# 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, 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, West Florida Research and Education Center, University of Florida, Jay, FL 32565 (2016)

John L. Lindquist, Department of Agronomy, University of Nebraska, Lincoln, NE 68583-0817 (2002)

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

Kevin Bradley, President Hilary Sandler, Secretary
Janis McFarland, President-Elect Rick Boydston, Treasurer

Scott Senseman, Vice President Sarah Ward, Director of Publications

Dallas Peterson, Past President Mark Bernards, Chair, Constitution and Operating Procedures

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 \$411.00; UK £285.00; EUR €376.00.

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 2017 by the Weed Science Society of America.
All rights reserved. Reproduction in part or whole prohibited.

#### On the Cover

This photo is from Bravo et al. (Pp 339-349). It shows one of the plants that come from a population that apparently adapted to taller crops and is GR and another that comes from a population adapted to smaller crops and is GS. Additionally, below you can see a few examples of the great diversity in morphology that we found among Palmer amaranth populations. Photo by Ramon Leon.



Volume 65 Number 3 May-June 2017

### PHYSIOLOGY/CHEMISTRY/BIOCHEMISTRY

Multiple Resistance to Glyphosate and Acetolactate Synthase Inhibitors in Palmer Amaranth ( <i>Amaranthus</i> palmeri) Identified in Brazil. Anita Küpper, Ednaldo A. Borgato, Eric L. Patterson, Acácio Gonçalves Netto, Marcelo Nicolai, Saul J. P. de Carvalho, Scott J. Nissen, Todd A. Gaines, and Pedro J. Christoffoleti	31
Confirmation of a Three-Way (Glyphosate, ALS, and Atrazine) Herbicide-Resistant Population of Palmer Amaranth ( <i>Amaranthus palmeri</i> ) in Michigan. <i>Jonathon R. Kohrt, Christy L. Sprague</i> , <i>Satya Swathi Nadakuduti, and David Douches</i>	32
WEED BIOLOGY AND ECOLOGY	
Differentiation of Life-History Traits among Palmer Amaranth Populations ( <i>Amaranthus palmeri</i> ) and Its Relation to Cropping Systems and Glyphosate Sensitivity. <i>Washington Bravo, Ramon G. Leon, Jason A. Ferrell, Michael J. Mulvaney, and C. Wesley Wood</i>	339
Identification and Biological Characteristics of Ryegrass ( <i>Lolium</i> spp.) Accessions in Arkansas.  Mohammad T. Bararpour, Jason K. Norsworthy, Nilda R. Burgos, Nicholas E. Korres, and Edward E. Gbur	350
Effect of Temperature on Germination Characteristics of Glyphosate-Resistant and Glyphosate-Susceptible Kochia (Kochia scoparia). Vipan Kumar and Prashant Jha	36
The Effects of Single- and Multiple-Weed Interference on Soybean Yield in the Far-Eastern Region of Russia. <i>Jong-Seok Song, Jin-Won Kim, Ji-Hoon Im, Kyu-Jong Lee, Byun-Woo Lee, and Do-Soon Kim</i>	37
Which Traits Allow Weed Species to Persist in Grass Margin Strips? Stéphane Cordeau,  Matthew R. Ryan, David A. Bohan, Xavier Reboud, and Bruno Chauvel	38
Plant Development and Seed Biology of Windmillgrass ( <i>Chloris truncata</i> ) in Southern Australia.  The D. Ngo, Peter Boutsalis, Christopher Preston, and Gurjeet Gill	39
Winter Preference for Weed Seed and Waste Grain by Native Mice in Row-Crop Agriculture. Jacob L. Berl, Hunter A. Johnstone, Jonathan Y. Wu, Elizabeth A. Flaherty, and Robert K. Swihart	400
Growth, Development, and Seed Biology of Feather Fingergrass ( <i>Chloris virgata</i> ) in Southern Australia.  The D. Ngo, Peter Boutsalis, Christopher Preston, and Gurjeet Gill	41
WEED MANAGEMENT	
Rolled Mixtures of Barley and Cereal Rye for Weed Suppression in Cover Crop-based Organic No-Till Planted Soybean. <i>Jeffrey A. Liebert, Antonio DiTommaso, and Matthew R. Ryan</i>	42
ERRATUM	44