55 —120. Multivariable approaches for determining groundwater vulnerability to agrochemical movement in soil, Part 1: Classification and regression tree analysis of California Central Valley. J. Troiano, S. Huber, F. Spurlock, J. Marade, C. Dharmasri, W. Phelps, **W. Chen**

2:20 —121. Multivariable approaches for determining groundwater vulnerability to agrochemical movement in soil, Part 2: Cluster analysis of California statewide groundwater vulnerability. **J. Troiano**, F. Spurlock, J. Marade, W. Chen

2:45 —122. Modeling atrazine occurrence in shallow groundwater in agricultural areas of the United States. **P. E. Stackelberg**, R. J. Gilliom, D. M. Wolock, N. Nakagaki

3:10 — Intermission

3:25 —123. Use of a geographic information system (GIS) with process-based simulation modeling to predict atrazine concentrations in shallow groundwater across the United States: Simulation approach and testing against nationwide observations. **J. E. Barbash**, F. D. Voss

3:50 —124. Mapping the vulnerability of European groundwater to the leaching of pesticides with a process-based metamodel of EuroPEARL. **A. Tiktak**, J. Boesten, M. Vanclooster

Agricultural Biomass, Biobased Products, and Biofuels
Defining the Challenges
Cosponsored with FUEL, SUST, CELL, and CINF
C. J. Hapeman, J. H. Massey, and J. R. Barone, *Organizers*
J. N. Seiber, *Organizer, Presiding*

Section B
McCormick Place South -- Rm S103D, Level 1

1:20 — Introductory Remarks

1:25 —125. Agricultural biomass, biobased products, and biofuels: Challenges and opportunities. **G. Buchanan**

1:55 —126. Biomass-to-ethanol conversion: Strategies for developing flexible biorefineries. **W. J. Orts**, K. M. Holtman, G. M. Glenn, R. Offeman, G. H. Robertson, S. H. Imam, D. W. S. Wong

2:20 —127. Chemical and physical properties of pretreated biomass that affect enzyme accessibility and digestibility. **M. F. Davis**, C. Ishizawa, T. Jeoh, W. S. Adney, M. E. Himmel, D. K. Johnson

2:45 —128. Biodiesel: Science based regulation and consumer protection. **K. L. Armbrust**, J. Rodriguez

3:10 — Intermission

3:25 —129. Enzyme and microbial bioconversion of agricultural and forestry residues for transportation fuel. **J. D. Peterson**, K. Brandon, D. Cook, E. DeCrescenzo, E. de Ximines, A. Jangid, Z. Cvetkovich, J. Young

3:50 —130. Coproduction of fuel ethanol and new value added coproducts. **D. B. Johnston**

4:15 —131. Energy balance of switchgrass grown for cellulosic ethanol in the Northern Plains, USA. **M. R. Schmer**, K. P. Vogel, R. B. Mitchell, R. K. Perrin

4:40 — Panel Discussion

International Award for Research in Agrochemicals
Symposium in Honor of Gerald T. Brooks
Second of two sessions
Cosponsored with BASF Corporation
D. W. Gammon and R. D. Wauchope, *Organizers*

Section C
McCormick Place South -- Rm S105D, Level 1

1:30 —132. DDT and cyclodiene resistance: Old mechanisms give resistance to new compounds. **R. H. ffrench-Constant**

1:55 —133. Insect P450: Diversity of structure and function. **R. Feyereisen**

2:20 —134. Pharmacokinetic approaches to optimize insecticidal chemistry. **M. G. Ford**

2:45 —135. Pyrethroids, knockdown resistance, and sodium channels. **D. M. Soderlund**

3:10 — Intermission

3:25 —136. Cyclodiene-induced alterations in mammalian dopaminergic pathways as a possible cause of environmentally-induced Parkinsonism. **J. R. Bloomquist**

3:50 —137. Bioassays for persistent organic pollutants in receptor-mediated reporter gene expression systems. **H. Ohkawa**, H. Inui, Y. Tanaka

4:15 —138. *In vitro* metabolic interactions of pesticides in humans. **E. Hodgson**

4:40 — Concluding Remarks

WEDNESDAY MORNING

Estimation of Environmental Exposure to Agrochemicals Using Spatial Data Analysis and Geographic Information Systems
Surface Water

S. H. Jackson and R. J. Gilliom, *Organizers*
P. Hendley, *Organizer, Presiding*

Section A
McCormick Place South -- Rm S103B/C, Level 1

8:30 — Introductory Remarks. **P. Hendley**.

8:35 —139. Connecting watersheds and water quality: Understanding the transport of agricultural chemicals to streams. **D. M. Wolock**

9:00 —140. Estimating pesticide concentrations in U.S. streams from watershed characteristics and pesticide properties. **W. W. Stone**, C. G. Crawford, R. J. Gilliom

9:25 —141. Flow accumulation-based application of the WARP model to identify stream segments with high pesticide exposure risk. **M. F. Winchell**, S. H. Jackson, J. Hanzas

9:50 —142. Hydrology-based screening tool for estimating catchment vulnerability to corn herbicide runoff. **C. Leu**, P. Sweeney

10:15 — Intermission

10:30 —143. Estimating the likelihood of occurrence of selected pesticides and nutrients at specific concentrations in Coastal Plain streams on the basis of landscape characteristics. **S. W. Ator**, J. M. Denver, A. C. Neale, A. M. Pitchford

10:55 —144. Integration of spatially detailed information to assess the role of agricultural sources in nutrient loading to the Chesapeake Bay. **S. D. Preston**, J. W. Brakebill

11:20 —145. Regression models for explaining and predicting organochlorine pesticide concentrations in whole fish from U.S. streams. **L. H. Nowell**, C. G. Crawford, N. Nakagaki, G. P. Thelin, D. M. Wolock

11:45 —146. Examining the relative proximity of agriculture to surface water across Europe. **C. M. Holmes**, M. Matella, P. Hendley, P. Sweeney, S. J. Maund

Agricultural Biomass, Biobased Products, and Biofuels
Process and Product Control
Cosponsored with FUEL, SUST, CELL, and CINF
J. N. Seiber, J. H. Massey, and J. R. Barone, *Organizers*
C. J. Hapeman, *Organizer, Presiding*

Section B
McCormick Place South -- Rm S103D, Level 1

8:30 — Introductory Remarks

8:35 —147. Biobased: Making it competitive and sustainable. **R. Fireovid**

9:00 —148. Developing herbaceous energy crops as feedstocks for bioethanol production. **B. S. Dien**, M. A. Cotta, H -J. G. Jung, K. P. Vogel

9:25 —149. Alternative feedstocks for renewable green energy fuel. **A. E. Brown**, E. R. Easterling, E. C. Rogers, W. E. Holmes, R. Hernandez, W. T. French

9:50 —150. *Aspergillus flavus* genomic data mining provides clues for its use in producing biobased products. **J. Yu**, W. C. Nierman, D. Bhatnagar, T. E. Cleveland

10:15 — Intermission

10:30 —151. Fully automated molecular biology routines for evaluation and characterization of industrial yeast strains optimized for ethanol production from cellulosic biomass and for biobased-pesticide expression. **S. R. Hughes**

10:55 —152. Biological abatement for removal of inhibitors from biomass sugars. **N. N. Nichols**, C. K. Chambliss, G. P. van Walsum, L. N. Sharma, B. S. Dien

11:20 —153. FT-IR analysis of oil feedstock and biodiesel quality. **J. R. Barone**

11:45 —154. Effects of production practices on biodiesel quality. **J. Rodriguez**, K. L. Armbrust

Recent Advances in Sustainable Household, Structural, and Residential Pest Management
C. J. Peterson and D. M. Stout II, *Organizers*

Section C
McCormick Place South -- Rm S105D, Level 1

8:10 —155. Biological activities of a bait toxicant for population management of subterranean termites. **N -Y. Su**

8:35 —156. Metaflumizone: A semicarbazone insecticide for structural pest control from BASF. **R. W. Davis**, D. Calibeo-Hayes, C. Klein, J. Schuh

9:00 —157. MIKRON formulation: A new process for making pesticides. **D. L. Richman**, J. B. Ballard

9:25 —158. Natural product technologies for use in pest management. **G. E. Paluch**, J. R. Coats

9:50 —159. *Quo vadis*: Recent advances in the management of German cockroaches. **R. A. Suranyi**, D. L. Sundquist

10:15 — Intermission

10:30 —160. Initial soil penetration of aqueous termiticide solutions. **C. J. Peterson**

10:55 —161. American healthy homes survey: A national study of residential pesticides measured from floor wipes. **D. M. Stout II**, K. Bradham, V. R. Highsmith, C. W. Croghan, P. A. Jones, W. Friedman, E. A. Pinzer, D. Cox, G. Dewalt

11:20 —162. Residential exposure to piperonyl butoxide through pyrethroid insecticide use. **M. K. Williams**, D. Holmes, L. A. Hoepner, D. E. Camann, F. P. Perera, R. M. Whyatt

11:45 —163. Potential for human exposures to pet-borne diazinon residues following residential lawn applications. **M. K. Morgan**, D. M. Stout II, P. P. Egeghy

WEDNESDAY AFTERNOON

Estimation of Environmental Exposure to Agrochemicals Using Spatial Data Analysis and Geographic Information Systems Integrated Approaches and Spatial Data Applications
S. H. Jackson and P. Hendley, *Organizers*
R. J. Gilliom, *Organizer, Presiding*

Section A
McCormick Place South -- Rm S103B/C, Level 1

1:35 —164. Assessing the potential transfer of pesticides to groundwater and surface waters throughout Europe: The EU-funded project FOOTPRINT. **I. G. Dubus**

2:00 —165. National assessment of pesticide environmental risk from agricultural sources using a microsimulation modeling approach. **R. L. Kellogg**, S. Plotkin

2:25 —166. ArcSWAT: A tool for parameterization of common watershed water quality models and landscape characterization. **R. Srinivasan**, M. F. Winchell

2:50 —167. GeoSTAC (GEOSpatial Tools and ACcess): A compilation of standardized geospatial data and tools for agrochemical exposure assessments. **P. L. Havens**, K. Carr, P. Hendley, S. Jackson, T. Ramanarayanan, D. A. Staats, M. Thomson, C. Holmes, J. Amos, A. Wadley, M. Winchell, R. Srinivasan

3:15 — Intermission

3:30 —168. Development and application of spatially-distributed pesticide use information for assessing water quality. **G. P. Thelin**, N. Nakagaki

3:55 —169. Applications of the preferential flow model MACRO to the estimation of pesticide loss in the agricultural landscape: A historical perspective. **I. G. Dubus**, N. J. Jarvis

4:20 —170. A procedure to identify representativeness of experimental site for pesticide leaching field study at European level. **M. Balderacchi**, J. Hollis, C. Gustin, M. Trevisan, E. Capri

4:45 —171. Preserving local variability and large scale spatial structure in semi-national assessments. C. M. Harbourt, J. Amos, **P. Miller**, J. J. Prenger, P. Hendley

Agricultural Biomass, Biobased Products, and Biofuels
Process Characterization
Cosponsored with FUEL, SUST, CELL, and CINF
J. N. Seiber, C. J. Hapeman, and J. H. Massey, *Organizers*
J. R. Barone, *Organizer, Presiding*

Section B
McCormick Place South -- Rm S103D, Level 1

1:30 — Introductory Remarks

1:35 —172. Product identification from the catalytic cracking of *cis*-9-octadecenoic acid. **T. J. Benson**, R. Hernandez, W. T. French, M. G. White, E. G. Alley, W. E. Holmes

2:00 —173. *Parthenium argentatum* as a source of biobased products. **C. M. McMahan**, K. Cornish, M. Whalen

2:25 —174. Castor oil: Biosynthesis and uses. **T. A. McKeon**, X. He, G. Q. Chen, J -T. Lin

2:50 —175. Structure-function relationships of a catalytically efficient β-D-xylosidase. **D. B. Jordan**

3:15 — Intermission

3:30 —176. Enzymatic dewatering of distillers grains. **A. B. Henriques**, D. B. Johnston, M. H. Al-Dahhan

3:55 —177. Biobased industrial lubricants. S. Z. Erhan, **B. K. Sharma**

4:20 —178. Recent advances in bioconversion of agricultural biomass to butanol by fermentation: Employing potential of available renewable resources to produce a superior biofuel. **N. Qureshi**, B. C. Saha, X -L. Li, S. R. Hughes, M. A. Cotta

4:45 —179. Synthesis of long-chain unsaturated-α,ω- dicarboxylic acids from renewable materials via olefin metathesis. **H. L. Ngo**, T. A. Foglia

Sustainable Forest Pest Management
E. A. Arthur, R. Ripperger, and C. J. Peterson, *Organizers, Presiding*

Section C
McCormick Place South -- Rm S105D, Level 1

1:20 — Introductory Remarks

1:35 —180. Streamside management zones for protecting water quality: A critical review of current knowledge. **J. L. Michael**

2:00 —181. New and old methods of protection of trees against bark beetles: What works, what doesn't, and why. **K. D. Klepzig**, B. L. Strom, L. M. Roton

2:25 —182. Efficacy of verbenone flakes for area-wide and individual tree protection from attack by mountain pine beetle in western North America. **N. Erbilgin**, N. Gilette, S. Mori, M. Hansen, J. Stein, J. Webster, D. Owen, G. Fiddler, D. L. Wood

2:50 —183. Technological advances using disparlure for slowing the spread of gypsy moth. **A. H. Onken**

3:15 — Intermission

3:30 —184. Imidacloprid and management of hemlock woolly adelgid in forests: Fine tuning for environmental stewardship. **R. S. Cowles**

3:55 —185. Compatibility of eastern hemlock (*Tsuga canadensis*) wood tissue with an enzyme-linked immunosorbent assay for imidacloprid residue detection. **B. M. Eisenback**, D. E. Mullins, S. M. Salom, L. T. Kok

4:20 —186. Eastern Hemlock water use: Implications for systemic insecticide application. **J. M. Vose**, C. R. Ford

4:45 —187. Immediate impact of imidacloprid treatment for control of hemlock woolly adelgid on aquatic macroinvertebrate communities. **J. Hanula**, M. Churchel, C. W. Berisford, J. Vose

THURSDAY MORNING

Estimation of Environmental Exposure to Agrochemicals Using Spatial Data Analysis and Geographic Information Systems Risk Assessment and Ecological Applications
R. J. Gilliom and P. Hendley, *Organizers*
S. H. Jackson, *Organizer, Presiding*

Section A
McCormick Place South -- Rm S103B/C, Level 1

8:30 — Introductory Remarks. **S. H. Jackson**.

8:35 —188. Using National Agricultural Pesticide Risk Analysis (NAPRA) WWW decision support system to estimate the environmental exposure of fungicide use on soybean rust in Indiana. **D. Deb**, B. A. Engel, L. Hahn

9:00 —189. SADA: A freeware decision support tool integrating GIS, sample design, spatial modeling, and environmental risk assessment. **R. N. Stewart**

9:25 —190. Landscape dynamics of Bt, bats, and insect resistance in the Winter Garden region of Texas. **S. T. Purucker**, P. Federico, T. G. Hallam, K. Kennard, G. F. McCracken

9:50 —191. Generic spatial-aggregation tool for ecological modeling: NhdPlus case study. **R. Srinivasan**, S. Mylevaganam

10:15 — Intermission

10:30 —192. Application of spatial analysis in estimating drinking water exposure for the *N*-methyl carbamate cumulative risk assessment. **N. C. Thurman**, D. Young

10:55 —193. Use of geospatial data in endangered species risk assessments for pesticides. **M. Corbin**, N. C. Thurman, M. Thawley

11:20 —194. Framework for a spatial aquatic model for pesticide risk assessments. **M. Corbin**, N. C. Thurman, M. Thawley

Agricultural Biomass, Biobased Products, and Biofuels
Improving Bioproduct Design
Cosponsored with FUEL, SUST, CELL, and CINF
J. N. Seiber, C. J. Hapeman, and J. R. Barone, *Organizers*
J. H. Massey, *Organizer, Presiding*

Section B
McCormick Place South -- Rm S103D, Level 1

8:30 — Introductory Remarks

8:35 —195. Properties of biodegradable feather keratin polymers. **J. R. Barone**

9:00 —196. Biopolymers from polylactic acid and milk proteins. **C. Onwulata**, P. Tomasula

9:25 —197. Extraction and electrospinning of zein extracted from corn gluten meal using acetic acid. **G. W. Selling**, K. K. Woods

9:50 —198. Improved physical properties of zein using glyoxal as a crosslinker. **K. K. Woods**, G. W. Selling

10:15 — Intermission

10:30 —199. Arthropod repelling constituents from a southern folk remedy: Investigations of the American beautyberry, *Callicarpa americana*. **C. L. Cantrell**, C. T. Bryson, S. O. Duke, J. A. Klun, J. F. Carroll

10:55 —200. Biobased herbicides. **F. E. Dayan**, S. O. Duke

11:20 —201. Single-use, disposable food containers: Starch-based alternatives to petroleum-based plastics. **G. M. Glenn**, C. N. Ludvik, A. P. Klamczynski, W. J. Orts, S. H. Imam, D. Wood

11:45 —202. Incorporation of bacteriocin in edible pectin films for antimicrobial packaging. L. Liu, T. Jin, C -K. Liu, **K. B. Hicks**, A. K. Mohanty, R. Bhardwaj, M. Misra

Pesticide Runoff/Leaching Mitigation by Riparian Buffers: Application of the REMM
M. Nett, *Organizer*
R. C. Everich and R. D. Wauchope, *Organizers, Presiding*

Section C
McCormick Place South -- Rm S105D, Level 1

8:20 — Introductory Remarks

8:35 —203. Field evaluation and simulation modeling of pesticide runoff buffer effectiveness. **R. C. Everich**

9:00 —204. Herbicide abatement by a riparian wetland system. **C. P. Rice**, K. Bialek, G. W. McCarty, W. D. Hively, J. Angier

9:25 —205. Vegetative buffer management to mitigate potential off-site pesticide movement in the Mississippi Delta. **M. A. Locke**, M. T. Moore, R. M. Zablotowicz, M. A. Weaver, R. L. Bingner

9:50 —206. Riparian ecosystem management model (REMM): Regulatory interests and perspective. **R. D. Jones**

10:15 — Intermission

10:30 —207. EXPRESS: The EXAMS/PRZM exposure simulation shell. **L. Burns**

10:55 —208. Application of REMM to design edge-of-field buffers. **R. Lowrance**, R. G. Williams, R. D. Wauchope

11:20 —209. REMM pesticide algorithms: Sensitivity testing. **R. D. Wauchope**

11:45 —210. Estimating buffer width size for pesticide labels using a new version of REMM. **T. L. Estes**

12:10 —211. Comparison of REMM and PRZM implemented as a vegetated filter strip model. **J. J. Prenger**, J. M. Cheplick, W. M. Williams, A. M. Ritter, N. J. Snyder

12:35 — Concluding Remarks

THURSDAY AFTERNOON

Estimation of Environmental Exposure to Agrochemicals Using Spatial Data Analysis and Geographic Information Systems Risk Assessment and Ecological Applications
R. J. Gilliom and P. Hendley, *Organizers*
S. H. Jackson, *Organizer, Presiding*

Section A
McCormick Place South -- Rm S103B/C, Level 1

1:30 —212. Analysis of ecological risk posed by pesticides to surface waters in England. **C. M. Holmes**, R. Williams, C. D. Brown, S. Beulke, W. van Beinum, C. Wells, E. J. Pemberton

1:55 —213. FOCUS surface water scenarios: Relevance at the zonal/member state level. **G. O. Hughes**, O. Price

2:20 —214. Spatial approaches in agrochemical risk assessments: Challenges for the next decade. **P. Hendley**

2:45 — Concluding Remarks by Session Chairs

Agricultural Biomass, Biobased Products, and Biofuels
The Cellulosic Challenge
Cosponsored with FUEL, SUST, CELL, and CINF
J. N. Seiber, C. J. Hapeman, and J. H. Massey, *Organizers*
J. R. Barone, *Organizer, Presiding*

Section B
McCormick Place South -- Rm S103D, Level 1

1:05 — Introductory Remarks

1:10 —215. Fast pyrolysis and biooil production from energy crops being developed within USDA-ARS. **A. A. Boateng**

1:35 —216. Steam explosion method for producing microcrystalline cellulose from agricultural residues. **F. A. Agblevor**, M. M. Ibrahim, W. K. El-Zawawy

2:00 —217. Developing enzyme systems for biomass destruction. **D. Wong**, C. Lee, K. Wagschal, M. Smith, G. Robertson, W. Orts

2:25 —218. Process for obtaining cellulose acetate from agricultural by-products. **A. Biswas**, B. C. Saha, J. W. Lawton Jr., R. L. Shogren, J. L. Willett

2:50 — Intermission

3:05 —219. Fuel from herbaceous feedstocks: A switchgrass-centric perspective. **G. Sarath**, B. S. Dien, K. P. Vogel, H -J. G. Jung

3:30 —220. Hydrothermal conversion of wood: Reaction kinetics and process development. **B. Zhang**, M. von Keitz, K. Valentas

3:55 —221. Fractionating lignocellulose by using cellulose solvent and organic solvent. **Y -H. P. Zhang**, G. Moxley

4:20 — Concluding Remarks

AGRO DIVISION

AGRO 1
Glyphosate: A once-in-a-century herbicide
***Stephen O. Duke**, Natural Products Utilization Research Unit, USDA-Agricultural Research Service, P. O. Box 8048, University, MS 38677, Fax: 662-915-1035, sduke@olemiss.edu, and Stephen B. Powles, WA Herbicide Resistance Initiative, University of Western Australia*

Since its commercial introduction in the mid 1970s, glyphosate (*N*-(phosphonomethyl)glycine) has become the dominant herbicide of all time. There are several reasons for its success. It is a highly-effective, broad-spectrum herbicide, yet it is very toxicologically and environmentally safe. It translocates well, and its action is slow enough to take advantage of this. It is the only herbicide that targets 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS), so there are no competing herbicide analogues or classes. Since it became a generic compound, its cost has dropped dramatically. Perhaps the most important aspect of the success of glyphosate has been the introduction of transgenic, herbicide-resistant crops just over ten years ago. Approximately 90% of all transgenic crops grown world wide are glyphosate resistant, and the adoption of these crops is increasing at a steady pace. The use of this almost ideal herbicide is now being threatened by the evolution of glyphosate-resistant weeds.

AGRO 2
Current and future glyphosate-resistant crops of Monsanto
***Gerald M. Dill Jr.**, Soybean Biotech Trait Development Lead, Monsanto GG6A, 700 Chesterfield Parkway West, Chesterfield, MO 63017, Fax: 636-737-6950, gerald.m.dill.jr@monsanto.com*

Glyphosate resistance was first demonstrated in planta in 1983 by scientists at Monsanto and Washington University. Following several years of testing, a 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) derived from a glyphosate-resistant *Agrobacterium sp.* was selected as the best method for conferring glyphosate resistance in crop plants. Inserting this glyphosate insensitive form of EPSPS resulted in glyphosate resistance levels sufficient to allow commercially effective doses of glyphosate to be sprayed over crops to kill weeds. In 1996, glyphosate resistant soybeans were first marketed in the US. Since the initial launch, glyphosate-resistant cotton, corn, and canola have all been deployed commercially. This paper will discuss current global penetrations of glyphosate tolerant crops and future plans for conferring glyphosate resistance to other species. Herbicide use data, agronomic practices currently used with glyphosate-resistant crops and future strategies around glyphosate resistance currently under development will also be discussed.

AGRO 3
New multiple herbicide crop resistance and formulation technologies to augment the utility of glyphosate
***Jerry M. Green**[1], Christine B. Hazel[2], D. Raymond Forney[1], and Luann M. Pugh[1]. (1) DuPont Crop Protection, Stine-Haskell Research Center, Newark, DE 19714-0030, jerry.m.green@usa.dupont.com, (2) DuPont Pioneer Crop Genetics*

Weed spectras are shifting to populations that survive glyphosate and now growers need new weed management technologies to augment the utility of glyphosate. Unfortunately, no new herbicide modes of action are being commercialized to fill this need. Fortunately, new herbicide-resistance technologies to existing herbicides are being developed. One of the first multiple herbicide resistance technologies will stack a new metabolically-based, glyphosate-resistance mechanism with an active site based resistance to a broad spectrum of herbicides that inhibit acetolactate synthase (ALS). Additionally, this system will be commonly combined with glufosinate resistance and used in conjunction with the new formulation technology of homogenous blends to enable further the use of herbicides with other modes of actions. Homogenous blend formulations satisfy governmental regulations and allow new mixtures to be commercialized faster than traditional mixture formulations. Together, homogenous blends and multiple herbicide-resistant crops will offer growers a wider choice of herbicide actives and mixture ratios to augment glyphosate and satisfy their continually-changing weed management needs.

AGRO 4
Athenix technology for GRCs
***Nicholas Duck**, Brian VandeBerg, Volker Heinrichs, Laura Schouten, Nadine Carozzi, and Mike Koziel, Athenix, 2202 Ellis Road, Durham, NC 27703, Fax: 919-281-0901, nduck@athenixcorp.com*

Athenix has screened its extensive microbial collection for strains that are resistant to glyphosate. Resistance genes were cloned and characterized. Both metabolizing enzymes and resistant 5-enolpyruvylshikimate-3-phosphate synthases (EPSPS's) were found. Metabolizing or modifying glyphosate in transgenic plants presents specific regulatory challenges including determining the fate of glyphosate and demonstrating the safety of potentially-toxic end products or side reactions. For this reason, resistant EPSPS's were chosen as the best candidates for further product development. Athenix discovered a broad new class of EPSPS's which shares specific structural domains and is highly resistant to glyphosate inhibition. EPSPS's with a wide range of temperature optima were selected to provide improved product performance where variations in temperatures can contribute to poor performance with traditional glyphosate resistant products. Directed evolution technology has been used with certain family members to modify specific kinetic parameters and variants compared in transgenic plants in greenhouse tests and field trials.

AGRO 5
Grower perceptions and experiences with glyphosate-resistant weeds
Chuck Foresman *and Les Glasgow, Syngenta Crop Protection, Inc, 410 Swing Road, Greensboro, NC 27419-8300, chuck.foresman@syngenta.com*

The rapid adoption of glyphosate-tolerant (GT) crops is unlike any other technologial advancement in modern agriculture. But widespread use of glyphosate is revealing a flaw in the technology - resistance. Since the introduction of GT crops just ten years ago, six weed species have been confirmed resistant to glyphosate across sixteen states in the US. In 2006, Syngenta commissioned a study of 400 corn, soybean, and cotton growers to guage their perception of weed resistance and the effects it has on their farm today and will have in the future. Growers also discussed the economic impact they expect from glyphosate resistance and management of options they can employ to delay the problem. With 40 and 38% of growers in the north and south, respectively, believing that the glyphosate resistance problem is getting worse, it is clear that we need to act today with the adoption of solid, integrated weed-management solutions.

AGRO 6
Glufosinate-resistant crops
Jon Fischer*, Bayer CropScience, 5315 Indigo Way, Middleton, WI 53562, jon.fischer@bayercropscience.com*
Glufosinate ammonium (GA) is a non-selective, non-systemic herbicide that controls a broad spectrum of annual and perennial grasses and broadleaf weeds. It was first sold commercially for non-selective use in 1981. It was first used in combination with a GA resistant crop, LibertyLink canola, in 1995, followed by LibertyLink corn in 1997, LibertyLink cotton in 2003, and LibertyLink soybeans targeted for 2008. Total market size for GA use in North America has grown to about 9 million acres in 2006, almost all of which is applied to LibertyLink crops. The scope of use in the rest of the world matches that of North America, with use on non-resistant crops constituting the majority of use in those markets. The unique mode of action, favorable environmental and toxicological profile, broad spectrum weed control efficacy, and ease of use make GA an ideal complement to glyphosate-based weed control system.

AGRO 7
Economic impact of glyphosate-resistant crops
Leonard P. Gianessi*, Crop Protection Research Institute, CropLife Foundation, 1156 15th Street NW #400, Washington, DC 20005, lgianessi@croplifefoundation.org*

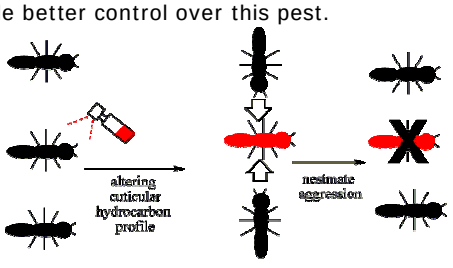
Widespread adoption of Roundup Ready crops and the reduced price for glyphosate has resulted in a significant decline in sales of herbicides in the US. The increased cost for Roundup Ready seeds has led to a corresponding increase in seed sales. Dramatic reductions in the prices of most alternative herbicides have occurred due to competition. Farmers have adopted Roundup Ready crops due to the simplicity of the system measured in terms of savings in management time, simplicity of herbicide selection, and increased flexibility in herbicide rates and in the timing of applications. The dominant role of glyphosate in major crops has led to a significant slowing of research and development for new herbicide active ingredients. Agricultural chemical companies are adjusting by shifting their focus into services, application, information, insecticides, fungicides, and other areas that can offset the value and profit decline in chemical sales accelerated by the use of Roundup Ready crops and glyphosate.

AGRO 8
Microwave-assisted synthesis of *N*-vanillylformamide
Mikhail M. Bobylev and ***Brent D. Keller****, Department of Chemistry, Minot State University, 500 University Avenue West, Minot, ND 58707, mikhail.bobylev@minotstateu.edu*

The Leuckart reaction is a fast and convenient method of synthesis of various formamides and amines and has been successfully used for the synthesis of many biologically active compounds, including agrochemicals and pharmaceuticals. Surprisingly, it has never been used for the synthesis of vanillylamine (I) from vanillin (II) via the intermediate *N*-vanillylformamide (III). In the literature, the intermediate III is described only once, when it was obtained via the formylation of I not by the reductive amination of II. In this work, we report a successful synthesis of III from II via a microwave assisted Leuckart reaction. This method provides a new synthetic pathway to I, which is a valuable intermediate in the synthesis of a number of biologically-active compounds. This method can also be used for the synthesis of other hydroxy-substituted benzylamines. The project is supported by NIH grant P20 RR016741 from the NCRR.

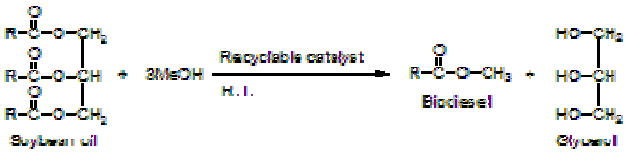
AGRO 9
Progress in synthesis and evaluation of potential nestmate recognition cues in the Argentine ant (*Linepithema humile*)
Robert Sulc[1]*, Kenneth J. Shea*[1]*, Neil D. Tsutsui*[2]*, Miriam Brandt*[2]*, Candice W. Torres*[2]*, and Mikoyan Lagrimas*[2]*. (1) Department of Chemistry, University of California, Irvine, Irvine, CA 92697, rsulc@uci.edu, (2) Ecology & Evolutionary Biology, University of California, Irvine*

The Argentine ant, *Linepithema humile*, which is native in South America, has been introduced to Mediterranean climates worldwide. In its introduced range, they form of extensive supercolonies which have greatly reduced intraspecific aggression. In Argentine ants, the cuticular profile is composed mainly of linear hydrocarbon molecules of 33 or more carbons which are believed to be responsible for nestmate recognition. The goal of this research is the synthesis of pure hydrocarbons believed to be responsible for nestmate recognition and test the effects on ant recognition. The ants were coated with known hydrocarbons identified as potential key elements in intercolony recognition (Figure 1). The ants' reactions were then observed to a treated nestmate. Identification of the essential hydrocarbons for nestmate recognition can permit control over aggression between nestmates by altering cuticular hydrocarbon profile. If successful, this could elucidate the nestmate recognition system in this species and enable better control over this pest.



AGRO 10
Development of new recyclable technologies for the production of biodiesel from soybean oil at room-temperature
Venkat Reddy Chinta Reddy *and John G. Verkade, Department of Chemistry, Iowa State University, 1311 Gilman Hall, Ames, IA 50011, chvreddy@iastate.edu*

Several recyclable technologies are being developed for the production of biodiesel from soybean oil, including the use of nano metal oxides, Merrifield resin-supported azidoproazaphosphatranes, and phosphonium or imidazolium (including task-specific) ionic liquids. These protocols operate well at room temperature except for the task-specific ILs which require 70 ºC. Phosphonium ionic liquids immobilized with organic and inorganic bases will be discussed. Biodiesel produced with our methods meet the ASTM standard for biodiesel sulfated ash. The main advantages of our methods are that: the catalyst or catalyst precursors are available from commercial sources; the catalysts are recyclable; the procedures are environmentally friendly, operationally simple and eliminate neutralization/washing steps required in current industrial processes using homogeneous base catalysts; and the use of refined SBO is not necessary.



AGRO 11
Bacterial degradation of toxaphene and DDT in laboratory microcosms and mesocosms
Yun Cheng *and Andrew Ogram, Department of Soil and Water Science, University of Florida, Gainesville, FL 32611, cyuf@ufl.edu*

A series of laboratory microcosms were firstly established with OCP-contaminated soils taken from Lake Apopka North Shore Restoration Area (NSRA) FL to identify anaerobic processes leading to the decomposition of the recalcitrant pesticides toxaphene and DDT. After a two-month incubation, significant loss of the parent compounds were observed in the lactate, butyrate, and H_2 microcosms relative to autoclaved controls with no exogenous electron donor. Based on these results, concepts for remediation of the contaminated area were confirmed up to the mesocosm scale using cattail or lactate as the electron donors plus a set of control with a cycle of anoxic followed by oxic conditions promoting degradation. Concentrations of OCPs were monitored every two weeks. Both lactate and cattail treated mesocosms showed significant disappearance of toxaphene. For the first time, this work demonstrated the bioremediation of toxaphene and DDT contaminated farmland using a cost efficient strategy.

AGRO 12
Effect of manganese and copper on the transformation of tetracycline antibiotics
Wan-Ru Chen*, Civil and Environmental Engineering, Georgia Institute of Technology, 200 Bobby Dodd Way, Rm 304, Atlanta, GA 30332, gtg351p@mail.gatech.edu, and Ching-Hua Huang, School of Civil and Environmental Engineering, Georgia Institute of Technology*

Tetracyclines (TCs) are among the frequently detected antibacterial agents in the aquatic environment, rendering evaluation of their fate and transport imperative. This study demonstrates that tetracycline (TC), oxytetracycline (OTC) and chlorotetracycline (CTC) readily undergo oxidative transformation in the presence of MnO_2, Mn^{II} ions or Cu^{II} ions under environmentally relevant conditions. Experimental evidence clearly indicates that the reaction mechanisms differ among the three metal systems. MnO_2 acts as a strong oxidant to oxidize adsorbed TCs at the mineral-water interface, in which the reaction rate is highly pH dependent. In contrast, the reactions of TCs with Mn^{II} and Cu^{II} ions are homogeneous, involve dissolved oxygen under aerobic conditions, and appear to be in a catalytic cycle. Comparison of reactivity observed among TC, OTC, CTC and their epimers and reaction product characterization indicate that different structural moieties of TCs are involved in the different metal systems.

AGRO 13
Fate and transport of biosolids-borne triclocarban
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Triclocarban (TCC) is an active ingredient in antibacterial bar soaps and a common constituent of domestic wastewater. The ultimate fate of wastewater-borne TCC, and the implications for human and environmental health, is not well understood. To date, environmental TCC research has focused primarily on analysis techniques, concentrations in various environmental compartments, and aquatic toxicity. Given the expected concentrations of TCC present in biosolids that may be land applied, research must now be directed toward characterizing the environmental transfer and ecological effects of biosolids-borne TCC. In summer 2006, 14C-TCC was used to perform a short-term biosolids-amended soil biodegradation study and to validate previously published biosolids-borne TCC extraction methods. Over the five-week degradation study, only ~7% of spiked 14C-TCC mineralized and intact TCC increased in the NaOH and combusted fractions, indicating incorporation into the humic fraction. TCC concentrations (5-34 ppm) in 9 biosolids representing various treatment processes were determined, and the Kow was measured (3.5+.06) by HPLC/MS.

AGRO 14
Environmental studies on the fate of pharma proteins produced in transgenic corns
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Transgenic plants are now considered to be an effective platform for the large-scale production of recombinant pharmaceutical proteins. Although various pharmaceutical proteins are reported to be expressed in crops, their environmental effects, as well as their environmental fate and behavior are little known. In this study, the fate of two highly homologous vaccine proteins, bacterially produced *V. cholerae* toxin subunit B (CTB), and corn-expressed *E.coli* heat-labile enterotoxin subunit B (LTB), in soil and water is studied. Although most bacterial CTB disappeared within 48 hours under any conditions, corn-expressed LTB was far more persistent. This may be the result of differences in the LTB vs CTB native proteins and/or the effect of the plant matrix in which the LTB is expressed.

AGRO 15
Phototransformation of penoxsulam in aqueous methanol and acetonitrile
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Penoxsulan, a triazolopyrimidin sulfonamide herbicide, is going to be introduced by Dow Agro Sciences in India. Because there is no detailed information available on the phototransformation of penoxsulfam, a study was conducted under UV light (λ_{max} 250 nm) and sunlight in mixtures of methanol: water (1:1) and acetonitrile: water (1:1) separately and in the presence or absence of sensitizer (TiO_2). The degradation of penoxsulam in different solvent systems followed first-order kinetics, and calculated half-lives were in the range of 51.9-73.4 h for UV light and 62.7-97.1 h for sunlight. The rate of disappearance of penoxsulam showed somewhat faster degradation in the presence of sensitizer and also in aqueous acetonitrile solution. From this study, a total of five photoproducts were identified and characterized on the basis of Q-T of micromass spectral data. The plausible mechanisms of phototransformation involved hydrolysis, breaking of a sulfonic bond, and loss of amino and sulfonic acid groups.

AGRO 16
Laboratory evaluation of the environmental fate of two monoterpenoid insecticides: Thymol and phenethyl propionate
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Thymol and phenethyl propionate (PEP) are active ingredients in pesticide products registered for use as insecticides, insect and animal repellents, fungicides, medical disinfectants, etc. In order to assess their environmental fate, a water dissipation study, a soil dissipation study and a soil column study were conducted using tritium-labeled thymol and PEP at the room temperature in the laboratory. Thymol and PEP degrade rapidly in water and in soil with a degradation half-life of < 5 days. The light does not influence the degradation profile for both pesticides in water. Two metabolites, 2-phenylethanol and 2-(4-hydroxyphenyl) ethanol, were detected in water and in soil although the levels of their formation were quite different. The importance of volatility of thymol was found, while the level of PEP volatility is low in a 30-day experimental period. Mineralization of thymol and PEP in soil is negligible with less than 3% evolved ^3H_2O. Bound residues of radioactivity for thymol and PEP are less than 6% in soil.

AGRO 17
In vitro **reduction of sodium ^{36}Cl-chlorate in bovine ruminal fluid**
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To test ruminal chlorate reduction and influence of dietary forage:concentrate, ruminally-cannulated steers were fed 20 or 80% concentrate diets. Ruminal fluid was collected, and incubated in vitro with 100 or 300 ppm chlorate for 0, 1, 4, 8, 16, or 24 h; autoclaved ruminal fluid was incubated for 24 h. Chlorate was measured by liquid scintillation counting after silver nitrate precipitation of [^{36}Cl]chloride. Chlorite (7-min half-life in live ruminal fluid) was not measured. Chlorate reduction (as concentration; ppm) was not affected by diet ($P \geq 0.18$); however, chlorate reduction (as percentage) tended to be greater ($P \geq 0.09$) at h8 and 16 in low concentrate diet. Chlorate in autoclaved controls at 24 h was intermediate ($P < 0.01$) between 0- and 24-h "live" ruminal fluid incubations. Attempts to isolate chlorate-respiring bacteria from ruminal fluid were unsuccessful. Chlorate reduction occurs in bovine ruminal fluid, but dietary concentrate had negligible effect.

AGRO 18
Glyphosate-resistant weeds in North America: The reasons and future implications for US agriculture
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The excellent level of broad-spectrum weed control provided by glyphosate and the good to excellent agronomic performance of glyphosate-resistant crops led to rapid acceptance by producers across the US. As a result of this extensive use and the ability of glyphosate alone to provide almost total weed control, the selection for resistance was soon at unparalleled levels in the history of herbicide use patterns. Glyphosate-resistant weed resistance has only been confirmed in the US in North America. Weeds that have developed glyphosate-resistant weed biotypes include common ragweed (*Ambrosia artemisiifolia*), common waterhemp (*Amaranthus rudis*), horseweed (*Conyza canadensis*), Italian ryegrass (*Lolium multiflorum*), Palmer amaranth (*Amaranthus palmeri*), and rigid ryegrass (*Lolium rigidum*). It is anticipated that more resistant biotypes will be discovered in the next few years. The reasons and implications for glyphosate-resistance in the US will be discussed along with other weed species that may develop resistant biotypes.

AGRO 19
Glyphosate-resistant weeds of South America: An overview
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Herbicide resistance in weeds is an evolutionary event which results of two combining factors: intense selection pressure and genetically-diverse weed populations. In South America, orchard (Argentina, Brazil, Chile) and cereal-legume (Argentina, Brazil) production systems show a strong reliance on glyphosate use as a pre-plant and pre-emergence herbicide to control weed populations. This trend has been magnified in the last years given the massive adoption of no-till glyphosate-resistant (GR) soybean crops in Argentina mainly and in Brazil. These crops allow the use of glyphosate as an in-crop herbicide. This agricultural technology facilitates the conditions to make these cropping systems ecologically vulnerable for evolution of GR weeds. The first glyphosate-resistance cases include highly- and genetically-diverse, annual weeds (*Lolium multiflorum*, *Coniza bonariensis*, *C. canadensis*) after recurrent strong glyphosate selections in Chilean and Brazilian fruit productions. Recently, the appearance of GR *Sorghum halepense* and *Euphorbia heterophylla* populations in Argentinean and Brazilian GR soybean fields, respectively, are of major concern. The present review summarizes the current knowledge on the physiology, ecology, and agronomy of all the mentioned GR weeds.

AGRO 20
Glyphosate-resistant weeds in Australia, Asia, Africa, and Europe
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Glyphosate, introduced to world agriculture progressively from 1974, is the world's most important herbicide. Until the mid 1990s, glyphosate usage in cropping was for broad-spectrum (burn-down) weed control before annual crop seeding and inter-row weed control in perennial crop species. However, from 1996 with the development of transgenic, glyphosate-resistant crops, glyphosate has become an in-crop herbicide. Transgenic glyphosate-resistant crops now dominate North and South American cropping. Glyphosate has replaced other herbicides such that the annual usage of glyphosate is equal to the total value of the next eleven most popular herbicides used worldwide. Where glyphosate has been used for burn-down weed control, target weed species have been slow to evolve glyphosate resistance. This slow development of resistance likely indicates that weedy plant species cannot easily evolve glyphosate resistance and that sufficient diversity in these agro-ecosystems has minimized the emergence of glyphosate resistant weeds. Nevertheless, with persistent glyphosate use for burn-down weed control, glyphosate resistant weeds have been documented in many countries. There can be greater risks of glyphosate resistant weed evolution with transgenic glyphosate-resistant crops because there is high glyphosate reliance, minimal herbicide diversity and greater opportunity for glyphosate-surviving weeds to produce seed. This presentation will review glyphosate resistant weed developments in world agriculture, except for the Americas. The looming major glyphosate resistant weed problems in the Americas will be reviewed by others. Thus, glyphosate-resistant weed evolution in parts of Asia, Australia, Africa and Europe will be considered. Inferences for sustainable glyphosate usage will be drawn from comparisons of situations in which glyphosate resistance has or has not occurred. This information is important in addressing the looming epidemic of glyphosate-resistant weeds which poses a major sustainability challenge to the ongoing efficacy of glyphosate in world agriculture. This challenge must be addressed.

AGRO 21
Evaluating an altered target-site variant of EPSPS for glyphosate resistance
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The herbicide glyphosate has eleven resistant weeds globally that can be sorted into sets of higher (6-10X) and weaker (2-4X) levels of resistance. *Eleusine indica*, *Lolium rigidum*, and *Lolium multiflorum* in the weaker set have 5-enolpyruvylshikimate-3-phosphate synthases (EPSPS's) where proline 106 is replaced by serine, threonine, or alanine. These P106-variant EPSPS's slightly alter the target site where glyphosate is positioned as a transition state mimic. Proline 106 is not in this target site but is five amino acids removed in a connecting α-helix. We studied an EPSPS bearing T102I, P106A (ca. 300 fold less sensitive to glyphosate) using native promoters from *Arabidopsis* and *Z. mays*, respectively, to determine the level of glyphosate resistance. Transgenic plants expressing TIPA-EPSPS at native levels had 10-30 fold (R/S) vegetative tolerance to glyphosate, however, they were male sterile. Therefore, weeds expressing these P106 variants should only be slightly resistant unless there is an additional enabling resistance mechanism.

AGRO 22
Resistance to glyphosate from altered translocation patterns
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Glyphosate is a highly-mobile herbicide that normally translocates throughout the plant. The accumulation of glyphosate in meristematic tissue is required to kill a plant. Therefore, a constitutive reduction in glyphosate translocation to meristematic tissue could result in resistance to glyphosate. In a number of glyphosate-resistant *Lolium rigidum* populations a change in the translocation pattern of glyphosate was observed compared to susceptible plants. In the resistant plants, glyphosate was preferentially accumulated in the leaf tip; however, in susceptible plants, glyphosate accumulated preferentially in the stem and roots. A single dominant gene controls resistance to glyphosate and the altered glyphosate translocation pattern co-segregates with glyphosate. In at least two populations of glyphosate-resistant *Conyza canadensis*, a similar mechanism of resistance has been observed. In this case, reduced translocation of glyphosate to roots was observed. It appears likely that altered translocation patterns could be a common mechanism of resistance to glyphosate in weeds.

AGRO 23
Weed species shifts in GRCs
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The adoption of glyphosate-based crop production systems has been an important revolution in agriculture. Unfortunately, it is clear that the changes in weed communities to species that do not respond to current glyphosate-based management tactics are increasing at an increasing rate. However, it must be stated clearly that glyphosate-resistant crops (GRCs) by themselves do not influence weeds. Rather, the management decisions imposed by growers on the crop system, specifically the frequent use of glyphosate, create the ecological selection pressure that ultimately results in significant changes in the weed community. Examples of weed shifts in GRCs include, but are not limited to, Asiatic dayflower (*Commelina communis*), common lambsquarters (*Chenopodium album*), common waterhemp (*Amaranthus tuberculatus*), and morning glory species (*Ipomea spp.*). The changes in weed communities are inevitable unless due consideration is given to developing a diverse weed management program and to reducing the selection pressure imparted by the glyphosate-based management practices used.

AGRO 24
Synthesized pheromone summons female sea lamprey into traps
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We tested the efficacy of using synthesized male sea lamprey mating pheromone, 3-keto petromyzonol sulfate (3kPZS) to lure ovulating female sea lamprey (Petromyzon marinus) into traps and disrupt female orientation to natural pheromone sources. Female capture rates were determined in traps baited with 3kPZS and in unbaited traps. Traps baited with 3kPZS at 10^{-11} M, 10^{-12} M, and 10^{-13} M captured an average of 46% of females, which was significantly more than the 0 % capture rate in unbaited traps. We tested if background concentrations of 3kPZS could disrupt female orientation to natural pheromones produced by males (approximate 3kPZS = 10^{-12} M). When 3kPZS was applied at 10^{-11} M and 10^{-10} M, individual females spent significantly less time at the natural pheromone source and more females were unable to locate the natural pheromone source. Collectively, our results demonstrate for the first time that a single synthesized pheromone may be used to trap and disrupt pheromone communication in a vertebrate. Our results may spur the discovery of new pheromones useful in the management of vertebrate agricultural pests.

AGRO 25
Mosquito repellents: Studies on natural product structure-activity
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Recent studies conducted in the ISU Pesticide Toxicology Laboratory evaluated mosquito repellency to essential oil mixtures containing different repellents possessing spatial and contact activities. These essential oil mixtures yielded residual contact and spatial repellency effects. Sampling within the repellency bioassay chamber with solid-phase microextraction measured the distribution of volatiles and supported the differences observed in spatial and contact repellency between treatments. Current research efforts are attempting to understand the specific chemical characteristics of active ingredients and mixtures (i.e. structure-activity as it relates to potency and spectrum of activity). Basic studies on natural product chemistries are needed to optimize efficacy and safety for use in pest management.

AGRO 26
Solving the mystery of ladybug's noxious odor
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Homeowners, small fruit growers, and wine makers are concerned with noxious compounds released by multicolored Asian ladybird beetles (*Harmonia axyridis, Coccinellidae*). Headspace solid phase microextraction coupled with multidimensional gas chromatography mass spectrometry – olfactometry (MDGC-MS-O) system was employed for rapid extraction, isolation and identification of compounds responsible for the characteristic odor of live *H. axyridis*. Thirty eight compounds were identified from headspace of live *H. axyridis* including four characteristic odorous compounds-2, 5-dimethyl-3-methoxypyrazine (DMMP); 2-isopropyl-3-methoxypyrazine (IPMP); 2-*sec*-butyl-3-methoxypyrazine (SBMP); and 2-isobutyl-3-methoxypyrazine (IBMP). This is the first report of H. axyridis releasing DMMP which is a component of the *H. axyridis'* characteristic odor. And this study also provided the first unambiguous evidence that IPMP is present in and is responsible for the characteristic odor of live H. axyridis. Quantification of three methoxypyrazines (MPs) (IPMP, SBMP and IBMP) were performed using external calibration. The proposed method was applied to the determination of the amount of three MPs emitted from live *H. axyridis*.

AGRO 27
Conjugated linoleic acid: A potential insect control agent
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Non-target pest toxicity, environmental persistence, and mammalian neurotoxicity of the traditional pesticides have initiated a push for more environmentally friendly, biorational pest control products. The natural product conjugated linoleic acid (CLA) was evaluated for insecticidal activity against the European corn borer (ECB). The effects of dietary CLA (*cis*-9, *trans*-11 and *trans*-10, *cis*-12 isomers) on ECB survival, fatty acid profiles, adult fecundity and egg fertility were studied. The survival of ECB neonates to the pupal and adult stage was decreased by 92% and 98%, respectively, at the 0.60% CLA (wt/vol) diet as compared to controls. CLA isomers were incorporated in pupal and adult tissues. Saturated fatty acids increased and monounsaturated fatty acids decreased in pupae and adults fed CLA diets, indicating an inhibition of the Δ9-desaturase. Linolenic acid was decreased in pupae and was not detected in adults reared on a 0.20% CLA (wt/vol) diet. Adult fecundity and egg fertility were not affected in ECB reared on 0.05, 0.10, or 0.20% CLA (wt/vol) diets.

AGRO 28
Investigating the mechanisms of glyphosate resistance in *Lolium multiflorum*
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The mechanisms conferring glyphosate resistance in two different *Lolium multiflorum* populations were studied. Based on a whole-plant dose-response bioassay, both OR and SF resistant populations are fivefold more resistant to glyphosate than the susceptible population. More shikimic acid accumulated in leaf tissue of the susceptible population when compared to the resistant populations after glyphosate treatment. cDNA sequence analysis indicated that the SF population has a proline 106 to serine amino acid substitution. There were no differences between the susceptible and the resistant populations in glyphosate leaf uptake; however, patterns of glyphosate translocation were different. In the OR population, more glyphosate accumulated in the tip of the treated leaf, whereas in the susceptible and in the SF population, more glyphosate accumulated in the non-treated leaves and the stem. Here, we report that glyphosate resistance in *L. multiflorum* is conferred by both target and nontarget site-based mechanisms.

AGRO 29
Chemical and biological availabilities of sediment-associated pyrethroid insecticides
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Two chemical approaches, Tenax extraction and Matrix solid phase microextraction (Matrix-SPME) were evaluated as potential alternatives to biological tests to measure the bioaccessibility of spiked radiolabelled pyrethroid insecticides, including bifenthrin, λ-cyhalothrin and permethrin, from two sediments different in characteristics to the freshwater oligochaete, Lumbriculus variegatus. Both chemical methods provided matrix- and chemical-independent estimates of bioavailability for these pyrethroid insecticides. The single point Tenax extraction at 6 h was the simplest and quickest screen for bioavailability of pyrethroids from sediment, while Matrix-SPME directly measured the freely dissolved pyrethroids in sediment pore-water and in turn, allowed for estimating the body residues within the organisms. The validated chemical approaches were then used to measure the bioavailability of pyrethroids from field-collected sediments with unexplained toxicity.

AGRO 30
Herbicide-induced hypoxic stress and hemoglobin gene regulation in an aquatic insect
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Atrazine is an extensively used herbicide and has been routinely detected in many surface and ground waters in the United States. We used a genomics-based technique known as restriction fragment differential display (RFDD)-PCR to systematically compare gene expression profiles between atrazine-treated and –untreated (i.e., control) larvae of the aquatic midge (*Chironomus tentans*) and revealed various up- and down-regulated genes associated with hypoxic stress in atrazine-treated midges. We isolated two down-regulated hemoglobin (Hb) cDNAs from atrazine-treated midges. Northern blot analysis showed that the expression of Hb genes was significantly lower in atrazine-treated midges than that in the control following 96-h exposure. In contrast, atrazine significantly enhanced oxygen consumption in a time- and concentration-dependent manner in atrazine-treated midges. Apparently, atrazine exposure results in increased oxygen consumption, leading to a hypoxic stress in the affected midges. Our study provides insights into the physiological risk that atrazine imposes upon non-target organisms.

AGRO 31
Development of methods to determine the aquatic fate and non-target effects of transgenic Bt proteins on aquatic invertebrates: Toward risk assessment
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Transgenic crops containing *Bacillus thuringiensis* (Bt) insecticidal crystalline (Cry) proteins were introduced in 1996. Thus far, there are few quantitative data concerning Bt protein fate and effects in aquatic systems, despite

multiple conceivable routes of transport. Laboratory studies were conducted to develop methods to determine the aerobic aquatic fate and non-target effects of Bt proteins on aquatic invertebrates. Enclosed microcosms containing corn leaf and stalk residue were used to examine the aerobic aquatic fate of Bt Cry1F protein. A short half-life was observed for Bt Cry1F, ranging from 0.7 to 2.6 days in leaf and stalk. Larvae of the aquatic midge, *Chironomus dilutus*, were fed corn root extracts expressing Bt Cry3Bb1 protein in a 10-day study. There was a significant decrease in survival for two treatments containing the highest volume of root extract, but there was no effect on larval growth. Additional studies must be conducted in order to assess the risk of transgenic Bt proteins to aquatic invertebrates.

AGRO 32
Fate of chlorate salts excreted from animals
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A new pre-harvest food safety technology, based upon the oral administration of chlorate to food animals, selectively eliminates gram-negative pathogens such as *E. coli* O157:H7 and *Salmonella* species in economically-important livestock species. Residue trials have demonstrated that chlorate salts are rapidly and extensively eliminated as parent chlorate in the excreta of cattle, swine, and broilers. Under proposed dosing regimens, environmental burdens of excreted chlorate could be significant, especially in areas of intensive farming. Chlorate is highly water soluble and its transport through soil columns was not restricted by a variety of soils. In soil batch studies, chlorate was sparingly converted to chloride ion by a few soil types. In batch studies utilizing a mixture of soil, urine, and feces, chlorate was rapidly reduced to chloride under aerobic and anaerobic conditions. Rapid reduction under *in vitro* conditions implies a short environmental half-life of chlorate under most waste-management systems.

AGRO 33
Mobility of a veterinary antibiotic tylosin in agricultural soil columns
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There is a growing concern about the persistence and impact of antibiotics after they are released in the environment. The veterinary antibiotic tylosin is of particular interest due to its wide use in livestock production. A column leaching study was carried out over a period of four weeks to determine mobility of tylosin in agricultural soils, alone, or amended with hog manure. Three types of soils (Hanlon, Nicollet-Webster, and Canisteo) were used to make packed soil columns for assessing transformation and mobility of tylosin in the laboratory. After simulated rain events, the collected leachates were subjected to analysis after purification and enrichment. At the end of the test period, each column was divided into three equal sections. Soil from each section was mixed well, and two aliquots from each section were extracted. Parent and metabolites were detected and quantified by an HPLC method. The results were compared with those from an intact soil column study.

AGRO 34
Comparative biotransformation of fluoroquinolone antibiotics in matrices of agricultural relevance
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Fluoroquinolones are important antibiotics used to treat bacterial infections in humans and animals. Residues enter the environment via urine and feces. In a soil degradation study with [2-^{14}C]sarafloxacin, only ≤0.6% $^{14}CO_2$ was released within 80 days. Similar findings for enrofloxacin (ENR), the first veterinary fluoroquinolone, prompted our investigation of its fate in matrices of agricultural relevance. Pure cultures of basidiomycetous fungi on wheat straw released ≤50% $^{14}CO_2$ from [4-^{14}C]ENR within 8 weeks. However, in samples of pre-rotted wheat straw, cattle dung pats, a manure hill, and two agricultural soils, only about 0.5 to 1% $^{14}CO_2$ was produced from [4-^{14}C]ENR during the first year, while rates from the [2',3'-^{14}C]piperazine substituent were in the order of 7 to 40%. Finally, complete biotransformation of [4-^{14}C]ENR in two soils, plant-derived humus and cattle dung was demonstrated by recording the fate of [4-^{14}C]-labeled parent drug ($t_{1/2}$ = 83-113 days). The identified metabolites were microbiologically inactive.

AGRO 35
Abiotic transformation of tetracycline antibiotics in a natural surface water and in the presence of MnO_2
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Tetracycline antibiotics used in animal husbandry have been reported as contaminants in surface waters and sediments. Here, we investigate the transformation of these bacterial protein synthesis inhibitors in a natural surface water and in the presence of hydrous manganese oxide (MnO_2). Oxytetracycline and chlortetracycline were incubated separately for 20 d at 10°C in the absence and presence of MnO_2 in sodium acetate/MOPS buffer and in pond water (pH 8). In the absence of MnO_2, chlortetracycline underwent substantial transformation to *iso*-chlortetracycline in buffered laboratory water; transformation was considerably less in the pond water. In the presence of MnO_2, both chlortetracycline and oxytetracycline were rapidly transformed to a variety of products in the buffered laboratory water. In pond water, the effect of MnO_2 addition was less pronounced, although a larger variety of products were formed. Factors responsible for the diminished reactivity of MnO_2 in pond water will be discussed.

AGRO 36
Livestock hormones in the environment
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Livestock manure may contain both endogenous and synthetic steroid hormones. The latter are used as growth hormones in livestock. This presentation reviews hormone use in livestock, transport, and fate of hormones to the environment, effects of hormones in humans and wildlife, and future research needs. The growth hormones approved for use are trenbolone acetate, zeranol, and melegestrol acetate. Hormones are excreted in the feces or urine and are transported to aquatic environments through run-off of land-applied manure. Sorption and degradation are the primary mechanisms of removal of hormones from the environment. Endogenous hormones sorb strongly to soils and degrade quickly under aerobic conditions, while synthetic growth hormones are persistent in the environment. Both types of hormones are extremely potent and may cause adverse reproductive effects at concentrations less than 10 ng/L. Future research emphasis should include the effects of sediments on aquatic species and the occurrence of growth hormones and testosterone in the environment and meat products.

AGRO 37
CAFOs and emerging contaminants: Research by the USGS TOXICS Program
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Research is documenting with increasing frequency that many chemicals (e.g., human and veterinary pharmaceuticals, hormones, fragrances, etc.) that have not historically been considered as contaminants are present in a variety of environments across the world. These emerging contaminants (ECs) are commonly detected in municipal, agricultural, and industrial wastewater sources. Since 1998, the United States Geological Survey (USGS) Emerging Contaminants Project (http://toxics.usgs.gov/regional/emc/index.html) has been conducting holistic source to receptor research on this rapidly advancing topic. The primary objectives of this project are: (1) to develop the analytical tools required for detecting ECs in the environment; (2) to document the occurrence, concentration, and composition of ECs in the environment; (3) to characterize contaminant sources and their potential pathways into the environment; (4) to determine processes and factors that affect the transport and fate of ECs; and (5) to assess the potential deleterious effects of ECs and complex mixtures of ECs on aquatic and terrestrial organisms and ecosystems. To carry out these research objectives, an interdisciplinary team of scientists has been assembled. The overall mission of this U.S. Geological Survey research is to provide reliable scientific data and information on ECs needed by regulators, resource managers, industry, and the public to make sound decisions about the use, disposal, and general management of these chemicals.

AGRO 38
Simulation modeling to aid in glyphosate-resistance management
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The evolution of resistance to glyphosate is a complex phenomenon under the control of interacting cultural, biological, and genetic parameters. Simulation models are useful tools to integrate these parameters to explore the key drivers for the evolution of resistance. They also provide a means to compare the efficacy of glyphosate-resistance management strategies. Using evolution of glyphosate resistance in Australian, populations of *Lolium rigidum* as an example, I will demonstrate the utility of models: i) to understand the biology of resistance; ii) to identify gaps in knowledge and highlight research priorities; iii) to design and to assess management strategies to minimise risks of resistance; and iv) to assess the potential impact of glyphosate-resistant crops on resistance evolution. Modeling outcomes and management principles will have application beyond the Australian experience.

AGRO 39
Sustainable use of glyphosate in North American cropping systems
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Monsanto has a broad internal and external effort to develop and tomimplement sustainable weed-control practices to help limit the spread of existing glyphosate-resistant biotypes and avoid selecting new ones. The goal of Monsanto's ongoing sustainability trials is to measure directly the net economic return to the grower among multiple weed control options. The options include factors other than choice of herbicide, such as tillage and crop rotation. As the results of these trials become available, the information will be published and incorporated into updated grower recommendations. Obviously, if additional species become resistant which are not the current subjects of these particular trials, weed control options for those other biotypes will be communicated as soon as the information is known. To date, this has worked quite effectively, suggesting that continuous Roundup Ready® cropping systems in North America can be managed in a sustainable manner.

AGRO 40
Sustaining glyphosate in South American cropping system
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South America represents about 12% of the global land area, and Brazil represents roughly 47% of that. The major sustainable agricultural system is based on a no-tillage system with GRCs (glyphosate-resistant crops) predicted as a major components. Societal benefits of glyphosate in the system include greater use of conservation tillage which reduces soil erosion and associated loading of pesticides, nutrients, and sediments into the environment. However, over-reliance on glyphosate and simpler cropping systems has led to weed shifts (WS) and herbicide-resistant (HR)

weeds. Research has been initiated to support farmers in cropping systems that fail to follow IPM tactics which results in WS and HR weeds (e.g., Italian ryegrass in Brazil and Chile, horseweed and wild poinsettia in Brazil, and johnsongrass in Argentina). Designing herbicide and non-herbicide strategies that effectively delay/manage HR weeds and undesirable WS in cropping systems based on recurrent glyphosate application is a challenge in South America.

AGRO 41
Managing the risk of glyphosate resistance in Australian glyphosate-resistant cotton production systems
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Glyphosate-resistant cotton varieties are now an important tool for weed control in Australian cotton production systems. To minimize the likelihood of resistance developing through the use of these new technologies, and to protect their sustainability, weed scientists, together with herbicide regulators, industry representatives, and the technology owners have developed a framework that guides the use of the technology. Central to this framework are a crop management plan (CMP) and a grower accreditation course. Simulation models which take into account the characteristics of the weed species, initial gene frequencies, and any associated fitness penalties are utilized to ensure that the CMP developed is sufficiently robust to minimize resistance risks. The simulations showed that when a combination of weed control options was employed in addition to glyphosate, resistance did not evolve over the 30 year period of the simulation. This underlines the importance of maintaining an integrated strategy for weed management to prevent glyphosate resistance evolving, and therefore prolonging the use of glyphosate-resistant cotton.

AGRO 42
Impacts of conservation crop production systems on soil and water resources: Glyphosate-resistant crops (GRCs) are part of the management toolbox
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From an environmental perspective, conservation management (e.g., reduced tillage, cover crops, crop rotation) is used to reduce runoff loss and improve soil conditions. A body of research is building concerning effects of conservation management on the environment, and many studies include GRCs or glyphosate as management components. However, virtually nothing has been published concerning joint impacts of conservation management and GRCs on environmental quality. This paper draws on research evaluating environmental impacts of conservation systems that include GR cotton, corn, and soybeans. In a long-term Mississippi study evaluating effects of conventional or glyphosate-based weed management under various corn-cotton cropping systems, continuous GR corn maintained greater soil organic carbon and nitrogen compared to conventional corn. Soil microbial community structure based on total fatty acid methyl ester (FAME) analysis indicated branched FAMEs, representing Gram-positive bacteria, and a mycorrhizal FAME were positively correlated with a conventional-herbicide system and saturated fatty acids were negatively correlated.

AGRO 43
Disease control activities of glyphosate in glyphosate-resistant crops
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The herbicidal activity of glyphosate is derived from inhibition of 5-enolpyruvylshikimate-3-phosphate synthase, a key enzyme in the synthesis of aromatic amino acids in plants, fungi, and bacteria. Recent studies in glyphosate-resistant crops have shown that in addition to its herbicidal activity, glyphosate may also exhibit activity against fungi thereby providing disease control benefits. This presentation will summarize our work in glyphosate-resistant wheat demonstrating that glyphosate has both preventive and curative activities against *Puccinia striiformis* and *Puccinia triticina*, which cause stripe and leaf rusts in wheat, respectively. We will also summarize our recent results from growth chamber studies in South Africa and field studies in South America that confirm the activity of glyphosate against *Phakopsora pachyrhizi* which causes Asian soybean rust.

AGRO 44
Environmental risk assessment of tylosin, narasin, and monensin
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Tylosin, narasin, and monensin are fermentation-derived antimicrobial agents approved for use in food animals for therapeutic purposes and/or for improved performance. In order to assess the environmental risk of use of these compounds, the physical-chemical characteristics, environmental fate, and ecotoxicity have been determined. Tylosin is very water soluble (5 g/L), has a log K_{ow} < 1.5 and has a log K_{oc} ranging from 2.3 to 3.3. Monensin and narasin have lower water solubility values (5 to 700 µg/L) and correspondingly greater log K_{ow} and log K_{oc} values than tylosin. The $t_{½}$ for degradation in soil is 13 to 15 days, 21 to 49 days, and 50 to 105 days for monensin, narasin, and tylosin, respectively. The three compounds are moderately toxic (monensin and narasin) or practically nontoxic (tylosin) to plants, fish, daphnids, birds, and earthworms in acute studies. However, all three compounds are more toxic to algae. The predicted environmental concentrations as well as those reported in the literature are low. Tylosin, narasin, and monensin do not appear to be a significant risk to the environment based on comparison of the environmental concentrations and the predicted no effect concentrations.

AGRO 45
Risks of agricultural pharmaceuticals in surface waters and soil
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We studied the geographic and temporal distribution of pharmaceuticals in a model watershed in Southern Ontario, Canada. Temporal concentration trends for five pharmaceuticals showed pulses occurring between May and November at similar but varying times. Compared to acute toxicity values and distributions of potency, the pharmaceuticals detected in the surface waters present small risks to aquatic organisms from acute effects. Effects on population and community responses in microcosms support the observation of low risk to the environment. Bioassays of twelve pharmaceuticals on the arbuscular mycorrhizal fungi, *Glomus intraradices* grown on *Daucus carota* root organ cultures showed that sulfamethoxazole was the most toxic to both the fungi and roots, with EC_{50} values of 67 and 57 µg/L, respectively. Root organ cultures are useful media to evaluate chemical stressors on arbuscular mycorrhizal fungi and to screen for root-based phytotoxicity. Risks to plants and mycorrhizal fungi from estimated environmental concentrations were small.

AGRO 46
Characterization of chlortetracycline-induced glutathione S-transferase to conjugate chloroacetanilide and chlorotriazine herbicides
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Chlortetracycline (CTC) is a commonly used antibiotic in animal husbandry. A majority of the antibiotic passes through the animal non-metabolized. When antibiotic-containing manure is applied to crop fields as fertilizer, the antibiotics may be taken up by crops and elicit phytotoxic effects in certain crops. Our study showed that soil amended with CTC induces expression of glutathione S-transferases (GST) in maize. *In vitro* reactions showed that GST from CTC-induced maize catalyzes the conjugation of CTC with glutathione. Analysis of reaction products by liquid chromatography/ion-trap mass spectrometry (LC/IT-MS) allowed the identification of stable CTC products conjugated with glutathione (GSH). Purified GSTs isolated from maize treated with CTC were able to produce nearly twice as much conjugated product relative to the GSTs isolated from non-treated control plants. Due to the prevalence of antibiotics in the environment, this work has raised concerns with regard to the potential of inducing herbicide resistance among target weeds when weeds are exposed to antibiotics. Herbicide detoxification via glutathione conjugations catalyzed by GSTs has been well documented and is one of the main determinants of plant susceptibility to herbicides. When GSTs isolated from maize control and CTC-treated plants were added to separate *in vitro* reactions containing three chloroacetanilide herbicides (metolachlor, propachlor, and alachlor) and one chlorotriazine herbicide (atrazine), the GSTs from the CTC-treated maize showed a reduced ability to conjugate the herbicides. Based on *in vitro* reactions, it appears that the GST isoform induced in CTC-treated maize has high specific activity towards CTC conjugation to glutathione.

AGRO 47
Risk assessment considerations for veterinary medicines in aquatic ecosystems
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In the United States, the European Union, Australia/New Zealand and Japan, prospective ecological risks of veterinary medicines are deterministically assessed following guidelines from the International Cooperation on Harmonization of Technical Requirements for Registration of Veterinary Medicinal Products; however, no regulatory framework is available for retrospective risk assessments of these compounds. This presentation provides a critical evaluation of prospective and retrospective risk assessment approaches for veterinary medicines in aquatic ecosystems and provides recommendations for alternative approaches for hazard characterization. Although existing prospective risk assessment approaches include tiered testing, aquatic hazard information is generated from standardized toxicity tests and subsequent application of uncertainty factors. These approaches are not, however, adequate to characterize aquatic risks for select compounds (e.g., trenbolone). Because veterinary medicines often have specific biological properties that are identified during the drug development process, specific assay types and species chosen for hazard assessment should consider known vertebrate information and extrapolation across species for modes of action. In addition, probabilistic approaches and lentic and lotic mesocosm studies are useful for higher tiered risk assessment of veterinary medicines.

AGRO 48
Targets, effects and risks in aquatic plants exposed to veterinary antibiotics
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Common receptors have been identified in plants for a number of heavily-used veterinary antibiotics affecting transcription and translation (tetracyclines macrolides, lincosamides, α-aminoglycosides, and pleuromutilins), metabolic pathways such as folate biosynthesis (sulfonamides), and fatty acid biosynthesis (triclosan). The demonstration of conserved receptors and pathways in plants is not surprising, although it has been largely overlooked in the risk assessment process to date, which typically relies heavily on physiological endpoints for deriving toxicity data. Although no significant risks were identified for higher plants, potential risks were identified for blue-green algae, where *Microcystis aeruginosa* was found to be highly susceptible to aminoglycoside, pleuromutilin, macrolide, α-lactam and tetracycline antibiotics and *Anabaena flos-aquae* indicated potential risks from exposure to triclosan. The green algal species *Selenastrum capricornutum* and *Scenedesmus subspicatus* also showed potential risks from

exposure to triclosan as well as the macrolide clarithromycin using the US FDA hazard quotient approach for pharmaceuticals.

AGRO 49
From laboratory results to field findings: Perception vs. reality on the effects of veterinary medicinal products (VMPs) toward non-target organisms
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Potential ecological effects of veterinary medicinal products (VMPs) are initially evaluated using the test results obtained from laboratory-scale experiments. However, the perceptions formed at this stage about the VMP's environmental impact on non-target organisms may be altered significantly when the reality in the field is examined. Ecosystems are not static, and many factors in nature may contribute to the overall ecological effects of a VMP. Unlike products that are introduced directly into the environment, VMPs are in most cases, metabolized by animals before being introduced into the environment. Exposure of sensitive non-target organisms to potentially injurious residues typically also depends, both spatially and temporally, upon actual use patterns in the landscape and upon the phenology and habitat preferences of the species at risk. Examples will be provided to illustrate how the prediction of environmental effects from laboratory results may be different from the field findings if biological and ecological factors are not taken into consideration.

AGRO 50
Risks from veterinary medicines in the environment to humans and ecosystems
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Veterinary medicines play an important role in the treatment and prevention of disease. While the side effects on human and animal health have been widely documented, only recently have the potential environmental impacts of medicines been considered. In this study, information from laboratory, semi-field, and field environmental-fate investigations was used alongside modelling approaches to characterize environmental exposure to veterinary medicines. Information on ecotoxicity was then applied to assess the potential risks to the health of aquatic and terrestrial ecosystems. Potential indirect effects on human health were also explored. The results indicate that for single active substances, exposure concentrations are generally below levels likely to cause effects on ecosystems or humans. However, the real environment will be exposed to a mixture of substances and their transformation products, and subtle effects such as the selection of antibiotic resistance might also be possible. These areas should be more thoroughly investigated in the future.

AGRO 51
Pollen vs. seed movement: Gene migration from glyphosate-resistant crops
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Gene migration, by pollen and seed, from glyphosate-resistant crops has occurred and continues to occur. Gene migration via pollen movement requires the existence of compatible species in both space and time. If a compatible species is present and has receptive flowers, gene migration can occur and produce a glyphosate-resistant offspring. The success of that offspring will depend on the hybridization potential between the species. Gene migration via seed movement is easier than through pollen movement because no compatible relative is required. Seeds are moved greater distances than pollen because they do not have the issue of short term viability that pollen has. Gene migration through seed movement will be even more difficult to contain than gene migration through pollen movement, in part because of seed dormancy and the subsequent seed bank formation and in part because seed movement is a function of the production system.

AGRO 52
Fate of glyphosate in soil and the possibility of leaching to ground and surface waters
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In soils, glyphosate can be inactivated by sorption and degradation. Both processes are strongly soil dependent. Glyphosate is fast and strongly bonded by variable-charge soil minerals, primarily aluminium and iron oxides. Glyphosate and phosphate may compete for sorption sites indicating risk of glyphosate leaching in agricultural soils saturated by phosphate because of surplus phosphate-fertilization. However, on most soils this competition seems modest indicating negligible glyphosate leaching in homogenous, non-fractured soils, while by-pass flow in fractured soils may lead to transport of glyphosate (and phosphate), and hence water pollution. Glyphosate degradation in soil is a microbially-mediated process and the extent depends on the soil type. Mineralization (complete degradation) has been found to correlate with the number of *Pseudomonas spp.* bacteria, but also with other microbial and chemical properties of the soils.

AGRO 53
Safety assessment of GR genes in food and feed
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The food and feed safety of biotechnology products such as glyphosate tolerant crops is established through a series of comprehensive studies. These studies evaluate the safety of the newly introduced protein and determine if the modified crop is as safe as conventional food/feed (substantial equivalence). The safety of the protein is established by a number of analyses including bioinformatic searches to assess similarity to known protein toxins/allergens, an *in vitro* digestibility study, and an acute mouse toxicity study. To establish substantial equivalence, the composition of the modified crop is compared to its conventional counterpart by assessing a wide variety of nutrients and anti-nutrients. In addition, animal feed performance and subchronic toxicity studies are conducted to confirm that the modified crop is nutritionally equivalent and does not produce adverse effects. Finally, the toxicological implications of metabolites formed by the action of the introduced enzyme on the herbicide or endogenous substrates must also be evaluated.

AGRO 54
Assessing the environmental consequences of glyphosate-resistant weeds in the US
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With the emergence of glyphosate-resistant (GR) weeds, the issue of alternatives to GR technology and their environmental consequences is of increasing importance. We previously presented an environmental indicator based on a standardized, well-known, acute mammalian toxicity measure, the LD_{50} dose for rats. This indicator allows for consistent aggregation of a specific environmental effect across many different pesticides. The study predicted that the use of GR soybean in the US Midwest reduces negative environmental effects of soybean production. In the present paper, we use the LD_{50} indicator with data from the USDA Agricultural Resource Management Survey to revisit the issue of the environmental effects of GR soybeans and to expand the analysis to include GR corn and cotton. Using an average treatments regression model, we identify the relative importance of different determinants of LD_{50} dose levels from herbicide use and the impact on those levels of not being able to use GR crops.

AGRO 55
Comparison of environmental effects of glyphosate-resistant crops vs. what they replace in Europe
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The commercial cultivation of genetically-modified, glyphosate-resistant crops, such as soybeans, occurs in some parts of Europe. In other parts of Europe, these crops have reached the field testing phase. For example, the large-scale, three-year field trials of the British Farm Scale Evaluations assessed the ecological effects of different herbicide regimes applied to three genetically-modified, herbicide-resistant crops, including glyphosate-resistant beets, on crops, invertebrates, and weeds, both in the fields and in their surroundings. Other studies predict the changes in the amounts of herbicides and other inputs used on crops if glyphosate-resistant crops are to replace conventional ones in Europe. Some studies also focus on the possible environmental effects associated with these predicted changes in inputs. These environmental effects can be expressed qualitatively and quantitatively using various calculation methods, while their scope may be either narrow or broad. Regional and national differences within Europe have to be taken into account.

AGRO 56
Glyphosate and hormesis: Environmental implications
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Glyphosate blocks the shikimic acid pathway inhibiting the production of several compounds involved with defense to pathogens, growth regulation, and allelopathic effects. Glyphosate is a herbicide used world-wide in conventional and no-tillage systems. Non-target plants can be exposed to low rates of glyphosate by herbicide drift of spray droplets and contact with treated weeds. In sugarcane, glyphosate is already applied at low rates (50 to 100g /ha) as a pre-harvest growth regulator and young plants growing after the harvest exhibit bleaching symptoms probably due to the inhibition of tyrosine synthesis. We summarize the information from several studies about the effects of low rates of glyphosate on plant growth and the synthesis of salicylic acid and pigments. Except for glyphosate-resistant soybean, growth of all plants was stimulated by 1.8 to 36 g of glyphosate/ha. Field and wind-tunnel assays showed that tallow-amine surfactants increased the drift and possible environmental effects of glyphosate.

AGRO 57
Evaluation of the fate of erythromycin A in aquaculture sediments
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Erythromycin A is one of the most widely-used antibiotics in animals and fish as well as in humans. It mimics aminoacyl tRNA that binds to bacterial 23S ribosome. The molecule consists of a 14-membered macrocyclic lactone, a neutral sugar, and a tertiary aminosugar. Erythromycin A used in aquaculture underwent various degradation pathways: i) acid/base-catalyzed hydrolysis; ii) intramoleuclar dehydration; iii) C13 to C11 translactonization; iv) clay/clay mineral-catalyzed degradation; and v) lactone hydrolysis catalyzed by erythromycin esterase (e.g., type EreA2). In the sediment microcosms, it displayed the logistic mineralization curves with the rate constants of 0.060-0.17 day^{-1} after a prolonged lag time which could be due to the low density of initially metabolizing microorganisms. From the geochemical and enzymatical degradation (inactivation) of erythromycin A, the aminosugar moiety remained intact,

so the derivatives were sensitively determined by LC-electrochemical detection in an oxidative mode or by LC-mass spectrometry in a positive ion-selected mode. The quaternary ammonium ions were strongly adsorbed to soil by cation exchange. The thermodynamically-favored formation of erythromycin-soil complexes might have effects not only in lowering concentration of antibiotics accessible to microorganisms, but also in accelerating the degradation by the acidity of clay surface. A slow rate of desorption of soil-sorbed erythromycin A (1.5 to 4 nmol/g-soil/day) resulted in no (or little) changes in the total microbial populations, but the prolonged exposure appeared to have a potential impact on the development of erythromycin resistant ereA2 gene-harboring pseudomonad and the horizontal gene transfer to other species particularly in an antibiotic-untreated sediment.

AGRO 58
Bioavailability of veterinary antibiotics in surface water
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Veterinary antibiotics are commonly used as feed additives in livestock production for growth promotion and disease prevention. These pharmaceuticals are often excreted by the livestock in urine and feces, and enter the environment via manure application. Little is known about the fate of veterinary antibiotics in terrestrial and aquatic ecosystems. Understanding the bioavailability of pharmaceuticals in environmental matrices is particularly important considering they are often in an active form. In this study, the bioavailabilities of radiolabeled erythromycin and sulfamethazine in water microcosms were evaluated using C8-Empore™ extraction disks as passive sampling devices and *Lumbriculus variegatus* in a bioassay. The disks and worms were incubated in treated water at several time points. At the end of the study, the disks and worms were extracted and the amount of radioactivity was determined. These were compared to levels in the water to determine bioaccumulation.

AGRO 59
Oxytetracycline at environmental interfaces studied by nonlinear optics
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The binding behavior of the veterinary antibiotic oxytetracycline (OTC) towards tailor-made environmental interfaces was investigated using the surface-specific laser spectroscopy technique second harmonic generation (SHG). The combination of synthesis and advanced laser spectroscopy allows us to isolate and measure the interaction of OTC with specific binding sites. We find that the strength of OTC adsorption depends on the moieties present at the functionalized fused quartz/water model interfaces indicating that OTC mobility in the environment is highly dependent on the chemical composition of natural organic matter in soils. A straightforward method of using contact angle measurements to predict OTC mobility across humic-acid containing mineral/water interfaces is proposed in the context of the emerging bacterial antibiotic-resistance development threat.

AGRO 60
Sorption, fate, and transport of endogenous steroid hormones in soils
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The natural hormones 17β-estradiol (E2) and testosterone (T) are present in animal manures that are applied to agricultural land as fertilizer, and potentially may act as endocrine disruptors. Laboratory incubation, batch, and column experiments have been conducted on a series of soils, and were used to interpret three years of field observations. In general, hormones were strongly bound to soil, and sorption of E2 and T could be correlated with organic matter and particle size. Lab incubation experiments indicated that degradation was primarily microbial. Transport of E2 and T was minimal in both disturbed and undisturbed soil columns. Variable concentrations of both hormones were detected in field lysimeters and wells. The field soil was sandy, subject to high water-table fluctuations and periodic anaerobic conditions, and all affected hormone detections. It is hypothesized that E2 present in animal waste would have the potential to persist under anaerobic conditions in sandy soil and have limited mobility, but that E2 and T would degrade under aerobic conditions.

AGRO 61
Sorption behaviors and binding mechanisms of ibuprofen with Al and Fe oxides and kaolinite
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In this study, we conducted a series of sorption experiments to examine the sorption behaviors and binding mechanisms of ibuprofen on the surface of Fe and Al oxides and kaolinite. The preliminary results indicate that ibuprofen shows a sharp sorption maximum on alumina at pH of 4.2-4.5. The maximum shifts to lower pH values of <3.0 for ibuprofen sorption on hematite and kaolinite. Using surface complexation theory, we have determined that the sorption maximum arises from carboxylic acid group of ibuprofen replacing a singly-coordinated surface hydroxyl to form a monodentate complex on the oxide and kaolinite surface. We also have observed the affinity of alumina for ibuprofen increases with increased amount of adsorbed ibuprofen but the affinity is still pH dependent. The results seem to suggest that ibuprofen is probably adsorbed as monodentate complexes at low concentration while as a chemically-bound micelle as the concentration increases.

AGRO 62

Degradation and bioavailability of sulfamethazine in pond water microcosms

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The antibiotic sulfamethazine can be transported from manured fields to farm ponds. We investigated the degradation and fate of sulfamethazine in small pond water microcosms. ^{14}C-phenyl-sulfamethazine was added to the pond water column in a swine manure slurry or in water. Residual concentrations in water and sediment were measured over a 63-day period. Sulfamethazine uptake by *Lumbriculus variegatus* was measured in the initial 14 days as an indicator of bioavailability.

AGRO 63

Effect of nonionic surfactants on the oxidation of carbaryl by anodic Fenton treatment

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As a potentially promising technology, anodic Fenton treatment (AFT) has been shown to be very successful in pesticide removal. However, the influence of other constituents in the pesticide formulation, such as nonionic surfactants, has not been addressed. In this study, the effect of Triton X (TX) on the degradation kinetics and pathways of carbaryl undergoing AFT was investigated in an effort to facilitate its practical application. The presence of Triton X-100 was found to slow down the carbaryl degradation rate. This result can be attributed to the consumption of hydroxyl radicals (•OH) by surfactants and the formation of a carbaryl•••TX•••Fe^{3+} complex, resulting in the unavailability of carbaryl to •OH attack. The modified AFT kinetic model, previously developed in this laboratory, shows an excellent fit to the carbaryl degradation profile (R^2>0.998), supporting the formation of the carbaryl•••TX•••Fe^{3+} complex. The carbaryl degradation rate decreased as Triton X-100 concentration increased from 20 to 1000 mg/L. Both •OH consumption by surfactants and complex formation are responsible for the degradation rate reduction below the critical micelle concentration (CMC), whereas the complex and micelle formation becomes a more dominant factor above the CMC. The effect of ethylene oxide (EO) numbers of a given nonionic surfactant mainly lies in the consumption of hydroxyl radicals, which increases with the length of EO chain, but does not significantly affect the formation of carbaryl•••TX•••Fe^{3+} complex. Based on the GC-MS and LC-ESI-MS results, no evidence was found that carbaryl degradation pathway was affected. Carbaryl was typically oxidized to 1-naphthol and 1,4-naphthoquinone similar to what is observed in the absence of surfactants. Triton X-100 was degraded via the breakdown of EO chains and oxidation of the terminal methyl group, which resulted in the production of a series of ethoxylate oligomers.

AGRO 64

Odorants from anaerobically-digested food waste and swine slurry

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Management of organic wastes such as food waste and swine slurry has been a great concern in Korea since direct landfill of the wastes was banned in 2005. Recently, mesophilic anaerobic digestion has received more attention from engineers as a solution to the waste issue. In this study, food waste and swine slurry have been co-digested in a bench scale two-phase anaerobic digestion system, where acidogenesis (HRT: 3 days) and methanogenesis (HRT: 10 days) occur in separate reactors. Various odorants including reduced sulfurs, volatile fatty acids, indole, skatole, and *p*-cresol from each unit process were analyzed using the headspace solid phase microextraction coupled with GC/MS. Contribution of each odorant to the overall odor was evaluated by calculating a simple odor index (concentration of odorant/odor threshold of the odorant). Levels of reduced sulfurs and volatile fatty acids emission from the organic materials were significantly reduced as they were digested. However, concentrations of indole, skatol, and *p*-cresol did not decrease. Rather, their levels in the headspace of the effluent material were from 2 (indole) to 30 (*p*-cresol) times higher than the raw wastes. Consequently, the overall odor index can increase approximately 130%. The ring structure of these three compounds was believed to make the compounds resistant to anaerobic degradation. Therefore, it is desirable to remove these ring structured odorants from the digested material, if it is to be recycled for land application.

AGRO 65

Determination of pesticide levels in human urine using high pressure liquid chromatography-tandem mass spectroscopy

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The agricultural sector consumes 675 million pounds of pesticides annually, comprising 75% of the total usage of conventional pesticides in the US. Of these pesticides, herbicides and organophosphorus (OP) insecticides are the most commonly used. In addition, pyrethroids insecticides are increasingly being used to replace the more toxic OP insecticides. Pyrethroids are also widely-used residential insecticides. We conducted a study to compare levels of various of pesticides, herbicides, and insecticides between farmers and the general population. Urine samples from farm workers and a control group were collected and analyzed using HPLC-tandem mass spectrometry. The levels of nineteen compounds, six herbicides, seven organophosphorous insecticides, and six pyrethroid insecticides in human urine were compared using an accurate and sensitive analytical method with detection limits below 1 ppb (ng/µL). As expected, we found the farmers to have higher exposures to herbicides and insecticides than their control group.

AGRO 66
Method development for multiresidue pesticide extraction from natural and processed foods
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Effective extraction of pesticide residues from food matrices has been demonstrated using multi-residue extraction methods. In many instances, the percent recovery of pesticide residues is sub-optimal (< 70%) and the employed methods are applicable to only one type of food. We are developing an accurate, high-throughput multi-residue method for extracting organophosphates and pyrethroids from a range of composite food matrices. A solid-phase extraction (SPE) cartridge composed of a Supelclean™ ENVI-Carb-II layer and a polymerically bonded, ethylenediamine-n-propyl Supelclean™ PSA phase resulted in the effective clean-up of food matrices after the fine-tuning of solvent polarity. The combination of SPE layers allowed the retention and subsequent elution of the target pesticide residues. Multi-residue pesticide extraction recoveries for an assortment of composite food matrices were reproducible (n = 3) at > 70% with an average standard deviation of 7.9 ± 0.8. The extraction protocol will be evaluated further to show applicability to other food matrices.

AGRO 67
Real-time detection of organophosphorus pesticides using carbon nanotube-based, field-effect transistor
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A novel nanobiosensor for real-time detection of organophosphate has been developed utilizing single-walled carbon nanotubes (SWNTs) and organophosphorus hydrolase (OPH). Horizontally aligned SWNTs are assembled to fabricate field-effect transistors using the AC dielectrophoresis technique. OPH, immobilized on the SWNTs by non-specific binding, triggers the enzymatic hydrolysis of organophosphates (OPs) such as paraoxon, consequently causing sensitive change in the channel conductance, which was measured and correlated to the concentration of organophosphate. Our results indicate the new nanobiosensor offers great promise for rapid environmental mornitoring of OP pesticides.

AGRO 68
Topical insect repellent based on refined oil of *Nepeta cataria*
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Insects and insect-borne diseases remain major problems for human society. In terms of personal protection, the first line of defense is the use of topical insect repellents. Although several synthetic repellent active ingredients are available, there is a desire for safe, effective natural alternatives. The naturally occurring iridoid monoterpene nepetalactone found in catmint oil has been demonstrated to be an insect repellent. Nepetalactone, however, has been shown to be a skin sensitizing agent. Nepetalactone can be converted to produce dihydronepetalactone (DHN), currently a minor component of catmint oil. DHN has a pleasant fragrance compared with nepetalactone, is more stable, and is not a skin sensitizer. In addition, it is an insect repellent with improved properties comparable to, and in some cases exceeding, that of the synthetic compound DEET. Here, the properties of catmint oil enriched in DHN are presented. Data from *in vitro* and from field efficacy studies with human volunteers against some of the common insect pests of human society are also discussed and compared to values from other commercial products.

AGRO 69
Uptake and translocation of residues into strawberry plants from ^{14}C-furfural treated soil
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Furfural is registered with the US EPA as an effective nematicide on greenhouse ornamentals. To support future food uses, a 104-day greenhouse study was conducted in which 6" ID cylinders containing a 12" sandy loam soil were dosed with ^{14}C-furfural 14 days prior to strawberry planting and at days 30 and 60 post-plant. Furfural and its ^{14}C residues present in soil and translocated into plant tissues were analyzed by reverse phase or Ion-exclusion HPLC/RAM. At 2 days following pre-plant dosing, 2-furoic acid was detected at 3.3, 66.0, and 2.7 ppm, respectively, at soil depths of 3, 6, and 9", however, no furfural was detected at any of these depths. At 14 days, neither 2-furoic acid nor other potential furfural metabolites were found at the 3, 6 or 9" soil depths. Following all soil applications, neither ^{14}C-furfural nor 2-furoic acid were translocated into the strawberry plant. Soil metabolites or microbial cell components derived from ^{14}C-furfural were translocated into the plant and incorporated into root, stem, leaf, and fruit tissues as normal cellular components (i.e., ^{14}C-organic acids such as malic, oxalic, glyceric, glycolic, succinic, and formic). Malic, glyceric, and glycolic acids, which are natural components of strawberry fruit, were detected at 14.4, 1.3, and 0.5 ppm, respectively.

AGRO 70
Role of mineral phosphorus fertilization on corn (*Zea mays L.*) Cd upptake
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The Cd content of maize is of the highest concern as a Cd reservoir and as the pathway of cadmium to the soil-plant-animal-human food chain. Thus, tolerance and adaptation of corn to higher Cd levels, although important from the environmental point of view, create a health issue. The phosphorus (P_2O_5) mineral fertilization and Cd loading effects were studied in a long-term field experiment set up at Experimental Station of the Research Institute for Soil Science and Agricultural Chemistry of the Hungarian Academy of Sciences on a calcareous chernozem soil at Nagyhörcsök in 1977. The soil had the following agrogeochemical characteristics: pH (KCl) 7.3, humus 3.0%, ammonlactate (AL) soluble-P_2O_5 60-80 mg/kg, AL-K_2O 180-200 mg/kg in the plowed layer. From 1977 to 2000, the experiment consisted of 4x3x2x4=96 plots in split plot design. The gross plot size was 4.9x7=34.3 m^2. The fertilizer rates in kg/ha of phosphorus (P_2O_5) were 0, 100 (in every year from 1977), 2000 (in 1977), and 4000 (in 1997); kg/ha/year of Cd were 0 and 70 from 1992 to 2001. In 2000, the main Cd actual transfer index (ATI) maximum and minimum values in the case of maize 4-6 foliaged phenophase ranged between +22.0 to -89.2% compared with control soils. The grain ATI maximum and minimum values changed between +14.4 to -89.2% as opposed to untreated plants. The highest yields reached around 10 t/ha. These study show that maize has the ability to a different degree to bioaccumulate Cd from soil to corn.

AGRO 71
Using GIS data to discern sources for pesticide runoff contributions to the Choptank River watershed
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The Choptank River is an estuary located on the Delmarva Peninsula of the Chesapeake Bay. Its watershed is 1756 km^2 and landuse is primarily crop production with some medium animal (dairy cows and poultry) feeding operations. Fifteen subwatersheds have been chosen in the upper part of the Choptank varying in agricultural land use (58-84%) and forested areas (10-40%). Remote sensed data and monthly stream samples and river samples under baseflow conditions have been collected. Samples were analyzed for current-use pesticides and nutrients. Results thus far indicate that several subwatersheds have consistently higher pesticide and/or nutrient concentrations. Earlier studies revealed that higher nutrient concentrations were generally observed in watersheds of higher agricultural use and have somewhat lower forested lands compared to the other subwatersheds; however, correlation coefficients between pesticide concentrations and agricultural and/or forested lands were 0.5 or less. This suggests that that other factors are involved, such as, type of agriculture, agronomic practices (tillage, irrigation, etc.), proximity to the stream, soil type, and size of the riparian area.

AGRO 72
Review of published studies on agricultural field buffer strip performance
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Across the agricultural regions of the United States, there is a need to quantify expected mitigation effectiveness of buffer zones on runoff, erosion, and pesticide losses. Therefore, a number of crop protection companies provided a grant to recognized runoff experts from Iowa State University to develop a detailed summary from the published literature on the efficacy of buffer strips for attenuating runoff, erosion, and pesticide losses. The project had multiple goals. The first goal of this effort was to create a summary of key results from more than 120 published studies pertaining to buffer strip performance and to enter the findings into a searchable database. The second goal of the effort was to publish findings from analysis of the literature. The first goal, summarizing key literature has been completed and the results have been entered into a Microsoft Access database. The focus of this presentation is to provide an overview on the utility of this database for furthering runoff buffer work that will likely be implemented into a GIS context.

AGRO 73
Web based on-demand report and GIS data generation for a nationwide, potable-well monitoring program
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LFR Inc. recently completed a nationwide, potable-well monitoring program which involved the collection of approximately 1,700 groundwater samples from private potable water supplies located in close proximity to agricultural fields treated with the pesticide of interest. A key study deliverable was the creation of approximately 1,700 high resolution aerial image and National Resource Conservation Service soil series overlays for each potable well sampled. A robust web-based database application was developed and deployed for the purpose of managing the GIS mapping tasks, storing and distributing geospatial data with GIS users, and providing the client with virtual real-time data access. Following completion of the GIS image, it was imported into a database which enabled the production of stand-alone report documents for each potable well sampled. Using active server page technology, these well reports provided real-time, on-demand report generating capabilities that could be viewed on-line or printed locally.

AGRO 74
Framework for detailed endangered species determination development in support of pesticide product registration
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Since FIFRA product registration is considered an action under the Endangered Species Act, US EPA is required to complete an endangered species assessment as part of the registration process. Registrants may support the assessment by submitting data on their own products. The goal of the assessment is to identify spatial co-occurrences of active ingredient, species, and crop, and to address each co-occurrence with a fully-qualified determination concerning potential effects on the species. The determination may state that there is no species concern for this co-occurrence, or, if there is a potential species concern, how the concern may be mitigated. Tools exist for developing determinations at the county level, but other tools are often needed for a more detailed review of local conditions. A framework for the development and implementation of such tools is provided in the context of the action area, the area potentially affected by the registration action. Components of the system would include mathematical models of runoff and drift and a data management system to use previous determinations as sources of information.

AGRO 75
Tiered approach to the use of best available data on species locations in pesticide assessments on endangered species
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US EPA Office of Pesticide Programs (OPP) must consider the impact of registration actions under the Endangered Species Act. Over ten years, the FIFRA Endangered Species Task Force LLC (FESTF) has developed data supporting the OPP assessment process: a system to house, to compare, and to retrieve assessment information (the FESTF Information Management System, IMS) and a resource for specific location data on endangered species (via a licensing agreement with NatureServe). Species assessments may be approached at the national, county, and sub-county level. Given the currently-available and electronically-compiled, species-location data sources, different data sets serve as the best available information for the level of investigation required. Logistically, a national-level species assessment cannot consider every individual species location point and instead must work from the best available data on species location at the county level. Even at this level, thousands of crop-species-use intersections must be resolved within the IMS. For those intersections not easily resolved at the county level, more detailed spatial assessment may be necessary. At the national level, a best available portrayal of species presence by county is practical for the assessment process. At the sub-county level over multiple jurisdictions, where pesticide use, species attributes, and other factors do not resolve assumptions about risk at the county or national level, a nationally-aggregated spatial database, such as that provided by NatureServe, provides best available data. When site-specific evaluation is needed, the NatureServe data may be further honed by the use of highly specific data within a single jurisdiction, if available. An example of such data might be those from individual state data collection programs or the Fish and Wildlife Service. The three data sources, and their use in a tiered assessment to support the evaluation of the three levels of species assessment, are examined here.

AGRO 76
FitoMarche: A tool to assess pesticide vulnerability maps and to estimate pesticide leaching in a stochastic way
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The use of models to predict the behavior of agrochemicals has been promoted in the EU directive 91/414. A new software package to draw pesticide vulnerability maps has been developed. The tool links ESRI ArcGIS 9 with MACRO 5.0 in standalone software called FitoMarche and uses ArcObjects libraries as a middle tier. FitoMarche is easy-to-use software that allows the user to simulate pesticide behavior at different scales, depending on the detail of the input data, because part of the scenario data is taken from shape files and the rest is stored in an internal database. The tool requires shape files to describe the simulation area, the soil the land use, the rotations, and the climate. Moreover FitoMarche can be used to assess the pesticide fate using a probabilistic approach. In this case, the shape file does not contain real data but a grid where each polygon is identified by a different identification code.

AGRO 77
Rural domestic well sensitivity: A case study for a shift from a pure hydrogeologic / detection analysis to a coupled hydrogeologic / detection / contextual study construct
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Many regional-scale, statistically-based analyses have been conducted to attempt to identify factors determining the relative vulnerability of rural (domestic) wells to the presence/magnitude of agrochemical residues. Most of these studies have relied upon shallow-well monitoring data and have attempted to correlate detections to landscape characteristics in national spatial databases of environmental properties. These efforts have typically met with limited success. Unfortunately, very few studies have combined sampling actual domestic wells for agriculturally derived contaminants along with collection of detailed well characteristics (e.g., construction parameters) that may also influence vulnerability. This presentation describes an extensive data mining exercise linked to traditional vulnerability indicators and a subsequent classification and regression tree (CART) analysis. Output from this investigation will be discussed in comparison to a GIS-based vulnerability analysis (1 km grid scale). Some strengths and weaknesses of these approaches to predicting rural well vulnerability will be examined.

AGRO 78
Using a combination of NASS cropping data and market research information to improve the spatial resolution of pesticide use estimates
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Often the most critical variable in pesticide exposure analysis is usage per unit area. For most of the US, only two primary sources exist, National Agriculture Statistics Service (NASS) and commercial market analysis; both datasets have large, sampling-related uncertainties. NASS data is only available at state resolution while market analysis data (collected by county) is only statistically valid for Crop Reporting Districts (CRD's). For large watersheds (e.g., HUC4/HUC6), both approaches probably provide satisfactory approximations but because analysis is now more frequently conducted at more local scales (e.g., HUC10), refined approaches are needed. Recent work has shown that direct use of currently-available, county-level, market analysis data introduces errors at the watershed scale but refinements involving CRD scale market data, NASS cropping information, and National Land Cover (NLCD) remote sensing data provides much improved, but still uncertain, data. Examples, strengths, and weaknesses of this approach will be shown.

AGRO 79
GeoSTAC: Enabling efficient environmental assessments
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GeoSTAC is a system for improving the efficiency of environmental exposure assessments, primarily related to pesticides. It is a collaborative effort between Crop Life America's member companies and two contract organizations that collated the data and developed the analysis tools. GeoSTAC data include a large repository of agricultural and environmental data, collecting together in consistent manner many agriculturally important datasets such as Census of Agriculture, watershed boundaries, soils data, and National Resources Inventory. The tools developed for GeoSTAC work with the ArcGIS® software suite from ESRI®. They enable quick integration of new data with the supplied datasets, rapid problem formulation and analysis, and produce metadata to describe the resulting maps and data. These tools provide an efficient and reliable interface to process many common environmental queries, drastically reducing the amount of time needed to perform if processed in a native GIS environment. GeoSTAC tools and data will be demonstrated.

AGRO 80
GIS toolset to streamline pesticide exposure vulnerability analysis of community drinking water sources
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A tool was developed to extend the capabilities of geospatial tools available within GeoSpatial Tools and ACcess (GeoSTAC) developed by Crop Life America. The Pesticide Use Allocation Tool was developed as an independent ArcGIS Extension, allowing it to be used with any combination of pesticide use, land use, and watershed spatial datasets. The utility of the toolset is further enhanced when combined with GeoSTAC. The tool integrates directly with the GeoSTAC databases, allowing the functionality of the toolset to expand and enabling more sophisticated levels of analysis. In addition to calculating total pesticide use within watersheds, the tool is capable of calculating a) percent of total watershed receiving pesticide application; b) percent crop area within watersheds; and c) percent of crops receiving pesticide application. Apart from guiding selection of surface water sources for drinking water monitoring, this tool can help refine the PRZM/EXAMS estimated, drinking-water concentrations conducted using the Index Reservoir methodology.

AGRO 81
Assessment of spatial exposure vulnerability using a watershed regression model
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The Watershed Regressions for Pesticides model (WARP) was employed to identify relative vulnerable watersheds due to the use of an active ingredient in urban areas. The assessment was conducted at 8-digit USGS Hydrologic Cataloging Units level for the registered states with the help of a geographic information system (GIS). A spatial use coverage was developed to identify the intense use area and to derive use intensity input of the WARP model. The rainfall erosivity, soil erodibility, and Dunne overland flow parameters of the WARP model were derived using GIS overlays of national coverages obtained from USGS over the 8-digit watershed coverage. In order to express the WARP estimate to rank watershed vulnerability, a simple index scheme was used. The watersheds were divided into five classes based on the vulnerability index. The results showed the most vulnerable watersheds mainly occurred in Texas, Louisiana, and Arkansas. The assessment also demonstrated the most vulnerable watersheds did not necessarily correspond to the states with high use. This can be attributed to the relatively low soil erodibility in these states and relatively high Dunne overland flow in certain areas of the states.

AGRO 82
Measured impact of herbicide tolerant corn on occurrence of conventional corn herbicides in surface water
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In intensely-farmed corn-growing regions of the United States, herbicides applied to conventional corn are sometimes detected in surface waters, principally as a result of rainfall-runoff occurring shortly after application of these herbicides to corn and other crops. In more recent years, an increasing number of growers have begun planting herbicide tolerant corn, a practice that can reduce or replace herbicides applied to conventional corn with post-emergence products containing other active ingredients, such as glyphosate and glufosinate, that have a lower potential for runoff to surface water. As a result, detections of some corn herbicides have decreased as herbicide tolerant corn production has been adopted. A Geographic Information System (GIS)-based analysis of surface water monitoring data and cropping patterns is used to assess the impact of herbicide tolerant corn adoption on the environmental occurrence of selected herbicides used in conventional corn production.

AGRO 83
Near-critical hydrolysis of lignocellulosic biomass
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To exploit available agricultural and forestry products and wastes for biobased fuels or materials, effective and economical methods to access the cellulosic portion of plant matter must be developed. Near-critical methods to convert lignocellulosic biomass into fermentable sugars were investigated. Distillers dried grains with solubles (DDGS), the residue from current ethanol production, and switchgrass were hydrolyzed at 50 to 175°C for 5 to 60 min using pure water and alkaline or acidic conditions. The reaction was heated via convection or microwave irradiation. LC characterization of the hydrolysis products and reducing sugar assays were performed. The percentage of hydrolytic conversion increased as a function of time and temperature. Dramatic improvements in the hydrolysis rate and yield were observed with microwave irradiation. Continuing studies are exploring microwave irradiation as a preferred method for the hydrolysis of lignocellulosic biomass.

AGRO 84
Amine hydroxy derivative of soybean oil as a lubricant additive
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The amphiphilic character of vegetable oils makes them an excellent candidate as lubricants and as specialty chemicals. Additional advantages of vegetable oils are that they are derived from renewable resources, are readily biodegradable, and are environmentally-friendly, non-toxic fluids. Industrial application of vegetable oils is limited due to poor thermo-oxidative stability, poor low temperature fluidity, and other tribochemical degrading processes that occur under severe conditions of temperature, pressure, shear stress, metal surface, and environment. This work describes the evaluation of an amine hydroxy derivative of soybean oil for possible application as a lubricant additive for biodegradable lubricants. The synthesis of this derivative retains the vegetable oil structure, eliminates polyunsaturation in the molecule, and adds polar functional groups that significantly improve adsorption on metal surfaces. Comparative tests with commercial products demonstrate its effectiveness.

AGRO 85
Direct production of bioethanol from raw starch by immobilized yeast cells surface engineered with amylolytic enzymes
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The production of bioethanol from starch by fermentation has gained considerable interest recently due to global research interest in biomass conversion for renewable energy production. Traditionally, the bioethanol production process requires both amylolytic enzymes for catalyzing the starch liquefaction and saccharification steps and yeast cells for fermenting glucose to ethanol. The concept of cell immobilization provides a promising strategy for recovery and reuse of the yeast cells. However, the enzymes still need to be refurnished at the beginning of each fermentation cycle which will lead to increased production cost. When insoluble starch is used as the substrate, additional production costs will incur with the energy-consuming cooking process before adding the enzymes. In this study, we have developed a process for direct production of bioethanol from insoluble raw starch using surface-engineered *Saccharomyces cereisiae*. The flocculating, recombinant-yeast strain co-displayed α-amylase and glucoamylase on its surface and could be conveniently immobilized within loofa sponge at high cell density. With this immobilized cell system, the concentration of bioethanol could reach 47 g/L in a recirculating, packed-bed bioreactor in 3 d. The ethanol yield could be maintained for at least four consecutive batches of fermentation. This fermentation system can be easily scaled-up and will be more cost effective than traditional systems when employing raw starch from agricultural wastes as the substrate.

AGRO 86
Succinoylation and characterization of cellulose in ionic liquid
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The investigation into the use of ionic liquids (ILs) as alternative solvents of cellulose functionalization has received increased interest over the past few years. The present study was undertaken to prepare succinic derivatives bearing carboxylic groups from sugarcane bagasse cellulose with succinic anhydride in a BmimCl/DMSO (1-butyl-3-methylimidzolium chloride/dimethylsulfoxide) system. The following parameters were investigated: the molar ratio of succinic anhydride/anhydroglucose units in cellulose from 1:1 to 12:1, reaction times of 5-120 min, and reaction temperatures from 85-105°C. The results showed that the degree of substitution (DS) of cellulose, ranging from 0.037 to 0.53, increased with each increment of reaction time, molar ratio, and reaction temperature. FT-IR and solid-state CP/MAS ^{13}C-NMR spectra of the succinoylated cellulosic preparations provided evidence for the succinoylation reaction. Succinoylation was found to occur at C-6, C-2, and C-3 positions of the cellulose ring. The thermal stability of the cellulosic derivatives decreased upon chemical modification.

AGRO 87
Coumarin derivatives as novel antifungal seed treatments
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Development of new and safer pesticides that are target specific is backed by a strong Federal and public mandate. Many plant-derived chemicals have proven pesticidal properties, including the compounds sesamol (3,4-methylenedioxyphenol) and coumarins (1,2-benzopyrone). Within this study, derivatives of coumarin resembling sesamol's structure were screened for antifungal activity. This *in vitro* screen included the soil-borne fungi *Macrophomina phaseolina* (charcoal rot) and *Pythium spp.* (seedling blight), two phylogenetically-diverse and economically-important plant pathogens. Results indicate that many of these coumarin derivatives work very effectively to inhibit fungal growth, and several have higher antifungal activity and stability compared to either the original coumarin or sesamol compounds alone. Several of the highly-active coumarin derivatives are brominated or iodinated compounds. In addition to the fungal inhibition assays, results of phytotoxicity testing using these compounds as seed treatments will also be reported. These positive results support additional research in natural pesticide development.

AGRO 88
Bioconversion and optimization of potato waste to lactic acid
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Potato waste produced from a potato processing plant was used as a raw commodity to produce reducing sugars by hydrolysis and then to lactic acid by fermentation. Hydrochloric acid (0.75N) was used to hydrolyze starch into dextrose. *Lactobacillus plantarum*, *L. pentosis*, and *L. casei* were used to convert the glucose to lactic acid. *Lactobacillus amylovorous* was used to convert from ground potato waste directly to lactic acid without acid hydrolysis. Ground potato waste that contains 4-6% of starch yielded 43g/L of glucose which represents 85.6 ± 11.6% conversion efficiency. Lactic acid production efficiency by *Lactobacillus plantarum*, *L. pentosis*, and *L. casei* were 70, 65, and 60% respectively. Direct conversion by *L. amylovorous*, was found to have 80% efficiency. Abiotic factors, i.e., substrate concentrations, pH, and temperature, were optimized for lactic acid production. It is concluded that 4% starch concentration, pH 6.5, and 37°C are the optimal conditions.

AGRO 89
Fixed-bed, biodiesel-production technology
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An integrated, high-productivity and high-efficiency, continuous-flow, fixed-bed process with *in situ* catalyst regeneration capability for cost-competitive biodiesel production is being developed at United Environment & Energy, LLC (UEE). This process uses the UEE proprietary heterogeneous catalyst that has been fully tested and validated in the batch process. Compared to the batch process, our fixed-bed process allows for higher volumetric productivity, elimination of the filtration step, and easy catalyst regeneration. Additionally, this new process has several advantages over the current homogeneous alkali-catalyzed commercial process, including production of high-quality biodiesel and glycerol, catalyst regeneration, simplified product separation and purification, and elimination of the washing step and waste stream. The commercialization of this new biodiesel production process will lead to the replacement of the low-efficiency, homogeneous, alkali-catalyzed, biodiesel-production process. This will expedite the substitution of petroleum diesel with domestically-produced alternative fuel.

AGRO 90

Water solubilization of lignocellulosic biorenewables via derivatization with phosphite esters

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Degradation of cellulosic materials is of intense interest because of its role in ethanol production. Current methods of ethanol production ferment corn starch from the dry mill process into ethanol, producing distillers dry grains and solubles (DDGS) as a major byproduct that also contains cellulosic material and is potentially capable of producing additional ethanol. A challenge in converting the cellulose in DDGS into ethanol is the robust nature of the cellulose due to intercellulosic chain hydrogen bonding which limits the ability of many methods to cleave the glycosidic bonds giving fermentable sugars. Phosphitylation of cellulosic material using reactive cage phosphites was thought to have potential to disrupt the hydrogen bonding in cellulose, consequently providing cellulases access to cellulose chains. Herein we report a method of treating DDGS and other lignocellulosic materials with trimethylolpropane phosphite in the presence of a slight excess of water to afford greater than 90% water solubility. For example, charging a pressure tube with 250 mg of DDGS, 7.14 g of trimethylolpropane phosphite, and 1 mL of water, followed by heating the mixture to 150°C for 24 h provided a 3.4 w/w% solution of DDGS in phosphite. Any insoluble material remaining was removed by adding 15 mL of methanol and filtering. Removal of the methanol filtrate resulted in a phosphite/lignocellulosic residue that was completely soluble in water, a key property for the possibility of downstream processing. Evidence for significantly higher solubilities achieved with DDGS and other lignocellulosics as well as for glycosidic bond cleavage will be presented.

AGRO 91

Low dose selection for glyphosate resistance in cross-pollinated *Lolium rigidum* vs. self-pollinated *Avena fatua*

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Glyphosate is the most important herbicide in agriculture. Single-gene glyphosate-resistance evolution has occurred, following lengthy selection. An alternative genetic path to glyphosate resistance in weed populations could be the enrichment under selection of several minor genes. The likelihood of resistance evolution would rely on additive genetic variability and the resistance rate could be influenced by the reproductive system. To test the potential for low dose glyphosate selection to lead to resistance, susceptible populations of *Lolium rigidum* and *Avena fatua* were subjected to different selection intensities resulting in 10 to 50% survival. The selected sub-populations were evaluated after one generation. In cross-pollinated *L. rigidum*, one generation of selection caused a shift towards glyphosate resistance. In self-pollinated *A. fatua*, no such shift was evident probably due to the lack of additive genetic variability. These studies indicate that low glyphosate rates can lead to resistance in cross pollinated *L. rigidum*.

AGRO 92

Photosynthesis and respiration rate of *Lolium multiflorum* (Italian ryegrass) biotypes resistant to glyphosate

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We evaluated the physiological characteristics of three Brazilian (R1-Ciríaco/RS; R2-Tapejara/RS; R3-Não-me-toque/RS), one Spanish (Sp) and one Chilean (C) glyphosate-resistant *Lolium multiflorum* biotypes and a susceptible one (S). Plants were cultivated in growth chambers (24/19ºC day/night, 16-h photoperiod, 200 µmol photons $m^{-2}s^{-1}$ and 50% humidity relative) with four replicates. IRGA (infrared gas analyzer) was used (1500 µmol photons $m^{-2}s^{-1}$ light) with 380 µmol CO_2 to evaluate CO_2 exchange. The analyses were done 30 days after sowing and four hours after application (2nd leaves) of 972 g/ha of Transorb formulation. The photosynthetic CO_2 uptake was unaffected by glyphosate application for all biotypes except S and R2. However, the respiration rate was not affected in R2. These results were confirmed by seed bioassay that showed five- and seven-fold more resistance to R1 and R2 than S, and nine fold to R3, C, and Sp, respectively.

AGRO 93

Biochemical and molecular characterization of bivalent anticholinesterases to the malarial mosquito

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There is urgent need for additional insecticides to control the spread of malaria and other diseases. Two genes, *ace*-1 and *ace*-2, encode acetylcholinesterase (AChE) in the malarial mosquito, *Anopheles gambiae*, with *ace*-1 being both toxicologically relevant for anticholinesterase activity and target-site resistance. Molecular analysis of *ace*-1, encoding *Torpedo californica* AChE, reveals an active site gorge leading to both catalytic and peripheral sites that interact simultaneously with bivalent tacrines to potently inhibit rat AChE. We are systematically screening the anticholinesterase activities of methylene-linked bivalent tacrines, 2-12 carbons long, to structurally probe *An. gambiae* AChE for the development of selective mosquitocides. The tether-length dependency of these anticholinesterase compounds in regard to human and *An. gambiae* AChE potency will be discussed and the implications of this structure-activity relationship for insecticide design.

AGRO 94
Winter detection of southern pine beetles using analytical georeferenced data
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The southern pine beetle (SPB) (*Dendroctonus frontalis* Zimmermann) is the most prolific forest pest in the southern United States. During the 2000 season alone, an estimated three hundred and fifty million dollars worth of timber was lost due to SPB. Currently, the most effective method of identifying serious infestations is during the summer using airplanes. However, the beetle's fast rate of reproduction and mobility in the summer make it impossible to monitor and to maintain beetle populations. Research indicates that SPB populations are more susceptible to control methods during the late fall and winter months when beetles aggregate into densely-populated, overwintering spots. This project tested the feasibility of locating these overwintering spots with the hope of removing individual trees. The frontalin emitted from overwintering beetles was detected using solid phase microextraction (SPME) fibers placed at georeference points in selected areas of the forest. These fibers were then analyzed by GC/MS to determine pheromone concentration. Three dimensional georeferenced plots where generated based on the concentration of frontalin to pinpoint accurately the infested forest locations.

AGRO 95
Plant glutathione S-transferases as mediators of antibiotic detoxification
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Antibiotics have been used for human and veterinary purposes for decades. In recent years, the use of antibiotics has increased dramatically, and with a large percentage of the antibiotics passing through the organism unaltered, questions have been raised as to the environmental affects of spreading the antibiotics as fertilizer on croplands. Some of the major concerns of constant, low-level, antibiotic pollution include: creation of antibiotic-resistant pathogens, plant phytotoxicity, and human consumption via the food and water supplies. Tetracyclines and sulfonamides are two classes of antibiotics that are highly used for both human and agricultural purposes. In the environment, concentrations of these two classes of antibiotics can range from 1-20 mg/kg. Studies addressing the environmental concerns have shown that both chlortetracycline and sulfadimethoxine (tetracycline and sulfonamide classes, respectively) have phytotoxic effects on pinto beans (*Phaselous vulgaris*) and maize (*Zea mays*), respectively. Other studies have shown that chlortetracycline can be taken up and accumulated in various crops at ppb levels. Recently, our lab has shown that maize plants have the ability to recognize and detoxify chlortetracycline (CTC) via induction of glutathione S-transferases (GSTs), while pinto beans were unable to induce such a response, leaving them susceptible to toxicity. Interestingly, it was not the inability of the pinto bean GSTs to recognize and to conjugate chlortetracycline, but rather it was due to the inability of these plants to induce adequate expression of the enzyme. On the other hand, a similar study using sulfadimethoxine-treated maize showed that the plants were able to recognize and induce GST expression, but were unable to conjugate the antibiotic, thus, leaving them susceptible to toxicity. This research has implications for furthering an understanding of the applicability of using phtyoremediation as a method for removing and detoxifying antibiotics from the environment.

AGRO 96
Investigating the fate of the veterinary antibiotics monensin, lasalocid, and tylosin in agricultural systems
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Monensin, lasalocid, and tylosin are antibiotics used as growth promoters and to prevent disease in animal husbandry. To aid in predicting the mobility and persistence of these antibiotics, we measured sorption by soils, assessed degradation in soils, and conducted a preliminary assessment of concentrations in a beef waste lagoon. Tylosin sorption was the greatest and was positively correlated to surface area, %clay, and cation exchange capacity. For monensin and lasalocid, organic carbon-normalized sorption was generally inversely proportional to pH. Monensin and lasalocid were degraded rapidly with half-lives ranging from 1.3 to 2.0 d and 1.5 to 4.3 d, respectively, with no significant effect of manure amendment. Tylosin degradation is slower with half lives of 2-4 weeks, which included a 10 d lag period. Only monensin was detected in the beef lagoon at 40 µg/L in the aqueous phase and 2000 µg/kg in the suspended solids.

AGRO 97
Transformation of sulfamethazine by hydrous manganese oxides
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Sulfonamide antimicrobials are widely used in human medicine and animal husbandry. These synthetic, bacteriostatic agents rank among the most frequently detected pharmaceuticals in US surface waters and have been reported in wastewater treatment plant effluent and manures. Sulfonamide antimicrobials enter soils through the application of manures and biosolids to agricultural fields as well as through effluent irrigation. To gain insight into the processes controlling the fate of these compounds in soils and subsurface environments, we examined the kinetics of sulfamethazine transformation by hydrous manganese oxides as a function of ionic strength, pH, reactant concentrations, and temperature. The initial rates of sulfamethazine transformation increased as pH decreased and were suppressed by increases in ionic strength. Transformation products were identified by liquid chromatography with tandem mass spectrometry. This study demonstrates that sulfonamides can undergo abiotic degradation in soils.

AGRO 98

Electrospray ionization mass spectroscopy shows speciation of phytate to be pH dependent

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Myo-inositol hexkis phosphate, or more commonly phytic acid (PA), is an organic phosphate molecule with twelve acidic protons. The acid dissociation constants (pK_a) are 1.9(3), 2.4(2), 3.2(1), 5.2(1), 6.3(1), 8.0(1), 9.2(1), and 9.5(2). The charged species fractions were calculated as a function of pH using the acid dissociation constants. Results predict three different charged species of phytic acid will be simultaneously present at almost any environmentally relevant pH. Analysis of the electro-spray ionization mass spectrometry (ESI-MS) solution spectra of iron and copper complexes of PA at pH 2.8, 6, and 13 confirmed that multiple charged species of PA occur simultaneously even in the presence of metal cations. Results showed minimal fragmentation of the parent phytate anions. Changes in the z of PA anions, not changes in the stability or fragmentation of the parent compound with pH, explain the observed fragmentation pattern.

AGRO 99

Antiviral activity of Keggin-type heteropoly compounds on tobacco plants

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Tobacco mosaic tobamovirus (TMV) is very resistant and contagious and has nearly 800 plant species as host plants. It survives deep in the soil for two years or more and through all procedures of tobacco treatment. To date, there is no satisfactory practical treatment against the virus. Heteropoly compounds (HPCs) with Keggin-type structure have been reported as inhibitors of several kinds of viruses, but little is known about their activity on plant viruses. We have investigated the antiviral activity of tungstophosphoric acid (WPA), its magnesium salt, and compounds with glycine and alanine for antiviral activity on tobacco plants. The transport and distribution of WPA and its compounds after foliar application on *Nicotiana tabacum*, var. *Samsum* infected with TMV, as host plant, were determined. Antiviral activity was demonstrated. In addition, plant growth was enhanced. It is important to estimate the distribution profile of selected WPA compounds through the host plant to gain an understanding of their antiviral activity mechanism. The stability of Keggin anions depends on the medium pH. The Keggin anion, $PW_{12}O_40_3^-$, may be easily hydrolyzed and decomposed to WO_4^{2-} and PO_4^{3-} through different polyanions; thus, the next aim is to define which form of Keggin anion is bioactive. According to that goal, the influence of the pH of fresh plant juice on the Keggin anion structure is followed. A very low fitotoxicity opens the possibility for further investigation of these compounds against plant viruses that could have large economic impact.

AGRO 100

Study on chemical character and activity of polysaccharides from several marine green alga collected in different localities and periods

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The marine green alga, Ulvaceae and Monostromaceae, contain abundant vitamin, trace elements, dietary fibers and protein, and are an important food source in many places of the world. Some of them have also been used as a drug in traditional Chinese medicine for many years. An in–depth knowledge of the chemical characterization of these seaweed extracts is a prerequisite to the understanding of their biological activity. Of further interest is to determine whether this chemical characterization information, together with ecophysicological variability, could be used to select potential drug source. In this paper, the polysaccharides from some marine green alga Ulvaceae and Monostromaceae collected in different localities and different periods of year were isolated and prepared by extraction in water and precipitation with ethanol. The chemical character and biological properties of these polysaccharides were investigated and evaluated.

AGRO 101

Ecological efficiency of use of organo-mineral composts in agriculture

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It is known that at present the accumulation of different organic waste fertilizers takes place on farms. One of them (waste manure from municipal economy) is rich in nutritive elements and others (waste of cotton-cleaning plants, waste of hydrolyze production, vegetative residues etc) are rich in organic substances. The heavy metal content is high in the waste of municipal economy, in silt of fresh water, and when the water outlet is high. On the one hand, the process of composting allows for preparation of a balanced mixture according to the elements of nutrition and organic substances, and on the other hand, it dilutes waste polluted with heavy metals and gets rid of pathogenic microorganisms in the process of storage. It should be noted, that the disinfecting of waste can be finished in soil. All the above-mentioned support the economical effect and are measured by an increase of yield of a raw cotton and ecological effect by decontamination of organic substances (waste): the introduction into the small biologic circulation of a significant amount of organic substances and elements of nutrition and all of these can stabilize the fertility and sanitary condition of soil. Our technological developments provide a significant ecological effect. The annual application of 20 tons of manure per hector improves the structure condition, increases the amount of organic substance in soil, makes the useful microflora more active, and improves agrochemical characteristics of soil. The combined use of organic and nitrogen-phosphorus fertilizers can increase the yield and quality of raw cotton and prevent the pollution of underground water and products of plant-growing by nitrites.

AGRO 102
Dissipation of bromide ion following an in-furrow application to bare soil
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This study was designed to determine the migration pattern of bromide ion through the unsaturated soil zone following an in-furrow application of potassium bromide. The study design consisted of a single treated plot which was divided into two replicate areas for sampling purposes. Each replicate area was instrumented with a total of sixteen suction lysimeters which were installed at four depths (3, 6, 9, and 12 feet) at each of four lateral distances (0, 12, 24, and 36 inches) measured from the center line of the furrow. Soil core samples were collected from each of the replicate areas at five lateral distances (0, 9, 18, 27, and 36 inches) from the center line of the furrow to a maximum depth of 8 feet below ground surface. Study results demonstrated the rapid vertical movement of the bromide ion below the treated furrow with negligible lateral dispersion from the narrow application band.

AGRO 103
Human exposure to surface pesticide residues: Dislodgeable foliar residues and pilot studies to predict bioavailability
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Entry into pesticide treated fields can present significant hazard to harvesters and other agricultural workers. Dislodgeable foliar residues (DFRs) are an important determinant of worker field entry intervals. DFRs are measured by using a weak detergent solution to wash the residues from the surface of leaf samples. This chemical process contrasts with the predominantly physical contact-transfer that occurs in the field. We are investigating two new procedures to measure physical TSRs (Transferable Surface Residues): an Automated Surface Wipe (ASW) and Benchtop Surface Roller (BSR). These two procedures transfer residues from treated surfaces by direct, physical contact. Study results show that DFRs are greater than TSRs, and DFRs decreased with time more sharply than TSRs did. DFRs may not adequately predict longer term exposure. Preliminary spot urine biomonitoring data indicate low exposure of harvesters to treated foliage. In-depth exposure studies will follow.

AGRO 104
Molecular modeling for screening of pesticide-nucleotide binding potentials
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Previous work in our laboratories has demonstrated that DNA in crop plants is susceptible to adduct formation as a result of treatment with pesticides. Generation of adducts is a consequence of direct binding with electrophilic sites on pesticide molecules or their metabolites but may also occur from electrophilic intermediates produced by oxidative stress or metabolic bioactivation from pesticides. This study has focused on the development of computational modeling tools for screening pesticides and metabolites for the potential of direct adduct formation with DNA adducts. Theoretical molecular modeling, employing a combination of semi-empirical and *ab initio* MO theory coupled with density functional theory, has been carried out to characterize these interactions in several classes of pesticides. Electrostatic potential mapping has been utilized to screen for potential interactions between nucleophilic sites on the DNA bases and electrophilic sites in the pesticide. Interaction energy maps have been computed at the van der Waals surface of both molecules to verify suspected reaction sites. Binding energies and transition state energies have been calculated for binding complexes at these putative reaction sites. Results of this study, compared with experiment, are used in constructing a QSAR model for genotoxic risk to plant DNA.

AGRO 105
Multiple-inlet plus intermittent rice irrigation increases rainfall capture and reduces non-point source runoff
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Field research was conducted in 2004-2006 to determine the potential for water savings and reduced nonpoint source runoff using multiple-inlet irrigation plus intermittent flooding as compared to continuously-flooded rice. Experiments were conducted at five farms ranging from the southern-most Mississippi Delta to the northeast corner of Arkansas. Each location consisted of two adjacent fields averaging 16 ha each. The two fields only differed in water management practice. The control field at each location was continuously flooded using the grower's traditional practices. The experimental field used multiple-inlet irrigation plus intermittent flooding, whereby the flood was established at the appropriate time using 38-cm diameter plastic pipe to deliver water to each paddy simultaneously. After two weeks of continuous flooding, the experimental field was allowed to dry until about half of each paddy had exposed soil. At this point, the 8 to 10 cm flood was reestablished. This cycle was repeated every 5 to 9 days throughout the growing season. All water inputs and flood depths were recorded. Water samples were collected on a weekly basis for nutrient and pesticide analysis. Intermittent flooding did not affect pest pressure, plant-nutrient content, or rice yield. However, intermittently flooded rice used 56 cm water per ha compared to 81 cm per ha with continuously flooded rice, representing a 30% savings in irrigation inputs. This savings was due to increased rainfall-holding capacity, and reduced over-pumping and subsequent tailwater runoff. Based on 25-year historical rainfall data, our model predicts an average increase in rainfall capture of 67% and a 60% reduction in tailwater runoff for the intermittent flood as compared to the conventional flood system. Adoption of intermittent flooding could significantly reduce energy and water use in rice production while improving surface water quality.

AGRO 106
Runoff losses of three pesticides and a conservative tracer from warm-season turf using simulated rainfall
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This study is part of a larger national research effort designed to improve the understanding and modeling of turf pesticide runoff. The specific objectives of the project are to investigate the effects of warm-season turfgrass species, mowing height, and plot size on pesticide runoff. The turfgrass species include Bermuda grass (*Cynodon dactylon* [L] Pers. x *Cynodon transvalensis* Burtt-Davy) and zoygrass (*Zoysia japonica* Steud.). The turfgrass species were maintained as either golf course fairways or residential lawns. The runoff studies were conducted on eighteen 3.7 x 9.1 m and four 6.1 x 24.4 m plots. These plots were arranged in a split-plot design and were sloped at 3% with minimal cross slope. Following a standardized field protocol, 2,4-D herbicide, flutolanil fungicide, and chlorpyrifos insecticide were co-applied at 1.12 kg ai/ha, 2.24 kg ai/ha and 2.24 kg ai/ha, respectively. A conservative tracer, KBr, was also applied at 10 kg/ha immediately before initiation of simulated rainfall. Simulated rainfall was applied to the plots 24 h after pesticide application at a rate of 38 mm/h for 90 min. Runoff water from the plots was collected at approximately five-minute intervals. The runoff and application monitor samples were analyzed by reverse phase High Performance Liquid Chromatography (HPLC) using UV-Vis detection. Maximum observed concentrations (ppb), total masses (g) and percentages of the applied chemicals observed in runoff water were determined. The effects of grass species, mowing height, and plot size on chemical runoff will be presented.

AGRO 107
Bioreporter-based chemical sensor of arsenic in agricultural samples
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Arsenic is a well-documented agricultural and drinking water contaminant due to its ubiquity in the Earth's crust. Arsenic was identified as a potential chemical threat agent by the Center for Disease Control's Chemical Preparedness and Response Plan. The objective of this research was to develop a bioreporter-based chemical biosensor for determination of arsenic contaminants in agricultural samples. These biosensors use genetically engineered signaling bacteria to sense and to signal the presence of arsenic. The signal in the form of bioluminescence is detected using in analytical transducers. The biosensor responded with a linear dynamic range of over an order of magnitude with detection limits below 50 ppb, the US EPA Maximum Contaminant Level. With the current configurations, arsenic was detected after 15 minutes of exposure to 35 minutes for 50 ppb. Biosensor configurations are being optimized for detection of arsenic contaminants in agricultural samples.

AGRO 108
Remote sensing of agricultural contaminants using biosensor networks over TCP/IP
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The biosensors described here are assemblies of genetically-engineered bioluminescent bacteria (bioreporters) coupled to a photomultiplier tube detector. Changes in bioluminescence intensity are positively correlated with analyte concentration for aqueous solutions of trichloroethylene, toluene, benzene, and salicylate. The current phase of this research is the implementation of a control and monitoring network for remote administration of biosensors. We demonstrate here the implementation of a biosensor network over TCP/IP with a GUI client.

AGRO 109
Crystal and molecular structures of organophosphorus pesticides
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As part of an NSF/STEP-funded summer undergraduate research program at Truman State University, the crystal and three-dimensional structures of three organophosphorus pesticides were determined by X-ray diffraction. The organophosphorus pesticide of primary interest is ethyl 2-diethoxythiophosphoryloxy-7-methyl-pyrazole[1,5-α]pyrimidine-6-carboxylate (also known as Pyrazophos and Afugan®), $C_{14}H_{20}N_3O_5PS$, a systemic fungicide. Pyrazophos exhibits 2 rotamers per asymmetric unit, and an intermolecular carbonyl oxygen---ring π system interaction. This interaction occurs along the b-axis and is present in only one of the rotamers. Also of note is a discrepancy between the observed position of a ring methyl and the placement contained in the current literature. *O*-2,6-dichloro-*p*-tolyl *O*,*O*-dimethylphosphorothioate (also known as Tolclofos-Methyl), $C_9H_{11}Cl_2O_3PS$, was also determined during the program, and of interest in this compound is the libration about the central phosphorus atom resulting in partial occupancies of the two methoxy groups. Structural similarities to Tolclophos-Methyl are noted in the OP insecticide Dicapthon (*O*,*O*-dimethyl-*O*-(2-chloro-4-nitrophenyl)phosphorothioate, $C_8H_9ClNO_5PS$).

AGRO 110

Influence of composts repared from tobacco wastes and phosphogypsum on the agrochemical properties of carbonate meadow soils of Zarafshan Valley

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At present, industrial wastes including wastes of cigarette fabrics and chemical enterprises have been accumulated in a large quantity. These wastes are the objects of pollution in the environment. On the other hand, due to the shortage of organic fertilizers, the humus contenthas decreased which is the main substance determining soil fertility. In this connection, the compost preparation from tobacco wastes and phosphogypsum solves the problem of utilization of these wastes and also the problem of a shortage of organic fertilizers for agriculture. For study of compost influence on the agrochemical properties of soil and maize productivity, the field experiments were carried out in the meadow soils of Zarafshan oasis, salinized by carbonates. The introduction of compost into the soil at the norm 30 t/ha rendered a positive effect on the humus content and nutritious substances. Thus, the content of easily-accessible nutritious substances of ammonium and nitrate nitrogen, mobile phosphorus, and potassium for plants increased. This resulted in improved growth and development of maize and its productivity; thus, in a grain of maize, the protein content, general nitrogen, phosphorus, and potassium were raised. Our experiments show, that composts also affect the agrochemical peculiarities of meadow soils as well as a manure. Thus, the composts prepared from tobacco wastes, phosphogypsum, and liquid manure improved the agrochemical properties of a meadow soil salinized with carbonate and increase maize productivity.

AGRO 111

Cd, Ni, Pb, Se, and Hg bioaccumulation and phytoremediation characteristics of Crotalaria (*Crotalaria juncea L.*) under mineral nitrogen fertilization influence

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Inside Sustainable Precision Agricultural Production (SPAP), heavy metal pollution has become of highest concern quite recently. Many sites have been identified as hazardous waste sites because of the presence of elevated concentrations of these elements. They will remain a threat to environment, ecosystem components, and the soil-plant-animal-human food chain until they are removed or immobilized. We can test and improve this situation by using different plant remediation technics. Crotalaria has a very high potential and important role in soil fertility as a green manure crop in the design of plant rotation to field plant production, in the animal foraging as a fodder-crop with a high protein content (30%), and in the phytoremediation by metal bioaccumulation ability. In a long-term field fertilization trial, an experiment was carried out on a calcareous chernozem meadow soil (Kunság-region of Hungary, Kunmadaras) in 2001. The agrochemical parameters of the ploughed layer of the region soils were as follows: humus 2.5-3.0%, pH (H_2O) 7.7, pH (KCl) 7.0, LE (Lakanen & Erviö, 1971) -P_2O_5 183-218 mg/kg, LE-K_2O 82-115 mg/kg, LE-Ca 1.3% according to soil analysis. The experiment involved 4Nx2DxGx3T=24 treatments in 3 replications giving a total of 72 plots. The N levels were 0, 100, 200, and 300 kg/ha/year. The toxic element translocation from soil to plant (amount of nutrient in the plant divided by the amount of nutrient in the soil) by N treatment at average effects were: Cd 1.08, Ni 0.05, Pb 0.09, Se 0.36, Hg 2.02. At harvest, total air dry phytomass (straw+leaf) yield ranged between 8.7-16.5 t/ha, depending on the N-treatment applied. These results suggest that crotalaria has a great ability for Cd, Ni, Pb, Se, and Hg phytoremediation.

AGRO 112

Triticale (*X Triticosecale W.*) Al, Cd, Co, Cr, Cu, Sr, Pb and Zn bioaccumulation in a long term field mineral fertilization experiment

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During the last decades toxic metal contamination has been one of the main topic researched in environmental science in several country, because the increase in the number of these element emiting sources has aroused concern and the degree and extent. Heavy metals are dangerous because they tend to accumulate in food chain. Triticale is a stabilized man-made hybrid of wheat (*Triticum eastivum L.*) and rye (*Secale cereale L.*). The crop is harvested mostly for forage but there is a small market for pancake mixes and crackers due to a savory, nutty flavor. Etanol plants will pay a premium for triticale over barley since it has more starch and no hull, making alcohol production more efficient. Field experiments were carried out on an acidic sandy brown forest soil at Nyírlugos in East-Hungary from 1962 to 2005. Soil geochemical parameters were as follow: humus 0.6%, pH (H_2O) 5.8, pH (KCl) 4.6, total N 32.8 mg/kg, AL (ammonium lactate soluble)-P_2O_5 43 mg/kg, AL-K_2O 52 mg/kg. The experiments involved 32 NPKCaMg treatments in 4 replications giving a total of 128 plots. N levels were 0, 50, 100, and 150 kg/ha/yr; P_2O_5 and K_2O were 0, 60, 120, and 180 kg/ha/yr; $CaCO_3$ were 0, 250, 500, and 1000 kg/ha/yr; and $MgCO_3$ doses were 0, 140, and 280 kg/ha/yr. The Cd, Co, Cr, Pb, and Zn element contents of leaf+straw before flowering time were ranged between 0.1-0.2 mg/kg, 0.2-0.7 mg/kg, 0.3-0.5 mg/kg, 0.4-1.5 mg/kg, and 26-39 mg/kg, respectively. The Al, Co, Cu, Sr, and Zn degree of grain at harvest were moved among 4.4-9.3 mg/kg, 0.1-0.4 mg/kg, 4.3-5.6 mg/kg, 3.2-10.2 mg/kg, and 36-50 mg/kg one by one in 1998. These survey shows triticale has potential Al, Cd, Co, Cr, Cu, Sr, Pb, and Zn bioaccumulation might for upground parts of the crop and via this way they can enter to food chain.

AGRO 113

Rye (*Secale cereale* L.) As, Cd, Hg, Ni, Pb, and Se phytotranslocation in a long-term field fertilization experiment

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During the last few decades there has been an impulse, both in the growth of industry and increasing intensity of agriculture which has included rised use of metal containing agrochemicals. However, the metals entering ecosystems can decline rapidly if emissions are stopped or their sourses are removed, there progressive evidence that metals accumulate in the biologically active layers of soils and sediments and remain there for very long proiods. The "Food Chain" scientificaly based responses to augmented heavy metal concentrations in the environment are no well researched and known as yet. The rye is harvested mainly for forage but there is a small market for bread and crackers. The greans may use for efficient bioetanol production. The crop has ability for accumulation of metals from soils to a different degree. Long-field experiment was set up on calcareous sandy soil at Örbottyán in Hungary in autumn 1959. Soil agrogeochemical parameters were as follow: humus 0.6-1.0%, pH 7.5-7.8, $CaCO_3$ content 3-7%, AL (ammonium lactate soluble)-P_2O_5 40-60 mg/kg, AL-K_2O 50-100 mg/kg. The experiment consisted of ten (0+NPK) treatments in five replications, giving a total of 50 plots arranged in a Latin square design. From the 26th year onwards fertilization rates were 0 and 120 kg/ha/yr N; 0, 60, and 120 kg/ha/yr P_2O_5 and 0, 60, and 120 kg/ha/yr K_2O. The toxic element translocation from soil ("ATI" Márton, 2004) to plant (x1 nutrient cc. of plant divided by x1 nutrient cc. of soil-1) by NPK treatment at average effects were of As: 0.0, Cd: 0.0, Hg: 0.0, Ni: 0.49, Pb: 0.0 and Se: 0.0 in 2005. Rye study results can demonstrate crop has ability for Ni and has no capacity for As, Cd, Hg, Pb and Se uptake under these conditions.

AGRO 114

Phytoremediation aspects of Cd kinetics in Hungarian and Indian soils

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Soil accumulates toxic heavy metals from a number of diverse sources. Cadmium (Cd) can directly affect the yields of crops and the quality of food for animals and human being. The movement of Cd in the soil is controlled by status of macronutrient, organic carbon, calcium carbonate, CEC and pH, which play an important role for formation and precipitation of Cd into less soluble and insoluble phosphates, sulphates, carbonates and other Cd complexes formation. To identify the plant availability of Cd by quantifying its release into the soil solution from element loadings similar to or exceeding its permissible limit in wastes applied to agricultural soils and to follow its redistribution in the solid and liquid phases under different soil moisture conditions. Periodic extractability of DTPA-extractable, plant available form of Cd was determined after incubated the soil at field capacity with different load of Cd (10, 20, 40, and 80 mg Cd/kg soil) in Hungarian and Indian heavy and light soils of different agro-ecological zones and correlated with some important soil properties. High order correlation of DTPA-Cd was observed with cation exchange capacity followed by organic matter and pH of the soils. Decreased amount of added Cd in the form of DTPA-Cd was observed with the increase in time intervals.

AGRO 115

Impact of mineral NPK fertilization on wheat (*Triticum aestivum* L.) Cd, Hg, Ni, Pb, and Se translocation

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Nowadays, sustainable (S) precision (P) agricultural (A) production (P)(SPAP) has become the major issue following global changes in all the world over. Concerns regarding heavy metals contamination in the environment affecting all ecosystem componets, including "soil-plant-animal-human" chain (SPAHC), have been identified with increasing efforts on limiting their bioavailability. Tolerance and adaptation of wheat to higher Cd, Hg, Ni, Pb and Se levels, although important from the environmental poin of view, create a helth risc. The nitrogen (N) x phosphorus (P_2O_5) x potassium (K_2O) mineral fertilization effects were studied on these metal uptake in a long-term field experiment set up at Experimental Station of the Research Institute for Soil Science and Agricultural Chemistry of the Hungarian Academy of Sciences on a calcareous chernozem soil at Nagyhörcsök in 1967. The soil had the following agrogeochemical characteristics: pH (KCl) 7.3, humus 3.0%, ammonlactate (AL) soluble-P_2O_5 60-80 mg/kg, AL-K_2O 180-200 mg/kg in the plowed layer. From 1967 to 2004 the experiment consisted of 20 treatment combinations in 4 replications giving a total 80 plots in split plot design. The gross plot size was 14.0x5.0=70.0 m^2. The fertiliser rates in kg/ha/yr of nitrogen (N) were 0, 100, 150, 200, and 250; phosphorus (P_2O_5) 0, 60, 120, and 180 and potassium (K_2O) 0, 100, and 150 kg/ha/yr. The heavy metal translocation from soil to plant (x1 metal cc. of plant divided by x1 metal cc. of $soil^{-1}$) by NPK treatment at average effects were of Cd: 0.23, Hg: 0.0, Ni: 1.12, Pb: 0.0 and Se: 0.0 in 2004. Wheat investigation results suggest crop has ability for Cd and Ni and has no capacity for Hg, Pb, and Se uptake under above conditions.

AGRO 116
1956-2006: Fifty years of insect toxicology
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Searching for the stimulus behind the science that became known as insect toxicology, one concludes that the driving force throughout has been the continually evolving resistance problem. This began with DDT-resistance in houseflies in Denmark around 1947 and was soon followed by resistance to the cyclodienes and eventually by resistance to herbicides, fungicides, and most other toxicant classes. Studies of both mode of action and inaction (resistance/tolerance) became routine with the techniques of molecular biology. Accurate pin-pointing of resistance mechanisms was commonplace by the end of the last century, although solutions to the problem were not. Prominent among pioneers of insect toxicology were Kearns and colleagues (1954) with the discovery of DDT-dehydrochlorinase. Then came the recognition of cytochrome (Cy) P450 involvement in vertebrate steroid metabolism, and swiftly thereafter, the finding that Cy P450 occurred in insects (Ray 1963) and was inhibited by pyrethrum synergists. After 1961, electron capture detection permitted metabolism studies undreamt of without radiotracers and changed this science forever. Aromatic ring hydroxylation was postulated by Boyland (1950) to proceed via labile epoxides and an epoxide hydrolase (EH), but firm evidence for EH awaited the discovery of labile dieldrin analogues (Brooks 1963). These were exciting novelties for a young, synthesis chemist, newly-turned insect toxicologist/resistance researcher. To have been involved personally at the beginnings of a research area of such widespread and enduring significance and to have witnessed the half century of advances since then has been a rare privilege.

AGRO 117
Gerry Brooks' epoxide hydrolase: Thirty-five years to a pharmaceutical
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The pioneering work of Gerry Brooks on cyclodiene insecticides led to the discovery of a class of enzymes known as epoxide hydrolases. The results from thirty-five years of work confirm Brooks' first observations that the microsomal epoxide hydrolase is important in foreign compound metabolism. Brooks and associates went on to be the first to carry out a systemic study of the inhibition of this enzyme. A second role for this enzyme was in the degradation of insect juvenile hormone (JH). JH epoxide hydrolases have now been cloned and expressed from several species and there is interest in developing inhibitors for them. Interestingly, the mammalian soluble epoxide hydrolase has emerged as a promising pharmacological target for treating hypertension, inflammatory disease, and pain. Nano to picomolar transition state inhibitors have been developed with good ADME (absorption, distribution, metabolism, and excretion). These compounds stabilize endogenous epoxides of fatty acids including arachidonic acid which have profound therapeutic effects.

AGRO 118
Pyrethroid action at calcium channels: Neurotoxicological implications
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Actions of cismethrin versus deltamethrin were evaluated using rat brain synaptosomes. Both stimulated calcium influx, but only deltamethrin enhanced calcium-dependent neurotransmitter release following depolarization. The action of deltamethrin was stereospecific, concentration-dependent, and blocked by omega-conotoxin GVIA. These findings delineate a separate action for deltamethrin and implicate N-type rat brain Cav2.2 voltage-sensitive calcium channels (VSCC) as target sites that are consistent with the *in vivo* release of neurotransmitter caused by deltamethrin. Deltamethrin (10-7 M) reduced the peak current (ca. -47%) of heterologously-expressed, wild-type Cav2.2 in a stereospecific manner. Mutation of threonine 422 to glutamic acid (T422E) in the alpha1-subunit results in a channel that functions as if it were permanently phosphorylated. In this case, deltamethrin enhanced the peak current (ca. +49%) of T422E Cav2.2 in a stereospecific manner. Collectively, these results substantiate that Cav2.2 is directly modified by deltamethrin, but the resulting perturbation is dependent upon the phosphorylation state of Cav2.2.

AGRO 119
Hawaii's GIS-based screening tool for pesticide leaching assessment
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Hawaii's water supply comes primarily from sole source aquifers. Past contamination of ground water with nematicides has prompted the State to develop and use a screening tool for the first-tier evaluation of pesticides prior to their registration in Hawaii. This tool has been implemented in a geographic information system (GIS) and covers all major islands of the state of Hawaii. The GIS database covers basic soil properties (bulk density, organic carbon content, porosity), hydrogeologic and climatic information (depth to water table, annual average recharge), and pesticide properties (half-life and organic carbon partition coefficient). Uncertainties in soil and pesticide properties are accounted for using first-order uncertainty analysis. The current version of the tool classifies pesticides as likely, uncertain, or unlikely to leach based on the uncertainty and a comparison of the revised attenuation factor (to what degree the pesticide will be attenuated within the given depth) with values and uncertainties of two reference chemicals. The two reference chemicals are a known leacher and non-leacher, particularly in Hawaii conditions. The GIS-based system has enabled the state to conduct area-wide assessments of the leaching potential of new and existing chemicals. However, the uncertainties associated with soil and pesticide properties can be large, thus one should use a conservative approach to interpret the results and in selecting the appropriate pesticide parameters in the screening tool. Despite this, Hawaii is one of the few

states that uses such an approach to pesticide leaching evaluation in a GIS framework.

AGRO 120
Multivariable approaches for determining groundwater vulnerability to agrochemical movement in soil, Part 1: Classification and regression tree analysis of California Central Valley
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Groundwater vulnerability to non-point source contamination is not necessarily intrinsic to natural hydro-geological systems. On the contrary, vulnerability is dynamic because of human activities, such as agriculture, which results in the use of measurable surrogate values to infer spatial locations of vulnerability. These variables are often complex, inter-correlated, and their exact mechanistic relationships to groundwater contamination is unknown. In this first part of the two sequential papers, a statistical multivariate approach, Classification And Regression Tree (CART), was employed to delineate areas vulnerable to simazine in the Southern Central Valley region of California where the herbicide is commonly used. Without *a priori* assumptions regarding the pathway for chemical movement to groundwater, the analysis related several combinations of spatial data to pesticide detections in ground water, including soil properties, estimated depth to groundwater, and land use. While land use is not a natural intrinsic property, it provides a surrogate measure for the soil management and agricultural practices particular to this region where soils contain a hardpan layer. The agricultural and soil conditions collectively result in a very low water infiltration rate, which lead to a pathway other than leaching to groundwater where dry wells/ponds were employed to capture runoff water. Removing the land use effect, classification of the CART analysis became more responsive to the inherent soil hydrological properties such as texture and slope. This hierarchical procedure of discrimination suggests the importance of the empirical selection of a wide range of factors without *a priori* assumptions. This observation is further verified in the second part of the presentation where a cluster analysis was performed on a much wider geography and using a greater range of chemicals detected in groundwater.

AGRO 121
Multivariable approaches for determining groundwater vulnerability to agrochemical movement in soil, Part 2: Cluster analysis of California statewide groundwater vulnerability
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Groundwater vulnerability to non-point source contamination is not necessarily intrinsic to natural hydro-geological systems. On the contrary, vulnerability is dynamic because of human activities, such as agriculture, which results in the use of measurable surrogate values to infer spatial locations of vulnerability. These variables are often complex, inter-correlated, and their exact mechanistic relationships to groundwater contamination is unknown. In the first part of this sequential presentation, a Classification And Regression Tree (CART) analysis was performed only for the Southern Central Valley region of California. In this second part, we used a cluster methodology to provide a statewide analysis of the predominant soil properties associated with areas where wells had been designated as contaminated by pesticide residues due to non-point source contamination. As in the CART approach, no *a priori* assumptions were imposed regarding the pathway for chemical movement to groundwater. An important result from this approach similar to the CART finding was that soils containing a hardpan soil layer were again found to delineate vulnerable areas. Further investigation discovered that the water infiltration rate of these soils was very low due to the prevalent agricultural practices of annual pre-emergence herbicide application, no soil tillage, and significant tractor and foot traffic. Groundwater contamination from these hardpan soils was a result of residues dissolved in winter rain runoff water that was directed to sensitive areas, thereby providing a pathway to ground water. This condition requires different management strategies than those developed to mitigate leaching of residues in coarse soil conditions. We conclude that while there are a number of apparent natural factors that render sites vulnerable such as soil texture and total rainfall, a comprehensive understanding of vulnerable areas must include measures for the effects of anthroprogenic activities on altering physical and chemical properties of soils and on natural drainage routes.

AGRO 122
Modeling atrazine occurrence in shallow groundwater in agricultural areas of the United States
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A linear-regression model for predicting the occurrence of atrazine in shallow ground water in agricultural areas throughout the United States was developed from (1) data on atrazine occurrence in 52 agricultural study areas, and (2) geographic information on atrazine-use intensity, presence of artificial drainage, amount of agricultural land, and soil characteristics (permeability and water-holding capacity). The intensity of atrazine use accounted for only 7 percent of the variation in observed atrazine occurrence, whereas variables describing soil characteristics and drainage practices accounted for nearly 50%, an indication that atrazine use alone is an insufficient predictor of occurrence because soil characteristics and drainage practices strongly affect atrazine transport to shallow ground water. The model not only identifies the primary factors governing transport of atrazine to ground water, but also identifies areas of likely occurrence for future monitoring.

AGRO 123
Use of a geographic information system (GIS) with process-based simulation modeling to predict atrazine concentrations in shallow groundwater across the United States: Simulation approach and testing against nationwide observations
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Over the past two decades, many tools have been employed to predict the likelihood of detecting surface-derived contaminants in ground water. Statistical relations have been used at large spatial scales to predict contaminant occurrence from various site-based parameters. At such scales, however, process-based simulations of the transport and fate of the compounds of interest have been relatively uncommon. This presentation will describe an approach that (1) employs a GIS pre-processor to provide spatially-structured data input to a process-based vadose-zone model (PRZM3 or RZWQM98) for any location in the conterminous United States, (2) simulates the transport and fate of pesticides to estimate their concentrations in the vadose zone beneath each selected location, and (3) compares the simulated concentrations (in this case for atrazine) with those measured in shallow ground water sampled from over 1,200 wells across the US between 1992 and 2001 by the U.S. Geological Survey's National Water-Quality Assessment (NAWQA) Program.

AGRO 124
Mapping the vulnerability of European groundwater to the leaching of pesticides with a process-based metamodel of EuroPEARL
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To support EU policy, indicators of pesticide leaching at the European level are required. For this reason, a metamodel of the spatially-distributed European pesticide leaching model EuroPEARL was developed. EuroPEARL considers transient flow and solute transport and assumes Freundlich adsorption, first-order degradation, and passive plant uptake of pesticides. Physical parameters are depth dependent while (bio)-chemical parameters are depth, temperature, and moisture dependent. The metamodel is based on an analytical expression that describes the mass fraction of pesticide leached. The metamodel ignores vertical parameter variations and assumes steady flow. The calibration dataset was generated with EuroPEARL and consisted of approximately 60,000 simulations done for 56 pesticides with different half-lives and partitioning coefficients. The target variable was the 80th percentile of the annual average leaching concentration at 1-m depth from a time series of 20 years. The metamodel explains over 90% of the variation of the original model with only four independent spatial attributes. These parameters are available in European soil and climate databases, so that the calibrated metamodel could be applied to generate maps of the predicted leaching concentration in the European Union. Maps generated with the metamodel showed a good similarity with the maps obtained with EuroPEARL which was confirmed by means of quantitative performance indicators.

AGRO 125
Agricultural biomass, biobased products, and biofuels: Challenges and opportunities
***Gale Buchanan**, USDA-Research, Education, and Extension, Jamie Whiten Bldg, Washington, DC 20022*

The U.S. Department of Agriculture (USDA) and U.S. Department of Energy (DOE) are committed to furthering President Bush's Advanced Energy Initiative (AEI). The AEI seeks to accelerate the commercialization of clean, affordable alternative and renewable sources of energy by changing the way we power our cars, homes, and businesses. The enormous benefits of renewable energy are more recognized and appreciated by Americans today. Renewable fuels are environmentally friendly, producing fewer emissions of greenhouse gases than fossil fuels. In addition to renewable fuels, agricultural and forestry resources provide renewable raw materials for a broad range of nonfood and nonfeed products, such as chemicals, fibers, construction materials, and lubricants. Development and commercialization of such biobased and bioenergy products provide new and expanded markets for agricultural feedstocks, accelerate market penetration, reduce U.S. dependence on foreign oil which contributes to our nation's security, and diversify agriculture while fostering rural and sustainable development.

AGRO 126
Biomass-to-ethanol conversion: Strategies for developing flexible biorefineries
***William J. Orts**, Kevin M. Holtman, Gregory M. Glenn, Richard Offeman, George H. Robertson, Syed H. Imam, and Dominic W. S. Wong, Western Regional Research Center, USDA-Agricultural Research Service, 800 Buchanan St., Albany, CA 94710-1100*

In order for ethanol production to be viable in the western states, a wide range of feedstocks will need to be utilized which will require flexibility in the processing capabilities. For example, California has a limited supply of corn starch, but is the leading agricultural producer of more than 30 distinctly different crops, ranging from garlic, to artichokes, strawberries, walnuts, and grapes. The USDA-ARS has addressed the need for flexible processing of lignocellulosic material via a targeted program aimed at creating the athletic biorefinery, whereby, biomass from a wide array of feedstocks is converted to ethanol within the same plant throughout all seasons. This summary will focus on our strategies to meet this target, including (1) new enzymes and technologies for cellulose-to-ethanol capabilities via directed evolution of microbes, (2) novel separation engineering for ethanol and bioproduct isolation, (3) application of bioproducts, biobased plastics, and co-product utilization, and (4) crop improvement via plant molecular biology. Specific research results will be presented on such areas as cold starch hydrolysis for reducing energy costs during ethanol production, microbial screening methods for improving enzyme specificity and yield, and engineering considerations in developing the flexible, athletic biorefinery. One example of particular note is development of a biomass-to-ethanol pilot plant utilizing a mixture of municipal solids waste (MSW) and ag-derived biomass.

AGRO 127
Chemical and physical properties of pretreated biomass that affect enzyme accessibility and digestibility
***Mark F. Davis**, Claudia Ishizawa, Tina Jeoh, William S. Adney, Michael E. Himmel, and David K. Johnson, National Bioenergy Center, National Renewable Energy Laboratory, 1617 Cole Blvd, Golden, CO 80401, mark_davis@nrel.gov*

Understanding the chemical and physical factors governing biomass recalcitrance to enzymatic deconstruction is critical to achieving the biomass refinery concept. Current pretreatment technologies utilizing thermochemical processing to improve the accessibility of the cellulose fraction of biomass to cellulase enzymes tend to be harsh and can result in the accumulation of toxic inhibitors that affect the fermentation process. If we are to replace, or improve current pretreatment regimes with more benign and thus less costly procedures, an in-depth understanding of barriers to cellulase enzymes becomes critical. In this presentation, we examine select chemical and physical properties of pretreated biomass and their impact on enzyme accessibility and ultimately, the conversion of biomass to ethanol. We will discuss how physical parameters such as porosity and cellulose morphology as well as chemical parameters such as hemicellulose and lignin removal affect enzymatic conversion rates. Our findings, based on cellulose hydrolysis and enzyme adsorption data, confirm that improving cellulose accessibility to enzyme attack is critical to efficient conversion. While the removal of xylan and lignin to levels of around 80% increases the digestibility of corn stover, at higher levels of xylan and lignin removal, digestibility was seen to decrease significantly. The study presented here represents an on-going effort at the National Renewable Energy Laboratory to understand biomass recalcitrance using a combination of physical and chemical characterizations and to elucidate the effect of pretreatment processes on cellulase-substrate interactions in enzymatic studies using purified cellulases.

AGRO 128
Biodiesel: Science based regulation and consumer protection
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While the use of agriculturally-based biomass is receiving increased attention for the sustainable use of natural resources, it is imperative that products produced and sold to the public are safe and meet specifications established by national associations as well as standards set by federal and state laws. In the case of biodiesel, current specifications only exist for pure (100%) biodiesel and do not address biodiesel blends that may be sold to the general public. Regulations are needed at the State level in order to insure that products produced or imported and sold in the states meet quality standards. In the absence of such standards, biodiesel products sold to consumers could have low flashpoints or exhibit cold-flow instability. The use of such products could damage equipment engines and undermine consumer confidence in this fledgling industry. For example, proposed regulations in Mississippi intend to limit the amount of alcohol allowed in biodiesel blends for retail sale and require current certificates of analysis to address product stability. Such regulations should assist the industry and allow it to grow on a national scale.

AGRO 129
Enzyme and microbial bioconversion of agricultural and forestry residues for transportation fuel
***Joy Doran Peterson**, Kate Brandon, Dana Cook, Emily DeCrescenzo, Eduardo de Ximines, Amrutra Jangid, Zeynep Cvetkovich, and Jenna Young, Department of Microbiology, University of Georgia, 204 Biological Sciences, Athens, GA 30602, jpeterso@uga.edu*

Political, environmental, and economic drivers have aligned to focus intense research and commercialization efforts on renewable fuels. Using agricultural and forestry residues as substrates for enzyme and microbial conversions to fuel adds value to existing processes, while removing a potential waste disposal concern. Substrates examined include: 1) sugar beets and residues, and 2) forestry residue and paper mill sludge. Pectin-rich sugar beet pulp was converted to over 100 gal ethanol/dton of pulp using fungal enzymes and bacterial catalysts. Using a processing residue like beet pulp or paper mill sludge has the added advantage of being collected in one site and already partially processed, thus decreasing overall ethanol production costs. Ethanol produced from fibrous materials such as forestry residues varied according to the additional chemical or physical pretreatment employed and from variations in residue composition. Using forestry residues and thinnings for transportation fuel could help reduce fire danger and improve forest health.

AGRO 130
Coproduction of fuel ethanol and new value added coproducts
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The production of fuel ethanol using the corn dry grind process produces distillers dried grains with solubles (DDGS) and carbon dioxide as the only coproducts. The DDGS are primarily used as feed for ruminant animals and have limited use in non-ruminants due to the high fiber content. The market price of DDGS has significantly decreased as the number of new dry grind production facilities has increased. The extraction of new coproducts from corn processing has been a long term focus of research in our laboratory. Recently, we began investigating the potential and feasibility of “co-production” of value added products with simultaneous production of ethanol. Several possible strategies have been investigated for making products that can enhance existing coproducts or produce ones that are unique and would represent completely new feeds for the industry. Preliminary data suggest a number of different microbially-derived products can be produced in series (or parallel) with ethanol production while utilizing many common unit operations. This strategy could greatly increase the number of possible products produced by a corn processing facility and could improve the overall economics of fuel ethanol production. An example of the integrated production of a value added product will be presented and an integrated cost model for production will be shown.

AGRO 131
Energy balance of switchgrass grown for cellulosic ethanol in the Northern Plains, USA
Marty R. Schmer[1], *Kenneth P. Vogel*[1], *Robert B. Mitchell*[1], *and Richard K. Perrin*[2]. *(1) Grain, Forage, and Bioenergy Research Unit, USDA-Agricultural Research Service, 344 Keim Hall, East Campus, Lincoln, NE 68508, mschmer@unlserve.unl.edu, (2) Agricultural Economics, University of Nebraska-Lincoln*

Switchgrass (*Panicum virgatum L.*) is a potential, herbaceous feedstock for cellulosic ethanol in the USA. Estimates on switchgrass energy inputs and ethanol energy yields are highly variable and are largely based on small-plot research. A five-year, field-scale trial was completed on 10 farms in the Northern Great Plains to evaluate the energy balance for switchgrass grown for cellulosic ethanol. Energy balances were calculated using the energy and resources group biofuel analysis meta-model (EBAMM) model based on known farm inputs. Nitrogen fertilizer, diesel fuel, and herbicides accounted for 62, 17, and 10%, respectively, of average agricultural energy inputs. Net energy values averaged 21.6 MJ L^{-1} with a range of 16.9 to 23.7 MJ L^{-1} for the ten farms. The EBAMM model showed that switchgrass on average produced an estimated 13.5 MJ of ethanol for one MJ input of petroleum.

AGRO 132
DDT and cyclodiene resistance: Old mechanisms give resistance to new compounds
Richard H. ffrench-Constant, *Center for Ecology and Conservation, University of Exeter in Cornwall, Tremough, Penryn, Truro TR10 9EZ, United Kingdom, r.ffrench-constant@exeter.ac.uk*

Numerous insects have developed resistance to the historically-important insecticides, DDT and the cyclodienes. Here we will review what is known about the mutations causing DDT and cyclodiene resistance and examine the extent to which these old mechanisms can confer resistance to new compounds, such as the fipronils and neonicotinoids. Details on point mutations in the Rdl encoded GABA receptor and up-regulation of cytochrome P450 genes in *Drosophila* will be discussed.

AGRO 133
Insect P450: Diversity of structure and function
René Feyereisen, *INRA & Université de Nice-Sophia Antipolis, 400 route des Chappes, BP167, 06903 Sophia Antipolis, France, rfeyer@sophia.inra.fr*

The complete sequence of several insect genomes highlights the diversity and evolution of insect P450 genes. The difficult task of assigning a function to the unexpectedly large number of P450 genes brings biochemical toxicology and endocrinology closer together as the boundaries between physiological function, detoxification, and environmental response gradually disappear. Pesticides and xenobiotics remain useful tools in defining the catalytic competence of purified, heterologously-produced P450 proteins and in understanding the regulation of P450 gene expression. This will be illustrated by examples from our research in which cyclodienes and juvenile hormones are prominent players.

AGRO 134
Pharmacokinetic approaches to optimize insecticidal chemistry
Martyn Glenn Ford, *Centre for Molecular Design, Portsmouth University, King Henry Building, King Henry I Street, Portsmouth PO5 4HS, United Kingdom, martyn.ford@port.ac.uk*

An ideal insecticide is a compound that is highly toxic to target insect pest species but with low toxicity to non-target organisms and with a high differential toxicity between insects and vertebrates. It should also have a low environmental impact and be rapidly removed from the environment when adequate control of pest species has been achieved. Very few compounds approach this ideal indicating the difficulty of designing insecticides to meet these diverse, often conflicting, criteria. Developments in the insecticide industry use the same computational chemical methods employed by the pharmaceutical industry to generate the necessary descriptions of the physicochemical properties of insecticides. However, useful *in vivo* physiological data in insects is very limited, in part, because of the very small size of insects compared with mammals. Nevertheless, such data has been used to provide a synthesis of the information that is pertinent to the problem of designing new and improved insecticides. This presentation will explore the available information on insecticide the pharmacokinetics in insects and assess the potential for developing computationally-based, quantitative, predictive models. This should help development teams working on new insecticides to prioritize their efforts in order to optimize the design of lead compounds.

AGRO 135
Pyrethroids, knockdown resistance, and sodium channels
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Knockdown resistance to DDT and the pyrethrins was first described in 1951 in the house fly. This trait, which confers reduced neuronal sensitivity to these insecticides, was subsequently shown to confer cross-resistance to all synthetic pyrethroid insecticides that have been examined to date. As a consequence, the worldwide commercial development of pyrethroids as a major insecticide class over the past three decades required constant awareness that pyrethroid over-use has the potential to re-select this powerful resistance mechanism in populations that previously were resistant to DDT. The demonstration of a tight genetic linkage between knockdown resistance and the house fly gene encoding the voltage-sensitive sodium channels spurred efforts to identify gene mutations associated with knockdown resistance and to understand how these mutations confer a reduction in the sensitivity of the pyrethroid target site. This presentation will review progress in understanding knockdown resistance at the molecular level.

AGRO 136
Cyclodiene-induced alterations in mammalian dopaminergic pathways as a possible cause of environmentally-induced Parkinsonism
***Jeffrey R. Bloomquist**, Department of Entomology, Neurotoxicology Laboratory, Virginia Tech, Blacksburg, VA 24061, Fax: 540-231-9131, jbquist@vt.edu*

A possible environmental trigger for the dopamine depletion seen in Parkinson's disease (PD) is exposure to pesticides as indicated from a number of epidemiological studies. In particular, the occurrence of PD was significantly correlated ($p = 0.03$) with the presence of brain residues (mean = 13 ppb) of the insecticide dieldrin. We have undertaken a series of studies to evaluate the effects of cyclodienes on dopaminergic pathways in the basal ganglia of C57Bl6 mice. Initial studies showed that heptachlor injections given three times over a two-week interval caused an up-regulation of both the plasma membrane dopamine transporter (DAT) and the vesicular monoamine transporter (VMAT). Heptachlor epoxide was also found to block the function of VMAT, but not the DAT. Up-regulation of the DAT occurred at doses (6-12 mg/kg) that had no effect on serotonin transport and correlated with more potent effects of cyclodienes on dopamine release than release of other transmitters. In murine striatal brain slices, the inhibition of nerve firing by cyclodienes was mediated by release of dopamine and not apparently, by GABA antagonism. Thus, an old putative mode of action of these compounds may have new relevance for mammalian toxicity.

AGRO 137
Bioassays for persistent organic pollutants in receptor-mediated reporter gene expression systems
***Hideo Ohkawa**, Research Center For Green Science, Fukuyama University, Fukuyama 729-0292, Japan, hohkawa@fubac.fukuyama-u.ac.jp, Hideyuki Inui, Kobe University, Research Center for Environmental Genomics, and Yoshikazu Tanaka, Suntory Ltd, Institute for Advanced Technology*

Contamination of the environment and agricultural products with persistent organic pollutants (POPs) including dioxins and organochlorine insecticides is a serious problem in the world. These chemicals are found in the environment and agricultural products at nano-level concentrations. They accumulate at extremely high levels on the top of food chains and expand to the whole earth particularly through aquatic ecosystems. Therefore, it is important to monitor these residues on-site and at real-time. In general, a high performance GC/MS is used for analysis of POPs. Some POPs specifically bind to a receptor and then induce the expression of certain genes, resulting in their toxicity and/or other biological activities in animals. On the other hand, certain ground plant species have deeply spread roots. These plants can absorb and accumulate nano-level chemicals from a wide area through their root systems. Therefore, we attempted to introduce an animal receptor-mediated reporter gene expression system into plants for the development of bioassay systems of POPs. The transgenic plants with an aryl hydrocarbon receptor (AhR)- or an estrogen receptor (ER)-mediated reporter gene expression system were generated and evaluated as bioassay systems of POPs. The bioassays appear to be useful for the fast screening of POP monitoring.

AGRO 138
***In vitro* metabolic interactions of pesticides in humans**
***Ernest Hodgson**, Department of Toxicology, North Carolina State University, Campus Box 7633, Raleigh, NC 29695-7633, Fax: 919-513-1012, ernest_hodgson@ncsu.edu*

Investigations utilizing recombinant human xenobiotic-metabolizing enzymes as well as human hepatocytes have revealed a number of interactions, not only between different pesticides but also between pesticides and endogenous metabolites. Organophosphorus insecticides (OPs) are potent inhibitors of the human metabolism of carbaryl, carbofuran, and DEET as well as the jet fuel components, nonane and naphthalene. Of potential importance are the observations that OPs are potent irreversible inhibitors of testosterone metabolism by cytochrome P450 (CYP) 3A4 and of estradiol metabolism by CYP3A4 and CYP1A2. All of these CYP inhibitions are believed to be due to the release of reactive sulfur during CYP catalyzed oxidative desulfuration. It has also been shown that the esterase responsible for the initial step in the metabolism of permethrin in human liver is inhibited by both chlorpyrifos oxon and carbaryl. A number of pesticides, including chlorpyrifos, fipronil, and permethrin and the repellent, DEET, have been shown to be inducers of CYP isoforms in human hepatocytes with fipronil being the most potent. Several pesticides, including fipronil and the pyrethroids, permethrin, and deltamethrin, show toxicity toward human hepatocytes with fipronil being the most potent. α-Endosulfan, which has shown promise as a model substrate for phenotyping CYP3A4 and CYP2B6 in human liver microsomes, is also an inducer of CYP2B6 acting through the SXR receptor.

AGRO 139
Connecting watersheds and water quality: Understanding the transport of agricultural chemicals to streams
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Pesticide and nutrient concentrations in stream water are affected by the physical connections between a stream and its watershed. Agricultural chemicals enter a watershed by either application to cropland or by atmospheric deposition. As contaminants, agricultural chemicals can be transported through the hydrologic system to the stream as overland and shallow subsurface flow, tile-drain flow, and ground-water discharge. Hydrologic flow paths to streams are determined by watershed characteristics, including topography, land use, climate, soil, and agricultural practices. Geographic delineation of watersheds and analysis of their characteristics provide a framework for understanding the hydrologic processes that affect the transport of agricultural chemicals to streams. Spatial analyses combined with statistical methods also can be used as predictive tools to estimate agricultural chemical concentrations in unmonitored streams. This presentation illustrates how geographic analysis clarifies the connection between watersheds and water quality by showing examples from the U.S. Geological Survey's National Water-Quality Assessment Program.

AGRO 140
Estimating pesticide concentrations in U.S. streams from watershed characteristics and pesticide properties
***Wesley W. Stone**, Charles G. Crawford, and Robert J. Gilliom, U.S. Geological Survey, 5957 Lakeside Boulevard, Indianapolis, IN 46278, wwstone@usgs.gov*

Empirical regression models have been developed by the U.S. Geological Survey (USGS) for estimating the concentration of atrazine and other pesticides in streams; the models are based on pesticide-use intensity and watershed characteristics. Separate models were developed to estimate time-weighted annual mean and selected percentile concentrations. The models were developed from USGS National Water-Quality Assessment Program monitoring data collected from more than 100 streams throughout the United States. 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 pesticide concentrations. The potential influence of regional factors on model performance was evaluated through application of the models to about 62,000 Reach File 1 watersheds across the United States. Trends in pesticide occurrence in streams were investigated through use of the models with 1992, 1997, and 2002 data.

AGRO 141
Flow accumulation-based application of the WARP model to identify stream segments with high pesticide exposure risk
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The Watershed Regressions for Pesticides (WARP) model has been used widely to assess pesticide exposure levels in surface waters. The model uses watershed-level inputs of pesticide use, drainage area, precipitation, rainfall intensity, soil erodibility, and the percentage of Dunne runoff to predict pesticide concentrations with a variety of recurrence intervals. A limitation of the watershed-based approach is the unaccountability of the spatial variability of exposure risk within a watershed. To overcome this limitation, we applied the concept of upstream flow accumulation to perform WARP calculations at every grid cell within a digital elevation model. The resulting WARP grid was then filtered by the flow accumulation area in order to represent only cells corresponding to perennial streams. The resulting dataset was converted to a vector stream layer which was used to identify proposed surface water monitoring locations at greatest risk for high pesticide exposures based upon the reach-level WARP predictions.

AGRO 142
Hydrology-based screening tool for estimating catchment vulnerability to corn herbicide runoff
***Christian Leu**, Environmental Sciences, Syngenta Crop Protection AG, Werk Rosental - Schwarzwaldallee 215, CH-4058 Basel, Switzerland, christian.leu@syngenta.com, and Paul Sweeney, Syngenta Crop Protection*

Most conventional catchment-scale approaches for estimating herbicide-runoff potential examine complex interactions between key drivers including rain, soil properties and topography; however, the quality and spatial resolution of these data layers can introduce significant prediction uncertainty. Conceptual models suggested that catchment-intrinsic drivers for herbicide-runoff transport are closely related to factors determining the relative importance of catchment baseflow vs. fast flow. Furthermore, because flow data is often more widely available, catchment vulnerability ranking based on flow statistics can improve spatial estimates of watershed runoff vulnerability. Data were analyzed from four tributaries of Lake Erie (USA) and two Swiss catchments. Long-term measurement of herbicide-runoff losses showed linear dependence on the fast flow discharged in the first month after herbicide application. The relationship depends on herbicide properties as well as on baseflow relative to total discharge (BFI). Illustrative examples demonstrating possible uses and limitations of the screening tool will be presented.

AGRO 143
Estimating the likelihood of occurrence of selected pesticides and nutrients at specific concentrations in Coastal Plain streams on the basis of landscape characteristics
***Scott W. Ator**[1], Judith M. Denver[1], Anne C. Neale[2], and Ann M. Pitchford[2]. (1) U.S. Geological Survey, 8987 Yellow Brick Road, Baltimore, MD 21237, Fax: 410-238-4210, swator@usgs.gov, (2) U.S. Environmental Protection Agency*

The occurrence of selected pesticides and nutrient compounds in nontidal headwater streams of the Mid-Atlantic Coastal Plain (North Carolina through New Jersey) during winter and spring base flow is related to land use, soils, and other geographic variables that reflect sources and environmental fate and transport of these compounds. Water samples were collected between mid-February and early June 2000 from a randomly designed survey of 174 streams representing the range of land-use and hydrogeologic settings in the Coastal Plain. Logistic regression was used to relate measured stream chemistry to features of contributing watersheds, including agricultural or urban land use, soils, and other geographic characteristics. Regression models estimate the likelihood of occurrence of selected pesticide and nutrient compounds at specific concentrations in more than 9,000 headwater streams throughout the Coastal Plain and provide insight into natural and human factors affecting the distribution of such compounds in streams.

AGRO 144
Integration of spatially detailed information to assess the role of agricultural sources in nutrient loading to the Chesapeake Bay
***Stephen D. Preston** and John W. Brakebill, MD-DE-DC Water Science Center, U.S. Geological Survey, 8987 Yellow Brick Road, Baltimore, MD 21237, spreston@usgs.gov*

Agriculture is widely accepted as one of the primary causes of excessive nutrient loading that has led to eutrophication of the Chesapeake Bay. To better understand the relative importance of agricultural sources and the environmental processes that affect nutrient loading, data analysis methods are needed for integrating the various types of spatially explicit information that are currently available. Consistent with that need, the U.S. Geological Survey has developed statistical tools known as spatially referenced regression models which provide a means of relating watershed characteristics to measures of stream loading within a detailed spatial framework. The technique is referred to as "SPARROW" (SPAtially Referenced Regressions On Watershed Attributes). Using this technique, models were developed that provide spatially-detailed estimates of nutrient loading for three separate time periods. Among other applications, the models are currently being used to

evaluate: 1) the primary sources of nutrients; 2) the locations of those sources; and 3) the role of attenuation factors in the delivery of nutrients to the Bay.

AGRO 145
Regression models for explaining and predicting organochlorine pesticide concentrations in whole fish from U.S. streams
Lisa H. Nowell, *Charles G. Crawford, Naomi Nakagaki, Gail P. Thelin, and David M. Wolock, U.S. Geological Survey, Placer Hall, 6000 J Street, Sacramento, CA 95819, Fax: 916-278-3070, lhnowell@usgs.gov*

Empirical regression models were developed to predict organochlorine pesticide concentrations in whole fish from unmonitored U.S. streams on the basis of fish lipid content and watershed characteristics. Models were developed for DDT compounds, chlordane compounds, and dieldrin using whole-fish data collected from 650 streams nationwide by the U.S. Geological Survey's National Water Quality Assessment (NAWQA) Program. The most important explanatory variables were fish lipid content and various watershed characteristics, including past agricultural-pesticide use intensity, surrogate variables representing past termiticide use, population density, and forested land where past pesticide use was likely minimal. Variables representing fish taxa or geographic regions were of secondary importance. These models typically explained 50-70 percent of the variability in pesticide concentrations measured in whole fish. Only one model (*p,p'*-DDT) was improved substantially when the measured pesticide concentration in bed sediment from the same streams was included as an explanatory variable.

AGRO 146
Examining the relative proximity of agriculture to surface water across Europe
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A context-setting exercise was performed to rank the relative severity of five sites examined for surface water exposure by spray drift compared to other agricultural regions of Europe. The five sites represented three major crop types: vines, arable crop, and orchards. Europe-wide spatial data on land cover and surface water were used to estimate the percentage of crop, amount of water, and proximity of crop to water at a 10 km grid level. The distribution for the approximately 26,000 resulting grids across Europe was then compared to the distribution for each of the detailed sites. These comparisons showed that for each crop, the 90th percentile of the individual sites is equivalent to a greater than 90th percentile (i.e., 98th percentile) in the distribution for Europe. In other words, this methodology indicates that the detailed study areas are more extreme than most sites in Europe.

AGRO 147
Biobased: Making it competitive and sustainable
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The Agricultural Research Service (ARS), the in-house research agency of USDA, conducts research to develop solutions to agricultural problems of high national priority. This includes fundamental, long-term, high-risk research as well as more applied, focused, problem-solving research. Research related to biobased products focuses on developing feedstocks and industrial products (including biofuels and bioenergy) that expand markets for agricultural materials, replace imports and petroleum-based products, and offer opportunities to meet environmental needs. New and advanced technologies are developed, modified, and utilized to convert plant and animal commodities and by-products to new products. This includes development of energy crops as well as new crops to meet niche markets, such as natural products for use as nutriceuticals, biopesticides, and other high-value materials. ARS research must also be responsive to consumer demands for high-quality, safe products and to government and consumer pressures providing products that are environmentally-friendly and are produced using processes that are not harmful to people, animals, and the environment. Successful completion of these goals will allow ARS to contribute to a sustainable and profitable agricultural production system.

AGRO 148
Developing herbaceous energy crops as feedstocks for bioethanol production
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Perennial herbaceous crops with high biomass yields are promising substrates for producing bioethanol. A variety of biomasses including cool and warm season grasses and a legume are being evaluated for this purpose. As a first approach, biomass materials were pretreated with dilute sulfuric acid and either converted to sugars by solely adding commercial cellulase preparations or to ethanol by co-adding *Saccharomyces cerevisiae*. Sugar and ethanol yields were influenced by both plant type and harvest maturity. Conversion efficiency was found to decrease and carbohydrate content to increase with maturity. Also, alfalfa stem was more recalcitrant than other sources of biomass tested to pretreating with dilute acid. A critical issue found for herbaceous biomass was the relatively high amounts of soluble sugars compared to other sources of biomass. It was determined that treating with dilute acid may be impractical as the pretreatment converts these sugars to furans which inhibit the subsequent yeast fermentation. Currently, other pretreatment methods are being explored that are more amendable to preserving these sugars.

AGRO 149
Alternative feedstocks for renewable green energy fuel
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High prices for petroleum have enhanced interest in alternative fuels such as biodiesel. Currently, the majority of biodiesel is produced from the transesterification of soybean and canola oils resulting in fatty acid methyl esters and glycerol, an unwanted by product. Feedstocks which do not compete with food crops and the development of alternative uses for glycerol is needed for biodiesel to become an economically feasible energy source. We examined *Hesperis matrinalis*, a winter planted annual and *Rhodotorula glutinis*, an oleaginous yeast, as two potential lipid sources. The yeast cells were cultivated on medium containing glycerol alone and in combination with a variety of sugars. The oils were extracted from both sources, transesterified, and analyzed by GC/MS to identify the free fatty acid content. *H. matrinalis* generated 23% oil and *R. glutinis* generated between 16% and 34% oil depending on the medium. The following were identified by GC/MS as the major components of the fatty acid profile: palmitic (C_{16}:0), steric (C_{18}:0), oleic (C_{18}:1), linoleic (C_{18}:2), and linolenic (C_{18}:3).

AGRO 150
***Aspergillus flavus* genomic data mining provides clues for its use in producing biobased products**
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Aspergillus flavus is notorious for its ability to produce aflatoxins. It is also an opportunistic pathogen that infects plants, animals, and human beings. The ability to survive in the natural environment, living on plant tissues (leaves or stalks) or live or dead insects, make *A. flavus* a ubiquitous species that can be found almost everywhere on our planet. The saprophytic property of *A. flavus* has rarely been explored for its potential benefit. In the course of investigating its pathogenic mechanism, we have identified a gene encoding for a pectinase that is capable of degrading complex starch into simple sugars for its nutrition. It is well known that *A. flavus* possesses a whole array of degrading enzymes that can breakdown organic matter, such as cellulose, and produce energy. *A. flavus* whole genome sequencing has been completed at The Institute for Genomic Research (TIGR). Genes identified in the *A. flavus* genome that potentially encode for enzymes involved in degrading organic matter, include cellulases, 11 amylases, 5 proteinases, 8 polygalacturonases, and hundreds of hydrolases. These fungal enzymes could play important roles for its saprophytic property. The *A. flavus* whole genome microarrays can be used for genome-wide gene profiling and genetic expression studies. Genetic engineering of the fungal genome can be considered to create a highly efficient bio-degrader for bioconversion or for organic waste recycling, particularly in the production of biofuels.

AGRO 151
Fully automated molecular biology routines for evaluation and characterization of industrial yeast strains optimized for ethanol production from cellulosic biomass and for biobased-pesticide expression
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To meet increasing demand for energy from agricultural materials to replace petroleum-based energy sources, fuel ethanol production from agricultural feedstocks must be optimized. USDA-ARS has developed the first fully-automated platform employing molecular biology routines to optimize genes for engineering an industrial *Saccharomyces cerevisiae* strain to ferment xylose from corn fiber as well as glucose from corn starch. The automated platform is also used to incorporate genes into this yeast to express a commercially-useful, biobased product with pesticidal activity against the corn earworm in addition to expressing xylose isomerase and other genes for fermentation of xylose from hydrolyzed cellulosic biomass. Genes are optimized using an amino acid scanning mutagenesis strategy; the improved yeast strain is then screened for optimal growth on pentose sugars. All operations of the automated workcell will be discussed, including expression protocols for profiling and characterizing the pesticide and the optimized open reading frames.

AGRO 152
Biological abatement for removal of inhibitors from biomass sugars
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An important barrier to commercialization of the biomass-to-ethanol process is the presence of substances that are toxic to fermenting microorganisms. Organic acids, aldehydes, phenolics, and furan compounds arise during acid hydrolysis of lignocellulosic biomass and may cause slow or failed fermentations. We have developed a bioremediation strategy to detoxify biomass sugars prior to fermentation. Microorganisms were enriched from soil for their capacity to metabolize ferulic acid, furfural, and 5-hydroxymethylfurfural and for their ability to grow in acid hydrolysate of corn stover. The best isolate for removing inhibitors was a fungus, *Coniochaeta ligniaria* NRRL 30616. Analytical extraction of corn-stover hydrolysate followed by HPLC and LC-MS analyses has been used to quantitate a variety of aromatic acid, aliphatic acid, and aldehyde and phenolic degradation products. This approach was used to follow the removal of several important compounds during inhibitor abatement.

AGRO 153
FT-IR analysis of oil feedstock and biodiesel quality
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Fourier transform infrared (FT-IR) spectroscopy is used to evaluate the quality of various agriculturally-derived oils used as feedstocks for biodiesel production and the quality of the produced biodiesel. Most important to feedstock quality is the assessment of free fatty acid (FFA) content as evidenced by acid peaks in the spectrum that are separate from ester peaks. Many qualitative differences exist between the oil feedstock and the transesterified methyl esters and these will be highlighted. More importantly, quantitative assessment of the transesterification reaction is possible by monitoring the appearance of new methyl peaks in the FT-IR spectra. Quantitative results will be presented as equations that utilize the methyl peak areas intensities and positions in the FT-IR spectra to assess the extent of reaction.

AGRO 154
Effects of production practices on biodiesel quality
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The demand for transportation fuels is increasing around the world especially the demand for petroleum-based fuels. To cope with rising demand and dwindling petroleum reverses, alternative motor fuels such as biodiesel are at the forefront of commercialization. Biodiesel is composed of mono-alkyl esters of long chain fatty acids. These esters are produced when vegetable oil, animal fat, or recycled grease (containing triglycerides) is reacted with an alcohol, usually methanol. A stochiometric excess of alcohol and a catalyst is required for the effective production of the alkyl esters. In order to be commercially available and to receive federal and state incentives, biodiesel must meet the specifications in ASTM 6751, Standard Specification for Biodiesel Fuel (B100) Blend Stock for Distillate Fuels. A minimum flash point (closed cup) specification of 130°C is set by ASTM 6751 and is an indicator of flammability and a measurement of residual alcohol in B100. The excess alcohol can be removed by conventional or vacuum distillation. However, residual alcohol in the biodiesel phase can only be removed by water wash steps or by flash distillation. Improper removal of residual alcohol results in flash points below 130°C and safety concerns for consumers of these products.

AGRO 155
Biological activities of a bait toxicant for population management of subterranean termites
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One vital goal in subterranean termite IPM is to reduce termite damage potential by managing their populations in a large area. For an area-wide population management program, the target unit for control is the colony instead of the individual termite. To reduce the overall termite populations, all detectable colonies have to be eliminated one-by-one. Thus, the ability of a control measure to kill a subterranean termite colony, not just suppress or reduce the number of termites within a colony, is crucial. Two criteria, slow-acting and non-repellency, were early on identified as the characteristics required for a successful bait toxicant. A third characteristic that the lethal time has to be dose-independent was later found to be an important requirement for a bait toxicant to eliminate a colony successfully. Metabolic inhibitors, such as sulfluramid or hydramethylnon, are slow-acting and non-repellent (at certain concentrations), but their lethal times are generally dose-dependent. Thus far, only growth regulators are known to be dose-independent in their lethal time. Laboratory and field trials with metabolic inhibitors and growth regulations will be discussed.

AGRO 156
Metaflumizone: A semicarbazone insecticide for structural pest control from BASF
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Metaflumizone is a new semicarbazone insecticide developed by BASF. It exhibits good potency on a multitude of key insect pests (Hymenoptera, Isoptera, Orthoptera, Lepidoptera, Coleoptera & Diptera). Metaflumizone has shown no cross resistance with existing products and has favorable toxicological and environmental profiles. It has been designated as a reduced-risk candidate insecticide by the US Environmental Protection Agency. It is compatable with Integrated Pest Management and Insecticide Resistance Management Programs. Efficacy and use data will be presented on key urban pests in this presentation.

AGRO 157
MIKRON formulation: A new process for making pesticides
Dina L. Richman *and Jim B. Ballard, Pest Solutions, FMC Corp, 1735 Market Street, 19th Floor, Philadelphia, PA 19103, Fax: 215-299-6100, dina_richman@fmc.com*

FMC's new MIKRON formulations are thermodynamically-stable microemulsions made by a novel formulation technology that allows for the combination of hydrophilic and hydrophobic active ingredients in a homogeneous formulation. This technology is applicable to a wide variety of active ingredients including insecticides, fungicides, and herbicides. Currently, Quicksilver™ MIKRON Herbicide utilizing this technology, is commercially available and several other formulations are in development. These novel pesticides allow for easier application, have a wider applicator safety margin, and perform better than other formulations currently available.

AGRO 158
Natural product technologies for use in pest management
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In urban and agricultural pest control, there is a need for the development of alternatives to traditional insecticides. Plant essential oils are known to contain compounds with insecticidal activity. However, effective utilization of this activity has remained a constant challenge in pest management. Research conducted on the identification and characterization of plant oils and their individual components' toxic effects are aimed toward identifying an increased speed of kill and potency. Studies on the repellent properties of essential oil components, with an emphasis on increasing residual effects, are also a major focus of current research. Essential oil mixtures comprised of compounds with both spatial (monoterpenoids) and contact (sesquiterpenoids) repellency show high levels of residual control in our laboratory studies.

AGRO 159
***Quo vadis*: Recent advances in the management of German cockroaches**
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German cockroach, *Blattella germanica* (L.) is the most important insect pest in urban dwellings. Traditionally, conventional chemical control utilizing residual insecticides formed the foundation of cockroach management. However, development of wide-spread insecticide resistance inherently associated with the over reliance on chemical control, as well as increased public concern about exposure to pesticides provided the driving force for the implementation of Integrated Pest Management (IPM) in German cockroach control at the operational level. Insecticides remain at the center of the IPM approach but advances in insect diet science provided an ecologically-sound delivery technology: baits which form the basis of management today. The development of behavioral resistance in German cockroach populations to gel baits heralded the most recent challenge in cockroach control. Discussion of German cockroach management will be presented in this paper within the context of operational constrains and realities.

AGRO 160
Initial soil penetration of aqueous termiticide solutions
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The initial penetration of two termiticide formulations, Premise (imidacloprid) and Termidor (fipronil), were tested in four soils at three moisture levels in a laboratory study. In each situation, the highest concentrations of active ingredient were found in the top 1 cm of soil and decreased with increasing depth. Active ingredient concentration decreased in the top 1 cm as soil moisture increased, indicating deeper penetration in moister soil. Within a soil type, increasing soil moisture increased the depth of initial penetration. Increasing soil moisture, however, had little effect on the volume of soil with sufficiently-high concentrations to kill termites.

AGRO 161
American healthy homes survey: A national study of residential pesticides measured from floor wipes
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The US Environmental Protection Agency and the US Department of Housing and Urban Development conducted the American Healthy Homes Survey (AHHS) in 2006 to assess environmental concentrations of lead, allergens, mold, pesticides, and arsenic in and around U.S. residences. Questionnaire and environmental data were collected from a stratified, nationally representative sample of approximately 1,100 residences located across the US. Hard-surface wipe samples from 500 of these residences were analyzed for past and current-use insecticides, with emphasis on the pyrethroid class. The data are being used to estimate distributions of residential concentrations and potential exposure and to produce a database for examining changes in the occurrence, magnitude, and potential exposures over time. Furthermore, the data will be used to characterize relationships between product use and application information, indoor and outdoor source contributions, residential housing factors, and pesticide residue concentrations. A summary of collection methods and chemical analysis and concentrations will be presented. Disclaimer: Although this work was reviewed by EPA and HUD and approved for publication, it may not necessarily reflect official Agencies' policy.

AGRO 162
Residential exposure to piperonyl butoxide through pyrethroid insecticide use
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Piperonyl butoxide (PBO) is a pesticide synergist added to some pyrethroid insecticide formulations. It acts by inhibiting P450 enzyme activity and delaying detoxification of parent compounds. We collected questionnaire data on pest control and measured PBO in personal (n=203) and indoor (n=292) air samples from pregnant African American and Dominican women in New York City from 2000 to 2005. Of the total subjectss, 86.9% eported using pest control measures during pregnancy, 54.3% reported using higher toxicity pesticides (spray cans, pest bombs, and/or exterminators). PBO was detected in 74.6% and 45.5% of personal and indoor air samples (range, 0.2-608 ng/m^3). Levels in personal and indoor air were significantly higher among mothers reporting use of higher toxicity pesticides (ANCOVA, $p<0.001$). Pyrethroid use appears to have increased between 2000 to 2005. While no data are available on potential health effects resulting from chronic, low-level exposure to PBO, evidence of widespread residential exposure in this cohort warrants future research.

AGRO 163
Potential for human exposures to pet-borne diazinon residues following residential lawn applications
Marsha K. Morgan, *Daniel M. Stout II, and Peter P. Egeghy, National Exposure Research Laboratory, US Environmental Protection Agency, MD-56, Research Triangle Park, NC 27711, Fax: 919-541-0905, morgan.marsha@epa.gov*

A pilot-scale observational measurement study was performed to examine the potential for pet dogs to transport pesticide residues into homes following residential lawn applications. Sampling was performed at six households at pre, 1, 2, 4, and 8 days following a homeowner's application of a granular formulation of diazinon to the lawn. Samples collected included air, soil, dust, transferable residues (turf, floors), human urine (for the metabolite, 2-isopropyl-6-methyl-pyrimidin-4-ol [IMPy]), and dog paw wipes and fur clippings. Diazinon was measured in all environmental media collected at the households. Diazinon residues measured from the fur and paws of the dogs were likely tracked into the homes. Intimate contacts (petting) between the pet and occupants likely resulted in exposures to pet-bound diazinon residues. The results showed that turf applications may be both a direct and an indirect source for occupant and pet exposures to pesticides at residences.

AGRO 164
Assessing the potential transfer of pesticides to groundwater and surface waters throughout Europe: The EU-funded project FOOTPRINT
Igor G. Dubus, *Water Division, BRGM, Avenue C. Guillemin, BP 36009, 45060 Orléans Cedex 2, France, Fax: +33 (0)2 38 64 34 46, i.dubus@brgm.fr*

FOOTPRINT (Functional TOOls for Pesticide RIsk assessmeNt and managemenT) is a three-year research project funded by the European Union. The project aims at developing a suite of three pesticide risk prediction and management tools for use by three distinct end-user communities: farmers and extension advisors at the farm scale, water managers at the catchment scale, and policy makers/registration authorities at the national/EU scale. The tools will allow users to: i) identify the dominant contamination pathways and sources of pesticide contamination in the landscape; ii) estimate pesticide concentrations in local groundwater resources and surface water abstraction sources; and, iii) make scientifically-based assessments of how the implementation of mitigation strategies would reduce pesticide contamination of adjacent water resources. The methodology is based on the definition of a large number of agro-environmental scenarios and their modelling using the pesticide fate models MACRO and PRZM. Additional information is found at www.eu-footprint.org.

AGRO 165
National assessment of pesticide environmental risk from agricultural sources using a microsimulation modeling approach
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A microsimulation modeling approach is being used to quantify the risk from pesticide losses from farm fields for reporting at the national level. It is based on a subset of 20,000 National Resource Inventory (NRI) sample points statistically selected to represent cultivated cropland in the US. A new farmer survey was implemented to obtain information on pesticide use, field operations, and conservation practices at these sample points. The field-level physical process model APEX is used to estimate field-level losses of soil, water, and pesticides. The resulting simulation model captures the diversity of land use, soils, climate, and topography from the NRI, estimates losses of pesticides from farm fields, and provides a statistical basis for aggregating results to national and regional levels. Aggregated model output from APEX is used as an input to the SWAT/HUMUS national water quality model to assess reductions in pesticide risk attributable to implementation of conservation practices.

AGRO 166
ArcSWAT: A tool for parameterization of common watershed water quality models and landscape characterization
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ArcSWAT is a new ArcGIS interface to the Soil and Water Assessment Tool (SWAT) watershed water quality model. The interface features a sophisticated watershed delineation module that allows users to delineate automatically watershed and subbasin boundaries from DEMs or to import predefined watershed boundaries (such as from NHDplus) from which to perform a watershed analysis. The interface calculates watershed parameters including area, slope, longest flow path, slope length, and elevation. It also generates a watershed stream network, including network connectivity, calculation of stream length, cumulative drainage area, channel slope, channel width and channel depth. Upon completion of watershed subbasin delineation and parameter calculation, an analysis of watershed land use and soil characteristics is performed to identify unique hydrologic response units that form the building blocks of the SWAT model. ArcSWAT can be applied to other hydrologic models and environmental analyses that require topographic, land use, and soils characteristics of watersheds.

AGRO 167
GeoSTAC (GEOSpatial Tools and ACcess): A compilation of standardized geospatial data and tools for agrochemical exposure assessments
Patrick L. Havens[1], *K. Carr*[2], *P. Hendley*[3], *S. Jackson*[4], *T. Ramanarayanan*[5], *Dee Ann Staats*[6], *M. Thomson*[7], *C. Holmes*[8], *Joshua Amos*[8], *A. Wadley*[9], *M. Winchell*[9], *and R. Srinivasan*[10]*. (1) Dow AgroSciences, 9330 Zionsville Road, Indianapolis, IN 46268, phavens@dow.com, (2) Monsanto Company, (3) Syngenta Crop Protection, (4) BASF Corporation, (5) Bayer CropScience, (6) CropLife America, (7) DuPont Crop Protection, (8) Waterborne Environmental, Inc, (9) Stone Environmental, Inc, (10) Spatial Sciences Laboratory, Texas A&M University*

Geospatial technologies have become a core enabler for the performance of upper-tier risk assessments and product stewardship efforts for agrochemicals. As the number of potentially-applicable geospatial data sets and tools has grown, the difficulty of choosing those of appropriate quality, currentness, and traceability has also increased. To address this, CropLife America, through its Environmental Exposure Working Group, has developed and released publicly the GEOSpatial Tools and ACcess (GeoSTAC) product. GeoSTAC contains >55GB of fully documented and metadata-compliant GIS datasets and five ArcGIS extensions that automate a variety of processing tasks, enabling both expert and less-experienced GIS users to carry out easily routine and advanced analyses. Data and tools have been subjected to internal quality control, testing, and formalized external quality assurance. As a citable and documented system, GeoSTAC should lead to increased efficiencies and additional confidence in the application of geospatial methods in the exposure assessment process.

AGRO 168
Development and application of spatially-distributed pesticide use information for assessing water quality
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Information on the amount and spatial distribution of pesticide use is critical for water quality assessment. Estimates of agricultural pesticide use were developed by combining state-level information on the average pounds applied and the percent of crop acres treated with county harvested acreage from the Census of Agriculture and a national map of land cover. Using a Geographic Information System (GIS), a series of overlay functions were performed to associate tabular county use information with county boundaries and maps of agricultural land cover. Agricultural pesticide use intensity was used to estimate the amount of pesticides applied in 51 major river basins and ground-water systems being studied by the National Water Quality Assessment Program. Use estimates were used as explanatory variables in the development of models used to predict pesticide concentrations in unmonitored areas.

AGRO 169
Applications of the preferential flow model MACRO to the estimation of pesticide loss in the agricultural landscape: A historical perspective
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Losses of pesticides to surface water and groundwater are known to be influenced significantly by preferential flow processes for a wide range of soils. The dual permeability model MACRO considers two flow domains (micropores, macropores) and has been used extensively in the past to simulate the transport of water and pesticides in structured soil environments. The model reverts to a classical Richards' equation model in situations where preferential flow is of less significance. Therefore, the model is suited to the simulation of water and pesticide transport in a wide range of soils, from sandy soils to more structured clay soils. This capability means that MACRO is ideally suited to GIS-based modelling applications. The oral presentation proposes an overview of MACRO development history, current features, and validation status and will present the range of past applications of the model, from field validation studies to the most advanced GIS-based applications.

AGRO 170
A procedure to identify representativeness of experimental site for pesticide leaching field study at European level
Matteo Balderacchi[1], *John Hollis*[2], *Christophe Gustin*[3], *Marco Trevisan*[1], *and Ettore Capri*[1]*. (1) Istituto di Chimica Agraria ed Ambientale, Università Cattolica del Sacro Cuore, via Emilia Parmense, 84, Piacenza 29010, Italy, Fax: +39-0523599217, matteo.balderacchi@unicatt.it, (2) National Soil Resources Institute, Cranfield University, (3) Agricultural Chemicals, Monsanto Company*

The European representativeness of eleven monitoring sites located across Po valley in Italy was assessed. The sites were selected by an objective and repeatable methodology to represent the maize crop distribution within Italy. The monitoring studies investigated the leaching of pesticides to groundwater. Based on climatic, soil, and groundwater characteristics, areas were identified throughout Europe that were similar to the Italy study sites. Results showed that the Po valley monitoring sites were representative of extensive areas in Germany, France, Italy, Greece, and Portugal, together with smaller but significant areas in Spain, Austria, Belgium and Netherlands. The total area represented in Europe is estimated to be 13,840 km^2, representing 16.5% of the total maize crop in the fifteen European countries considered.

AGRO 171
Preserving local variability and large scale spatial structure in semi-national assessments
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Understanding the impact of spatially-variable landscape properties can be a critical component in assessing exposure. Researchers frequently encounter significant challenges in preserving the variability in landscape properties at a local scale while maintaining a base of comparison with stationarity at a semi-national scale. Agricultural variability is more frequently being described at the plot scale requiring an increased focus on data that preserves information at this resolution while remaining consistent over large regions. National data assemblies of soils, topography, land/drainage improvements, product use patterns, field delineations, rainfall, land cover, and hydrology are available; each data source varies in its detail, structure, size, and genesis. Only through GIS advances have researchers conceptualized how these data may be combined at a multi-state scale. Data users need to develop meaningful ways to interpret resulting information at

appropriate scales alongside an assessment of uncertainty. Examples, methods, and structural concepts will be discussed.

AGRO 172
Product identification from the catalytic cracking of *cis*-9-octadecenoic acid
Tracy J. Benson[1], *Rafael Hernandez*[1], *W. Todd French*[1], *Mark G. White*[1], *Earl G. Alley*[2], *and William E. Holmes*[2]. *(1) Dave C. Swalm School of Chemical Engineering, Mississippi State University, P.O. Box 9595, Mississippi State, MS 39762, tjb5@msstate.edu, (2) State Chemical Laboratory, Mississippi State University*

Although the growing demand for renewable fuels has led to an increase in annual production of biodiesel from 0.5 to 75 million gallons, biodiesel production is mainly limited to plant oils such as soybean and canola and gives off glycerol as an unwanted byproduct. Therefore, a new biofuel is needed that can utilize a wider variety of lipids without producing unwanted byproducts. Municipal sewage sludge and oleaginous yeasts are just two lipid sources that could be used to produce green diesel. These lipids (e.g., glycolipids, phospholipids, sphingolipids) can be cracked with superacids to produce diesel range organics that are usable in compression ignition engines. In this study, oleic acid, a major fatty acid component of many potential lipid feedstocks, was reacted at 0°C using triflic acid as the protonating catalyst. Analytical determinations using NMR, FTIR, and GC/MS identified a mixture of C_9-C_{14}, C_{16}, and C_{18} free fatty acids. This is indicative of γ cracking analogous found in heterogeneous catalysis of petroleum fuels. Both straight and branch chain isomers are formed for many of the carbon-lengths. Furthermore, decarboxylation to form diesel range organics can be achieved using high-temperature, transition metal catalytic reactions.

AGRO 173
***Parthenium argentatum* as a source of biobased products**
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Natural rubber, biosynthesized *cis*-1,4-polyisoprene, is the largest single volume elastomer in commerce, at ca. 9 million tons sold globally per year. It is a strategic raw material used in thousands of applications; critically in medical devices, personal protective equipment, and specialty industrial uses, especially aircraft tires. The US imports virtually all natural rubber used from *Hevea brasiliensis* rubber trees grown in Asia and Africa. Primarily due to its molecular structure, natural rubber displays outstanding performance properties that, despite significant investment and innovation, have not been duplicated by synthetically-produced polymers. Natural rubber latex prices have increased over 80% since the beginning of 2005. A 3 million ton shortage has been predicted over the next 10-15 years, driven by Asian growth, influenced by petroleum supply and price, and expected to worsen before it improves. Guayule (*Parthenium argentatum*), a woody desert shrub indigenous to the southwestern US, produces high molecular weight *cis*-1,4-polyisoprene with very low residual protein content, and has entered the commercial arena as an alternative material for the manufacture of medical devices safe for people suffering from Type I IgE-mediated *Hevea* latex allergies. Cultivation of guayule for latex production provides the favorable economics to support commercialization; moreover, the agricultural coproduct/bagasse produced with every ton of latex may prove key to its long term sustainable competitive advantage. The resin-rich bagasse shows significant promise as a feedstock for fuel production. Collection of the entire plant is required to harvest the rubber, the material is in the form of a finely divided dry solid after rubber extraction, and energy content is very high, even in comparison to proposed energy crops. The guayule biorefinery model ultimately describes production of high value primary product, coproducts, and bioenergy.

AGRO 174
Castor oil: Biosynthesis and uses
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Castor oil is unique among commodity oils in its fatty acid composition and consists of 90% ricinoleate (12-hydroxy-octadec-*cis*-9-enoate). The mid-chain hydroxyl group imparts physical and chemical properties that make it useful in many industrial applications. Among its uses are lithium grease, surfactants, cosmetics, polymers, and engineering plastics. Biochemically, the castor seed is very efficient in converting oleate to ricinoleate (>90% efficiency). This efficiency results from the high rate of ricinoleate incorporation into the triacylglycerol fraction, with concomitant exclusion of oleate. We have identified two enzymes which carry out the final step of castor oil biosynthesis, cloned cDNAs for these, and demonstrated that the substrate preferences of these two enzymes explains the efficient incorporation of ricinoleate into triacylglycerol. We believe that inclusion of these enzymes in a transgenic or microbial system could enhance the production of a castor oil substitute.

AGRO 175
Structure-function relationships of a catalytically efficient β-D-xylosidase
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β-D-Xylosidase from *Selenomonas ruminantium* has been revealed as the best catalyst known for promoting hydrolysis of 1,4-β-D-xylooligosaccharides and it has potential utility in saccharification processes. Kinetic parameters, k_{cat} and k_{cat}/K_m, are more than 10-fold larger than those reported for the enzyme isolated from other organisms. In cleaving 1,4-glycosidic bonds, the family 43 glycoside hydrolase acts through an inversion mechanism, and cleaves a single xylose residue from the nonreducing end of xylooligosaccharides per catalytic cycle without processivity. Three-dimensional structures of homologous GH43 xylosidases indicate that the enzyme active site has only two subsites for recognition of substrate, the two terminal xylosyl residues that share the sessile glycosidic bond. The pK_a values of the catalytic acid (ca. 7) and catalytic base (ca. 5) and the two subsites of the active site are key components of a kinetic model that accounts for catalytic properties such as substrate specificities, inhibitor binding, and influences of pH.

AGRO 176
Enzymatic dewatering of distillers grains
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The removal of water from coproducts in the fuel ethanol process requires significant energy input. In this study, the addition of cell-wall degrading enzymes and proteolytic enzymes was investigated to determine whether or not the enzymes could reduce the amount of water bound within the wet grains. This would have the effect of allowing more water to be removed during centrifugation, reducing the time and energy needed during the drying process. The experiment screened 15 cell wall degrading enzymes and 5 proteases. The results were repeated in the lab until two enzymes were identified to have the highest DDGS (distillers dried grains with solubles) dewatering effect and ethanol production. A scale-up experiment was also performed to validate the results from the small-scale runs. A maximum reduction of 22% in water content of the solid phase of the DDGS after centrifugation was observed. Additionally, an increase of 2.5% (v/v) ethanol was produced in the enzyme treated mash compared to the control. These results could translate into energy savings of up to $2.2 million per year for a forty million gallon per year dry grind ethanol plant.

AGRO 177
Biobased industrial lubricants
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Vegetable oils as lubricants are preferred over mineral-based oils because they are biodegradable and non-toxic. They have very low volatility due to the high molecular weight of the triglyceride molecule and have a narrow range of viscosity changes with temperature. Their polar ester groups are able to adhere to metal surfaces producing good boundary-lubrication properties. Vegetable oils also have high solubilizing power for polar contaminants and additive molecules. On the other hand, vegetable oils have poor oxidative stability due primarily to the presence of *bis*-allylic protons; thus, vegetable oils are highly susceptible to radical attack and subsequently undergo oxidative degradation to form polar oxy-compounds. This phenomenon results in the formation of insoluble deposits and increases in oil acidity and viscosity. In addition, the presence of the ester functionality renders these oils susceptible to hydrolytic breakdown. Low temperature studies have also shown that, in contrast to mineral oil based fluids, most vegetable oils undergo cloudiness, precipitation, poor flow, and solidification at -10°C upon prolonged exposure to cold temperatures. Contamination with water in the form of emulsions must be prevented at every stage of production. Here we present a series of structural modifications of vegetable oils using anhydrides of different chain lengths. The chemically-modified base oils exhibit superior oxidation stability in comparison with unmodified vegetable oils. A systematic approach of antioxidant/antiwear additive synergism to improve the oxidation and cold flow behavior of vegetable oils using pressure differential scanning calorimetry and rotary bomb oxidation tests will also be presented.

AGRO 178
Recent advances in bioconversion of agricultural biomass to butanol by fermentation: Employing potential of available renewable resources to produce a superior biofuel
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As a result of sharp increase in gasoline/petroleum prices we, at the National Center for Agricultural Utilization Research, have intensified our research program on bioconversion of agricultural biomass, such as corn stover, corn fiber, rice and wheat straw, rice hulls, switch grass, and miscanthus, to biofuels (ethanol, butanol, acetone) and other chemicals by fermentation. In order to achieve economic production of these compounds, various unique approaches have been applied, including upstream processing (hydrolysis of biomass to release sugars), genetic manipulation of microorganisms, bioreactor and bioprocess development, and product separation and purification. Butanol, which is a superior fuel than ethanol, can be produced using *Clostridium beijerinckii* P260. We have used a number of agriculturally-based substrates including corn, corn fiber, and wheat straw for the production of this valuable fuel. A number of processes have been developed that include: i) batch; ii) fed-batch; iii) separate hydrolysis and fermentation; iv) combined hydrolysis and fermentation; and v) simultaneous hydrolysis, fermentation, and recovery processes. The details of these processes on the production of butanol from agricultural biomass will be presented. DuPont Chemicals and British Petroleum recently announced plans to commercialize this valuable fermentation process to produce motor fuel.

AGRO 179
Synthesis of long-chain unsaturated-α,ω- dicarboxylic acids from renewable materials via olefin metathesis
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Fats and oils are abundant domestic renewable materials composed of long-chain fatty acids, which are used widely by industry. Long-chain-α,ω-unsaturated dicarboxylic acids, which may have important uses in applications such as biodegradable polymers, are not readily available but can be produced from the long-chain, unsaturated fatty acids common to fats and oils. This presentation will discuss the self-metathesis of unsaturated fatty acids to generate long-chain-α,ω-unsaturated dicarboxylic acids. This was accomplished using a second-generation Grubbs catalyst to catalyze the solvent-free self-metathesis of mixed unsaturated fatty acids obtained from soybean, rapeseed, tall, and linseed oils which afforded two important product classes, unsaturated dicarboxylic acids and hydrocarbons, in very high molar conversions. The metathesis reactions were performed with 0.01 mol% catalyst loading at 50°C under

solvent-free conditions. Under these reaction conditions, the conversion of starting fatty acids was >80% and isolated yields of unsaturated dicarboxylic acids were >70%.

AGRO 180
Streamside management zones for protecting water quality: A critical review of current knowledge
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Water quality is defined by its physical, chemical, and biological attributes. In forestry, streamside management zones (SMZs) are stipulated by best management practices (BMPs) and are designed to minimize chemical and sediment loading and to maintain stream temperature regimes in an effort to insure against violation of the antidegradation policy implicit in the Clean Water Act of 1972. SMZ widths recommended by the various states for protection of water quality are based on stream classification, hillside slope, soils, and intended water use. Width recommendations increase with increased stream size beginning with first-order perennial streams. Most states do not recommend protection of ephemeral or intermittent streams. Research suggests most non-road related sedimentation and much of the herbicide chemical loading of forest streams comes from the upper reaches of watersheds where intermittent and ephemeral channels are not protected and that additional water quality protection can accrue from minimal protection of these channels.

AGRO 181
New and old methods of protection of trees against bark beetles: What works, what doesn't, and why
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Protection of pines from attack by southern bark beetles has relied on sprayed pesticides. However, up until a few years ago, political, environmental, and legal restrictions resulted in the absence of a labeled insecticide for bark beetle control in the southern US. As a result, we conducted research which has identified efficacious chemical pesticides (one of which has been newly labeled) for control of these important insects. We have also investigated the efficacy of injected systemic pesticides, essential oils, mineral coatings, non-host phytochemicals, and plant defense elicitors for the control of southern pine beetle. While some of these compounds and technologies showed some promise early in trials, none of them effectively controlled southern pine beetle. Some of these compounds were active against fungi associated with the southern pine beetle. We discuss the results of our current studies, as well as the limitations of these types of strategies.

AGRO 182
Efficacy of verbenone flakes for area-wide and individual tree protection from attack by mountain pine beetle in western North America
Nadir Erbilgin[1], *Nancy Gilette*[2], *Sylvia Mori*[2], *Matthew Hansen*[3], *John Stein*[4], *Jeff Webster*[5], *Donald Owen*[6], *Garry Fiddler*[7], *and David L. Wood*[1]. *(1) Department of Environmental Science, Policy and Management, University of California, Berkeley, 140 Mulford Hall, Division of Organisms and Environment, Berkeley, CA 94720, Fax: 510-643-5098, erbilgin@nature.berkeley.edu, (2) Pacific Southwest Research Station, USDA-Forest Service, (3) Rocky Mountain Research Station, USDA-Forest Service, (4) Forest Health Technology Enterprise Team, USDA-Forest Service, (5) Total Forestry, (6) California Department of Forestry and Fire Protection, (7) Redding Silviculture Laboratory, USDA-Forest Service*

Verbenone, an anti-attractant pheromone for several scolytine beetle species, was tested in a laminated flake formulation for protection of pines from attack by *Dendroctonus ponderosae*, the mountain pine beetle. Two aerial applications of the pheromone releasing flakes were made in *Pinus contorta* (lodgepole pine) stands, one in California and one in Idaho. One simulated aerial application was made in a *Pinus albicaulis* (whitebrak pine) stand in Wyoming. Finally, one test of individual tree protection, where flakes were sprayed onto tree boles from ground level using a hydraulic sprayer, was conducted in a lodgepole pine stand in California. All tests showed significant reduction in tree attack by beetles and significant reduction in numbers of beetles attracted to nearby baited traps.

AGRO 183
Technological advances using disparlure for slowing the spread of gypsy moth
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The Gypsy Moth Slow-the-Spread Project (STS) is the most-advanced, regional, integrated pest management program in the world. The key element to the success of STS is the use of mating disruption as an efficacious, target-specific tactic to control isolated gypsy moth populations in the transition zone between the generally infested and non-infested areas. The gypsy moth mating disruption product used in STS is Disrupt II. Disrupt II is a three-layered laminate flake product manufactured by Hercon Environmental consisting of two outside barrier films and a middle reservoir layer containing the female gypsy moth pheromone, disparlure. The pheromone flakes measure 1/32 x 3/32 inches and are aerially applied by the USDA-Forest Service. Since 2001, approximately 2.6 million acres have been treated as part of the STS program. Treatment success has ranged from 84–97%, and a 50% reduction in the rate of spread has been achieved.

AGRO 184
Imidacloprid and management of hemlock woolly adelgid in forests: Fine tuning for environmental stewardship
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Hemlock woolly adelgid (HWA), a sucking insect from Japan, may soon eliminate native hemlocks from the southern Appalachian Mountains. Field trials of imidacloprid demonstrate that it is suitable as a temporary option for managing HWA. Although control of HWA is difficult to achieve with trunk injections, soil application of imidacloprid has extraordinarily long-term effects and potently suppresses adelgid populations; population reductions are typically ca. 80, 99, and 90% at 1, 2, and 7 years following a single soil application. Long-term suppression is mediated by mobilization of the active ingredient or its metabolites to each growth flush following application. The systematicity (requiring water solubility) of imidacloprid would seem incompatible with treating riparian trees in environmentally-sensitive areas. However, efficient binding of imidacloprid to organic matter in soil allows soil treatment of most forest trees. Optimum dosing may use hemlock morphometrics or adjustment of the frequency (in years) between treatments.

AGRO 185
Compatibility of eastern hemlock (*Tsuga canadensis*) wood tissue with an enzyme-linked immunosorbent assay for imidacloprid residue detection
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Eastern hemlock (*Tsuga canadensis*) wood tissue samples were evaluated for residues of the insecticide imidacloprid with a commercially-available competitive enzyme-linked immunosorbent assay (ELISA) kit. Matrix effects were present in all trees tested and there were false positives in untreated tissues and elevated determinations of imidacloprid concentrations in spiked tissues. When matrix effects were overcome by dilution with water, results revealed a logarithmic relationship between the optical density of ELISA wells and the proportion of tissue extract present in the sample. In tissue samples spiked with imidacloprid, matrix effects caused ELISA to report artificially-higher imidacloprid concentrations unless they were first diluted at least 200-fold. The degree of dilution factor necessary to overcome matrix effects varied between trees, with minimum dilutions ranging from 200 to 1000-fold. The limit of detection of the kit is estimated to be 60-300 µg/L. Methanol was tested as a solvent for tissue extractions. Imidacloprid in 1% methanol solution caused artificially-higher imidacloprid determinations compared with equivalent concentrations prepared in water. In spite of the presence of matrix effects, ELISA remains a valuable tool for qualifying and quantifying imidacloprid within hemlock tissues, as long as operators remain aware of its limitations and address its propensity for error.

AGRO 186
Eastern Hemlock water use: Implications for systemic insecticide application
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Hemlock woolly adelgid (HWA) is causing widespread mortality of eastern hemlock throughout much of its range. Stem or soil injection of insecticide are widely used as control measures; however, the efficiency and effectiveness of these methods depend on understanding the amount and timing of water use by eastern hemlock trees. We used sapflow-based approaches to estimate water use and predicted that insecticide concentrations would be as much as 10-fold lower in large trees using current dosage guidelines. Water use increases exponentially with tree size, but recommended dosage increases linearly. We provide simple mathematical and graphical models that can be used to estimate the amount and timing of water use by eastern hemlock based on tree size and climatic conditions. We anticipate that the data and model presented will be useful in improving the effectiveness and efficiency of systemic insecticide applications.

AGRO 187
Immediate impact of imidacloprid treatment for control of hemlock woolly adelgid on aquatic macroinvertebrate communities
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Imidacloprid is considered to be a safe and effective compound that provides up to two years of protection against the hemlock woolly adelgid. However, it is believed to be highly toxic to certain aquatic organisms. Since hemlocks frequently grow near streams, there is concern that treatments over large areas may impact aquatic fauna. The objective of this study is to determine if there are negative effects on aquatic macroinvertebrates due to soil injections of imidacloprid. Soil injections were performed in the Chattahoochee National Forest in northeastern Georgia in November 2005. Aquatic macroinvertebrate and water samples were collected every 14 days for the first 3 months following treatment, and monthly thereafter. Biotic indices, including number of taxa, number of EPT (Ephemeroptera, Plecoptera, and Trichoptera) taxa, and abundance were calculated for each sample date and compared between dates to determine the level of impact. Initial analyses show no immediate effect of imidacloprid treatments on aquatic macroinvertebrates.

AGRO 188
Using National Agricultural Pesticide Risk Analysis (NAPRA) WWW decision support system to estimate the environmental exposure of fungicide use on soybean rust in Indiana
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Asian soybean rust (ASR) is a foliar plant disease caused by the fungus *Phakopsora pachyrhizi* and is classified as a potentially devastating disease for US soybean production. It has been detected in the soybean fields of Midwestern US very recently (October 2006) but did not cause any damage to 2006 soybean production as most of the crop was already harvested. There is a chance that ASR might enter the soybean fields of the Midwestern US during the growing season in the coming years and may cause significant damage. The only option for managing soybean rust is to use fungicides which were labeled for emergency use under Section 18 labels by the US EPA. Since soybean fields normally do not receive widespread applications of fungicides, it would be helpful to understand the potential environmental impact of using large quantities of fungicides to combat a potential ASR outbreak. Currently, the affect of the fungicides (used to combat soybean rust) on both surface and ground water resources and off-target species is not fully known. This project will use the NAPRA WWW hydrologic/water quality model (1) to predict fungicide concentrations in runoff and shallow groundwater as a result of their application to control soybean rust; (2) to evaluate the environmental risk posed by them; and (3) identify areas of Indiana that are most vulnerable to contamination by fungicides. This would provide a basis for prioritizing implementation of best management practices to the most vulnerable areas.

AGRO 189
SADA: A freeware decision support tool integrating GIS, sample design, spatial modeling, and environmental risk assessment
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Spatial Analysis and Decision Assistance (SADA) is Windows freeware that incorporates tools from environmental assessment into an effective problem-solving environment. Developed by the University of Tennessee with DOE, EPA, and NRC support, SADA integrates GIS, geospatial analysis, statistical analysis, human health and ecological risk, cost/benefit analysis, sampling design, and decision support. SADA continues as an evolving freeware product targeted to individuals needing the integration of existing models into a spatial context. As a result, applications have extended into other disciplines with strong emphasis on spatially distributed data. Spatially delineating attributes of concern such as agrochemicals provides the foundation for exposure assessment and risk characterization in SADA. The explicit use of geospatial risk under formal decision frameworks provides better informed decisions that identify areas of concern and optimize both initial and secondary sampling designs. We present an overview of SADA methods that can support agrochemical exposure assessment particularly in soils.

AGRO 190
Landscape dynamics of Bt, bats, and insect resistance in the Winter Garden region of Texas
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A landscape model is developed that addresses the implementation of genetically modified crops in the Winter Garden region of Texas. The principal strategy for delaying resistance in insects to Bt modified crops is a combination of a high Bt dose to the insect in the crop and the creation of a spatial refuge in close proximity so that susceptible insects will mate with insects that develop resistance. We examine the resistance population dynamics of the pest insects on a landscape of genetically-modified crops and refuges, including the effects of mass migration of susceptible moths from Mexico, and then explore the impacts that differential foraging of Mexican free-tailed bats on refuge insects can have on the dynamics of time to resistance. Model results have implications for the impacts of biotechnology on large bat populations, insect resistance monitoring in this area, and the value of agroecosystem services provided by bats.

AGRO 191
Generic spatial-aggregation tool for ecological modeling: NhdPlus case study
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In this contemporary world, everything is connected to everything else within a sustainable ecosystem. The booming concept of Integrated Water Resources Management (IWRM) also reflects this as watershed studies are developed in the context of a holistic view of water and related land resources extent problems and other myriad concerns. However, the consideration of watershed spatial scale is paramount from management perspective to make the decision makers to be effective with the available scale of the information and the scale of decision making. ArcObjects, Microsoft's Component Object Module (COM) based technology, allows developers to expand ArcGIS platforms and develop customized applications. With this relatively new technology and Structured Queried Language (SQL), study is carried out to develop a generic, spatial-aggregation tool in a GIS environment to query and to delineate larger basins subsuming smaller ones based on decision makers criteria such as channel velocity, catchment area, stream length, stream order and so on. Based on above said criteria, the developed tool generates a set of sub-watersheds which links attribute tables while delineating larger basins. Subsequently, the tool uses queried sub-watersheds to update/regenerate all the attribute tables and stand alone tables of concerned hydrological parameters needed for a ecological modeling to make decision making easy.

AGRO 192
Application of spatial analysis in estimating drinking water exposure for the *N*-methyl carbamate cumulative risk assessment
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The Food Quality Protection Act requires US EPA to consider multiple routes of exposure for pesticide groups having a common mechanism of action. In order to quantify potential exposure to *N*-methyl carbamate (NMC) pesticides in drinking water sources, US EPA used geographic information system (GIS) tools and spatial data sets to identify potential high exposure areas, to develop modeling scenarios for surface- and ground-water exposure estimates, to place exposure estimates and existing monitoring data in context with drinking water sources throughout the NMC use area, and to identify similar areas of potential exposure based on monitoring and modeled exposure estimates. The use of GIS tools and spatial data allowed US EPA to quickly identify the extent of potential concern associated with high NMC residues in drinking water. This presentation describes how US EPA identified high leaching-potential areas in the southeast similar to those areas known to have elevated NMC concentrations based on monitoring data.

AGRO 193
Use of geospatial data in endangered species risk assessments for pesticides
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The US EPA Office of Pesticide Programs (OPP) is responsible for conducting ecological risk assessments for all new and currently registered pesticides. As part of this process, OPP is responsible for ensuring each pesticide registration (which constitutes the Federal action) is in compliance with the Endangered Species Act (ESA). Increasingly, OPP is incorporating geospatial analysis into ecological risk assessments to evaluate the potential impact of pesticide registrations on threatened and endangered species. Recent examples of geospatial analysis include use of GIS-based information to define action areas, to refine exposure assessments, and to characterize baseline risk assessments. In each example, geospatial data have been evaluated within a GIS framework to provide a clearer understanding of the co-occurrence of stressor (pesticide) and receptor (listed species). The use of GIS in communicating risk has resulted in better communication between risk assessors and risk managers, and ultimately, provided more usable information to the public.

AGRO 194
Framework for a spatial aquatic model for pesticide risk assessments
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The US EPA Office of Pesticide Programs (OPP) conducts aquatic exposure assessments for ecological risk and human health (drinking water) assessments for all new and currently registered pesticides. OPP's current aquatic exposure assessments are based on a combination of modeling estimates and available monitoring data. Modeled exposure estimates rely on scenarios that use site specific soil, agronomic, and climatic data to represent a geographic area and that yield high-end exposures. By providing snapshots over a broader area, monitoring data can supplement modeled exposure estimates. Currently, OPP is developing more spatially-explicit modeling that relies on geospatial data to predict aquatic exposures across a selected landscape. Such a spatial modeling approach would provide exposure estimates for hydrologic landscapes using a geographic information system (GIS) - based tool. This presentation discusses the framework for a spatial aquatic model developed in OPP for regulatory purposes.

AGRO 195
Properties of biodegradable feather keratin polymers
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The properties of a recent class of polymers created from poultry feather keratin are described. A “cradle to grave” approach is employed and production of the polymers, uses, and finally biodegradation characteristics will be described. Properties are dependent on the amino acid composition of the feather keratin and modification of the amino acids to elicit new properties. Melt-state properties of the feather keratin such as viscosity can be modified with the use of reducing agents such as sodium sulfite and lubricants such as poultry fat. Solid-state properties can be modified using divalent transition metal ions to affect stiffness and smell.

AGRO 196
Biopolymers from polylactic acid and milk proteins
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Polylactic acid (PLA) is a commercially-available biodegradable polymer derived from lactic acid and is used in many products as an alternative to petrochemical-derived polymers. However, the physical properties limit its use in many applications. Using dairy proteins to substitute for portions of PLA in a formulation may extend its use and prevent shortages of PLA. This work reports on the mechanical and thermal properties of composites made from PLA substituted with starch-whey concentrates and casein blends (DPB). The blends were extruded under the following conditions: mass flow rates (27 to 102 g/min), solids feed rates (0.43 to 2.85 g/sec), moisture (30 to 75%); extrusion melt profiles were: 75, 90, 100, 100, 90, 80°C; and molding conditions at 200°C and 12,000 psi. The physical properties of the extruded DBP were moisture 14-18%, peak tensile strength 4.5 mPa, thickness 3.9 mm, elongation at break 45%, and storage modulus 5.0 mPa. Injection molded product peak melt temperature shifted down in order: PLA 132.8°C, DBP/PLA (10/90%) 149.4/130.3°C, DBP/PLA (20/80%) 148.8/128.2°C, indicating softening of PLA when combined with DBP. Dairy proteins, whey and casein, may provide an advantage by lowering the peak molding temperature of PLA allowing for more biomaterials to be used. Further work is needed to improve the extrusion compounding and miscibility of this high-temperature melting PLA and high-temperature burning-DBP blend.

AGRO 197
Extraction and electrospinning of zein extracted from corn gluten meal using acetic acid
G. W. Selling *and Kristen K. Woods, Plant Polymer Research, USDA-Agricultural Research Service, National Center for Agricultural Utilization Research, 1815 N. University St., Peoria, IL 61604, sellingg@ncaur.usda.gov*

It has been demonstrated that zein fibers can be produced using the electrospinning technique. Fibers electrospun from acetic acid solution under suitable conditions provide fibers with a more consistent morphology (round, 0.5-2.0µ fibers) compared to fibers produced form aqueous ethanol solutions. Spinning continuity of zein acetic acid solutions is significantly improved as well. Commercial zein is produced via extraction of corn gluten meal using aqueous alcohol solvents. In order to better model a possible commercial process, acetic acid was used to extract zein from corn gluten meal. It was found that acetic acid removes more protein than the more traditional solvent systems. The impact of time, temperature, and other solvents on extractability will be presented. The zein acetic acid solution obtained from corn gluten meal was successfully electrospun producing fibers of similar quality to that produced from commercial zein.

AGRO 198
Improved physical properties of zein using glyoxal as a crosslinker
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The effect of the crosslinkers, glyoxal, methylglyoxal, and formaldehyde, on the physical properties of zein films was studied. Crosslinker concentrations varied from 0.3-6% by zein weight. Films crosslinked with glyoxal and formaldehyde showed a significant increase in tensile strength under certain pH conditions. Films of glyoxal reactions conducted at basic pH gave the highest overall tensile strength, with a 52% increase compared to the control film. Formaldehyde films had improved tensile strength when reacted at acidic or neutral pH. Methylglyoxal had no effect on the tensile strength of zein films. Zein films crosslinked with glyoxal or formaldehyde were found to swell, rather than degrade, when placed in three compatible solvents. Films crosslinked with glyoxal were resistant to boiling water. Denaturing gel electrophoresis of glyoxal and formaldehyde reactions showed the presence of high molecular weight moieties when compared to control reactions.

AGRO 199
Arthropod repelling constituents from a southern folk remedy: Investigations of the American beautyberry, *Callicarpa americana*
Charles L. Cantrell[1]*, Charles T. Bryson*[2]*, Stephen O. Duke*[1]*, Jerome A. Klun*[3]*, and John F. Carroll*[4]*. (1) Natural Products Utilization Research Unit, USDA-Agricultural Research Service, P.O. Box 8048, University, MS 38677, clcantr1@olemiss.edu, (2) Southern Weed Science Research Unit, USDA-Agricultural Research Service, (3) Chemicals Affecting Insect Behavior Laboratory, USDA-Agricultural Research Service, (4) Animal Parasitic Diseases Laboratory, USDA-Agricultural Research Service*

Based on botanical lore of insect repellent properties, essential oil extracts from *Callicarpa americana* and *Callicarpa japonica* were investigated. Bioassay-guided fractionation of *C. americana* extracts using the yellow fever mosquito, *Aedes aegypti*, led to the isolation of α-humulene, humulene epoxide II, and intermedeol, and a newly isolated terpenoid (callicarpenal). Similar work involving *C. japonica* resulted in the isolation of an additional compound, spathulenol, as well as the four compounds isolated from *C. americana*. Heretofore, 13,14,15,16-tetranor-3-cleroden-12-al, callicarpenal, has never been identified from natural sources. In bite-deterrent studies spathulenol, intermedeol, and callicarpenal showed significant bite-deterring activity against *Aedes aegypti* and *Anopheles stephensi*. The repellency of callicarpenal and intermedeol against workers of red imported fire ants, *Solenopsis invicta* and black imported fire ants, *Solenopsis richteri* will also be reported. In addition, callicarpenal and intermedeol were evaluated in laboratory bioassays for repellent activity against host-seeking nymphs of the blacklegged tick, *Ixodes scapularis*, and lone star tick, *Amblyomma americanum* and results will be presented.

AGRO 200
Biobased herbicides
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Herbicides amount to more than half of all agricultural pesticides used in the developed world. The availability of insect and disease resistant transgenic crops that reduces the reliance on other synthetic pesticides will contribute to a further increase in the relative proportion of herbicides in the pesticide market. The use of biobased herbicides, either in the form of phytotoxic natural products applied conventionally or in the form of allelopathic crops that would repress the growth of weeds by releasing their own phytotoxins, can potentially be used as low input alternatives. Simple biobased herbicides such as acetic acid, fatty acids, and oils are commonly used as alternative to synthetic compounds. However, the most widely-used, natural herbicide is the microbial secondary metabolite bialaphos (a natural form of phosphinothricin or glufosinate). This glutamine synthase inhibitor was first introduced in Japan in 1984 and is now used under one form or another in more than 40 countries. Its synthetic counterpart is most commonly used on genetically engineered glufosinate-resistant crops that either express the bar or PAT genes. Other natural products have served as templates for the development of commercial analogues. For examples, the *p*-hydroxyphenylpyruvate dioxygenase inhibitors, sulcotrione and mesotrione, were derived from leptospermone, a natural triketone, isolated from bottlebrush. Allelopathy is an often-overlooked approach to reduce synthetic pesticide output. However, work in allelopathic rice demonstrated that excellent weed control could be achieved using half the normal rate of herbicide. Selection of highly allelopathic crop varieties, either through traditional breeding or using genetic engineering techniques, may also provide novel and low input environmentally-friendly approaches to weed control.

AGRO 201
Single-use, disposable food containers: Starch-based alternatives to petroleum-based plastics
Gregory M. Glenn[1], *Charles N. Ludvik*[1], *Artur P. Klamczynski*[2], *William J. Orts*[2], *Syed H. Imam*[2], *and Delilah Wood*[2]. *(1) Bioproduct Chemistry and Engineering Research, USDA-Agricultural Research Service, Western Regional Research Center, 800 Buchanan Street, Albany, CA 94710, Fax: 510-559-5936, gmg@pw.usda.gov, (2) Bioproduct Chemistry and Engineering, USDA-Agricultural Research Service*

The use of valuable petroleum resources to make single-use, disposable plastic foodservice containers has raised concerns among environmental and consumer groups. Billions of single-use food service containers are used each year in the U.S. alone to dispense beverages and serve food. Starch is an abundant, inexpensive, renewable resource derived primarily from cereal and tuber crops. A baking technology has been developed to produce degradable food containers with functional properties similar to those of polystyrene foam products. The product is a composite material consisting of a vapor barrier film, starch, fiber, and other minor ingredients. Starch/fiber foam composites have also been made using extrusion technology. The extruded composite materials containing fiber have improved tensile strength and modulus and are more stable during aging than materials that do not contain fiber.

AGRO 202
Incorporation of bacteriocin in edible pectin films for antimicrobial packaging
LinShu Liu[1], *Tony Jin*[2], *Cheng-Kung Liu*[3], ***Kevin B. Hicks***[1], *Amar K. Mohanty*[4], *Rahul Bhardwaj*[4], *and Manjusri Misra*[5]. *(1) Crop Conversion Science and Engineering Research Unit, USDA-Agricultural Research Service, Eastern Regional Research Center, 600 E. Mermaid Lane, Wyndmoor, PA 19038, Fax: 215-233-6406, lsliu@errc.ars.usda.gov, kevin.hicks@ars.usda.gov, (2) Food Safety Intervention Technology Research Unit, USDA-Agricultural Research Service, (3) Fats, Oils and Animal Co-Products Research Unit, USDA-Agricultural Research Service, (4) School of Packaging, Michigan State University, (5) Composite Materials and Structures Center, Michigan State University*

Edible, antimicrobial films were prepared by extrusion blown film process. Blends of pectin, fish skin gelatin or soybean flour protein, and a bacteriocin, nisin were chosen to prepare the edible, antimicrobial films. The blends were prepared using a ZSK-30 twin-screw extruder. The compounded pellets were then used to prepare blown film using a Killion-KLB-100 extruder. The films retained activity against the indicator bacterial, *L. plantarum*. The resulting films also possess appropriate mechanical properties for food packaging.

AGRO 203
Field evaluation and simulation modeling of pesticide runoff buffer effectiveness
Robert C. Everich, *Makhteshim-Agan of North America Inc, 31 Split Rock Road, Norwalk, CT 06854, Fax: 203-621-3086, rob@manainc.com*

In order to mitigate the effects of pesticides on aquatic environments and organisms, US EPA has assigned label restrictions to certain agrochemicals products. These include requiring the establishment of well-maintained, vegetative runoff buffers adjacent to treated fields that are located near bodies of water. Although extensive research has been undertaken into the most effective compositions and sizes for runoff and spray drift buffers, the database is incomplete. In 2006, a simulated rainfall study was conducted to evaluate the effectiveness of a 25 foot vegetative buffer on reducing edge-of-field concentrations of the insecticide, novaluron. The study plots were contour planted to cotton; a single application of novaluron at the maximum labeled-rate was made to the plots followed by two successive runoff-generating simulated-rainfall events, at approximately 48 and 144 hours after application. Empirical data collected from the study is currently being used to test the new pesticide module of the Riparian Ecosystem Management Model (REMM) developed by the USDA-ARS Southeast Watershed Research Laboratory in Tifton GA. An additional objective of this project is the development of a REMM-PRZM interface to investigate the potential implementation of REMM as a pesticide regulatory tool to allow the appropriate integration of PRZM outputs, as mitigated by buffer interactions, to EXAMS.

AGRO 204
Herbicide abatement by a riparian wetland system
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Riparian buffers are touted for their ability to remove agricultural contaminants; however, little is known about the specific processes that function to arrest pesticide movement and transport. Five years of data have been gathered on the movement and fate of atrazine and metolachlor into a riparian wetland that borders a cornfield in Maryland. Base-flow conditions in the first-order stream flowing through the system are entirely groundwater fed. This results in relatively high stream concentrations of certain metabolites of the herbicides, especially metolachlor ethane sulfonic acid and metolachlor oxanilic acid. There also appears to be a major loading of pesticides through drift and volatile transfer to the trees within the buffer region. Data will be presented on the relative concentrations of herbicides and their metabolites in the various compartments of the riparian buffer to provide a better understanding of contaminant movement and fate in this first-order riparian ecosystem. Studies are now underway to extrapolate these results to a nearby watershed on Maryland's Eastern Shore.

AGRO 205
Vegetative buffer management to mitigate potential off-site pesticide movement in the Mississippi Delta
Martin A. Locke[1], *Matthew T. Moore*[1], *Robert M. Zablotowicz*[2], *Mark A. Weaver*[2], *and Ronald L. Bingner*[1]. *(1) National Sedimentation Laboratory, USDA-Agricultural Research Service, Water Quality & Ecology Research Unit, 598 McElroy, Oxford, MS 38655, Fax: 662-232-2988, mlocke@ars.usda.gov, (2) Southern Weed Science Research Unit, USDA-Agricultural Research Service*

Buffers are a physical barrier or transition zone between agriculturally-active areas and sensitive wetlands or water bodies. Buffers can be strategically placed at field or water body edges to mitigate off-site movement of runoff and associated contaminants. Vegetated buffers occur as natural or constructed wetlands, vegetated drainage channels, riparian forest areas, or grass strips. This paper reviews research in the Mississippi Delta demonstrating efficacy of various types of buffers for mitigating pesticide loss. Not only do buffers provide a physical impediment to runoff, but

they are also a venue for processing deposited contaminants. Organic-rich soils and plant residues within buffer zones may sorb pesticides or facilitate pesticide degradation. Chemical uptake by plants or sorption to live plants also may trap and sequester or metabolize contaminants. Research from Beasley Lake Watershed will be used to develop riparian buffer components within the USDA AnnAGNPS watershed conservation planning model based on REMM technology.

AGRO 206
Riparian ecosystem management model (REMM): Regulatory interests and perspective
***R. David Jones**, Office of Pesticide Programs, U. S. Environmental Protection Agency, 1200 Pennsylvania Avenue 7507P, Washington, DC 22460, rdjwork@comcast.net*

Vegetated filter strips (VFS) are frequently considered as a potential practice for the mitigation of runoff of pesticides from agricultural fields. Currently, it is difficult to evaluate the efficacy of using VFS in a way that is useful for regulatory risk assessment of pesticides. In this presentation, the criteria that EPA's Pesticide Program uses to evaluate modeling tools will be discussed. In addition, the author will present an initial evaluation of REMM as a potential regulatory tool.

AGRO 207
EXPRESS: The EXAMS/PRZM exposure simulation shell
***Lawrence Burns**, Office of Research and Development , National Exposure Research Laboratory, U.S. Environmental Protection Agency, 960 College Station Road, Athens, GA 30605, burns.lawrence@gmail.com*

EXPRESS is a graphical user interface (GUI) for ecological, pesticide-exposure studies using the EPA regulatory GENEEC, FIRST, PRZM, and EXAMS models. It includes a nation-wide assemblage of 30-year meteorological datasets and standardized model input Ascenarios@ developed specifically for regulatory analyses. Multiple-year pesticide concentrations in the water column and benthic sediments of aquatic ecosystems, generated by linked PRZM+ EXAMS simulations, are analyzed to produce, for each year, a suite of exposure metrics. From period-of-record simulation results, the upper tenth percentile concentrations are generated for comparison with toxicological levels of concern. The impact of spray drift buffers on contamination of the EPA standard drinking-water reservoir is available within EXPRESS in a special ORD study mode incorporating results from the AgDISP model. Similarly, REMM represents a potential source of evaluation of the efficacy of runoff buffers as mitigation measures to control water-borne losses of field-applied pesticides.

AGRO 208
Application of REMM to design edge-of-field buffers
***Richard Lowrance**[1], Randall G. Williams[1], and R. Don Wauchope[2]. (1) Southeast Watershed Research Laboratory, USDA-Agricultural Research Service, 2379 Rainwater Road, PO Box 946, Tifton, GA 31794, lorenz@tifton.usda.gov, (2) Southeast Watershed Research Laboratory, (Retired) USDA-Agricultural Research Service*

The Riparian Ecosystem Management Model (REMM) is used to estimate the effects of buffer size, vegetation, and soil properties on the movement of water, sediment, nitrogen, phosphorus, and pesticides. Interactions among hydrology and sediment transport and pesticide properties control pesticide dynamics in buffers. Pesticides enter and move through the buffer system based on their octanol/water partitioning coefficient and their half-life in soil. The partitioning can be affected by the ionization of the pesticide based on soil pH. Pesticides bound in litter or taken up by vegetation are treated as sinks. Pesticides in solution or adsorbed to soil and to sediment are subject to transport and/or degradation. REMM simulates processes that are important to buffer function such as infiltration/co-deposition, litter (residue) interception of water and chemicals, and interactions of surface runoff, groundwater, and exfiltration. The effects of buffer properties on water and sediment transport processes important to pesticide dynamics will be illustrated.

AGRO 209
REMM pesticide algorithms: Sensitivity testing
***R. Don Wauchope**, Southeast Watershed Research Laboratory, (Retired) USDA-Agricultural Research Service, PO Box 748, 2316 Rainwater Road, Tifton, GA 31794, Fax: 229-386-7215, don@tifton.usda.gov*

REMM has been enhanced to provide estimates of the effects of a buffer system on pesticide inputs into surface and subsurface water systems by runoff or leaching from agricultural fields. The algorithms used to describe pesticide fate and behavior in buffers will be described and the results of a sensitivity analysis looking at all principle parameters (site characteristics, weather pattern, and pesticide properties) will be reported.

AGRO 210
Estimating buffer width size for pesticide labels using a new version of REMM
***Tammara L. Estes**, Stone Environmental, Inc, 535 Stone Cutters Way, Montpelier, VT 05602, Fax: 847-251-8656, tlestes@stone-env.com*

A new version of REMM is being developed which contains a module for modeling pesticide movement through a buffer adjacent to an agricultural field. Current pesticide labels often require buffer strips adjacent to fields as a condition of pesticide application. However, estimating a buffer width wide enough to be prevent nearby water body contamination has been difficult to determine since no quantitative methods are currently available. This new REMM version may provide a means of estimating minimum buffer width requirements for future pesticide labels. This paper will discuss possible methods for estimating buffer widths with REMM under varying environmental, crop, and pesticide application conditions.

AGRO 211
Comparison of REMM and PRZM implemented as a vegetated filter strip model
Jessica J. Prenger, *J. Mark Cheplick, W. Martin Williams, Amy M. Ritter, and Nathan J. Snyder, Waterborne Environmental, Inc, 701 Devonshire Dr, Suite B15, Champaign, IL 61820, Fax: 217-378-4661, prengerj@waterborne-env.com*

The Riparian Ecosystem Management Model (REMM) is compared to an implementation of the Pesticide Root Zone Model (PRZM) for modeling vegetated filter strips (VFS). A two-stage approach was used to adapt PRZM for VFS modeling, similar to the scheme used by REMM to simulate a three-zone riparian corridor. The models were calibrated to data from a vegetated filter strip field study, and the results compared. The analysis compares the ability of REMM and PRZM to predict water runoff and pesticide load reductions though a runoff buffer. These models could aid in the development of vegetated filter strip design and in evaluations procedures.

AGRO 212
Analysis of ecological risk posed by pesticides to surface waters in England
Chris M. Holmes[1], *Ryan Williams*[2], *Colin D Brown*[3], *Sabine Beulke*[4], *Wendy van Beinum*[4], *Claire Wells*[5], *and Emma J. Pemberton*[5]. *(1) Waterborne Environmental, Inc, 897-B Harrison St. SE, Leesburg, VA 20175, Fax: 703-777-0767, holmesc@waterborne-env.com, (2) Waterborne Environmental Inc, (3) Environment Department, University of York, (4) Central Science Laboratory, (5) Environment Agency*

A national-level risk mapping exercise was undertaken to identify specific situations within England with the greatest potential for impacts on aquatic biodiversity from normal agricultural use of pesticides. Calculations of exposure via spray drift and drainflow were differentiated by landscape type, region, and crop and compared with toxicity to the indicator organisms *Daphnia magna* and algae. The approach incorporated regional-level information on pesticide usage, crop production, and spatial information on the location of agricultural fields. Risk was mapped for each of 5,760 individual catchments. Pesticide use in orchards was found to pose the greatest risk. Landscape analysis using GIS datasets and aerial imagery investigated local characteristics of orchard cultivation for almost 1,500 individual stream segments adjacent to orchards in Herefordshire, Kent, and East Anglia. Surface waters adjacent to orchards in the east and south-east of England were predicted to be most at risk of ecological impacts from agricultural pesticide use.

AGRO 213
FOCUS surface water scenarios: Relevance at the zonal / member state level
Gregory O. Hughes *and Oliver Price, Cambridge Environmental Assessments, Woodthorne, Wergs Road, Wolverhampton WV6 7XY, United Kingdom, greg.hughes@cea-res.co.uk*

The FOCUS surface water scenarios were designed to represent a limited number of realistic worst-case pedoclimatic scenarios across Europe. They are broadly representative of agriculture as practiced in major production areas and account for drainage, runoff, and spray drift entry into edge-of-field water bodies. Several member states have investigated the relevance of the FOCUS SW scenarios to their specific landscapes using newer and/or higher resolution datasets. The use of newer or higher-resolution datasets at the zonal and member state level will change the perceived relevance of these scenarios. We explore these changes and the implications on the interpretation of surface water risk assessments using a series of worked examples at both the zonal (Mediterranean) and member state (UK) level. These observations are used to suggest a framework and methodology that allows for regional assessment and the subsequent selection and characterization of relevant scenarios for higher-tier environmental risk assessments.

AGRO 214
Spatial approaches in agrochemical risk assessments: Challenges for the next decade
Paul Hendley, *Product Safety, Syngenta Crop Protection Inc, 410 Swing Road, P.O. Box 18300, Greensboro, NC 27410, paul.hendley@syngenta.com*

Since 1995, use of spatial approaches in higher-tier agrochemical exposure assessments has steadily increased in the US and then in the EU. Subsequently, more sophisticated risk assessments and endangered species evaluations have included increasing contributions from spatial analysis. To continue the integration of spatial approaches in providing critical support to agriculture and environmental sciences, we face many challenges and development needs in the next decade: (1) improved data sets and enhanced data access; (2) agreement on Good Spatial Assessment Practices for landscape analyses; (3) improved tools for handling complex data; (4) improved tools for displaying temporal variation on maps; (5) changing attitudes to GIS technology and broadening training base; (6) linking assessment spatial-approaches to ecology and sustainability goals; and (7) linking agricultural stakeholders and their knowledge to their landscapes. To address these challenges, we need science-based fora for stakeholders at national and international scales to suggest standards, data needs, and priorities.

AGRO 215
Fast pyrolysis and biooil production from energy crops being developed within USDA-ARS
A. A. Boateng, *Eastern Regional Research Center, USDA-Agricultural Research Service, 600 E. Mermaid Lane, Wyndmoor, PA 19038, akwasi.boateng@ars.usda.gov*

The US DOE-USDA biomass initiative vision is counting on lignocellulosic conversion to boost the quantities of biofuels produced from starches in order to achieve the much needed energy security. However, with the current challenges in the lignocellulosic conversion to ethanol via the sugar technologies, other methods including thermochemical conversion of biomass to useable energy carrier forms may provide nearer term solution and are receiving attention nationally. One such technique is fast pyrolysis, rapid thermal decomposition of organic compounds in the absence of oxygen to produce liquids, char and gas, is being considered by ARS researchers for energy crops conversion. Pyrolysis of energy crops including alfalfa stems, cool and warm-seasoned perennial grasses such as reed canary grass, eastern gamma grass, Bermuda grass and switchgrass being developed at ARS has been studied. Effect of maturity at harvest and, in some cases, genotype have been characterized and will be presented. Fluidized-bed process production of biooil from Cove-in-Rock switchgrass cultivar including material and energy balances will be discussed. The potential for the use of the pyrolysis oil as a diesel grade fuel for stationary power applications and its upgrading into transportation fuels will also be discussed.

AGRO 216
Steam explosion method for producing microcrystalline cellulose from agricultural residues
Foster A. Agblevor[1], *Maha M. Ibrahim*[2], *and Waleed K. El-Zawawy*[2]. *(1) Department of Biological Systems Engineering, Virginia Polytechnic Institute & State University, 213 Seitz Hall, Blacksburg, VA 24061, Fax: 540-231-3199, fagblevo@vt.edu, (2) Cellulose and Paper Department, National Research Center*

Economical and environmentally-friendly, disposal methods for agro-industrial and agricultural residues in many countries are becoming a major concern especially for small scale producers. The cotton ginning industry in the US has major challenges disposing of cotton gin waste at small scale-ginning plants, and the Nile delta in Egypt has a major pollution problem from burning of agricultural residues after harvesting the fields. We investigated steam treatment technology for adding value to the agricultural residues such as cotton gin waste and corn cobs as a method of waste disposal as well as generating new product streams for the industry. Corn cobs and cotton gin waste were steam exploded at severities parameters of 3.0 to 4.8. After steam treatment, the hemicellulose fraction was extracted with hot water at 80°C and the lignin fraction was extracted with 20 wt% NaOH solution at 80°C. The extracted solid residue was thoroughly washed with water and bleached with hydrogen peroxide. The corn cob material was readily bleached to a high degree of brightness, whereas the cotton gin waste material was more difficult to bleach. The products were characterized with FTIR, TGA, X-ray diffraction, scanning electron microscope, and the degrees of polymerization (DP) for each were determined by intrinsic viscosity method. The results showed that the products had similar characteristics as commercial Avicel PH101 microcrystalline cellulose. In the case of the corn cob, the DP was higher than that of Avicel PH101 but decreased with increased severity of steam treatment. The crystallinity index determined from FTIR analysis showed a higher degree of crystallinity for the cotton gin waste sample than the corn cob sample.

AGRO 217
Developing enzyme systems for biomass destruction
Dominic Wong, *Charles Lee, Kurt Wagschal, Michael Smith, George Robertson, and William Orts, Western Regional Research Center, USDA-Agricultural Research Service, 800 Buchanan Street, Albany, CA 94710, dwsw@pw.usda.gov*

The conversion of agricultural crops and residues to fermentable feedstock for the production of bioethanol represents a major source of renewable energy. The key to economically viable and effective biomass conversion includes the development of novel enzymes and enzyme systems to achieve total deconstruction of the plant cell wall. The WRRC enzyme group is focusing on the use of molecular biology techniques to discover, express, and engineer enzymes for the complete degradation of the hemicellulose fraction in plant cell walls. We construct and screen metagenomic libraries to isolate novel genes, clone and express them in *E. coli* or yeast systems, and characterize the enzymes for mutagenic improvement and evaluation. The xylanolytic enzymes currently under development include: endo-β-1,4-xylanase, β-xylosidase, α-L-arabinofuranosidase, α-glucuronidase, acetylxylan esterase, and feruloyl esterase. Enzyme systems consisting of various combinations of individual enzymes are to be integrated into yeast for simultaneous conversion and fermentation.

AGRO 218
Process for obtaining cellulose acetate from agricultural by-products
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A method for preparing the commercially-useful product, cellulose acetate, from discarded byproducts such as rice hull, wheat straw, and corn fiber, will be discussed. This work will provide potential new markets and applications for low-value agricultural wastes and co-products. By converting the cellulose in these residues into cellulose acetate as opposed to saccharifying cellulose to glucose, the overall cost of producing ethanol from lignocellulosic biomass may be reduced.

AGRO 219
Fuel from herbaceous feedstocks: A switchgrass-centric perspective
Gautam Sarath[1], *Bruce S. Dien*[2], *Kenneth P. Vogel*[1], *and Hans-Joachim G. Jung*[3]. *(1) Grain, Forage, and Bioenergy Research Unit, USDA-Agricultural Research Service, 344 Keim Hall, East Campus, Lincoln, NE 68583-0937, Fax: 402-472-4020, gsarath1@unl.edu, (2) Biochemistry Research Unit, USDA-Agricultural Research Service, (3) Plant Science Research Unit, USDA-Agricultural Research Service*

Switchgrass is poised to become an important perennial biofuel source. The principal components that can be utilized from switchgrass biomass are soluble sugars, starch, and cell-wall polysaccharides. Depending on the conversion platform, the presence of lignin in the cell walls can hinder or enhance conversion of biomass into fuels. Partitioning of carbon between the different cell wall components as well the amount and type of lignin can be altered through genetics and management; however there is a trade-off between lignin, cellulose and the ability of the plant to survive (fitness). Much of our work is focused on elucidating physiological- and management-related factors that will result in switchgrass plants with good conversion properties. A longer-term goal is discovering cellular mechanisms (genes and proteins) that affect these cell-wall traits. This presentation will explore some of our current biochemical knowledge on these fronts.

AGRO 220
Hydrothermal conversion of wood: Reaction kinetics and process development
***Bo Zhang**, Marc von Keitz, and Kenneth Valentas, BioTechnology Institute, University of Minnesota, 1479 Gortner Avenue, Suite 140, St. Paul, MN 55108, zhan0260@umn.edu*

Direct thermochemical conversion of lignocellulosic biomass to a crude bio-oil has been proposed as an alternative to biological ethanol production which may result in lower energy input per unit of energy output. In this study, we designed a batch pressure vessel equipped with an induction heating system which reduces heat-up times by approximately two orders of magnitude. With this system, the direct conversion of four types of lignocellulosic biomass, aspen pulp wood (*Populus tremuloides*), aspen wood pre-treated with dilute acid, lignin extracted from aspen and pine, and aspen residues, were studied using the following treatment variables: heating rate (5-140°C/min), cooling rate (4-80°C/min), reaction temperature (300-450°C, corresponding to a pressure range of 3000-5000 psi), reaction time (1-30 min), particle sizes, and catalysts. Comparisons were made considering the reaction products obtained under the different treatment conditions and the various sources of lignocellulosic biomass. At 350°C, the bio-oil yields of aspen, pretreated aspen, residues, and lignin are 23.7, 40.6, 28.2, and 78%, respectively. The major compounds from biomass liquefaction were identified and quantified by GC-MS. A simplified kinetics model of lignin liquefaction was constructed to predict the yield of liquid products. Since the bio-oil yields of aspen fractionations containing cellulose and hemicellulose are relatively lower, supercritical gasification was conducted to evaluate the suitability as a biorefining option.

AGRO 221
Fractionating lignocellulose by using cellulose solvent and organic solvent
***Y-H. Percival Zhang** and Geoff Moxley, Biological Systems Engineering, Virginia Polytechnic Institute and State University, 210-A Seitz Hall, Blacksburg, VA 24061, Fax: 540-231-3199, ypzhang@vt.edu*

Production of fuels, chemicals, and materials from renewable lignocellulosic biomass will offer benefits to the environment, economy, and national security. The transition from the fossil fuel-based economy to the carbohydrate economy will happen inevitably. Cost-effectively overcoming the recalcitrant lignocellulose is the greatest technological barrier to lignocellulose biorefineries. We have invented an environmentally-friendly lignocellulose fractionation technology by sequentially applying a nonvolatile cellulose solvent (concentrated phosphoric acid), a highly volatile organic solvent (acetone), and water. We tested this new technology to corn stover, switchgrass, hybrid poplar, and Douglas fir. The resulting amorphous cellulosic materials with little remaining lignin and hemicellulose were hydrolyzed by cellulases with nearly theoretical sugar yields (ca. 97% in 24 h) for corn stover, switchgrass, and poplar. The highest overall sugar yields (ca. 95% of the original glucan) were attributed to the facts of (1) no sugar degradation during the fractionation and (2) the highest enzymatic cellulose digestibility during the amorphous cellulose hydrolysis step. Isolation and co-utilization of high value lignocellulose components, lignin, acetic acid, and hemicellulose, is vital to achieving profitability for small-size biorefineries and for protection from fluctuating product prices. For example, a small-size lignocellulose biorefinery with a capacity of 100 tons per day will produce approximately 3 million gallons of ethanol plus co-products – high quality lignin and acetic acid. Our process analysis suggests that the estimated cost of ethanol production from lignocellulose fractionation technology is approximately $1.00-1.20/per gallon primarily because the value of the co-products, the highest sugar yields, and the low enzyme use drive down ethanol production costs.

AUTHOR INDEX

Joginder S. (Joe) Chib, 65, an organic chemist, died on Oct. 31, 2006, after a three-year fight with progressive supranuclear palsy.

Born in India in 1941, he received his bachelor's degree in 1962 and master's degree in 1964, both in chemistry from Sagar University. He moved to the U.S. to pursue a Ph.D. in organic chemistry at Stevens Institute of Technology, in New Jersey.

After receiving his Ph.D. in 1968, Chib performed postdoctoral research at the New York Zoological Society. Then he worked in agricultural chemistry for Union Carbide, Rhône-Poulenc, and Battelle Laboratories. During his time working in industry, he earned his M.B.A. from Campbell University in North Carolina in 1989.

His M.B.A. served as an impetus to start his own contract laboratories, Pittsburgh Environmental Research Laboratories, in 1993. At PERL, Chib's group performed environmental fate studies and developed a novel apparatus to simulate and study the photolysis of chemicals in a controlled naturalistic environment. He retired in 2004.

Chib's family, friends, and colleagues remember him as a gentle individual who had a love for teaching and learning. He is survived by his wife, Pushp, and three children. He joined ACS in 1970.

AGRO Scrapbook

San Francisco Fall 2006

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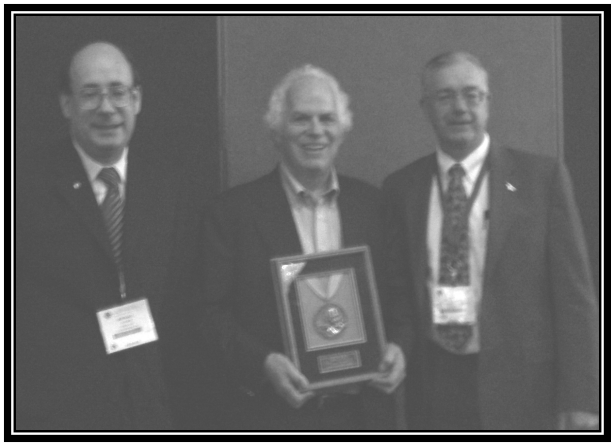

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Stanley Prusiner

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-Tim Ballard, tballard@en-cas.com
AG-LIST manager

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Environmental chemistry
Environmental fate/effects
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The AGRO Division of the American Chemical Society maintains a Communications System, AG-LIST, dedicated to keeping members informed about what is happening in our Division and the Society. Keeping up with meeting agendas, calls for papers, committee progress, party locations, elections and other timely announcements is as simple as sending an e-mail. In fact, sending an e-mail is exactly how you get connected. Join the over 900 professionals who have subscribed to AG-LIST.

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