

WEED SCIENCE



WEED SCIENCE

Published six times a year by the Weed Science Society of America

William K. Vencill, *Editor*

The Weed Science Society of America publishes original research and scholarship in the form of peer-reviewed articles in three international journals. *Weed Science* is focused on understanding “why” phenomena occur in agricultural crops. As such, it focuses on fundamental research directly related to all aspects of weed science in agricultural systems. *Weed Technology* focuses on understanding “how” weeds are managed. As such, it is focused on more applied aspects concerning the management of weeds in agricultural systems. *Invasive Plant Science and Management* is a broad-based journal that focuses not only on fundamental and applied research on invasive plant biology, ecology, management, and restoration of invaded non-crop areas, but also on the many other aspects relevant to invasive species, including educational activities, policy issues, and case study reports. Topics for *Weed Science* include the biology and ecology of weeds in agricultural, forestry, aquatic, turf, recreational, rights-of-ways, and other settings; genetics of weeds and herbicide resistance; chemistry, biochemistry, physiology and molecular action of herbicides and plant growth regulators used to manage undesirable vegetation, and herbicide resistance; ecology of cropping and non-cropping systems as it relates to weed management; biological and ecological aspects of weed control tools including biological agents, herbicide resistant crops, etc.; effects of weed management on soil, air, and water. Symposia papers and reviews are accepted. Consult the editor for additional information.

Associate Editors (Assignment Year)

Muthukumar V Bagavathiannan, Texas A&M, College Station, TX 77843 (2015)
Carlene Chase, Horticultural Sciences Department, University of Florida, Gainesville, FL 32611 (2016)
Bhagirath Singh Chauhan, Queensland Alliance for Agriculture and Food Innovation (QAAFI), The University of Queensland, Queensland, Australia (2014)
Sharon Clay, South Dakota State University Plant Science Department, Brookings, SD 57007 (2002)
Adam Davis, USDA-ARS, Global Change and Photosynthesis Research, Urbana, IL 61801 (2007)
Franck E. Dayan, USDA-ARS-NPURU, National Center for Natural Products Research, University, MS 38677 (2003)
Anita Dille, Kansas State University, Department of Agronomy, Manhattan, KS 66506 (2013)
Timothy Grey, Department of Crop and Soil Science, University of Georgia, Tifton, GA 31793 (2009)
Marie Jasieniuk, Department of Plant Sciences, University of California, Davis, CA 95616 (2016)
Prashant Jha, Montana State University, Bozeman, MT 59717 (2017)
Ramon Leon, Department of Crop and Soil Sciences, North Carolina State University, Raleigh, NC 27695 (2016)
John L. Lindquist, Department of Agronomy, University of Nebraska, Lincoln, NE 68583-0817 (2002)
Sara Martin, Ag Canada, Ottawa, Canada (2018)
Vijay Nandula, Mississippi State University, Delta Research & Extension Center, Stoneville, MS 38776 (2008)
Chris Preston, Australian Weed Management, University of Adelaide, PMB1, Glen Osmond, SA 5064, Australia (2003)
Neha Rana, Monsanto, Chesterfield, MO 63005 (2017)
Dean Riechers, Department of Crop Sciences, University of Illinois, Urbana, IL 61801 (2011)
Hilary Sandler, University of Massachusetts–Amherst Cranberry Station, East Wareham, MA 02538 (2008)
Steven Seefeldt, USDA-ARS, University of Alaska, Fairbanks, AK 99775 (2011)
Patrick J. Tranel, Department of Crop Sciences, University of Illinois, 360 ERML, Urbana, IL 61801 (2002)
Martin M. Williams II, USDA-ARS Global Change and Photosynthesis Research, Urbana, IL 61801 (2008)
Tracy Candelaria, *Managing Editor*

Officers of the Weed Science Society of America

Scott Senseman, <i>President</i>	Darrin Dodds, <i>Secretary</i>
Larry Steckel, <i>President-Elect</i>	Phil Banks, <i>Treasurer</i>
William Curran, <i>Vice President</i>	Sarah Ward, <i>Director of Publications</i>
Janis McFarland, <i>Past President</i>	Mark Bernards, <i>Chair, Constitution and Operating Procedures</i>

Weed Science (ISSN 0043-1745) is an official publication of the Weed Science Society of America, 12011 Tejon Street, Suite 700, Westminster, CO 80234 (720-977-7940). It contains refereed papers describing the results of research that elucidates the nature of phenomena relating to all aspects of weeds and their control. It is published bimonthly, one volume per year, six issues per year beginning in January.

Membership includes online access to *Weed Science*, *Weed Technology*, *Invasive Plant Science and Management*, and the online *WSSA Newsletter*. Dues should be sent to WSSA, 12011 Tejon Street, Suite 700, Westminster, CO 80234 no later than December 1 of each year. Membership in the society is on a calendar-year basis only.

New subscriptions and renewals begin with the first issue of the current volume. Please visit the *Weed Science* subscription page at <https://www.cambridge.org/core/journals/weed-science/subscribe>; Email: subscriptions_newyork@cambridge.org in USA, journals@cambridge.org outside USA.

Weed Science publishes six times a year in January, March, May, July, September, and November. Annual institutional electronic subscription rates: US \$431.00; UK £300.00.

Please use Editorial Manager to access manuscript submissions (<http://www.editorialmanager.com/ws>). Authors are asked to pay \$65 per page as a portion of the cost of publication, plus an additional processing charge of \$55 per manuscript if none of the authors are WSSA members. The Editor can make exceptions in advance when justified.

The Weed Science Society of America fully subscribes to the belief that progress in science depends upon the sharing of ideas, information, and materials among qualified investigators. Authors of papers published in *Weed Science* are therefore encouraged, whenever practicable and when state and federal laws permit, to share genotypically unique, propagative materials they might possess with other workers in the area who request such materials for the purpose of scientific research.

Weed Science published by the Weed Science Society of America.
Copyright 2018 by the Weed Science Society of America.
All rights reserved. Reproduction in part or whole prohibited.

On the Cover:

Image of waterhemp (*Amaranthus rudis*) population from Missouri with multiple herbicide resistance. Image credit: Dr. Lovreet Shergill.

WEED SCIENCE

Journal of the Weed Science Society of America

Volume 66 Number 3 May–June 2018

SYMPOSIUM

- Weed Management in 2050: Perspectives on the Future of Weed Science. *James H. Westwood, Raghavan Charudattan, Stephen O. Duke, Steven A. Fennimore, Pam Marrone, David C. Slaughter, Clarence Swanton, and Richard Zollinger*..... 275

SPECIAL TOPICS

- Detection of the Trp-2027-Cys Mutation in Fluazifop-P-butyl-resistant Itchgrass (*Rottboellia cochinchinensis*) using High-Resolution Melting Analysis (HRMA). *Walter Barrantes-Santamaría, Rolbin Castillo-Matamoros, Franklin Herrera-Murillo, Arturo Brenes-Angulo, and Luis Gómez-Alpizar*..... 286

PHYSIOLOGY/CHEMISTRY/BIOCHEMISTRY

- EPSPS Gene Amplification Primarily Confers Glyphosate Resistance among Arkansas Palmer amaranth (*Amaranthus palmeri*) Populations. *Shilpa Singh, Vijay Singh, Amy Lawton-Rauh, Muthukumar V. Bagavathiannan, and Nilda Roma-Burgos*..... 293
- Environmental Factors Moderate Glyphosate-induced Antagonism of POST Herbicides on the Rapid Response Biotype of Glyphosate-Resistant Giant Ragweed (*Ambrosia trifida*). *Nick T. Harre, Julie M. Young, and Bryan G. Young*..... 301
- Downy Brome (*Bromus tectorum*) Vernalization: Variation and Genetic Controls. *Nevin C. Lawrence, Amber L. Hauvermale, and Ian C. Burke*..... 310
- Herbicidal and Seed Dormancy Induction Activity of Fermentation Residual Vinasse. *Ramon G. Leon and Rocio van der Laet*..... 317
- Assessment of *Solidago* × *niederederi* Origin Based on the Accumulation of Phenolic Compounds in Plant Raw Materials. *Jolita Radušienė, Mindaugas Marksa, and Birutė Karpavičienė*..... 324
- Dormancy-linked Population Structure of Weedy Rice (*Oryza* sp.). *Te-Ming Tseng, Vinod K. Shivrain, Amy Lawton-Rauh, and Nilda R. Burgos*..... 331

WEED BIOLOGY AND ECOLOGY

- Differential Tolerance of Glyphosate-Susceptible and Glyphosate-Resistant Biotypes of Junglerice (*Echinochloa colona*) to Environments during Germination, Growth, and Intraspecific Competition. *Anil Shrestha, Larissa L. deSouza, Pahoua Yang, Lynn Sosnoskie, and Bradley D. Hanson*..... 340
- Multiple Herbicide-Resistant Junglerice (*Echinochloa colona*): Identification of Genes Potentially Involved in Resistance through Differential Gene Expression Analysis. *Alice A. Wright, Marianela Rodriguez-Carres, Rajkumar Sasidharan, Liisa Koski, Daniel G. Peterson, Vijay K. Nandula, Jeffery D. Ray, Jason A. Bond, and David R. Shaw*..... 347
- Gene Space and Transcriptome Assemblies of Leafy Spurge (*Euphorbia esula*) Identify Promoter Sequences, Repetitive Elements, High-Quality Markers, and a Full-Length Chloroplast Genome. *David P. Horvath, Sagar Patel, Münevver Dođramaci, Wun S. Chao, James V. Anderson, Michael E. Foley, Brian Scheffler, Gerard Lazo, Kevin Dorn, Changhui Yan, Anna Childers, Michel Schatz, and Shoshana Marcus*..... 355
- Weed Communities in Semiarid Rainfed Croplands of Central Argentina: Comparison between Corn (*Zea mays*) and Soybean (*Glycine max*) Crops. *Ruth B. Rauber, Manuel R. Demaría, Esteban G. Jobbágy, Daniel N. Arroyo, and Santiago L. Poggio*..... 368
- Effects of Incorporated Rye and Hairy Vetch Cover Crop Residue on the Persistence of Weed Seeds in the Soil. *Charles L. Mohler, Alan G. Taylor, Antonio DiTommaso, Russell R. Hahn, and Robin R. Bellinder*..... 379

WEED MANAGEMENT

- Investigations of 2,4-D and Multiple Herbicide Resistance in a Missouri Waterhemp (*Amaranthus tuberculatus*) Population. *Lovreet S. Shergill, Blake R. Barlow, Mandy D. Bish, and Kevin W. Bradley*..... 386
- Modeling the Impact of Harvest Weed Seed Control on Herbicide-Resistance Evolution. *Gayle J. Somerville, Stephen B. Powles, Michael J. Walsh, and Michael Renton*..... 395
- Bio-ionic Liquids as Adjuvants for Sulfonylurea Herbicides. *Katarzyna Marcinkowska, Tadeusz Praczyk, Bartosz Łęgosz, Agnieszka Biedziak, and Juliusz Pernak*..... 404