

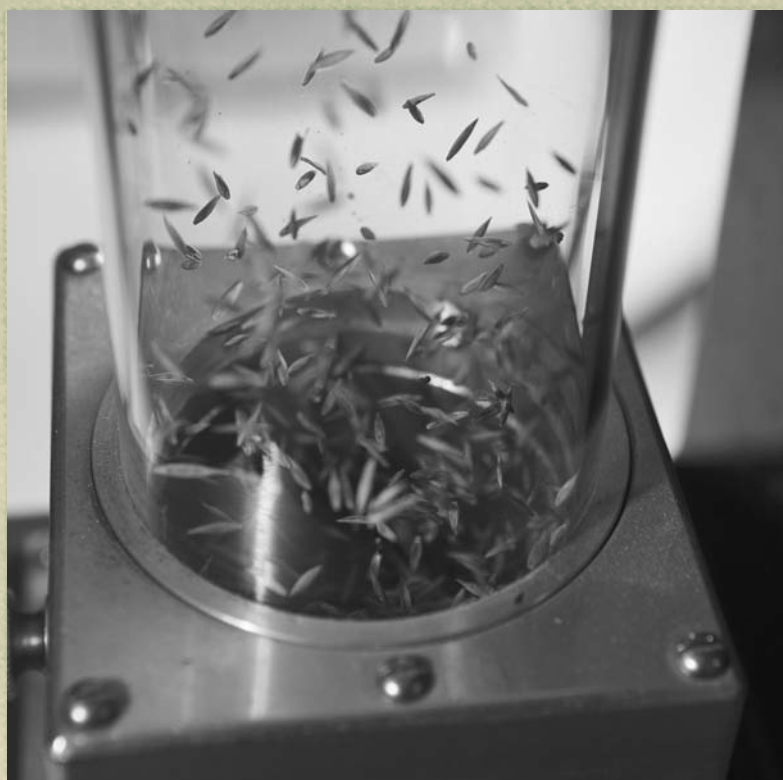
Seed Technology

An International Journal Serving Seed Scientists and Technologists

Volume 31

2009

Number 2



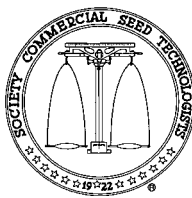
ISSN: 1096-0724

Published Jointly by the Association of Official Seed Analysts
and the Society of Commercial Seed Technologists

Seed Technology

*An International Journal
Serving Seed Scientists and Technologists*

Volume 31, Number 2 • 2009



Published jointly by:

ASSOCIATION OF OFFICIAL SEED ANALYSTS
SOCIETY OF COMMERCIAL SEED TECHNOLOGISTS

Editor-in-Chief:

Dennis M. TeKrony
Professor Emeritus
Plant and Soil Sciences Department
University of Kentucky
Lexington, KY 40546-0312
USA

Editor:

Cindy Finneseth
Seed Testing Coordinator
Division of Regulatory Services
College of Agriculture
University of Kentucky
103 Regulatory Services Building
Lexington, KY 40546-0275

Seed Technology

THIS JOURNAL is co-sponsored by the two predominant organizations in North America with a direct interest in seed technology: the Association of Official Seed Analysts and the Society of Commercial Seed Technologists.

ASSOCIATE EDITORS:

Riad Baalbaki, California Dept. of Food and Agriculture, Sacramento, CA, USA
Frank Bonner, Retired, USDA, Forest Service, Starkville, MS, USA
Kristina Connor, USDA-Forest Service, Auburn, AL, USA
Sabry Elias, Oregon State University, Corvallis, OR, USA
Robert L. Geneve, University of Kentucky, Lexington, KY, USA
Gwen Koning, Syngenta Crop Protection, Basel, Switzerland
Deborah Meyer, California State Seed Laboratory, Sacramento, CA, USA
Gary V. Munkvold, Seed Science Center, Iowa State University, Ames, Iowa, USA
Amanda Patin, SGS Mid-West Seed Services, Inc., Brookings, SD, USA
Fawad Shah, Washington State Dept. of Agriculture, Yakima, WA, USA
Pegadaraju Venkatramana, BioDiagnostics, Inc., River Falls, WI, USA
Richard Vierling, Indiana Crop Improvement Assn., Lafayette, IN, USA
Greg Welbaum, Virginia Tech, Blacksburg, VA, USA
Yujia Wu, USDA AMS Seed Regulatory and Testing Branch, Gastonia, NC, USA

AIMS AND SCOPE – *Seed Technology* is an international journal containing scientific and technological papers in all areas of Seed Science and Technology. The emphasis is on applied and basic research in seed physiology, pathology and biology that may relate to seed development, maturation, germination, dormancy and deterioration. Studies on seed production, sampling, testing, conditioning, distribution and storage are also included. Short communications from seed analysts and technologists are encouraged and will be published as Seed Tech Notes. These notes include new techniques, standardization of laboratory tests and documentation of anatomical and pathological observations of seed and seedling development. The journal also includes timely review articles of seed technology that may relate directly to the seed industry.

TYPES OF PAPERS – Original research papers, review articles and Seed Tech Notes are reviewed for publication. Manuscripts should be typed, double spaced and sent to the Editor electronically as a Word or WordPerfect document. Potential authors should note that there are no page charges and reprints can be ordered directly from the printer at a minimal fee. Refer to the last pages of this volume for Instructions to Authors for manuscript and Seed Tech Note submissions.

SUBSCRIPTIONS – *Seed Technology* is published one to two times annually. The annual subscription price for individuals is \$75.00 in North America and \$85.00 outside of North America; university and library annual subscriptions are \$125.00 in North America and \$135.00 outside of North America. All subscription prices are in US dollars and include postage. Subscriptions should be sent direct or through a bookseller to: Anita Hall, Executive Director, Society of Commercial Seed Technologists, Inc., 101 East State St., #214, Ithaca, NY 14850, USA, www.seedtechnology.net.

EDITORIAL

WE ARE PLEASED that both the Association of Official Seed Analysts (AOSA) and the Society of Commercial Seed Technologists (SCST) continue to be the joint sponsors of Seed Technology. Since 1922, these two organizations have partnered through many activities including a joint annual meeting to promote professionalism and uniformity in seed testing. Both AOSA and SCST members contributed to this issue of Seed Technology through abstracts from oral and poster presentations given at the 99th AOSA and the 86th SCST annual meeting held in Ft. Collins, Colorado May 30–June 4, 2009. Please review these abstracts and consult with the authors directly if you need more details on the methods or results presented.

Distance education has become an important alternative for many students who are off campus yet desire additional training toward a degree or updating in their discipline. To satisfy this growing demand in seed laboratories and the seed industry, several universities in the USA are offering distance learning courses in seed biology and technology. Dr. Greg Welbaum, Virginia Tech University, has recently summarized available courses in the October issue of CSA Newsletter of the Crop Science Society of America. We have invited Greg to write a similar review article for the next issue of Seed Technology. This is an excellent opportunity for updating in many areas ranging from seed anatomy and development to seed vigor or seed production.

An area in which we are focusing attention is in electronic options including manuscript submission and review to hasten the peer review process as well as formats for electronic delivery of Seed Technology. Our past issues have been converted to an electronic format and we currently are evaluating different methods to make future and past issues easily available. Comments and suggestions to implement online accessibility and utility are welcome.

As always, Seed Technology is committed to publishing applied and basic research in seed physiology, technology, pathology and biology. If you are interested in providing a review on a topic of interest, please contact the editorial staff with your proposal. Current research in the previously identified areas is of considerable interest to those engaged in the discipline of seed science and technology and we welcome submissions as full-length manuscripts and Seed Tech Notes as well as presentations from approved workshops and symposia.

Dennis M. TeKrony Cindy Finneseth
Editor-in-Chief Editor

COVER ILLUSTRATION: Tall fescue (*Festuca arundinaceae* Schreb.) seeds suspended in the glass column of a General blower. A properly-calibrated General blower is a valuable tool in the seed testing laboratory. This equipment is routinely used to separate light and heavy fractions of a sample and improves uniformity by eliminating analyst subjectivity in floret classification. Photo credit: Steve Patton, University of Kentucky Agricultural Communications Services.

Seed Technology

Instructions to Authors

Seed Technology is an international journal that publishes original papers, review articles, technical notes and symposia in all areas of seed science and technology. This includes information from applied and basic seed research in physiology, pathology and biology for all plant species. The journal relates to individuals interested in seed production, sampling, testing, conditioning, distribution and storage of agronomic, horticultural and forest seed crops. Papers are accepted on the understanding that they have not been published or submitted to any other scientific journal. The journal is published one to two times per year and is available as paper copies by contacting: Anita Hall, Executive Director, Society of Commercial Seed Technologists, Inc., 101 East State St., #214, Ithaca, NY 14850. Subscription information and order forms are available online at: <http://www.seedtechnology.net/journal.htm>.

Manuscripts must be clearly written using proper English. If English is not the primary language of the author, the manuscript should be reviewed by someone proficient in English prior to submission to the journal. Manuscripts should be submitted via e-mail as an electronic document in MS Word or WordPerfect for Windows. See "Guidelines for Submission" at the end of the instructions. Five types of submissions will be considered for publication:

- a. **Full-length manuscripts** should report new information to the subject area or expand on established knowledge to contribute additional information of value. Manuscripts undergo peer review to determine that adequate scientific methods were applied, that interpretations and conclusions are valid, and that all aspects of the study are adequately presented.
- b. **Seed Tech Notes** are appropriate for the reporting of seed laboratory or seed production research that may not justify a full paper, but provide important information of potential practical importance. This may include new techniques or developments, standardization of old techniques or anatomical, pathological or other documentation of seed or seedling development. The requirements for such notes are described below.
- c. **Technical Papers** presented orally or by poster at the annual meeting of the Association of Official Seed Analysts (AOSA) and Society of Commercial Seed Technologists (SCST) are invited, which cover topics of general interest to the seed biologist or technologist.
- d. **Symposia** or workshops presented to the AOSA/SCST membership may be recorded in the journal for future reference. Organizers should prearrange with the Editor to receive papers from the presenters of symposia and workshops within a specified timeframe for inclusion in a single journal issue.
- e. **Review articles** are welcomed by special prior arrangement with the Editor or Editor-in-Chief. Reviews should cover a summary of a seed biology or seed technology topic or an evaluation of a seed science or technology related publication. The content of reviews should have a strong technical and/or scientific base.

INSTRUCTIONS FOR FULL LENGTH PAPERS

Manuscripts should be arranged in the following order: **Title** (no separate title page), **Author(s)**, **Abstract**, **Text**, **Acknowledgments**, **References**, **Tables**, **Captions for Figures** (separate page) and **Figures**. The title should be concise (10 to 12 words) but informative, containing key words which describe the subject matter for use in abstracting systems. The name of the author(s) should be placed below the title with an asterisk (*) after the name of the corresponding author.

The **abstract** should concisely summarize the entire scope of the paper including findings and conclusions without reference to text or figures. **All categories of manuscripts or papers submitted to the journal must have an abstract.** It should appear immediately below the title and authors and consist of not more than 250 typed words. Authors may provide a translation of the abstract in one additional language, which will be printed in the journal following the primary abstract in English. Availability of abstracts in alternate languages should be discussed with the Editor early in the submission process. Accuracy in regard to content and grammar of the second abstract is the responsibility of the corresponding author. Do not include a list of key words.

The **text** of the manuscript should normally have the subject matter grouped under the following major headings: **Introduction**, **Materials and Methods**, **Results**, **Discussion** (Results and Discussion may be combined), **Acknowledgments** (optional) and **References**. Main headings are centered on each page and capitalized in bold type. Secondary headings begin at the left margin (do not indent) with the first letter capitalized and the entire heading in bold print. Use of a previous issue of the journal as a guide to format is recommended.

Author-Paper Documentation. Author-paper documentation is a single paragraph at the bottom of the first page (under abstract). The first sentence lists the authors (without professional titles) and their complete addresses. If the author has moved, provide the current address. Always end the author-paper documentation with: *Corresponding author (e-mail address of corresponding author). Received _____.

Style Manual. *Scientific Style and Format: The CBE Manual for Authors, Editors, and Publishers*, 6th edition, prepared by the Style Manual Committee of the Council of Biology Editors and published by the Cambridge University Press should be followed for writing papers submitted to *Seed Technology*. *The Publications Handbook and Style Manual* of the American Society of Agronomy can also be used as a detailed guide for both paper and electronic manuscript preparation and can be accessed on line at

<https://www.crops.org/publications/style/>

Abbreviations. Use standard abbreviations (for example, Fig., RH, °C) listed in *Scientific Style and Format* without definition. Other abbreviations should be defined at first usage and may be used thereafter without further definition. Names of states, provinces and countries should be abbreviated following city names, using appropriate abbreviations of the postal service in that country.

Units. Metric units must be used for all measurements and the SI system (Système International d'Unités) used insofar as possible.

Numbers. Use Arabic numerals for all numbers with two or more digits and for all measurements such as time, weight, or degrees except when the number is the first word in a sentence. Spell out numbers when they are the first word in a sentence or when they are less than 10 and not measurements, except when in a series in which one figure has two or more digits. Decimals should be expressed using a period (5.05, for example). The percentage sign should be used in conjunction with a number (5%), but percentage should be written in full when used as a noun (germination percentage). Dates should be given as 2 December, 1938, for example.

Nomenclature. Species should be described by their scientific ('Latin') names. At first mention in the main text the full binomial and authority must be given, but subsequently the genus should be abbreviated to its initial letter and the authority omitted. Authorities are not quoted after Latin names in the title or abstract. Crop varieties should be identified by single quotation marks, for example, 'Ranger' alfalfa (*Medicago sativa* L.)

Tables. Tables should be numbered consecutively with Arabic numbers and should be reduced to the simplest form. Each table should be typed on a separate page from the main text. Table headings should be brief but complete and self-contained. Use the following symbols for footnotes, in this order: †, ‡, §, ¶, #. Asterisks are used only to indicate statistical significance, with * and ** representing significance at the 0.05 and 0.01 probability levels, respectively. Do not duplicate table information in figures.

Figures. All electronic images should be submitted in their native file format without insertion into a .DOC or text file such as MS Word or WordPerfect. This is necessary because any graphic files embedded into a text file must be extracted for use with layout software during typesetting. Graphic files extracted from a text file are not as useable as the form they were in before insertion. Examples of acceptable graphic file types would be .TIF, .JPG, .BMP and .EPS. Images should be high resolution without compression. Alternatively, high quality original prints of photographs or halftone reproductions may be provided with good dark and white contrast. Photographs should only be submitted if they are essential for understanding the manuscript. Prepare drawings for graphs and charts with laser printer output on smooth white paper. For computer generated line art, submit original printouts, not poor quality copies. All figures should be of sufficient size and quality to allow for reduction by half or more for printing. Lettering should be kept at a minimum in graphs. All lettering, symbols and lines must be large enough, clear enough and thick enough to still be easily read and prominent after reduction. Preferred symbols for line art figures are black and white open and closed squares, circles and triangles. Do not use colors, shades of gray, or fine screens or patterns to fill bars on graphs or wedges on pie charts. Use solid black or white, well-spaced parallel lines, widely spaced dots, or other black and white line art methods. Again, any patterns and lines should be able to withstand reduction

by half or more. Label the back of each figure with the name of author and figure number. Figure captions should be brief, self contained and listed consecutively on a separate sheet at the end of the manuscript.

Acknowledgment. This section lists institutional sponsors with identification of the research project including granting agency recognition, if appropriate. This segment can also be used to thank anyone who was instrumental in or contributed to the completion of this study.

References. Either the author-year or numbered notation may be used in the text. Citations by authors in the text should appear as Smith (1996) or (Smith, 1996). Use “et al.” each time when there are three or more authors for a reference in the text, but give all authors in the reference list itself. In the reference list, arrange all published citations alphabetically by author: for example, last name and then initials of the first author, with each subsequent author listing arranged with initials/name first and then last name. Citations should include names of all authors, year, complete title, abbreviated journal title, volume number and inclusive pages. Cite personal communication and unpublished work only in the text, not in the reference list. Examples of acceptable references are:

- Koning, G., D.M. TeKrony, T.W. Pfeiffer and S.A. Ghabrial. 2001. Infection of soybean with soybean mosaic virus increases susceptibility to *Phomopsis* spp. seed infection. *Crop Sci.* 41: 1850–1856.
- Bernard, R.L. and M.G. Weiss. 1973. Qualitative genetics. p. 117–154. *In Soybeans: Improvement, production, and uses.* B.E. Caldwell, R.W. Howell, J.W. Judd and H.W. Johnson, (eds.) 1st ed., Agron. Monogr. 16. ASA, CSSA, and SSSA, Madison, WI.
- Fehr, W.R. and C.E. Caviness. 1977. Stages of soybean development. Spec. Rep. 80. Iowa Agric. Home Econ. Exp. Stn., Iowa State Univ., Ames.
- McGee, D.C. 1992. Soybean diseases. Am. Phytopathol. Soc., St. Paul, MN.
- AOSA. 2005. Rules for testing seeds. Assoc. Offic. Seed Anal., Las Cruces, NM.

It is always preferred for papers to have references, but some papers based on presentations or workshops may be acceptable without them by prior arrangement with the Editor.

Proofs, publication charges and reprints. One set of page proofs in Adobe Acrobat format will be returned to the corresponding author by e-mail attachment. Corrections should be restricted to printer’s errors and returned to the Editor promptly. *Seed Technology* does not require page charges, however reprints can be ordered from the publisher when returning corrected proofs.

GUIDELINES FOR SUBMISSION

Initial submission should be by e-mail attachment. The manuscript should be typed, double spaced with ample margins (at least 4.0 cm on each side) on one side of line-numbered paper (approximately 21 x 28 cm) to include the text of the manuscript; all pages should be numbered consecutively. All tables and figures should be typed on separate numbered pages from the main text in an

acceptable format. Macintosh and Windows versions of MS Word or Word-Perfect may be used for submission. If files are submitted as e-mail attachments, both files can also be accepted in MS-Works, RTF, ASCII, and other formats if the preferred options are not available. **Manuscripts should be e-mailed to the Editor:**

cindy.finneseth@uky.edu

Contact the Editor or Editor-in-Chief if you have questions:

Cindy H. Finneseth, Editor
Seed Testing Coordinator
Division of Regulatory Services
103 Regulatory Services Building
University of Kentucky
Lexington, KY 40546-0275
E-MAIL: cindy.finneseth@uky.edu
PHONE: (859) 257-2785, Ex. 256
FAX: (859) 257-7351

Dennis M. TeKrony, Editor-in-Chief
Plant and Soil Sciences Department
1405 Veterans Drive
429 Plant Science Building
University of Kentucky
Lexington, KY 40546-0312
E-MAIL: dtekrony@uky.edu
PHONE: (859) 257-5020, Ex. 80754
FAX: (859) 257-7874

INSTRUCTIONS FOR *SEED TECH NOTES*, TECHNICAL PAPERS AND SYMPOSIA OR WORKSHOPS

The format for *Seed Tech Notes*, technical papers and presentations from symposia or workshops is as for full length papers insofar as practical. The text headings may be the same as a full paper or may be arranged by **Abstract**, **Experimental Techniques**, **Results and Discussion**, and **References**, if that format is more suitable to the presentation of the material. The Experimental Techniques section will include a brief narrative of those elements normally included in the Introduction and Materials and Methods sections of full length papers. *Seed Tech Notes* and technical papers are usually much shorter and may present only preliminary research data compared to full length papers. These papers should not exceed four pages of printed text and a maximum of two figures, tables or photographs. Papers presented at committee meetings, symposia and workshops not containing cited references or other conventional journal paper elements may be considered for publication if these presentations contain information of a practical nature or general interest in seed biology and technology.

SYMPOSIA PUBLICATIONS

Manuscripts resulting from symposia on seed biology or technology topics will be considered for publication in a single volume of *Seed Technology* by prearrangement with the Editor. Manuscripts may originate from symposia sponsored by the Association of Official Seed Analysts or the Society of Commercial Seed Technologists or from appropriate seed symposia sponsored by other organizations. Symposia organizers desiring to publish a set of manuscripts in *Seed Technology* must solicit the Editor with the following information: (i) title, date and location of the symposium, (ii) the organization affiliated with the symposium, (iii) names, addresses, e-mail and telephone numbers of

symposium organizers and (iv) titles and abstracts for each paper to be considered for publication. Symposia papers are subject to the usual format described above for *Seed Technology* and will be reviewed by the editorial board prior to acceptance for publication.

If these guidelines are not closely adhered to, papers will be returned to authors for revision or released from further consideration for the journal.

ABSTRACTS from AOSA/SCST MEETING (continued from Back Cover)

Differential Scanning Calorimetry as a Tool for Nondestructive Measurements of Seed Deterioration in Lettuce (<i>Lactuca sativa</i> ‘Black Seeded Simpson’) / Jennifer Crane and Christina Walters . . .	200
The NCRPIS — Providing Diverse Plant Genetic Resources for Worldwide Research and Development / Maria Erickson, Lisa Pfiffner, Lisa Burke, David Kovach, Mark P. Widrlechner, Candice Gardner	201
Identification of Foxtail (<i>Setaria</i>) Impurities: Examination and Comparison of Four Species / Jennifer Neudorf and Ruoqing Wang	202
The Effect of Seed Vigor on the Uniformity of Soybean Seedling Emergence / D.B. Egli and M. Rucker	202
Preservation of Plant Genetic Resources at the National Center of Genetic Resources Preservation / David Ellis	203
Svalbard Global Seed Vault: Safeguarding the Future of Agriculture / David Ellis	204
Laboratory Methods to Break Dormancy in Eastern Gamagrass (<i>Tripsacum dactyloides</i> L.) Seeds / Cindy L.H. Finneseth and Robert L. Geneve	204
Identification and Characteristics of <i>Solanum</i>, <i>Physalis</i>, <i>Datura</i>, and <i>Quincula</i> Species / Patsy Jackson	205
A High-throughput System for Integrated Extraction and PCR Amplification of DNA from Seed and Leaf Tissue for Plant Genotyping Studies / Steve Michalik	206
Annonaceae Seeds: Desiccation Tolerant with Unusual Physiologies / Gayle M. Volk, Remi Bonnard, and Christina Walters	206
Seed Storage Containers: Implications of Water Permeability Properties on Moisture Management / Christina Walters and Lisa Hill	207
Cryogenic Storage of Cereal Grains: Results from a 20-Year Experiment / Christina Walters, Lana Wheeler, Phil Stanwood	208
National Seed Herbarium / Ruoqing Wang and Jennifer Neudorf . . .	208
Instructions to Authors	211

Editorial – Dennis M. TeKrony and Cindy Finneseth 119

REFEREED PAPERS

Seed Germination Differences between Glyphosate-Resistant and -Susceptible Italian Ryegrass Populations /
Vijay K. Nandula, Daniel H. Poston and Krishna N. Reddy 123

Overcoming Seed Dormancy in *Cleome gynandra* L. to Improve Germination / R.M. Muasya, J.N. Simiyu, C.W. Muui, N.K. Rao, M.E. Dulloo and L.S. Gohole 134

Promoter Analysis of Soybean Seed Coat Peroxidase Gene *Ep* /
Huabang Chen and Richard A. Vierling 144

Cardinal Germination Temperatures of Some Medicinal Plant Species / F. Nadjafi, L. Tabrizi, J. Shabahang and A. M. Mahdavi Damghani 156

Effect of Provenance, Temperature and Pretreatment on Germination of *Albizia chinensis* / C.S. Dhanai and A.K. Uniyal . . . 164

SEED TECH NOTES

How to Prepare a Master Calibration Sample: Procedure and Applications Using Tall Fescue as a Model /
Adriel Garay, Sabry Elias and Heather Nott 179

Laboratory Tests for Predicting Seedling Emergence of Safflower (*Carthamus tinctorius* L.) Cultivars /
Farhad Khavari, Farshid Ghaderi-Far and Elias Soltani 189

ABSTRACTS from oral and poster presentations at the 2009 AOSA/SCST MEETING, Ft. Collins, Colorado

Comparison of Two Accelerated Aging Test Methods /
S.G. Elias, R. Balbaaki, M.B. McDonald and J.M. Filho. 197

Comparison of Inert Matter Content Separated from Tall Fescue Samples Using the AOSA Manual Method and a Uniform Blowing Procedure / Adriel Garay, Sabry Elias and Heather Nott 198

How to Produce and Assure Uniformity in Master Calibration Samples / Adriel Garay, Sabry Elias and Heather Nott 199

Bonafide BDI®-Ryegrass, A Novel, DNA-based Diagnostic Tool for Adventitious Presence Test in Perennial Ryegrass / A.C. Chandra-Shekara, Michael Thompson and Pegadaraju Venkatramana 200

(CONTINUED ON Inside Back Cover)