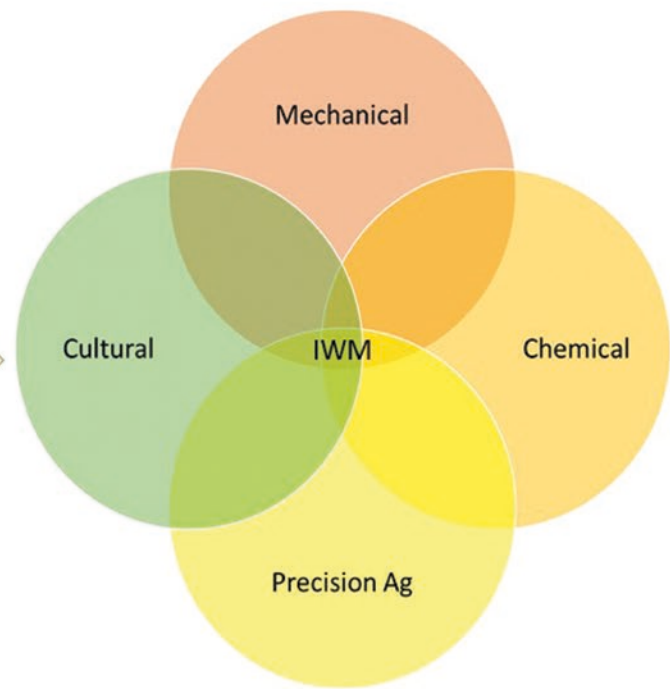
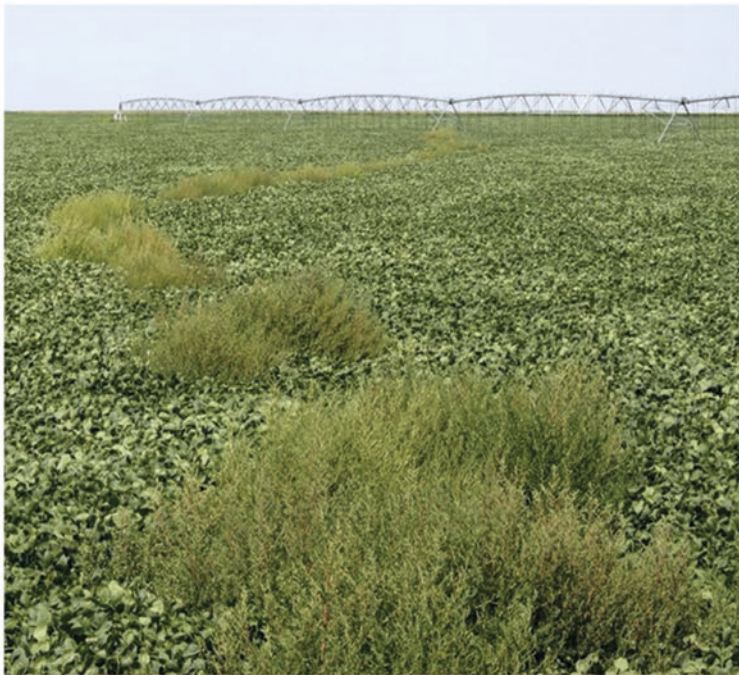


WEED SCIENCE



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)
Nicholas Basinger, Department of Crop & Soil Sciences, University of Georgia, Athens, GA 30602 (2022)
Nathan Boyd, University of Florida, Wimauma, FL 33598 (2021)
Caio Brunharo, Department of Plant Science, Penn State University, University Park, PA 16801 (2022)
Ian Burke, Washington State University, Pullman, WA 99164 (2019)
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)
Timothy Grey, Department of Crop and Soil Science, University of Georgia, Tifton, GA 31793 (2009)
Erin Haramoto, University of Kentucky, Lexington, KY 40506 (2020)
Prashant Jha, Iowa State University, Ames, IA 50011 (2017)
Mithila Jugulam, Kansas State University, Manhattan, KS 66506 (2019)
Vipan Kumar, Kansas State University, Hays, KS 67601 (2020)
Ramon Leon, Department of Crop and Soil Sciences, North Carolina State University, Raleigh, NC 27695 (2016)
Sara Martin, Ag Canada, Ottawa, Canada (2018)
Chris Preston, Australian Weed Management, University of Adelaide, PMB1, Glen Osmond, SA 5064, Australia (2003)
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)
Debalin Sarangi, University of Wyoming, Powell, WY 82435 (2020)
Patrick J. Tranel, Department of Crop Sciences, University of Illinois, 360 ERML, Urbana, IL 61801 (2002)
Te-Ming Paul Tseng, Mississippi State University, Mississippi State, MS 39762 (2019)
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

<http://wssa.net/society/bod/>

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 \$441.00; UK £307.00.

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 2022 by the Weed Science Society of America.
All rights reserved. Reproduction in part or whole prohibited.

On the Cover:

Integrated weed management (IWM) tactics are needed to manage glyphosate-resistant kochia (*Bassia scoparia*) in glyphosate-resistant soybeans (*Glycine max* L.). Photo credit: Vipan Kumar & Phil Stahlman.

WEED SCIENCE

Journal of the Weed Science Society of America

Volume 70 Number 3 May 2022

REVIEWS

- A unified framework for the analysis of germination, emergence, and other time-to-event data in weed science. *Andrea Onofri, Mohsen B. Mesgaran and Christian Ritz* 259
- Western United States and Canada perspective: are herbicide-resistant crops the solution to herbicide-resistant weeds?. *Caio A. C. G. Brunharo, Roger Gast, Vipin Kumar, Carol A. Mallory-Smith, Breanne D. Tidemann and Hugh J. Beckie* 272

RESEARCH ARTICLES

- First report of ALS inhibitor-resistant green kyllinga (*Kyllinga brevifolia*). *David P. Westbury, Patrick E. McCullough, J. Scott McElroy, Claudia A. Rutland and Jinesh Patel* 287
- Characterization of target-site resistance to ALS-inhibiting herbicides in *Ammannia multiflora* populations. *Wei Deng, Zhiwen Duan, Yang Li, Hanwen Cui, Cheng Peng and Shuzhong Yuan* 292
- Rapid photosynthetic and physiological response of 2,4-D-resistant Sumatran fleabane (*Conyza sumatrensis*) to 2,4-D as a survival strategy. *Jéssica F. L. Leal, Amanda dos S. Souza, Junior Borella, André Lucas S. Araujo, Ana Claudia Langaro, Monique M. Alves, Luana Jéssica S. Ferreira, Sarah Morran, Luiz H. S. Zobiolo, Felipe R. Lucio, Aroldo F. L. Machado, Todd A. Gaines and Camila F. de Pinho* 298
- Concurrent evolution of seed dormancy and herbicide resistance in field populations of dominant weed species in Western Australian cropping systems. *Aniruddha Maity, Roberto Lujan Rocha, Yaseen Khalil, Muthukumar Bagavathiannan, Michael B. Ashworth and Hugh J. Beckie* 309
- Additive and synergistic interactions of 4-hydroxyphenylpyruvate dioxygenase (HPPD) and photosystem II (PSII) inhibitors for the control of glyphosate-resistant horseweed (*Conyza canadensis*) in corn. *John C. Fluttert, Nader Soltani, Mariano Galla, David C. Hooker, Darren E. Robinson and Peter H. Sikkema* 319
- Benzobicyclon efficacy is affected by plant growth stage, HPPD Inhibitor Sensitive 1 (HIS1) expression and zygosity in weedy rice (*Oryza sativa*). *Chad Brabham, Jason K. Norsworthy, Xueyan Sha, Vijay K. Varanasi and Fidel González-Torralva* 328
- Seed germination ecology of leucaena (*Leucaena leucocephala*) as influenced by various environmental parameters. *Sachin Dhanda and Bhagirath Singh Chauhan* 335
- Improving upon the interrow hoed cereal system: the effects of crop density and row spacing on intrarow weeds and crop parameters in spring barley. *Margaret R. McCollough and Bo Melander* 341
- Survey of weed flora and weed management practices in Florida strawberry fields. *Nathan S. Boyd and Laura Reuss* 353
- Evaluating the effects of extended preharvest intervals on glyphosate and glufosinate residues in almonds. *Katie Martin and Bradley D. Hanson* 361