Publications Handbook & Style Manual

American Society of Agronomy
Crop Science Society of America
Soil Science Society of America

Publications Handbook and Style Manual

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Chapter 1. Manuscript Preparation

The American Society of Agronomy (ASA), Crop Science Society of America (CSSA), and Soil Science Society of America (SSSA) have a reputation for publishing high-quality papers in their journals, books, and other publications. Authors are strongly urged to have their papers thoroughly reviewed by competent colleagues before submitting those papers for consideration by any ASA, CSSA, and SSSA publication.

This chapter deals mainly with journal formats, but the discussion applies broadly to the other formats (see Chapter 9).

Publications of ASA, CSSA, and SSSA follow the *Publication Manual of the American Psychological Association*, 7th edition (APA, 2020), for reference and citation styles. For questions of scientific style and format beyond what is covered in this manual, consult the style manuals of the American Chemical Society (Coghill & Garson, 2006), the Council of Science Editors (CSE, 2006), and the *Chicago Manual of Style* (UCP, 2017). Recent issues of ASA, CSSA, and SSSA journals also provide examples of the desired format. Be consistent in whatever style choices you make.

All manuscripts are critically reviewed before they are published in any ASA, CSSA, or SSSA journal, monograph, book, or special publication. Written guidelines for manuscript submission can be accessed online.

DETAILS OF MANUSCRIPT PREPARATION

Eligibility of Authors

Membership is not required for publishing in ASA, CSSA, or SSSA publications. Some of the journals, however, assess a surcharge to nonmembers. Authors who wish to join a society to avoid this charge should do so before the paper is accepted for publication. For information on membership, visit https://www.agronomy.org/membership/become-a-member/, https://www.crops.org/membership/become-a-member/, or https://www.soils.org/membership/become-a-member/. Eligibility policies are summarized in each journal's author instructions.

Publication Charges

Publication and open access charges vary depending on the journal and whether at least one of the authors is a member of ASA, CSSA, or SSSA. These charges are subject to change. Check the journals' instructions to authors for current information.

No Prior Publication, No Simultaneous Submission

Except for reviews or timely essays, papers published in the scientific journals of the ASA, CSSA, and SSSA must be original reports of research. Submission of a scientific manuscript for review is understood to imply that the work is original and unpublished and not being considered for publication elsewhere. If portions of the paper have been submitted or published elsewhere, the authors must disclose that fact at the time of submission and provide details of relevant prior publications.

Whether publication in nontechnical outlets constitutes prior publication is decided on a case-by-case basis. In general, publication in nontechnical media will be considered prior publication only if substantially all of the data and conclusions have been published.

Posting of preprints to a preprint server is considered acceptable but requires citing of the preprint. Note the use of a preprint server in the cover letter, and as appropriate, state how the manuscript has been adjusted or updated between the preprint version and

the version submitted to the journal. Failure to alert the journal in your cover letter to any prior publication of your submission may be viewed as an ethical violation.

Manuscript Handling

Manuscripts are handled by similar procedures in ASA, CSSA, and SSSA journals. The basic policy is that at least two independent scientists must agree before a paper is accepted for publication or released back to the author (rejected). Release of a paper by a journal does not preclude its resubmission to that same or another ASA, CSSA, SSSA journal after its weaknesses have been eliminated. For example, a paper released because it needed another year of data may be resubmitted after those data have been gathered and the results incorporated into the paper. Such a resubmission must be accompanied by a copy of the original release letter. A manuscript may be released before review, either because it does not conform to acceptable standards or because the subject matter is outside the scope of the journal.

Manuscript Submission

Manuscripts are submitted via the journal's online manuscript submission system. Consult the instructions to authors for details.

Receipt of manuscripts will be acknowledged. Communication from editorial board members and the headquarters staff is usually with the corresponding author only; normally the submitting author is the corresponding author (see Authorship, below). The cover letter or title page should give the corresponding author's current phone number and email address for use during review and production.

A journal editor may determine that the submitted paper's subject matter is more suitable for a different society journal. In those cases, the editor will release the paper and suggest the corresponding author transfer their paper to that journal.

Manuscript Processing

Upon receipt, each paper is assigned a unique manuscript number that identifies the manuscript. Refer to the manuscript number in all subsequent communications during the review process. Authors will be informed as the manuscript moves through the various steps involved in review, acceptance or release, and production. (See also Chapter 8.)

After a manuscript has been accepted for publication, it receives a separate manuscript number and DOI. It is then edited for style and grammar and prepared for publication.

Anonymous Review

All papers submitted to ASA, CSSA, SSSA journals are given an anonymous review—meaning that the names of reviewers are not revealed to the authors of the papers or to the other reviewers.

Most ASA, CSSA, and SSSA journals use a single-anonymous review process, where the authors do not know the names of the reviewers. Some use a double-anonymous process and also withhold the names of the authors from the reviewers. Check the individual journal's instructions to authors for details on the review process. For journals that use a double-anonymous process, prepare the manuscript with no identifying information, such as byline, addresses/affiliations, and acknowledgments. The author should provide that information on a separate title page. In addition, take care to label tables and figures with reference to the paper's title, not author names. Any identification in headers or footers should be similarly anonymous. Authorship may also be unintentionally revealed

through such software features as document summaries. If this is a concern, consult your software experts.

When authors submit a manuscript via the online submission system, they will be asked to enter contact information into the system database, and the editors will have access to this information so that they can contact the authors about the outcome of the review.

SUBMISSION SPECIFICS

All accepted manuscript files are edited in Microsoft Word. Therefore, authors are encouraged to compose manuscripts in Microsoft Word. The manuscript must use continuous line numbering. We prefer that the text is double spaced, for ease of reading.

Do not use complicated fonts and features available in Microsoft Word. Limited use of italics, bold, and superscripts and subscripts is acceptable.

Do not use such word-processing features as automatic footnoting and outlining. These features interfere with both electronic editing and typesetting. If you need to place a numbered list in your manuscript, enter the numbers and use appropriate tabs and indents manually instead of using automatic outlining.

Headings and Subheadings

Headings guide the reader, but too many headings can be distracting. Keep headings short. Abbreviations are allowed in headings.

Differentiate between the heading levels in your manuscript. For style, examine recent issues of the publication to which the manuscript will be submitted. In most ASA, CSSA, and SSSA journals, Level 1 headings (the main headings) are used for the main sections, such as Introduction, Materials and Methods, Results, and Discussion, with Level 2 headings used for subsections. Level 3 and Level 4 headings are allowed, but use them sparingly. You may number headings for clarity if desired.

TYPES OF JOURNAL ARTICLES

The most common type of paper to appear in ASA, CSSA, and SSSA journals is the original research paper. The journals also publish other paper types. Consult the instructions to authors of each journal for a description of all current types of papers.

Review Papers

Review papers are usually less formal than full-length articles. Such papers should provide a synthesis of existing knowledge and give new insights or concepts not previously presented in the literature, or at least not with the same level of detail.

These articles should not be considered exhaustive reviews of the literature but should include enough literature review to provide a basis for understanding and interpretation of the topic under consideration.

A good review is often one of the most important ways to advance an area of science. Readers expect a review paper to

- deal with an important subject that needs a scholarly review,
- cover the entire spectrum of the subject, not just the segment about which the author of the review paper has published articles,
- present a balanced coverage that is fair to all the work it reviews, and
- add a perspective to the entire subject and contribute significantly to understanding.

Issue Papers

The intent of these papers is to stimulate discussion and possibly a rethinking of current views. They may be provocative and controversial. Our journals use different headings for such papers, such as "Perspectives" or "Forum" papers. Check the individual journal's online author instructions for details.

Notes and Short Communications

Notes and Short Communications represent a separate category of scientific manuscripts. Papers in this category typically describe research techniques, apparatus, and observations. Observations usually are limited to studies and reports of unrepeatable phenomena or other unique circumstances. These articles are usually shorter than research papers.

Occasionally, an editor may determine that a paper submitted as a research paper will better fit this category, or vice versa. If the author agrees, the manuscript can be transferred to or from this category of papers.

The review procedure for these papers is identical to that for research papers.

Letters to the Editor

All our journals publish Letters to the Editor. Letters may contain comments on articles appearing in the journals or general discussions about research relevant to the journal and are limited to 1000 words. Letters must be approved by the editor and may be peer reviewed. If a letter discusses a published paper, the author of that paper will be invited to submit a response to the comments; typically, the response is published along with the letter.

Core Ideas and Plain Language Summaries

At submission, most journals ask authors to to prepare three to five core ideas (up to 115 characters each, spaces included), which will appear with the accepted article and on the journal's table of contents. Some of our journals may ask for plain language summaries in place of or in addition to core ideas.

Research Papers

Manuscripts of research papers prepared for ASA, CSSA, and SSSA journals are normally arranged in the following order:

1. Title and byline
2. Core Ideas
3. Author–paper documentation (addresses/affiliations, email address of the corresponding author, etc.—see below)
4. Abstract
5. Plain Language Summary
6. Abbreviations
7. Introduction
8. Materials and Methods
9. Results (can be combined with the discussion section)
10. Discussion (no separate summary section, which duplicates the function of the abstract; a summary statement may, however, be given as a closing paragraph)
11. Conclusions (optional; this may be a titled section or part of the discussion section)
12. Data Availability Statement
13. Author Contributions (this is generated from metadata provided during submission)
14. Acknowledgments (optional)

15. Conflict of Interest Statement
16. References
17. Figure captions and tables should be placed in the main text close to where they are first called out for submitted manuscripts. For *accepted manuscripts*, figure captions and tables appear after the reference list, and figures should be submitted as separate high-resolution image files in the following acceptable formats: EPS, TIF, PDF, or JPG.

For journals with a double-anonymous review process, the byline, author–paper documentation, and acknowledgments should not be included at the time of submission to ensure anonymity—authors will be asked to add these items once the paper has been accepted.

Sometimes a Theory section substitutes for or precedes Materials and Methods. Any section may include subheadings to guide the reader through different aspects of the topic.

Manuscript Format

Title. The title represents the article's content. It is best to start the title with key words—not with words such as "Effect of" or "Influence of." A good title briefly identifies the subject, indicates the purpose of the study, and introduces key terms or concepts. Titles may be descriptive (e.g., Variables A and B under C Conditions), declarative (A Relates to B in C Manner), or even a question (Does A Do X?).The recommended limit is 12 words.

Keep titles free of nonstandard abbreviations, chemical formulas, or proprietary names, and avoid unusual or outdated terminology. Use common names of crops and chemicals. If a crop or microorganism has no common name or if the common name is in dispute, then the scientific name (with authority) may be used in the title.

Authorship. (Added at acceptance for double-anonymous journals.) We encourage the use of full names in bylines (e.g., Morgan L. Jones or M. Louise Jones instead of M. L. Jones). The *corresponding author* deals with proofs; their email is published with the article. The authors of the paper decide the sequence of author names; the order should be agreed upon by all authors involved.

Author–Paper Documentation. The author–paper documentation appears on the first page of the published article or given on a separate title page for double-anonymous journals. The purpose is to give addresses for all authors and an email address for the corresponding author (*author documentation*), as well as any necessary institutional identification such as a grant support, dissertation requirement, or a journal article number (the *paper documentation*). In the manuscript, put this paragraph after the byline, on the cover page only. Alternatively, any necessary institutional identification can be placed in the Acknowledgments section.

Group together all authors at a single address in the order they appear in the byline. Do not include professional titles. Following complete addresses for all authors (without postal codes), provide the corresponding author's address (including postal code) and email address. EXAMPLE:

Neha Kothari, B. Todd Campbell, Jane K. Dever, and Lori L. Hinze

Neha Kothari and Jane K. Dever, Texas A&M AgriLife Research, 1102 East FM 1294, Lubbock, Texas, USA
B. Todd Campbell, USDA-ARS, 2611 W. Lucas St., Florence, South Carolina, USA
Lori L. Hinze, USDA-ARS, 2881 F&B Rd., College Station, Texas, USA

Correspondence: Lori L. Hinze, USDA-ARS, 2881 F&B Rd., College Station, TX 77845, USA. Email: lori.hinze@usda.gov

If an author has moved, the current address can be added, but if the previous address is a funder, then the previous should be retained. The address where the work was done should go first; the current address normally goes at the end:

A. Smith and B. Jones, Department of Crop Sciences, University of Illinois, 1102 S., Goodwin Ave., Urbana, Illinois, USA
A. Smith, current address: Department of Agronomy, Purdue University, West Lafayette, Indiana, USA

Acknowledgment of grant funding, support information, and personal thanks belong in the acknowledgments section at the end of the paper (or title page for double-anonymous journals). Any required government or institutional disclaimer in reference to commercial products or trade names mentioned in the text should also be placed in the acknowledgments section.

Footnotes. Footnotes are not allowed.

Abstract. A journal abstract has two typical uses. It helps readers decide whether to delve into the paper; abstracts are also published via abstracting and indexing services. Because the abstract will be seen and read by many more people than will read the paper, all important aspects in the paper should be reflected in the abstract. The abstract should call attention to new techniques, observations, or data. Be specific.

An *informative abstract* (also called a *substantive abstract*) presents the paper in miniature, complete within itself. It moves from an introductory statement of the rationale and objectives or hypotheses, through materials and methods, to the results and conclusions. (A *descriptive abstract* is more like a table of contents for the paper and is rarely used in scientific publications.)

Because an informative abstract has to stand alone, do not deflect the reader with phrases such as "will be discussed" or "will be explained." For the same reason, do not include reference, figure, or table citations. Statistics also are inappropriate in an abstract unless they are the central finding of the study. Limit your use of abbreviations, and define the ones you do use.

At first mention in the abstract, give the complete scientific name (with authority) for plants. The scientific names of plants should be repeated at the first mention in the main text. In the main text, give scientific names of other organisms, including causal agents of diseases. These are not necessary in the abstract, The scientific names for larger animals (e.g., sheep) do not need to be given unless germane to the article and/or there may be confusion as to what animal is being discussed. Complete soil series descriptions should be provided upon first mention in the main text; they do not need to be given in the abstract. Using the common names of chemicals is acceptable. The full names of chemicals can be provided at first mention in the main text if germane to the article.

Write the abstract as a single paragraph, with a limit of 250 words (~1500 characters) for full-length papers and 150 words (~900 characters) for notes. Some abstracting services truncate text beyond a certain length; what is lost is most likely the conclusions.

Reproduced below (with permission of the author) is a published abstract with its structure labeled. This example shows both the overall construction of the abstract and the contents of its parts. (From *Agronomy Journal*, *78*, 720–726 [1986], updated to conform to new style guidelines.)

Introduction. Use the introduction to review published literature and issues related to your topic. An introduction helps the reader recognize what your research contributes to the current knowledge in your subject area. To orient readers, give a brief reference to

Dryland Grain Sorghum Water Use, Light Interception, and Growth Responses to Planting Geometry

J. L. Steiner

ABSTRACT

Rationale	Crop yields are primarily water-limited under dryland production systems in semiarid regions.
Objectives or hypothesis	This study was conducted to determine whether the growing-season water balance could be manipulated through planting geometry.
Methods	The effects of row spacing, row direction, and plant population on the water use, light interception, and growth of grain sorghum [*Sorghum bicolor* (L.) Moench] were investigated at Bushland, TX, on a Pullman clay loam (fine, mixed, superactive thermic Torrertic Paleustoll).
Results	In 1983, which had a dry growing season, narrow-row spacing and higher population increased seasonal evapotranspiration (ET) by 7 and 9%, respectively, and shifted the partitioning of ET to the vegetative period. Medium population crops yielded 6.2 and 2.3 Mg ha^{-1} of dry matter and grain, respectively. High population resulted in high dry matter (6.1 Mg ha^{-1}) and low grain yield (1.6 Mg ha^{-1}), whereas low population resulted in low dry matter (5.4 Mg ha^{-1}) and high grain yield (2.3 Mg ha^{-1}). Row direction did not affect water use or yield. In 1984, dry matter production for a given amount of ET and light interception was higher in the narrow-row crops. Evapotranspiration was less for a given amount of light interception in the narrow-row crops and in the north–south row crops.
Conclusions	Narrow-row planting geometry appears to increase the partitioning of ET to the transpiration component and may improve the efficiency of dryland cropping systems.

previous concepts and research. Include (a) a brief statement of the problem that justifies doing the work, or the hypothesis on which it is based; (b) the findings of others that will be further developed or challenged; and (c) an explanation of the general approach and objectives. This last part may indicate the means by which the question was examined, especially if the methods are new. Limit literature references to essential information, and do not rely on old references when newer ones are available.

Abbreviations and acronyms defined in the abstract should also be defined in the main body of the text.

Materials and Methods. In the Materials and Methods section, give enough detail to allow a competent scientist to repeat the experiments, mentally or in fact.

In the materials section, describe the preparation method, equipment, and measurements, using SI-acceptable units. Not all materials need to be identified by brand name and manufacturer. For example, if any standard test tube will work, it is not necessary to state the manufacturer of the tubes you used. If, however, the test tube must be lined with Teflon or be made of Pyrex (or in any other way differ from standard), then say so and, if such a test tube is not readily available, tell where it can be obtained.

When a product must be identified by trade name, add the name of the manufacturer or a major distributor parenthetically after the first mention of the product. EXAMPLE: "Soil respiration was measured with a CO_2 analyzer (Model LI-6251, LI-COR)." If the particular product is both essential to the research and no longer commercially available, describe a suitable substitute and its source.

In the case of specially procured or proprietary materials, give the pertinent chemical and physical properties (e.g., purity, pH, concentration). Chemical rather than trade names

are preferred. EXAMPLE: "Reference Suwannee River fulvic acid (IHSS-FA) and humic acid (IHSS-HA) were purchased from the International Humic Substance Society (IHSS)."

Plants and other organisms, including viruses, insects, bacteria, and pathogens should be identified accurately at first mention by scientific name (with authority for plants) and cultivar name if applicable. Scientific names for larger animals (e.g., sheep) should be given if relevant to the article and/or there may be confusion as to what animal is being discussed. Identify soils by great group name at least and preferably by soil series name and description.

Cite references for your methods and reference the edition you used. If the techniques are widely familiar, use only their names. If a method is modified, outline the modification or cite a reference, unless the modification is trivial. Give details of unusual experimental designs or statistical methods.

The Materials and Methods section may be arranged chronologically, by a succession of techniques, or in any other logical manner, such as by experiment or location, and may include tables and figures.

Results. Use tables, graphs, and other illustrations in the Results section to provide the reader with a clear understanding of representative data obtained from the experiments. Call attention to significant findings and special features (e.g., one quantity is greater than another, one result is linear across a range, or a particular value is optimum), but do not repeat in detailed prose what is already clear from an examination of the graphics.

If you have minimal results, describe them in the text. You may want to summarize more complicated results in tables or figures.

If you do not have a separate Discussion section, relate the results to your objectives and to each other.

Discussion. Use the Discussion section to interpret your results. Give particular attention to the problem, question, or hypothesis presented in the introduction. A good discussion typically covers most or all of the following steps:

1. Relate the results to the original objectives.
2. Explain the principles, relationships, and generalizations that can be supported by the results.
3. Address any exceptions or lack of correlation that qualify the findings, or difficulties that point to areas for further investigation.
4. Explain how the results relate to previous findings, whether in support, contradiction, or simply as added data.
5. Present conclusions, supported by a summary of the evidence.

Whether combined with the Results section or standing alone, the Discussion section should focus on the meaning of your findings, not recapitulate them.

Scientific speculation is encouraged, but it should be reasonable, firmly founded in observation, and subject to tests. It must also be identified as such. Where results differ from previous results for unexplained reasons, possible explanations should not be labored. Controversial issues should be discussed clearly and fairly.

References. The References section lists only the literature cited in the paper. Authors are encouraged to cite only significant, published, and up-to-date references.

Figure Captions, Tables, and Figures. In the *submitted manuscript*, tables and figures (review quality) with captions should be placed into the text document at first mention. Figures can also be submitted separately as image files in the following acceptable formats: EPS, TIF, PDF, or JPG.

For *accepted manuscripts*, figure captions and tables appear after the reference list, and figures should be submitted as separate high-resolution image files in the following acceptable formats: EPS, TIF, PDF, or JPG. No separate list of table titles is needed.

Color figures of accepted manuscripts must adhere to our color policy (see Chapter 5 and our online "ASA, CSSA, SSSA Editorial Policies" for details). To maintain clear contrast, use line patterns instead of shading and avoid thin, light lines. As feasible, plan for reduction to one-column width (84 mm, or ~3.25 inches). The original should be one-third to one-half larger than the intended final size. Keep relative sizes in mind when adding symbols, letters, and numbers.

See Chapters 5 and 6 for more information on figures and tables.

SUPPLEMENTAL MATERIAL

Most journals of ASA, CSSA, and SSSA accept supplemental material that will enhance and support your research. Supplemental files will appear online. Authors are encouraged to submit materials that contribute to the content and quality of the article or to use supplemental material as a means to shorten the text of manuscripts. Ancillary information such as some experimental data, including schematics of apparatus and maps of study sites, or material of interest mainly to specialists are examples of potential supplemental material. When using supplemental material to shorten the text of a manuscript, keep in mind that the Materials and Methods section should provide enough detail to allow the reader to determine whether the interpretations are supported by the data. Check the journal's author instructions to confirm that they accept supplemental material.

Supplemental material undergoes peer review and so should be submitted along with the original manuscript. A list of the supplemental material should be included in the main manuscript directly preceding the reference list. Supplemental tables and figures should be cited in order in the main manuscript.

Supplemental material should be formatted with a cover sheet listing authors and manuscript title, and the number of pages, figures, and tables. Tables and figures should be numbered Supplemental Table S1, S2, Supplemental Figure S1, S2, etc.

Ideally, the supplement should consist of a single PDF or MS Word file (rather than a series of files with individual images or structures); however, most file types are allowed, including video, spreadsheets, and PowerPoint files. To keep file size down, please compress large files if possible. The following are not allowed: executables (.exe) of any kind or TeX.

In place of supplemental material, our journals encourage the use of data repositories that assign DOIs to the data.

CITATION STYLE

ASA, CSSA, and SSSA journals follow the APA citation style as found in the *Publication Manual of the APA,* 7th edition (APA, 2020) The author–year notation system is required; do not use numbered notation.

Two authors. For within-text citations of papers with two authors, name both authors. Use an ampersand for citations in parentheses.

Murphy and Jones (2018) supported...

(Murphy & Jones, 2018)

Three or more authors. With three or more authors, use the first author's last name plus "et al."

Murphy et al. (2018)

(Murphy et al., 2018)

Exception: If two references with the same year shorten to the same form (e.g., Murphy, Smith, Davis, & Xu, 2018, and Murphy, Xu, Smith, Jones, & Davis, 2018; both shorten to Murphy et al., 2018), list as many of the authors' surnames as needed in the citation to differentiate the two references, followed by "et al."

Murphy, Smith, et al. (2018) and Murphy, Xu, et al. (2018)

Two or more works within the same parentheses. Separate citations with a semicolon.

(Murphy, 2001a; Murphy & Wong, 2001; Murphy et al., 2001)

(Murphy, 2001; Murphy et al., 2001, 2002; Murphy & Davis, 2002)

Two or more articles by the same author(s) in the same year. Add a distinguishing lowercase letter (a, b, c, etc.) to the year in both the text and references list. Separate citations with a comma.

(Murphy, 2001a, 2001b)

Authors with the same last name. Use first initials with the last names to help prevent confusion.

(E. Murphy, 2001; C. Murphy, 2011)

See APA (2020) for additional examples.

Citing Quotations

Direct quotations from a book or very long chapter require a page number in the text citation. When practical, the exact page number is preferred for any quotation.

Citing Unpublished Sources

Only literature available through libraries or other readily accessible public media may be cited. All other material, such as personal communications (information from someone other than the authors) and unpublished data (information from one or more author named in the byline), is cited in the text as parenthetical matter. Give both the source and the date for the information. Examples:

(R. D. Jackson, personal communication, March 4, 2023)

(unpublished data, 2023) *[when all authors are responsible for the data]*

(Faribault, unpublished data, 2023) *[when only the author Faribault is responsible for the data]*

Placing “unpublished data” or “personal communication” between the name and year clearly distinguishes these citations from those in the reference list.

The terms *in review* and *in press* are not synonymous. Material that is in press has been accepted for publication but has not yet been published. This material may be listed in reference sections because the reader will eventually be able to locate it. Material submitted for publication but not yet accepted may be included in the reference list of your paper during the review process, but upon your paper’s acceptance these entries must be converted to citations of unpublished data or personal communication. If the change from review status to in press status occurs before or by the proof stage, the citation can be restored and completed.

Reviewers and editors are not expected to verify the accuracy of the literature citations. Authors should check the alphabetical reference list against the citations in the body of the manuscript before submitting the manuscript for publication.

REFERENCES

Journals and books of ASA, CSSA, and SSSA follow the APA reference style as found in the *Publication Manual of the APA,* 7th edition (APA, 2020).

Preparing the Reference List

Authors are responsible for the completeness and accuracy of all references.

If you have consulted abstracts, theses or dissertations, extension bulletins, in-press articles, or secondary materials during your research or for early drafts of the paper, check again upon acceptance for publication whether this this information has been published in a more readily available source.

Alphabetization

Arrange the list alphabetically by the surnames of authors. All single-authored articles of a given individual should precede multiple-author articles with the same first author. Alphabetize entries with the same first author according to surnames of succeeding coauthors and then by year, when the names are repeated exactly. Two or more articles by the same author (or authors) are listed chronologically and then by title. Articles by the same author or authors published within a single year by adding lowercase letters, a, b, c, etc., to the year. EXAMPLE:

Shotwell, C. A., & Smith, G. W. (2011).
Shotwell, O. L. (1998a).
Shotwell, O. L. (1998b).
Shotwell, O. L., Goulden, M. L., & Hesseltine, C. W. (2001).
Shotwell, O. L., Hesseltine, C. W., & Goulden, M. L. (1997).
Shotwell, O. L., Hesseltine, C.W., & Goulden, M. L. (2000).
Shotwell, O. L., Hesseltine, C. W., Vandegraft, E. E., & Goulden, M. L. (1999).

Authors

An author can be a person, committee, or organization responsible for the work. Only when no author can be determined for a document should "anonymous" be used. For web pages, it is most common to use the name of the organization as the author. EXAMPLES:

University of Wisconsin–Madison. (2012). *Wisconsin's environmental mesonet (Wisconet)*. https://wisconet.wisc.edu/

Food and Agriculture Organization. (2021). *World food and agriculture—Statistical yearbook, 2021*. FAO.

The author's name is listed by last name first, followed by initials (Smith, J. R.). For works by more than one author, all authors' names are inverted (Smith, J. R., Li, L., & Rosen, C.). For works by two authors, use an ampersand (&) between the names. For works by 3 to 20 authors, list all authors, with an ampersand before the final author. For works by more than 20 authors, list the first 19. After the 19th author, use an ellipsis (...) in place of the author names. Then provide the final author's name. There should be no more than 20 names (Basso, B., Dumont, B., Maestrini, B., Shcherbak, I., Robertson, G. P., Porter, J. R., Smith, P., Paustian, K., Grace, P. R., Asseng, S., Bassu, S., Biernath, C., Boote, K. J., Cammarano, D., De Sanctis, G., Durand, J.-L., Ewert, F., Gayler, S., Hyndman, D. W., ... Rosenzweig, C.).

Titles

Use sentence-style capitalization for titles and subtitles of articles, book chapters, bulletins, and books, capitalizing the first letter of the first word as well as proper nouns and adjectives. Capitalize journal titles. Book and journal titles should be italicized.

Acronyms and Abbreviations

Use acronyms or commonly understood abbreviations (e.g., SSSA, USEPA, ICRISAT) for publishers in the reference list and in the text citation. For institutional authors, it is usual to spell out acronyms and abbreviations. Some organizations do not need to be defined in the references and may stand alone as institutional authors, including IPCC and international agricultural research centers in the Consultative Group on Agricultural Research (CGIAR; www.cgiar.org/)—CIAT, CIFOR, CIMMYT, CIP, ICARDA, ICLARM, ICRAF, ICRISAT, IFPRI, IITA, ILRI, IBPGR, IPGRI, IRRI, ISNAR, IWMI, and WARDA. Thus, the text citation "CIMMYT (1988)" would appear in the reference list as "CIMMYT. (1988)." Alphabetize such abbreviations letter by letter.

Use postal state abbreviations with publisher locations to identify US states or Canadian provinces (see Table 2–2).

Style of the Reference List

Some common types of references are shown below. Extensive rules and examples for references of all kinds are given in the APA *Publication Manual* (APA, 2020).

Periodicals

Each reference to a periodical publication must include, in order, the author(s), year of publication, full title of the article, publication in which it appears, and volume and inclusive page numbers. For publications without consecutive pagination (i.e., each issue within the volume begins with page 1), include the issue number. EXAMPLE: *11*(2):5–10. An article ID may take the place of the page range.

First author, second author, & third author. (Year). Title of article. *Journal Title, Vol no.*(issue no.), page range. DOI (Digital Object Identifier)

Journal article without a DOI.

Bordoli, J. M., & Mallarino, A. P. (1998). Deep and shallow banding of phosphorous and potassium as alternatives to broadcast fertilization for no-till corn. *Agronomy Journal, 90,* 27–33.

Journal article with a DOI.

Doerge, T. A. (2002). Variable-rate ntirogen management creates opportunities and challenges for corn producers. *Crop Management, 1.* https://doi.org/10.1094/cm-2002-0905-01-RS

Kato, C., Nishimura, T., Imoto, H., & Miyazaki, T. (2011). Predicting soil moisture and temperature of Andisols under a monsoon climate in Japan. *Vadose Zone Journal, 10,* 541–551. https://doi.org/10.2136/vzj2010.0054

Basso, B., Dumont, B., Maestrini, B., Shcherbak, I., Robertson, G. P., Porter, J. R., Smith, P., Paustian, K., Grace, P. R., Asseng, S., Bassu, S., Biernath, C., Boote, K. J., Cammarano, D., De Sanctis, G., Durand, J.-L., Ewert, F., Gayler, S., Hyndman, D. W., ... Rosenzweig, C. (2018). Soil organic carbon and nitrogen feedbacks on crop yields under climate change. *Agricultural & Environmental Letters*, *3*, 180026. https://doi.org/10.2134/ael2018.05.0026

Article in serial publication.

Brown, P. D., & Morra, M. J. (1997). Control of soil-borne plant pests using glucosinolate-containing plants. *Advances in Agronomy, 61,* 167–231.

Edwards, A.C., & Cresser, M.S. (1992). Freezing and its effect on chemical and biological properties of the soil. *Advances in Soil Science, 18,* 59–79. *[After Vol. 20, Advances in Soil Science is no longer published as a serial with volume numbers. Treat listings in later editions as you would a chapter in a book.]*

Article not in English with English abstract.

Title translated into English

Rosolem, C. A., Silverio, J. C. O., & Primaves, O. (1982). Foliar fertilization of soybean: II. Effects of NPK and micronutrients. (In Portuguese, with English abstract.) *Pesquisa Agropecuária Brasileira*, *17*, 1559–1562.

Title in original language

Rosolem, C. A., Silverio, J. C. O., & Primaves, O. (1982). Adubação foliar de soja: II. Efeitos de NPK e micronutrientes. (In Portuguese, with English abstract.) *Pesquisa Agropecuária Brasileira, 17*, 1559–1562.

Article not in English and without English abstract (translated title).

He, X., Xie, W., Deng, S., & Lu, S. (1983). The problems and achievements about improving use of red-yellow soil in China. (In Chinese.) *Chinese Journal of Soil Science, 2,* 1–4. https://doi.org/10.19336/j.cnki.trtb.1983.02.001

Articles in press.

For an in-press article, use the current year as the date. If the manuscript has been posted online ahead of publication, include the DOI.

Author. (Year). Article title. *Journal title.* DOI link (in press).

Preprint papers.

Include the DOI or other persistent indentifier if one is given. For articles without a DOI, include the URL.

Al-Halbouni, D., Watson, R. A., Holohan, E. P., Meyer, R., Polom, U., Dos Santos, F. M., Comas, X., Alrshdan, H., Krawczyk, C. M., & Dahm, T. (2021). *Dynamics of hydrological and geomorphological processes in evaporite karst at the eastern Dead Sea: A multidisciplinary study*. Hydrology and Earth Systems Science Discussions. https://doi.org/10.5194/hess-2021-37

Huijser, D., Goodman, J., & Brewer, B. J. (2015). *Properties of the affine invariant ensemble sampler in high dimensions*. arXiv. https://arxiv.org/pdf/1509.02230.pdf

Magazine article.

Davenport, C. H. (1981, March 2). Sowing the seeds. *Barron's*, p. 10.

Mulla, D. (2021). Trends in satellite remote sensing for precision agriculture. *Crops and Soils, 54*(1), 3–5. https://doi.org/10.1002/crso.20093

Books (including bulletins, reports, multivolume works, series)

Author. (Year). *Book title.* Publisher.

Brown, J. (1966). *Soils of the Okpilak River region, Alaska* (CRREL Research Report 188). U.S. Army Cold Regions Research Engineering Laboratory.

Budavari, S. (Ed.). (1996). *The Merck index* (12th ed.). Merck.

California Certified Organic Farmers. (1995). *California Certified Organic Farmers certification handbook*. CCOF.

Chemical Abstracts Service. (1989). *Chemical Abstracts Service source index: 1907–1984 cumulative, plus annual supplements*. Chemical Abstracts Service.

Doty, W. T., Amacher, M., & Baker, D. E. (1982). *Manual of methods: Soil and environmental chemistry laboratory*. Department of Agronomy, Pennsylvania State University.

Dzombak, D. A., & Morel, F. M. M. (1990). *Surface complexation modeling: Hydrous ferric oxide*. Wiley.

Fehr, W. R., & Caviness, C. E. (1977). *Stages of soybean development* (Special Report 80). Iowa Agricultural and Home Economics Experiment Station, Iowa State University.

Goering, H. K., & Van Soest, P. J. (1971). *Forage fiber analysis (apparatus, reagents, procedures, and some applications)* (USDA Agriculture Handbook 379). U.S. Government Printing Office.

Schneiter, A. A. (Ed.). (1997). *Sunflower technology and production*. ASA, CSSA, and SSSA.

Soil Survey Staff. (1999). *Soil Taxonomy: A basic system of soil classification for making and interpreting soil surveys* (Agriculture Handbook 436, 2nd ed.). U.S. Government Printing Office.

Southern Cooperative Series. (1983). *Reference soil test methods for the southern region of the United States* (Southern Cooperative Series Bulletin 289). Georgia Agricultural Experiment Station. *[Publisher varies as the series rotates among institutions.]*

Steel, R. G. D., & Torrie, J. H. (1960). *Principles and procedures of statistics, with special reference to the biological sciences*. McGraw-Hill.

Steel, R. G. D., & Torrie, J. H. (1980). *Principles and procedures of statistics: A biometrical approach* (2nd ed.). McGraw-Hill.

Taylor, B. N. (1995). *Guide for the use of the International System of Units (SI)* (NIST Special Publication 811). U.S. Government Printing Office.

USEPA. (1981). *Process design manual for land treatment of municipal wastewater* (USEPA Report 625/1-77-008, COE EM1110-1-501). U.S. Government Printing Office.

Westerman, R. L. (Ed.). (1990). *Soil testing and plant analysis* (3rd ed.). SSSA.

Online Books

Online books usually correspond to printed versions, and the reference style is similar. Use the DOI if available.

Boverhof, D. R., & Gollapudi, B. B. (Eds.). (2011). *Applications of toxicogenomics in safety evaluation and risk assessment*. Wiley. https://doi.org/10.1002/9781118001042

Chapter in a Book

The entry for a chapter or article within a larger work must give the author(s), year, chapter title, the word "In," any editors, and the publication title, followed by the volume (for multivolume works), edition (when more than one has been published), page range, publisher, and DOI if known.

Author. (Year). Chapter title. In Editor name(s) (Ed.), *Book title* (page range). Publisher. DOI

Boutton, T. W. (1991). Stable carbon isotope ratios of natural materials: II. Atmospheric, terrestrial, marine, and freshwater environments. In D. C. Coleman & B. Fry (Eds.), *Carbon isotope techniques* (pp. 173–185). Academic Press.

Buresh, R. J., Smithson, P. C., & Hellums, D. T. (1997). Building soil phosphorus capital in Africa. In R. J. Buresh et al. (Eds.), *Replenishing soil fertility in Africa* (pp. 111–149). SSSA. https://doi.org/10.2136/sssaspecpub51.c6

Gardner, W. H. (1986). Water content. In A. Klute (Ed.), *Methods of soil analysis: Part 1. Physical and mineralogical methods* (2nd ed., pp. 493–544). ASA and SSSA.

Online Chapter in a Book

Casado, M. R., Corstanje, R., Bellamy, P., & Marchant, B. (2013). Issues of sampling design in wetlands. In R. D. DeLaune et al. (Eds.), *Methods in biogeochemistry of wetlands* (pp. 1–19). SSSA. https://doi.org/10.2136/sssabookser10.c1

Conference, Symposium, or Workshop Proceedings and Transactions

An entry for conference proceedings is similar to an entry for a book. Conference proceedings often have two titles: the title of the book of proceedings and the name of the conference or symposum. Capitalize the name of the conference; use sentence style for the name of the book.

Published proceedings.

Editor. (Year). *Title of book: Number and Name of Conference.* Publisher.

Faw, W. (Ed.). (1992). *Forages '92, grassroots of animal agriculture: 1992 American Forage Grassland Council Proceedings.* AFGC.

Pascale, A. J. (Ed.). (1989). *Proceedings of the World Soybean Research Conference IV*. Orientación Gráfica Editora S.R.L.

Wilkinson, D. (Ed.). (1993). *Proceedings of the 49th Annual Corn and Sorghum Industry Research Conference*. American Seed Trade Association.

Chapter in a proceedings volume.

Papers published in a proceedings volume are treated much like a book chapter. If only an abstract of the article appears in the proceedings, insert "[Abstract]" after the article title and before the period. Include the DOI at the end if one is available.

Dawson, J. C., & Goldringer, I. (2009). Direct or indirect selection in breeding for organic agriculture. In H. Østergård et al. (Eds.), *Proceedings of the BioExploit/Eucarpia Workshop on the Role of Marker Assisted Selection in Breeding Varieties for Organic Agriculture* (pp. 15–18). BioExploit Project.

Golding, K. A., Davidson, D. A., & Wilson, C. A. (2010). Micromorphological evidence for the use of urban waste as a soil fertiliser in and near to historic Scottish towns. In R. J. Gilkes & N. Prakongkep (Eds.), *Proceedings of the 19th World Congress of Soil Science, Brisbane, Australia: Soil solutions for a changing world* (pp. 12–15). IUSS.

Power, J. F., & Biederbeck, V. O. (1991). Role of cover crops in integrated crop production systems. In W. L. Hargrove (Ed.), *Cover crops for clean water: The Proceedings of an International Conference, West Tennessee Experiment Station, April 9–11, Jackson, Tennessee* (pp. 167–174). Soil and Water Conservation Society.

Abstracts.

Cite meeting abstracts only until a more formal publication becomes available.

Caldwell, B. A. (1997). Fatty acid esterase activity in forest soils and ectomycorrhizal mat communities. In *1997 Agronomy abstracts* (p. 223). ASA.

Krischnamurti, G. S. R., & Huang, P. M. (1991, October). The role of Al in Fe(II) transformation. In *Abstracts, Annual Meeting, Clay Mineral Society* (p. 96). Clay Mineral Society.

Papers and poster sessions presented at meetings.

Use the following format when citing unpublished conference papers. Include the month of the meeting. When possible, avoid citing conference papers older than 2 years. If subsequent publication is known, cite the published form.

Author. (Date). *Title of paper* [Paper or poster presentation]. Conference name, Place of Conference. DOI or URL

Kaeppler, S., De Leon, N., Sekhon, R., Hansey, C., Buell, C., Lin, H., & Childs, K. (2011, October 16–19). *Expression analysis supporting functional genomics research in maize* [Paper presentation]. 2011 ASA, CSSA, and SSSA International Annual Meeting, San Antonio, TX.

Miscellaneous

Dissertations and theses.

Christianson, L. E. (2011). *Design and performance of denitrification bioreactors for agricultural drainage* [Doctoral dissertation, Iowa State University]. Iowa State University Digital Repository. https://lib.dr.iastate.edu/etd/10326

Oba, M. (2015). *Adsorption selectivity of cations in constrained environments* [Master's thesis, University of Connecticut]. UCONN Library. https://opencommons.uconn.edu/gs_theses/781/

Software and software documentation.

References are not needed for common software such as Microsoft Excel and SAS software.

Abacus Concepts. (1991). *SuperANOVA user's guide* (Release 1.11). Abacus Concepts.

Minitab. (1998). *MINITAB 12* [Software]. Minitab.

Map.

Cite a map separately only if it is a stand-alone publication. If there is no author for a map, do not use "Anonymous." In such cases, the name of the map stands in for the author.

Author. (Year). *Map title* [map type, e.g., demographic map]. Map number (if included). Publisher. Notes (e.g., scale).

Patent and plant patent.

Dudeck, A. E. (1995). *Bermudagrass plant 'FHB-135'* (U.S. Plant Patent No. 9030). U.S. Patent and Trademark Office.

Titcomb, S. T., & Juers, A. A. (1976). *Reduced calorie bread and method of making same* (U.S. Patent No. 3,979,523). U.S. Patent and Trademark Office.

Performance and variety test.

Pietsch, D., Gaas, R., Rosenow, D. T., Miller, F., & Peterson, G. C. (1992). *Grain sorghum performance tests in Texas: 1991* (Technical Report 92-2). Texas Agricultural Experiment Station.

Schapaugh, W. T., & Roozeboom, K. L. (1993). *1992 Kansas performance tests with soybean varieties* (Report of Progress 673). Kansas State University.

Tyler, J. M., & Bell, P. P. (1998). *Uniform soybean tests, southern states, 1997.* USDA-ARS.

Crochet, W. D. (2011). *The uniform soybean tests, northern states: 2010.* USDA-ARS.

Standard.

Institution. (Year). *Title* (Rule number). Publisher.

ASABE (1993). *Manure production characteristics* (ASABE Standard D384.1). ASABE.

ASTM. (2003). *Specification for concrete aggregates* (ASTM Standard C33). ASTM International. https://doi.org/10.1520/C0033-03

Electronic Sources

Treat electronic sources as you would the same kind of material in print. Start with the author, date, article or web page title, and further information essential to the online reference. When citing an entire website, give the URL in text only.

Some electronic sources are the equivalent of personal communications or unpublished data (e.g., email, an online interview or chat session, or information posted on an individual's home page). Cite these in the text only as personal communication; include the date (F. Li, personal communication, January 29, 2019).

Author. This is the *organization* or *person* responsible for the web page. The webmaster or contact person for the page is not usually considered the author. If the page's author is not listed, use the title of page as author.

Date. Three dates are important: (a) the date when the publication was placed on the internet or was copyrighted, (b) the latest date of any update or revision, and (c) the date of access if the page's content is likely to change over time.

Title. Book and journal titles are usually clearly stated on a website. For original content from online sources, other than formally published documents such as journal articles and books, include as much of the following as can be determined: Author of the content, date, title or description of the page, website name, and the URL. Citations to databases should include the URL or preferably, the DOI if one is given. Include the site name for web pages on websites.

For citing an online document that gives no publication date, use n.d. If the author is the same as the website name, omit the site name to avoid repetition.

Author. (Year). *Title of document*. Site name. URL

Rummer, B., Prestemon, J. P., May, D., Miles, P., Vissage, J., McRoberts, R., Liknes, G., Shepperd, W. D., Ferguson, D., Elliot, W., Miller, S., Reutebuch, S., Barbour, J., Fried, J., Stokes, B., Bilek, E., & Skog, K. (2003). *A strategic assessment of forest biomass and fuel reduction treatments in western states*. USDA Forest Service. http://www.fs.fed.us/research/pdf/Western_final.pdf

Soil Survey Staff. (n.d.). *Web soil survey: Soil data mart*. USDA-NRCS. http://websoilsurvey.nrcs.usda.gov

USEPA. (2002). *National Water Quality Inventory: 2000 report* (EPA-841-R-02-001). http://www.epa.gov/305b/2000report/

Electronic, Non-Internet Sources

It is standard practice to indicate a publication is not in print format by placing after the title a word that describes the specific nonprint medium. Use brackets, such as [CD].

Watschke, T. L., DiPaola, J. M., & Shepard, D. P. (2012). *Turf growth regulation* [CD]. CSSA.

Chapter 2. General Style Conventions

This manual should be used as a primary source for conventions and style in all ASA, CSSA, and SSSA publications. Other style manuals supplement this manual, including *Scientific Style and Format* (CSE, 2006), the *ACS Style Guide* (Coghill & Garson, 2006), and the *US Government Printing Office Style Manual, 2008* (USGPO, 2008). Authors are also encouraged to look at recent articles in ASA, CSSA, and SSSA journals for the general style and format used.

This chapter addresses a few of the more common or troublesome questions of style in terms of ASA, CSSA, and SSSA publication requirements and guidelines. It only incidentally covers English grammar, style, and usage.

To improve the quality of your writing, consult this manual and any of the excellent books available that cover grammar, punctuation, and other points of English usage (APA, 2020; UCP, 2017). The *ACS Style Guide* (Coghill & Garson, 2006) and *Scientific Style and Format* (CSE, 2006) address scientific writing and usage in general and provide detailed guidelines and examples within the sciences.

Strategies for eliminating awkwardness and cumbersome constructions include writing short, declarative sentences; keeping subjects and verbs as close together as possible; and, given a choice, selecting shorter and simpler rather than longer words (try vs. endeavor, show vs. demonstrate). In addition, a sentence recast in the active voice is often both shorter and clearer than the passive form.

ABBREVIATIONS AND SYMBOLS

Define abbreviations at first mention in the abstract and main text and again in the tables and figures. Provide an alphabetical list of abbreviations, placed after the abstract. The common abbreviations in Table 2–1 do not need definition, nor do SI units (Chapter 7) or chemical element symbols. For commonly used abbreviations and statistics that do not need definition, see Table 4–1.

Rules for abbreviating and lists of many accepted abbreviations and acronyms are given in *Scientific Style and Format* (CSE, 2006, p. 135–140) and in the *ACS Style Guide* (Coghill & Garson, 2006, Chapter 10). Acronyms do not have periods; nor do SI unit symbols. Abbreviations may or may not have periods.

Use abbreviations sparingly. If you do abbreviate, use a standard abbreviation rather than making up one specific to your paper. If you must devise an abbreviation, use letter groups that are not already familiar abbreviations for other phrases, that are not identical to units of measure, and that will not be confused with an element symbol. (For example, do not abbreviate leaf appearance interval as LAI, even if you are not going to discuss leaf area index).

Additional useful points are as follows.

- In a full date (format: month day, year), spell out the month. Always abbreviate the month in references and tables. (See also Chapter 7.)
- In a series of measurements, give the unit(s) at the end (e.g., 2–10°C; 5, 10, and 20 kg ha^{-1}).
- The symbol % is used with numerals. Unlike with other units, the symbol is repeated with each number in a range or series (e.g., 10%–20%) . Do not use the word *percent* with a numeral.
- Use United States as a noun. Use the abbreviation "US" for United States as an adjective (e.g., US Cotton Belt). You may use "USA" as a noun in tables and titles.

TABLE 2–1 These common abbreviations do not need definition. Use may be restricted to use in tables and figures (T) or with numeric values (N). For statistics symbols and abbreviations, see Table 4–1. For other unit symbols, see the tables in Chapter 7.

Abbr.	Meaning (restriction)	Abbr.	Meaning (restriction)
a.i.	active ingredient	GIS	geographical information system
asl	above sea level (N)	GPS	global positioning system
avg.	average (T)	h	hour (N)
BCE	before common era	i.d.	inside diameter (N)
bp	base pair	max.	maximum (T)
CE	common era	min	minute (N)
CI	Cereal Investigation [number] [a]	min.	minimum (T)
cM	centimorgan	no.	number
coef.	coefficient (T)	o.d.	outside diameter (N)
conc.	concentration (T)	PI	Plant Introduction, Plant Identification [no.]
Da	dalton	s	second (N)
diam.	diameter (N,T)	sp., spp.	species
DNA	deoxyribonucleic acid	v/v	volume per volume
dry wt.	dry weight (N,T)	vs.	versus
Exp.	experiment (N)	w/v	weight per volume
fresh wt.	fresh weight (N,T)	w/w	weight per weight
g	gravity constant		

ARS	Agricultural Research Service
EU	European Union
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
USDA	United States Department of Agriculture
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

[a] The CI must be followed by a two-letter abbreviation for the applicable cereal genus: CI*av* for oat, CI*ho* for barley (*Hordeum*), CI*tr* for wheat (*Triticum*), etc.

- Abbreviate the names of states, provinces, and territories when following a city name, using the US postal abbreviations (Table 2–2). Otherwise, spell out place names in full.
- Use the abbreviations "lat" and "long" with geographical coordinates (e.g., 30° N lat; 89°24′04″ N lat; 30° W long). Omit the abbreviations when both coordinates are given (12°39′ N, 8°00′ W; 27°33′00″ S, 151°58′00″ E). Decimal degrees are allowed.

SPELLING AND CAPITALIZATION

Merriam-Webster's Collegiate Dictionary (Merriam-Webster, 2019) is the dictionary used by ASA, CSSA, and SSSA editing staff regarding spelling, capitalization, and compound terms. Whichever your dictionary, use American spelling instead of British, except in quotations and reference titles, and choose the first spelling of a word.

The *Chicago Manual of Style* and the CSE style manual contain chapters on distinctive treatment of words, including hyphenation and compounds (UCP, 2017, Chapter 7; CSE, 2006, Chapter 6). The *ACS Style Guide* (Coghill & Garson, 2006) has several helpful lists, including the spelling, abbreviation, and presentation of chemical elements and compounds. An additional resource for specialized terms in the physical and life sciences

TABLE 2–2 Postal abbreviations for states, provinces, and territories in USA, Canada, and Australia.

Area	Abbrev.	Area	Abbrev.
United States			
Alabama	AL	Montana	MT
Alaska	AK	Nebraska	NE
Arizona	AZ	Nevada	NV
Arkansas	AR	New Hampshire	NH
California	CA	New Jersey	NJ
Colorado	CO	New Mexico	NM
Connecticut	CT	New York	NY
Delaware	DE	North Carolina	NC
District of Columbia	DC	North Dakota	ND
Florida	FL	Ohio	OH
Georgia	GA	Oklahoma	OK
Hawaii	HI	Oregon	OR
Idaho	ID	Pennsylvania	PA
Illinois	IL	Puerto Rico	PR
Indiana	IN	Rhode Island	RI
Iowa	IA	South Carolina	SC
Kansas	KS	South Dakota	SD
Kentucky	KY	Tennessee	TN
Louisiana	LA	Texas	TX
Maine	ME	Utah	UT
Maryland	MD	Vermont	VT
Massachusetts	MA	Virginia	VA
Michigan	MI	Washington	WA
Minnesota	MN	West Virginia	WV
Mississippi	MS	Wisconsin	WI
Missouri	MO	Wyoming	WY
Canada			
Alberta	AB	Nunavut	NU
British Columbia	BC	Ontario	ON
Manitoba	MB	Prince Edward Island	PE
New Brunswick	NB	Quebec	QC
Newfoundland and Labrador	NL	Saskatchewan	SK
Northwest Territories	NT	Yukon Territory	YT
Nova Scotia	NS		
Australia			
Australian Capital Territory (Canberra)	ACT	South Australia	SA
		Tasmania	TAS
New South Wales	NSW	Victoria	VIC
Northern Territory	NT	Western Australia	WA
Queensland	QLD		

is the *New Oxford Dictionary for Scientific Writers and Editors* (Martin, 2009). This book is not primarily a dictionary of definitions but of usage and style.

The first letter is capitalized in the following cases:

- Regions, sections, or groups of sites commonly associated together (e.g., Corn Belt, the Midwest, the South, the West). Do not capitalize the adjectival form (e.g.,

midwestern practices, southern states, western Texas). Note the following distinction: the southeastern United States, but the US Southeast.
- The first letter of genus and all higher taxa (e.g., family and order), but not lower taxa (specific name or epithet, subspecies, variety).
- Trademarked names. Trademarks are adjectives and must modify a generic noun. It is a misuse of a trademark to pluralize it or to derive a verb or noun from it. For ASA, CSSA, and SSSA publications, omit the various trademark symbols, such as ® and ™.
- Words specified by number, and so treated as proper nouns (e.g., Treatment 1, Day 2, Exp. 3, Year 4, No. 5 [but Paper no. 6]). Exceptions may apply within special fields (e.g., chromosome 6 and metaphase I).
- The first word after a colon if the colon introduces a quotation, a complete sentence, or a direct question.
- Any title of office immediately preceding a name (SSSA President Jane Smith). Do not capitalize titles standing alone (e.g., the SSSA president was elected).

If a chemical name to be capitalized (as in titles, or beginning a sentence) begins with a Greek letter, a numeral, or a prefix in italics or small capitals, leave that unchanged and capitalize the next letter. EXAMPLES: β-1-4-Glucose, *p*-Coumaric acid, and D-Glyceraldehyde.

Words derived from proper names but now in common usage tend not to be capitalized (e.g., paris green, bunsen burner, petri dish; but Erlenmeyer flask). Common names, races, and market types of crops are not capitalized, even if the name comes from a proper noun (e.g., bermudagrass, japonica rice, pima cotton, spanish peanut, sudangrass).

Months and days of the week are capitalized; seasons are not.

PUNCTUATION

The standard rules of punctuation are adequate for all ASA, CSSA, and SSSA publications. The APA and ACS style manuals (APA, 2020; Coghill & Garson, 2006) treat punctuation clearly and comprehensively.

The following rules address usages that often give authors trouble.

Commas

- Use a comma before "and" or "or" in a series of three or more items (the so-called Oxford, or series, comma). EXAMPLES: "0.8, 2.1, and 3.9 kg ha^{-1}"; "shoot biomass, root biomass, leaf blade or leaflet length and width, and plant height."
- Commas and periods come before a closing quotation mark, an asterisk, or a superscripted footnote number; semicolons and colons come after. Do not double periods at the end of a quotation: "Once is enough."

Lists

- Use a semicolon to separate a series of items within a list if any one of them includes a comma. EXAMPLE: Treatments in the second fertilizer study were rates of 56, 112, and 448 kg ha^{-1} N; 25 and 49 kg ha^{-1} P; and 47, 93, 139, 186, and 279 kg ha^{-1} K.
- Punctuation in display lists (where each item starts on a new line) depends on the content and context. Use no period if all are short, independent phrases. If any one of the items is a complete sentence, end each item with a period. If the list is functionally part of the introductory sentence, punctuate with commas or semicolons and a final period, just as you would if the sentence had no line breaks.
- For display lists, bullets or arabic numbers (1, 2, 3, etc.) followed by a period for each item are preferred. For run-in lists in text, lowercase letters (a, b, c, etc.) in parentheses are preferred, although numbers are acceptable.

Brackets

- For parentheses within parentheses, substitute square brackets for the inner pair. EXAMPLE: "(Lloyd-Jones, 1873 [as cited by Andrews, 1996])." Two exceptions in prose are required in ASA, CSSA, and SSSA publications:
  - Use brackets to enclose scientific names that already contain parentheses, as in "soybean [*Glycine max* (L.) Merr .] was. . . ." Alternatively, use commas: "soybean, *Glycine max* (L.) Merr., was. . . ."
  - For mathematical usage, fences are used in the order {[( )]}. See Chapter 7.

COMPOUND WORDS AND DERIVATIVES
Hyphens, Spaces, and Dashes

A word containing a prefix, suffix, or combining form is a derivative and is most often written as one word. Compound words used to express an idea different from that expressed by the separate parts are usually written as one word. Hyphens and en-dashes are used to avoid a confusing sequence of letters, a confusing sequence of adjectives, a jumble of ideas, or possible confusion with a word of the same spelling without the hyphen (e.g., co-op, as distinct from coop). Comprehensive rules for compounds are found in the *Chicago Manual of Style* (UCP, 2017) and *Scientific Style and Format* (CSE, 2006).

Most compounds and derivatives fall under these general rules:

Hyphens

- Derivatives are usually written as one word. EXAMPLES: antiquality, clockwise, fourfold (but 10-fold or 1.5-fold), nonadditives, nonsignificant, postdoctoral, preemergent, reuse, shortwave.
- Use hyphens with prefixes to words that begin with a capital letter and in a few awkward combinations that bring like vowels together. EXAMPLES: un-American, semi-independent.
- Hyphenate a compound adjective when used before, but not after, the word it modifies. EXAMPLE: a winter-hardy plant; the plant is winter hardy.
- Use a hyphen after a prefix to a hyphenated adjective. EXAMPLES: semi-winter-hardy plant, non-winter-hardy plant.
- Use a hyphen in a compound adjective that includes a number. EXAMPLES: 10-year-old field, 6-kg samples, 4-mm depth.
- Hyphenate compound modifiers starting with the adverb "well," except when another adverb precedes it. EXAMPLE: well-known method, but very well known method.
- Do not use a hyphen after an adverb formed by adding "-ly" to an adjective. EXAMPLE: an intensively cultivated hillside.
- Use a hyphen for compound adjectival expressions as needed for clarity (e.g., "on a per-gram basis," "winter-grown cereals," but "low molecular weight substance").
- Use hyphens to join numbers and prefixes in chemical names (e.g., *trans*-2-bromocyclopentanol). For exceptions, see the *ACS Style Guide* (Coghill & Garson, 2006, Chapter 12).

En-dashes

- Use an en-dash instead of a hyphen in a compound or prefixed adjective that has a phrase in one of its parts (and the phrase cannot be hyphenated). EXAMPLES: "*Avena sterilis*–derived resistance genes"; "pre–Civil War surveys."
- Use an en-dash instead of a hyphen after a superscript or subscript. EXAMPLES: F_3–derived; NO_3–N (but "nitrate N" when spelled out).

- Use an en-dash between joined nouns of equal importance. EXAMPLES: Webster–Nicollet soil complex; oxidation–reduction potential; Waller–Duncan *k* ratio; corn–soybean rotation; Fusarium wilt–root-knot nematode complex.
- As a specialized instance of the previous rule, use an en-dash between two chemical compounds (e.g., $HCl–H_2SO_4$).
- Use an en-dash to indicate a range of numbers. EXAMPLES: "p. 23–49."; "*Plant Disease, 66*, 172–176"; ; "during the final study years (1997–1999)," "the 1999–2000 winter wheat growing season". EXCEPTION: If either of the numbers is negative, or is otherwise modified, use the word "to" instead of the dash. EXAMPLES: "(0% to ≤5%)" or "(–5 to 10°C)".

If you cannot distinguish hyphens from en-dashes in your manuscript, use hyphens throughout. The copyeditor will convert as necessary.

MISCELLANEOUS POINTS OF USAGE

The following entries address common difficulties in scientific usage.

Affect vs. effect (*verb*). "To affect" means to act upon something that already exists; "to effect" means to bring some thing or condition into existence.

Affect vs. effect vs. impact (*noun*). An "effect" is a result or outcome; an "affect" is an emotion (the term is used chiefly in psychology); an "impact" is a collision, the force of a collision, or (by extension) a major effect. That is, "impact" is not a neutral equivalent of "effect."

Alternate vs. alternative. Use "alternate" to mean occurring or following by turns, or alternating in time or space—first one, then the other. Use "alternative" for one of two or more mutually exclusive possibilities.

Between vs. among (*prep.*). Use "between" for two entities, "among" for more than two.

British spelling. Except in references and quotations, change British to American spelling (e.g., "analyse" to "analyze"; "behaviour" to "behavior"; "grey" to "gray"; "modelled" to "modeled").

cf. (Latin *confero*, compare). Use "cf." sparingly, to mean “see, for a contrasting view.” For scientific writing, the English "see" and "compare" are preferable.

Compare to vs. compare with (*verb + prep.*). Use "compare to" for overall likenesses and contrasts and for subjective, qualitative comparisons ("Shall I compare thee to a summer day?" [Shakespeare, Sonnet 18]). Use "compare with" for objective, quantitative comparisons (e.g., the results of the low-P treatment were compared with those of the high-P treatment). Also, do not be afraid to simplify "more ... compared with" to "more ... than" (e.g., "more biomass at the second harvest than the first" instead of "more biomass at the second harvest compared with the first").

e.g. (Latin *exempli gratia*, for example) vs. i.e. (Latin *id est*, that is). Use "e.g." to mean "for example"; use "i.e." to mean "that is." Use the abbreviated forms only in parentheses; otherwise, use the English words.

Ensure vs. insure (*verb*). Use "ensure" to mean "make certain that a desired outcome occurs." Use "insure" to mean "protect" against monetary loss (as in an insurance policy).

Further vs. farther (*adj. or adv.*). "Further" means in addition or to a greater extent; "farther" implies distance in space or time.

Geographical names. Use common English equivalents of place names where such exist (e.g., Rome, not Roma; Munich, not München; Mexico City, not México; but Buenos Aires, Beijing).

Percent vs. percentage vs. percentage point. "Percent" is used with numeric values and is spelled out only at the beginning of a sentence. "Percentage" describes such a value and is always spelled out. "Percentage point" is used with numeric values and refers to a step of 1% in a percentage value; it is treated as a word, not a unit, and so is not abbreviated. EXAMPLES: "Grain fill was 20%"; "Nine percent of the plants"; "the percentage of grain fill"; "was reduced by 1.2 percentage points."

Restrictive and nonrestrictive clauses (that; which). Generally, "that" introduces a restrictive clause, one that gives information essential to the meaning of the sentence. Example: "Only soil samples that contained >30% clay were tested." If in such sentences the restrictive "that" clause were omitted, essential meaning would be lost.

"Which" introduces a nonrestrictive clause, one that gives only incidental, supplemental information. EXAMPLE: "The rejected samples, which received no further treatment, were stored for use in a separate study." If in such a sentence the nonrestrictive "which" clause were removed, the basic statement remains.

We suggest following a simple rule: Use "that" with no preceding comma when the added phrase is restrictive; use "which" with a preceding comma when the added phrase is nonrestrictive.

Subject–verb agreement. The cause for errors in subject–verb agreement is often confusion about the number of the subject. Two singular nouns joined by "and" require a plural verb unless the two nouns function as a single entity (e.g., "research and development"). When two or more nouns are joined by "or," the verb takes the number of the closest subject. Collective nouns take a singular verb when the group as a whole is meant (usually preceded by "the") (e.g., "The series of experiements was...."; "A series of experiments were....").

Units of measure should be treated as collective nouns that take a singular verb:

- Six milliliters of the solution was....
- After 3 h, 6 mL of the solution was....

Use vs. employ (*verb*). "Use" is the simpler word, and neutral. "Employ" carries additional connotations, as of advantageous use or hiring for wages.

Use vs. utilize (*verb*). The meanings are not identical. Use "utilize" (meaning "to turn to practical use") only to indicate that some unexpected use was found for an object or procedure ("kerosene tins utilized as champagne glasses").

Words of foreign origin. Foreign words in common usage in English and that appear in the main section of *Merriam-Webster's Collegiate Dictionary* (e.g., ad hoc, a priori, et al., in situ, in vitro, in vivo, per se, vice versa, and vs.) are considered to have been incorporated into the language. They are thus considered English words and are set in roman type, not italic. Do not hyphenate such foreign words, even in adjectival position.

/ (slash or solidus). With a few exceptions (e.g., and/or), it is best to reserve the slash for mathematical division and ratios. To express a combination of ideas, "and" or "or" can usually be substituted for the slash. EXAMPLE: For phrase "Appearance of collar/ligule of

first leaf," change the wording to "collar or ligule," "collar and ligule," or "collar and/or ligule."

DATES

In running text, capitalize and spell out the names of days and months. For complete dates, give the month, day (one or two digits), and year (four digits), e.g., August 1, 2023. Abbreviate names of months and days of the week in tables and references. Standard abbreviations for months are Jan., Feb., Mar., Apr., Aug., Sept., Oct., Nov., and Dec.; May, June, and July are not abbreviated.

Dates may also be identified as day of the year (i.e., in the year's sequence of 365 or 366 days), thus: Day of Year 235. Its typical abbrevation (DOY) should be defined at first use. Note that *Julian day* does not mean day of the year. A Julian day describes a date in terms of days elapsed since Greenwich noon on January 1, 4713 BC. Julian dates are used primarily in astronomy, information science, and space science.

GREEK LETTERS

The Greek alphabet, showing both uppercase and lowercase letters, is given below. Modifications of a few of these letters may be acceptable, but the ones given here should be used insofar as possible.

	Upper case	**Lower case**		**Upper case**	**Lower case**		**Upper case**	**Lower case**
alpha	A	α	iota	I	ι	rho	P	ρ
beta	B	β	kappa	K	κ	sigma	Σ	σ, ς
gamma	Γ	γ	lambda	Λ	λ	tau	T	τ
delta	Δ	δ	mu	M	μ	upsilon	Y	υ
epsilon	E	ε	nu	N	ν	phi	Φ	ϕ, φ
zeta	Z	ζ	xi	Ξ	ξ	chi	X	χ
eta	H	η	omicron	O	o	psi	Ψ	ψ
theta	Θ	θ, ϑ	pi	Π	π	omega	Ω	ω

Chapter 3. Specialized Scientific Style Conventions

This chapter provides a guide for conventions of scientific style in all ASA, CSSA, and SSSA publications.

The specialized vocabulary used in various scientific disciplines has precise meaning to those engaged in that discipline but occasionally a different meaning to scientists practicing a different discipline. Except as new terminology itself forms the content of a paper (as in reports on gene names for a given crop, or proposals for new evaluation scales), authors should avoid making up new terms. If new developments seem to call for new terms, authors are advised to consult others who work in the field in question before deviseing a new terminology. It is also wise to do a literature search for related materials published by the Societies and elsewhere to see if a consensus on terminology exists or is emerging. In some cases, simply consulting a good dictionary, or the chapters on specialized terms in the major scientific style manuals, is enough to resolve a terminology question.

CROP SCIENCE GLOSSARY

The *Glossary of Crop Science Terms* is available on the CSSA website (www.crops.org/publications/crops-glossary).

Earlier lists of terms compiled by various committees on crop terminology were published in *Crop Science* (Leonard et al., 1968; Shibles, 1976). These reports cite relevant articles and lists published in related fields and include previously published reports issued by earlier committees. In addition, letters in the journal may comment on various aspects of terminology (e.g., Dybing, 1977).

SOIL SCIENCE GLOSSARY

The *Glossary of Soil Science Terms* is available on the SSSA website (www.soils.org/publications/soils-glossary). It contains definitions of more than 1800 terms, a procedural guide for tillage terminology, an outline of the US soil classification system, and the designations for soil horizons and layers. Obsolete terms are noted as such.

CROP GROWTH STAGING SCALES

The CSSA Ad Hoc Committee on Growth Staging for CSSA Publications in 1996 developed a list of growth staging scales for society publications. The committee recommends that staging scales be used in all ASA, CSSA, and SSSA publications when referring to the morphological development stage of plants. References for crop-specific scales recommended by the committee for some major crops are listed in Table 3–1. This list is not intended to include all scales in the literature, but rather the most recent versions for some major crops. If no staging scale exists for a crop, it is recommended that the BBCH (Biologische Bundesanstalt, Bundessortenamt und CHemische Industrie) scale be used (Lancashire et al., 1991).

SOIL IDENTIFICATION

All soils discussed in publications of ASA, CSSA, and SSSA should be identified according to the US soil taxonomic system or World Reference Base for Soil Resources the first time each soil is mentioned. Taxonomic identification given in the abstract need not be repeated in the text. If possible, give the series name in addition to the family name. If the series name

is not known, give the family name. If the family name is not known, give the subgroup or a higher category name. At a minimum, specify the great group (the one-word name that is the third-highest taxon, beneath suborder and order; e.g., Dystroxerepts, Fragiudalfs, Medisaprists, Natrargids).

The descriptive name may be in the singular or plural, according to meaning. Use the singular form if the reference is to a single pedon or polypedon or to a single class. EXAMPLES:

- The soil material used in this study was collected from the A horizon of a Brookston pedon (a fine-loamy, mixed, mesic Typic Argiaquoll).
- A Cisne soil, fine, smectitic, mesic Vertic Albaqualf, was described and sampled at this site.
- Criteria for the Typic Hapludult subgroup were examined.
- Ontario soils, in the fine-loamy, mixed, mesic Glossoboric Hapludalf family, were studied in greater detail.

Use the plural form in reference to several or all of the soils (polypedons) of a class. EXAMPLES:

- Soils of the Ramona series (fine-loamy, mixed, thermic Typic Haploxeralfs) were treated.
- All soils used in the experiments are Typic Dystrochrepts.

For field experiments, the soil present in the plots or fields should be identified, preferably as phases of soil series so that surface texture and slope are known in addition to profile properties. Any dissimilar inclusions that are present also should be named and their extent suggested. It also may be appropriate to name and briefly describe the common

TABLE 3–1 Some recommended staging scales and sources for ASA, CSSA, and SSSA publications. Recommendations are as developed by the Ad Hoc Committee on Growth Staging for CSSA publications (C392.1) in 1996.

Crop	Citation
Alfalfa	Kalu & Fick (1981)
	Fick & Mueller (1989) [a]
Corn	Ritchie et al. (1996)
Cool-season forage grasses	Haun (1973)
	Moore et al. (1991)
Cotton	Elsner et al. (1979)
Red clover	Ohlsson & Wedin (1989)
Small-grain cereals	Haun (1973)
	Zadoks et al. (1974)
	Tottman (1987) [b]
Sorghum	Vanderlip & Reeves (1972)
Soybean	Fehr & Caviness (1977)
	Ritchie et al. (1994) [c]
Stoloniferous grasses	West (1990)
Sunflower	Schneiter & Miller (1981)
Warm-season forage grasses	Moore et al. (1991)
	Sanderson (1992)
All crops and weeds	Lancashire et al. (1991) [d]

[a] Enhancement of Kalu & Fick (1981). [b] Enhancement of Zadoks et al. (1974). [c] Enhancement of Fehr & Caviness (1977). [d] The BBCH (Biologische Bundesanstalt, Bundessortenamt und CHemische Industrie) scale as presented by Lancashire et al. (1991) can be used for all other crops and weeds.

soils of the area surrounding the study site. Use the present tense if the soil still exists or reasonably is thought to still exist. EXAMPLE:

> The 5-ha study area is mapped as Yolo silt loam, 0%–2% slopes. The Yolo soils are fine-silty, mixed, nonacid, thermic Typic Xerorthents. Small areas of Cortina very gravelly sandy loam soils (loamy-skeletal, mixed, superactive, nonacid, thermic Typic Xerofluvents) occupy about 10% of the study area.

The US taxonomic system should be identified as the US Soil Taxonomy at first use, after which it may be referred to as Soil Taxonomy. Amendments to Soil Taxonomy (Soil Survey Staff, 1999) have been issued in the *National Soil Survey Handbook* (https://www.nrcs.usda.gov/resources/guides-and-instructions/national-soil-survey-handbook) and in *Keys to Soil Taxonomy* (Soil Survey Staff, 2014). Additional issues of the handbook and new versions of the keys manual can be expected. Updated versions of these and other resources are available online at the Soil Survey home page (https://www.nrcs.usda.gov/resources/data-and-reports/web-soil-survey).

If possible, consult with members of the National Cooperative Soil Survey (NCSS) and check the current USDA-NRCS official soil series descriptions (https://soilseries.sc.egov.usda.gov/osdname.aspx) for proper identification of soil designations and nomenclature for soil horizons.

For soils outside the United States, authors are encouraged to give soil identification according to Soil Taxonomy in addition to the identification in their national system. EXAMPLE:

> Soil at the site is a Hythe clay loam, classified as a fine, montmorillonitic, frigid Mollic Cryoboralf in the USDA classification (Soil Survey Staff, 1994) and a Gray Luvisol in the Canadian classification (Canada Soil Survey Committee, 1978).

MUNSELL COLOR NOTATION

Munsell color notations may be used alone in text, tables, or figures. First mention in the abstract or text may be accompanied by the appropriate word descriptions in parentheses, thus: 10YR 5/4 (yellowish brown).

LIGHT MEASUREMENTS AND PHOTOSYNTHESIS

ASA, CSSA, and SSSA publications use the radiometric system with SI units denoting the energy or the quantum content of the radiation used by plants. (See also Chapter 7.)

Terms recommended by the Committee on Crop Terminology for the expression of photosynthetic energy and photosynthetic capacity are as defined by Shibles (1976). These terms, with their suggested abbreviations and units, are as follows.[1]

- *Photosynthetically active radiation* (PAR): radiation in the 400-to-700-nm waveband.
- *Photosynthetic photon flux density* (PPFD): the number of photons in the 400-to-700-nm waveband incident per unit time on a unit surface. Suggested units: $\mu mol\ m^{-2}\ s^{-1}$.
- *Photosynthetic irradiance* (PI): the radiant energy in the 400-to-700-nm waveband incident per unit time on a unit surface. Suggested units: $W\ m^{-2}$.

[1] Since 1976, the Societies have abandoned the einstein (a name for 1 mole of photons) in favor of the mole. Note that in the original Shibles (1976) article, the typographic errors "nE" and "nmol" are to be read as μE and μmol.

- *Apparent photosynthesis* (AP): photosynthesis estimated indirectly and uncorrected for respiratory activity. The term *apparent photosynthesis* is preferred to *net photosynthesis* or *net assimilation* because the latter terms imply measurement of a photosynthetic product.
- *CO_2 exchange rate* (CER): The net rate of carbon dioxide diffusion from (–) or to (+) an entity, such as a plant tissue, organ or canopy, a soil surface, etc. Suggested units: μmol cm^{-2} s^{-1}. (Use this term instead of *net CO_2 exchange* except in the rare instance when the measurement does not involve a rate.)

Reporting PAR in photon units (PPFD) is preferred to energy units (PI), but both are acceptable. Because *irradiance* is specifically defined in energy units (W), the term cannot be applied to photon flux density.

Abandoned as a term is *light intensity* to denote the amount of light incident on a surface (Dybing, 1977). The *Crop Science* editorial board has discontinued the use of the photometric system and units scaled to the response of the human eye.

BIOLOGY

Scientific Names

For plants, pathogens, and insects and related pests, give both a common name and the scientific name. For plants, include the authority. The scientific names for plants should be given at first mention in both the abstract and the main text. EXAMPLE:

Sorghum [*Sorghum bicolor* (L.) Moench] was. . . .

The scientific name is the two-part genus–species binomial—or, for subspecies and varieties, the trinomial. For abbreviations of authorities, the primary source is *Authors of Plant Names* by Brummitt and Powell (1992). Common names, if they exist and are not in dispute, are used in titles of articles, chapters, and books.

Abbreviate the genus in a scientific name of organisms after first mention, except at the beginning of a sentence or if there is potential for confusion; always spell out the specific name or epithet. Abbreviate authorities (used for plants only).

For the names of crops, use the singular. Although the ordinary English preference is for terms such as *oats*, *beans*, and *peas*, the formal name of a crop defined by a single genus or species is given in the singular: oat, bean, pea, soybean, and so forth. This rule applies even when discussing multiple types of a crop.

For common names that are taxonomically inaccurate, join the parts into a single word. For example, writing "pigeonpea" and "chickpea" as one word indicates that these are not *Pisum* species; similarly, the use of a hyphen in the common name indicates that Douglas-fir is not an *Abies* species.

Correct scientific names are in accordance with published rules. For plants, the *International Code of Botanical Nomenclature* (McNeill et al., 2006; http://ibot.sav.sk/icbn/main.htm) governs; updates appear in *Regnum Vegetabile* as mandated by the International Botanical Congress, which meets every six years. For cultivated plants, the rules of nomenclature are published as the *International Code of Nomenclature for Cultivated Plants* (Brickell et al., 2016). A practical guide to these codes and to the standards for animals, bacteria, and viruses is published in *Scientific Style and Format* (CSE, 2006, Chapters 21–24).

The scientific names for larger animals (e.g., sheep) do not need to be given unless germane to the article and/or there may be confusion as to what animal is being discussed.

Virus species do not have Latin names, but the name of the virus (as approved by the International Committee on Taxonomy of Viruses) should be written in italics, with the first word capitalized (e.g., *Tomato spotted wilt virus*).

To find up-to-date scientific names, consult one of the major online databases:

- https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysimple.aspx for plants, especially economic plants (USDA National Plant Germplasm System, Germplasm Resources Information Network [GRIN] database)
- https://plants.usda.gov for plants, especially noncrop plants (USDA-NRCS)
- https://nt.ars-grin.gov/fungaldatabases/ for fungi (USDA Systematic Botany and Mycology Laboratory; Farr & Rossman, 2017)
- https://www.apsnet.org/edcenter/resources/commonnames/Pages/default.aspx for plant disease names (American Phytopathological Society)
- http://texasinsects.tamu.edu/ for insect scientific names (Texas A&M University)
- https://ictv.global/taxonomy (International Committee on Taxonomy of Viruses)

The International Plant Names Index, a product of a collaboration between the Royal Gardens, Kew, the Harvard University Herbaria, and Australian National Herbarium, is available online (https://www.ipni.org/). (This replaces the Kew Index.)

Standard printed reference works for nomenclature include *Hortus III* (Bailey, 1976) and *World Economic Plants: A Standard Reference* (Wiersema & León, 1999) for plants; Farr et al. (1989) for fungi; Bergey's manual (Garrity et al., 2001–2011) for bacteria; and, for viruses, Büchen-Osmond (2003).

Cultivars

The terms *cultivar* and *variety* are synonymous as applied to names of cultivated plants, but cultivar is strongly preferred to avoid confusing cultivated variety (a term of convenience) with botanical variety (a subtaxon to species).

Crop cultivars must be identified as such at first mention in abstract or text. This identification may be given in one of the following two ways:

1. By single quotation marks inside punctuation. EXAMPLE: 'Vernal' alfalfa or *Medicago sativa* L. 'Vernal'.
2. By use of the word *cultivar*. EXAMPLE: the cultivar Vernal.

Use single quotes around a cultivar name when it follows the scientific name (e.g., *Triticum aestivum* L. 'Cheyenne'); you do not need to use single quotes after the word cultivar (e.g., the cultivar Cheyenne). Place punctuation outside of the single-quote marks. Do not use cultivar quotes with landraces or experimental lines. With the exception of *Crop Science* and *Journal of Plant Registrations*, single quotes are not needed when cultivar names are written alone unless their absence would create confusion.

Journal of Plant Registrations publishes articles on registered cultivars, germplasms, parental lines, genetic stocks, and mapping populations. Information on these registrations is also available from the GRIN database (https://npgsweb.ars-grin.gov/gringlobal/search.aspx), usually with some additional narrative. The database entries include pending registrations and are linked to plant variety protection status.

Citing Genetic Material

Authors of CSSA publications must cite plant introductions, as well as registered cultivars, germplasm, parental lines, and genetic stocks when they are mentioned in the text of

the Introduction, Discussion, or Characteristics section of research papers. Such genetic materials must also be cited when they are used to develop unreleased genetic populations that are the focus of the research paper, unless the development of the population can be cited more directly. Authors are encouraged to cite the *Journal of Plant Registrations* if possible. Other sources for citation information include GRIN, maintained by the USDA. Registrations published in *Crop Science* and the *Journal of Plant Registrations* are indexed on the GRIN website at https://npgsweb.ars-grin.gov/gringlobal/query/query.aspx. A general search in GRIN is available at https://npgsweb.ars-grin.gov/gringlobal/search.aspx.

Reference Examples

Lewis, J. M., Siler, L., Souza, E., Ng, P. K. W., Dong, Y., Brown-Guedira, G., Jiang, G.-L., & Ward, R. W. (2010). Registration of 'Ambassador' wheat. *Journal of Plant Registrations 4,* 195–204. https://doi.org/10.3198/jpr2009.05.0243crc

Germplasm Resources Information Network. (1993). Germplasm Resources Information Network (GRIN) database. *Festuca arundinacea* Schreb. POACEAE 'Maximize'. USDA-ARS. https://npgsweb.ars-grin.gov/gringlobal/accessiondetail.aspx?id=1444051

Genetics and Molecular and Cell Biology

Genes are named according to established conventions, which vary in part among crops. As an example, a standard for cotton is Kohel (1973). Many of these are summarized in *Scientific Style and Format* (CSE, 2006, p. 298–312); see also the entries for gene and genotype in the *New Oxford Dictionary for Scientific Writers and Editors* (Martin, 2009). Check with an expert in your field to find the appropriate published standards, including updates. Accepted names of genes are set in italics and may be modified with letters or numbers (with or without superscripts, with or without italics). Proposed names follow the conventions for the crop in question but are set in roman type.

Use italics for the variables in ploidy formulas (e.g., $2n = 2x = 42$).

Spell out amino acids in text, without capitalization. In formulas and sequences, use the abbreviations shown in Table 3–2.

For enzymes, follow nomenclature for name and number (Webb, 1992).

For genetics, the CSE manual (CSE, 2006) is an excellent guide to style for specialized terms and usages in molecular and cell biology, as is the *New Oxford Dictionary for Scientific Writers and Editors* (Martin, 2009). The Oxford book gives, for example, complete rules for names of restriction enzymes: three letters in italics to identify the source bacterium (e.g., *Hin* for *Haemophilus influenzae*, or *Bam* for *Bacillus amyloliquefaciens*), then letters in roman type to indicate the strain (e.g., d or H), then capital roman numerals to indicate the type of enzyme (e.g., I, II, or III), all leading to characteristic names such as *Hin*dIII (for enzyme III from strain d of *H. influenzae*) or *Bam*HI (for enzyme I from strain H of *B. amyloliquefaciens*).

CHEMISTRY

You may use chemical symbols instead of words for elements, ions, or compounds, except at the beginning of a sentence. These symbols do not have to be defined the first time they are used. Where the representation is general and the chemical species is not specified, do not indicate the ionic charge (e.g., Ca, Fe, K, NH_4, NO_3, SO_4, and PO_4). Whenever a specific ion of known valence state is described in a manuscript, indicate the charge in superscripts as the charge number followed by a plus (+) or minus (–) sign; where the

charge number is 1, use only the sign (e.g., Ca^{2+}, NH_4^+, NO_3^-). Where the oxidation state is not obvious in a formula or where the oxidation state is known and is important, it should be designated by a roman numeral in parentheses; for example, Fe(II).

The amounts and proportions of fertilizer nutrient elements must be expressed in terms of the elements or in other ways as needed for theoretical purposes. The amounts or proportions of the oxide forms (P_2O_5, K_2O, etc.) may also be included, in parentheses.

You may use the common or generic name of a chemical (e.g., atrazine, 2,4-D, etc.). If germane to the article, give the full chemical names for compounds at first mention in the text. (If many names need mention, they may be listed in a table instead of parenthetically throughout the text.) EXAMPLES:

atrazine [6-chloro-*N*-ethyl-*N′*-(1-methylethyl)-1,3,5-triazine-2,4-diamine]

cyanazine {2-[[4-chloro-6-(ethylamino)-1,3,5-triazin-2-yl] amino]-2-methylpropanenitrile}

Use the most up to date chemical names available. Trade names should be avoided whenever possible. If it is necessary to use a trade name, it should be capitalized and spelled out as specified by the trademark owner. Omit the various trademark symbols, such as ® and ™.

In the United States and Canada, the authority for names of chemical compounds is *Chemical Abstracts* and its indexes. The American Chemical Society's *ACS Style Guide* (Coghill & Garson, 2006) and the Council of Science Editors' *Scientific Style and Format* (CSE, 2006) contain additional details on nomenclature in chemistry and biochemistry. Publications of the American Chemical Society's committee on nomenclature and the nomenclature commissions of the International Union of Pure and Applied Chemistry (IUPAC) are available through Chemical Abstracts Service, Columbus, OH.

Chapter 7 of this manual has further information regarding SI units and concentration.

TABLE 3–2 Amino acids and their abbreviations.

Amino acid	Long abbreviation	Short abbreviation
Alanine	Ala	A
Arginine	Arg	R
Asparagine	Asn	N
Aspartic acid	Asp	D
Cysteine	Cys	C
Glutamic acid	Glu	E
Glutamine	Gln	Q
Glycine	Gly	G
Histidine	His	H
Isoleucine	Ile	I
Leucine	Leu	L
Lysine	Lys	K
Methionine	Met	M
Phenylalanine	Phe	F
Proline	Pro	P
Serine	Ser	S
Threonine	Thr	T
Tryptophan	Trp	W
Tyrosine	Tyr	Y
Valine	Val	V

Information on pesticides is found in the *Herbicide Handbook* of the Weed Science Society of America (Shaner, 2014), the *Crop Protection Handbook* (Meister, current edition), and the British Crop Protection Society's *Pesticide Manual: A Worldwide Compendium* (Tomlin, 2011). See also the *Merck Index* (https://merckindex.rsc.org/).

The chemical names of the organic substances used for pesticides may include locants and descriptors consisting of numerals, letters (italic, roman, small-capital, or Greek letters), symbols, and words in various combinations. Below is a selection of common usages:

- Use italics for the prefixes *anti, asym, c, cis, cyclo, d, endo, exo, l, m, n, o, p, r, s, sec, t, tert,* and *trans*. Do not capitalize these prefixes, even at the beginning of a sentence or in a title.
- Use italics for the capitalized prefixes *R, R*, S, S*, E,* and *Z* and enclose them in parentheses.
- Use italics for symbols of chemical elements indicating ligation or attachment to an atom (e.g., *O, P, N, S*) or when indicating added hydrogen (*H*).
- Use Greek letters to denote position or stereochemistry (e.g., α-amino acids).
- Enclose the stereochemistry prefixes for plus and minus in parentheses: (+), (–), and (±).
- Use roman (regular) type for multiplying prefixes (e.g., hemi, mono, di, tri, deca; semi, uni, sesqui, bi, ter, deci; bis, tris, decakis).

For a full treatment with examples, including details of punctuation and capitalization in various contexts, see the *ACS Style Guide* (Coghill & Garson, 2006, Chapter 12).

Chapter 4. Statistical Design and Analysis

Readers must be able to understand how the authors designed and conducted their studies so that the results can be judged for validity and also serve as a basis for the design of future research. The selection of a statistical method and its appropriateness depend on the questions or information sought, the validity of theoretical assumptions, the adequacy of the sampling design, and the type, quantity, and quality of the observations. The reporting of the results from each analysis should include a brief description of the statistical method and a literature citation providing its full detail, verification of the degree to which assumptions have been met, and complete descriptions of sampling design and experimental observations in relation to the efficacy of the statistical analysis. In all cases, a measure of the statistical confidence should be reported and interpreted in relation to the question answered or conclusion reached by the authors.

TREATMENT AND EXPERIMENTAL DESIGN

Designing a controlled experiment requires two components: treatment design and experimental design. Treatment design includes the factors of interest, the levels of each factor, the relationship among the factors (e.g., a factorial treatment structure), and the selection of blocking variables and covariates. Experimental design refers to the method of arranging the experimental units and the method of assigning treatments to the units. Included should be any information about blocking, multiple experimental unit sizes (e.g., in split and strip plots), the number of sites and years or independent runs of the experiment, the number of replicates, a description of conditions at field sites and in greenhouse or controlled environmental chambers, and how measurements were made for specific traits. In studies where the experimental units and observational or sampling units were not the same, each should be clearly identified. The number of experimental units used and the number of samples taken from each unit should be clear to the reader.

The treatment and experimental designs dictate the proper method of statistical analysis and the basis for assessing the precision of the treatment means. A measure of the precision achieved, either as a standard error or a confidence interval, should be reported for all data on which conclusions are drawn.

SPATIAL AND TEMPORAL STATISTICAL ANALYSES

Data observed at different points in space and/or time on the same experimental material are often correlated. Many methods of statistical analysis are available for examining such data. For observations that are temporarily or spatially independent, parametric and nonparametric statistical methods are available. For those that manifest temporal or spatial dependence, methods derived from regionalized variable analysis and applied time series may be selected.

ABBREVIATIONS AND SYMBOLS

There are a number of widely used and accepted abbreviations in statistics. Those given in Table 4–1 do not require definition in ASA, CSSA, and SSSA publications. However, the use of a particular symbol without definition may lead to confusion or misunderstanding. For example, in statistical methods and experimental design textbooks, symbols used for the number of blocks in a randomized complete block design include *r, b, J*, and *n*. In some cases, the same symbol may be used for more than one purpose. In such cases, the meaning can usually be understood from the context. For example, β is used almost universally to

represent the probability of a Type II error in hypothesis testing and is commonly used to represent population regression coefficients. If there is any doubt as to whether a symbol's meaning will be clear to the reader, it is best to define the symbol.

TABLE 4–1 Some widely used statistical abbreviations and symbols.

Abbreviation or symbol [a]	Explanation
ANOVA	Analysis of variance
b (β)	Regression coefficient
CV	Coefficient of variation
df	Degrees of freedom
F	Snedecor's F statistic
LSD	Fisher's least significant difference
n	Sample size
P, p	probability
r (ρ)	Correlation coefficient
r^2	Coefficient of determination
R^2	Coefficient of multiple determination
RMSD	Root mean square deviation
RMSE	Root mean square error
s, σ, SD	Standard deviation
s^2 (σ^2)	Variance
SE	Standard error
$s_{\bar{x}}$ ($\sigma_{\bar{x}}$), SEM	Standard error of the mean
t	Student distribution (Student t test)
$\bar{x}$ (μ)	Arithmetic mean
α	Probability of a Type I error
β	Probability of a Type II error
χ^2	Chi-square statistic

Note: In addition, the symbols *, **, and *** are used to show significance at the $\alpha = 0.05$, 0.01, and 0.001 levels, respectively. Significance at other levels is designated by additional footnotes, using other symbols (e.g., †, ‡, §, ¶, etc.).

[a] Symbols in parentheses are for the population analog of the corresponding sample quantity.

Chapter 5. Tables

The bulk of the detailed information in a paper is typically presented in its tables. Do not overload the text with information that could be presented better in a table. As you prepare your article, consider whether a table is most appropriate.

- If the text is crowded with detail, especially quantitative detail, consider creating a table.
- Consolidate similar information into one table to let the reader compare easily so that the reader does not have to search for related information.
- If a table has only a few rows and columns, try stating the findings in a few sentences. Information in small tables can often be presented better in the text.

Both tables and figures are used to support conclusions or illustrate concepts, but they have essential differences in purpose. Tables present numbers for comparison with other numbers or summarize or define concepts, terms, or other details of a study. Graphs reveal trends or delineate selected features. Sometimes the two purposes overlap, but they rarely substitute for one another. Data presented in tables should not be duplicated in graphs, and vice versa.

Readers often study tables and figures before they read the text. Therefore, each table and figure should stand alone, complete and informative in itself.

Tables are often used for reporting extensive numerical data in an organized manner. They should be self-explanatory. Number the tables in the order in which they are cited in the text.

GUIDELINES FOR PREPARING TABLES

Follow these guidelines to ensure that your tables will be prepared efficiently and accurately for typesetting, with little chance of introduced errors.

- Use Microsoft Word's table feature when creating a table. That is, the table that you create should have defined cells. DO NOT create tables by using the space bar and/or tab keys.
- Do not use the enter key within the body of the table. Instead, separate data horizontally with a new row.
- Do not insert blank columns or rows.
- Asterisks or letters next to values indicating statistical significance should appear in the same cell as the value, not an adjacent cell (i.e., they should not have their own column).
- Spell out abbreviations at first mention in tables or add an abbreviations footnote, even if the abbreviation has already been defined in the text. The reader should be able to understand the table content without referring back to the text.
- To highlight individual values in tables, you may use boldface type, italic type, or underlining. Any highlighting must have a supplemental note of explanation; attach the note symbol to the first value that is so highlighted. Do not use color or shading.

STRUCTURE OF A TABLE

The principal parts of a table are shown in Table 5–1. The remaining tables in this chapter show the basic structure as adapted for different types of information: a typical table (Table 5–2), a table with units varying row to row (Table 5–3), a table with both measured values and analysis of variance (Table 5–4), and a table without numeric data (Table 5–5).

The examples are drawn from published papers; commentary for this manual is added in italics.

Keep table titles brief but sufficiently detailed to explain the data included. Typically, specify the crop or soil involved, the major variables presented, and the place and year. Do not include units of measurement; these belong in a row of their own, just beneath the column headings, or in row headings.

Each column should have a heading describing the material below it. Give units in the first row below the headings. When the same units apply to adjacent columns, state the unit only once and use em dashes on each side of the unit to indicate how many columns are included. (See Tables 5–2 and 5–4 for examples.)

The column headings should reflect the type of data shown. That is, it is not enough to state "Yield of corn." in the table title and then label columns only with 1994, 1995, and 1996, with a units row showing Mg ha^{-1}. Add a spanner heading, "Yield," above the year headings.

When the type of data varies row to row, put the units at the end of the stub entry describing the row. Separate the units from the row descriptor with a comma or parentheses. The column headings in this kind of table do not reflect the values shown but indicate some other grouping, such as time or place or experimental conditions.

TABLE NOTES

As shown in Table 5–1, four types of notes are used with tables: a general note that applies to the entire table, a note for abbreviations, notes that show statistical significance, and notes that give specific information. The asterisks *, **, and *** are always used in this order to show statistical significance at the 0.05, 0.01, and 0.001 probability levels, respectively, and cannot be used for other notes. Significance at other levels is designated by an alternate symbol (e.g., a dagger; see also Table 4–1). Lack of significance is usually indicated by "ns" and needs a note only if the lowest level of significance shown is higher than the nonsignificance level. EXAMPLE:

TABLE 5–1 Table titles should be understandable to someone who has not read the text. The table below shows the main components of a typical table in ASA, CSSA, and SSSA publications.

Column heading for stub [a]	**Spanner head** [b]			
		Subspanner head [c]		
	Column heading	**Column heading**	**Column heading** [d]	**Column heading** [e]
unit [f]	unit	——	unit ——	
(Stub)	(Field)			
	Independent line [g]			
Stub heading				
Row heading	value 1	value 2*	value 3***	value 4*
Row subheading [h]	value 5	value 6**	value 7**	value 8*
Row heading	value 9	value 10*	value 11**	value 12*
	Independent line [i]			
Stub heading				
Row heading	value 13	value 14	value15**	value 16

Note: General note (applies to the table as a whole).

Abbreviations: List of abbreviations used in the table.

[a, b, c, d, e, f, g, h, i, etc.] Specific notes (on one line or each starting on a new line if that improves readability).

*Significant at the 0.05 probability level. **Significant at the 0.01 probability level. ***Significant at the 0.001 probability level.

Table 5–2 is an example of a typical table that shows the consistent relation of the uppermost spanner heading to the units and the data values. Adapted from Saseendran et al. (1998; Agronomy Journal 90, pp. 185–190).

TABLE 5–2 Grain and straw yield in 1993 for 'Jaya' rice under rainfed conditions at Kerala Agricultural University in India, as measured and as calculated using CERES-Rice v3.0.

Date	Grain yield		Straw yield	
	Measured	Calculated	Measured	Calculated
	kg ha^{-1}			
June 8	6100	5689	4600	7785
June 15	300	312	100	184
June 22	2300	2160	14,500	16,213
June 29	3200	3207	4200	6743

** Significant at the 0.01 probability level.

*** Significant at the 0.001 probability level.

† ns, nonsignificant at the 0.05 probability level.

For specific notes, use superscript letters. Cite the letters just as you would read a table—from left to right and then from top to bottom, and reading across all spanner and subheadings for one column before moving on to the next. Regardless of where the asterisks first appear in a table, asterisked significance notes come after any specific notes keyed to the letters.

Mean comparisons: When letters are used to display the significance of pairwise mean comparisons in tables or figures, the meaning of letters should be concisely described in captions. Two examples of suitable verbiage: "Means not sharing a letter are

Table 5–3 is an example of a table with units varying row to row (unlike the usual pattern seen in Table 5–2). Adapted from Bordovsky et al. (1998; Agronomy Journal 90, pp. 638–643).

TABLE 5–3 Surface soil (0–15 cm) properties of Miles fine sandy loam soil at Munday, TX.

Property	Value	Qualifier
Physical		
Soil texture, g kg^{-1}		
Sand	800	
Silt	130	
Clay	70	
Slope, % [a]	1	
Erosion factor *K*	0.24	medium
Mean permeability, m × 10^{-6} s^{-1}	28	moderately rapid
Mean available water capacity, m^3 m^{-3}	0.12	very low
Mean liquid limit†	22	
Mean plasticity index	5	
Chemical		
Mean pH	7.8	mildly alkaline
Organic matter, g kg^{-1}	3.3	low
Available N, mg kg^{-1}	1	very low
Available P, mg kg^{-1}	52	high high
Available K, mg kg^{-1}	240	high
Available Ca, mg kg^{-1}	1237	high
Available Mg, mg kg^{-1}	500	high
Available Na, mg kg^{-1}	111	low
Available S, mg kg^{-1}		high

[a] Source: Soil Survey of Knox County, Texas (1979).

Table 5–4 shows how to incorporate ANOVA results. The centered independent heading is used, together with the new main entry line in the stub, to alert the reader to a change in the type of data for the rows that follow. Adapted from Porter et al. (1996; Agronomy Journal 88, pp. 750–757).

TABLE 5–4 Wheat N uptake (1988) as affected by fertilizer N and indigenous soil N.

Fertilizer N rate	df	Fertilizer N uptake	df	Soil N uptake
kg ha^{-1}		kg ha^{-1}		kg ha^{-1}
0		–		85a
56		28a		67ab
112		47b		63b
	ANOVA			
Source of variation				
N rate (N)	1	***	2	*
Microplot (M)	3	NS†	3	NS
N × M	3	NS	6	NS
CV, %		22		16

Note: Means not sharing a letter are significantly different at the 5% level of significance according to a *t*-test.
*Significant at the .05 probability level. ***Significant at the .001 probability level. †NS, nonsignificant.

As shown in Table 5–5, sometimes a table is the best way to organize words. Adapted from Einhellig (1996; Agronomy Journal 88, pp. 886–893).

TABLE 5–5 Studies reporting stress enhancement of the action of allelopathic chemicals.

Stress	Bioassay	Species	Allelochemical	Reference
High temperature	SG	soybean; grain sorghum	ferulic acid	Einhellig and Eckrich (1984)
High temperature	plantlets	barley	gramine	Hanson et al. (1983)
Low nutrients	RE	barley	phenolic acids	Glass (1976)
Low N or P	RE	barley	*p*-coumaric acid; vanillic acid	Stowe and Osborn (1980)
Low N or K	SG	*Schizachyrium scoparium*	hydrocinnamic acid	Williamson et al. (1992)
Moisture stress	G, SG	grain sorghum	ferulic acid	Einhellig (1987, 1989)

Abbreviations: G, germination; RE, root elongation; SG, seedling growth.

significantly different at the 5% level of significance according to a *t*-test" or "Means with a letter in common are not significantly different at the 5% level according to Tukey's HSD test." Also see Piepho (2018), "Letters in mean comparisons: What they do and don't mean," *Agronomy Journal* 110, 431–434.

If individual values in a table are highlighted using italic or bold type or underlining, attach the note symbol to the first value that is so highlighted. If standard errors or standard deviations are included, either in parentheses or with ±, attach the note symbol to the first value that includes this addition.

Chapter 6. Figures

Many of the descriptions and basic concepts, key natural trends, key discoveries, and some of the conclusions are presented in figures. As you prepare your article, consider whether a figure is appropriate.

- Can a difficult prose explanation be better described with a figure?
- Does your figure show more than could be said in a few well-chosen words? A figure is not always better.

Readers often study tables and figures before they read the text. Therefore, each figure should be able to stand alone, complete and informative in itself.

Figures are often the best means of presenting scientific data. Poorly rendered figures or figures that merely repeat information given in the text, however, can confuse the reader or clutter the manuscript; thus, each figure should serve its purpose well or be omitted. Figures encompass at least four substantially different kinds of illustrations in black and white, shades of gray, color, or some combination:

- Graphs (line, bar, pie, etc.).
- Line drawings or maps.
- Photographs and micrographs.
- Animated illustrations, which are shown in stop-motion frames.

Line or bar graphs are the most common figures in ASA, CSSA, and SSSA journals, followed by line drawings, micrographs, and standard photographs. Color may be used at no extra charge for online publications.

Graphs and charts improve the general presentation of a technical publication by reporting data in an easily comprehensible manner. They are generally used to show trends rather than the detailed information in a table.

The style of the graphs and charts and the size and appearance of letters and numbers should be consistent within a paper.

Whenever possible, figures should be horizontal. This format takes up less space in the article. Do not draw a box around line-art figures. Multipanel figures should be labeled (uppercase, A, B, C, etc.; or lowercase a, b, c, etc.) and combined into one file.

COLOR FIGURE POLICY

To allow greater accessibility to our sciences by color-blinded individuals, we require the following guidelines be implemented when generating color figures. This policy is effective as of April 1, 2022.

- Avoid unnecessary color: Grayscale generally provides a more faithful representation when a single quantity is being displayed.
- Avoid troublesome color combinations: greens, reds, browns, and oranges.
- Use green/magenta color combinations instead of green/red combinations.
- Use separate monochrome images for the different color channels if no suitable color combination can be found.
- For line drawings that require color, use redundant coding by adding different textures, shapes, or line types to the colors across figures.

See the online "ACA, CSSA, SSSA Editorial Policies" page for additional resources for creating illustrations.

FILE FORMATS

For ASA, CSSA, and SSSA publications, high-resolution JPEG, PDF, EPS, or TIF (TIFF) files are the preferred file types. Images should have a minimum resolution of 300 dpi. For EPS files, be sure all fonts are embedded; all lines should be at least 0.5 point. Figure art submitted as PDFs should be distilled using Adobe Acrobat Distiller's "Press Quality" setting. For photographs, use high-resolution TIF or JPEG files.

FIGURE QUALITY AND ACCURACY

Because authors are the only ones working with the original graphics file, corrections are the sole responsibility of the author. Authors should not submit figures under the assumption that minor errors will be corrected by someone else at a later stage.

In biplots, PCA plots, multi-dimensional scaling plots, or any other plots based on a singular value decomposition or spectral decomposition (eigenvalue analysis) of a multivariate data matrix, it is important to make sure that both axes are equally scaled exactly, i.e. the aspect ratio is 1:1. This means that the distance in metric units (e.g., millimeters) between two tick marks on the horizontal axis is exactly the same as the distance between the equivalent pair of tick marks on the vertical axis. Also see Malik, W., Piepho, H.P. (2018), Biplots: Do not stretch them! *Crop Science*, 58, 1061–1069.

Clearly label all figures in the file name (e.g., Figure1.pdf). (If the paper is submitted for double-anonymous review, be sure to omit the author's name within the file name.)

FIGURE SIZE

The final size of the published figure depends to some extent on where it will appear. For journals, a single column is approximately 8.5 cm (3.5 inches, or 20 picas) wide, and full-page width is approximately 17.8 cm (7 inches, or 42 picas). For books, check with the book editor for the optimum size. Figures can be placed lengthwise on a page, but this is not the ideal layout.

Figures that fit within a single journal column's width are an economical use of space. Avoid creating figures that have unnecessary white space. Figures do not have to fill the allotted one or two columns; that is, reduction is based on content, not on a width of exactly one or two columns.

FONT SIZE AND TYPE

Use these recommended fonts where possible: Arial, Helvetica, Calibri, Times New Roman, Symbol.

All figure elements, including letters, numbers, and symbols, must be legible at their final size. In general, authors should make the figure type size large enough so that it is at least 8 points after reduction. No type should be less than 6 points. As an example, for a 16-cm-wide figure, choose 16-point type, so that when the figure is reduced to fit in a single journal column, the type is reduced to 8-point size.

STYLE

For text within a figure, we suggest using either sentence-style capitalization (only the first word has an initial capital) or title capitalization (each major word has an initial capital). Use only lowercase for units of measure.

Position decimal points correctly, at the base of the numbers and in a size large enough to stand reduction. Decimal points should be in proportion to the numbers they accompany. Do not use commas in place of decimal points.

Be sure that the overall style in the figures follows journal standards. For example, if you use Mg ha^{-1} in the text, do not use Mg/ha in the figures.

In addition:

- Define all abbreviations in the caption, even if they appear in the overall abbreviations list.
- Italicize variables.
- Check the spelling of all text in each figure.

THE GRAPHIC ELEMENTS

Axis scale. Do not crowd the interval marks on axis scales. Fewer may be better. Rarely, if ever, rule in the coordinates grid—not even in light lines or dots. (Light lines may break up, and light dotted lines may disappear entirely.)

In-figure legend. Include a legend to identify symbols, lines, and patterns. (A legend is a list of correspondence between the patterns and symbols and their meaning.) Put the legend inside the figure box, preferably above or to the right of the figure.

Fill patterns and shading. If you need to shade parts of your figure, keep in mind that the spaces between the elements of that shading will be reduced when the figure is reduced. Many patterns built into computer programs become solid black when reduced to 50% of the original size. Search for patterns, or create your own, that will not condense to black.

For bar graph patterns, use solid black, solid white, black diagonal lines, sharp crosshatching, a sharp dot screen, or a random dot pattern. Dot patterns must be fairly coarse to reproduce well. Light grays and fine, light dots are likely to become muddy or blotchy or even disappear altogether in reproduction. Shades of gray may turn into indistinguishable muddy blacks.

Choose symbols and patterns of similar weight and tone to avoid making one set of data look inherently more important than another.

Lines. Every line in a figure should have meaning and purpose, so authors should avoid using decorative borders, shadows, and other three-dimensional effects. Lines should be of consistent weight and sufficiently heavy (at least 0.5 point) to ensure a high-quality reproduction.

Three-Dimensional Graphs. Use three-dimensional graphs only to represent three dimensions of data. If there are no data for the *z* axis, do not use three-dimensional formatting.

PHOTOGRAPHS

Submit photographs as high-resolution TIF or JPEG files. Indicate the scale, or at least provide a reference point to indicate relative size. For micrographs, indicate the power at which the image was taken, either in the caption or on the figure itself.

If photographs are taken in a series, maintain the same height and angle of the camera, the same distance from the subject, and the same angle of the sun. (A picture taken 3 m from the subject at 0800 h will appear quite different from one taken of the same subject from 6 m at 1700 h.)

Selection

Make sure that the photograph shows something unique, interesting, and clearly identifiable. Use photographs only if they show something essential to your point.

Combinations

When two or more photographs are to be combined into one figure, each part of a composite figure should be clearly identified on the figure by uppercase (A, B, C, etc.) or lowercase letters (a, b, c, etc.). Use the same letters to identify the parts in the caption and in text citations.

Letters, numbers, arrows, scales, and other marks that appear in a light area of the photo should be black. If they appear in a dark area, they should be white, or placed on a white circular or square background. Sufficient contrast is also essential for size bars used in micrographs.

Permissions

If a person or named product is shown in the photograph, the author is responsible for obtaining written permission for use of the photograph from the person or the manufacturer of the product. A copy of the release must be forwarded to headquarters after acceptance; ASA, CSSA, and SSSA are not responsible for any claims that may result from using the figure. For more information on permissions, see Chapter 10.

CAPTIONS

Number figures in the order they are cited in the text. For submission, it is good to include the caption with the actual figures as well as in the manuscript so that reviewers do not have to hunt through the manuscript to understand the figures. See Chapter 1 and individual journal instructions for details on figure and table placement.

A figure caption should be brief but sufficiently detailed to stand on its own. Identify curves or symbols in a legend within the figure itself, not in the caption. Define abbreviations in the caption. Do not write separate captions for the parts of a compound figure. Use sentence-style capitalization for figure captions, capitalizing the first word and all proper nouns.

In both captions and in-text citations, spell out the full word "Figure." Use uppercase or lowercase labels for figure citations ("Figure 1A, Figure 1A–C, Figure 2B,D" OR "Figure 1a, Figure 1a–c, Figure 2b,d") to match the case used in the figure.

Do not be too brief in your caption. A caption that states only “Analysis of data” or “Results of Experiment 2,” for example, is not sufficient.

Chapter 7. Numbers, Mathematical Equations, and Units of Measure

NUMBERS

- The decimal separator in ASA, CSSA, and SSSA publications is a comma, used for five-digit numbers and higher (e.g., 10,000).
- As an exception to usage for other numbers, monetary values are always written with commas, e.g., $1,000.
- Dates, page numbers, percentages, time, numbers preceded by capitalized nouns, and numbers followed by units of measure are expressed as numerals (e.g., Table 1, Chapter 1, 2%, Journal Article no. 1, Treatment 3, 1 g, 5 s).
- A numeral is used for a single number of 10 or more, except when the number is the first word of the sentence. Numerals are used to designate the numbers nine and below when two or more numbers are used and any of them are greater than nine: ". . . 2, 5, and 20 pots were planted," but "a group of 12 plants was incubated at three temperatures."
- Use the abbreviation or symbol for units only with numeric values. Use the same form for both singular or plural (e.g., 1 kg; 14 g; 2 h).
- At the beginning of a sentence, spell out the numeric value and the unit of measurement that follows (e.g., "Fifteen liters . . . was added"). Within a sentence, use the usual numerals and symbols ("15 L . . . was added"). Note the use of singular verb.
- Ordinal numbers are treated like cardinal numbers: third, fourth, 33rd, 100th, except in references, where digits are used (e.g., 5th ed., 7th Congress).
- For large numbers ending in zeros, good practice is to use a word or prefix for part of the number (e.g., 1.6 million, not 1,600,000; 23 μg, not 0.000023 g).
- Rounding treatment means to one-tenth of their estimated standard error is often acceptable. For example, if the estimated standard error is 1.43, the means should be rounded to the nearest 0.1, and if the standard error is 18.4, the means should be rounded to the nearest 1.0.
- A zero is used before the decimal point with numbers that are less than 1 when the unit can exceed 1, such as 0.23 cm, Cohen's $d = 0.70$, 0.48 s.
- A zero does not need to be used before a decimal fraction when the statistic cannot be greater than 1 (e.g., correlations, proportions, and levels of statistical significance: p, beta, alpha), such as $r(24) = -.43$, $p = .028$.
- For monetary values, use the appropriate currency symbol. You may use the full numeric form (e.g., $1,500,000) or a combination of numbers and words ($1.5 million). It is generally advisable to include the country prefix at first use and at every use if more than one country currency is used where the dollar is the unit of currency (e.g., US$500, Can$350, NZ$300).
- For complete dates, give the month, day (one or two digits), and year (four digits), e.g., August 1, 2023.
- Use the abbreviations a.m. and p.m. to distinguish between the halves of the day, e.g., 12:02 a.m. Time zones may be used if needed to avoid ambiguity. Do not capitalize

the names of times zones when spelled out. Capitalize the abbrevations of time zones, without periods, when they directly following the time (e.g., 11:30 a.m. CST). The 24-h system, which is indicated by four digits—the first two for hours and the last two for minutes—may be used if needed to avoid ambiguity. In this system, the day begins at midnight, 0000 h, and the last minute is 2359 h. Thus, 2400 h on December 31, 2022, is the same as 0000 h on January 1, 2023.

MATHEMATICAL EXPRESSIONS

Mathematical equations and symbols often must be retyped and reformatted during composition. Therefore, to help prevent the introduction of errors, preparation of the manuscript copy and identification of letters and symbols must be clear.

Use keyboard formatting where possible (i.e., bold, super-/subscripts, simple variables, Greek font, etc.), and use MathType (preferred) or Microsoft Word Equation Editor (only if MathType is not available) for display equations. If your equations are drawn from calculations in a computer language, translate the equation syntax of the computer language into standard mathematical syntax. Likewise, translate variables into standard mathematical format. If you need to present computer code, do that in an appendix.

Position and Spacing

The position and spacing of all elements of an equation must be exactly as they are to appear in printed form.

Place superscript and subscript letters and symbols in the correct positions.

Put a space before and after most mathematical operators (main exception is the solidus sign for division). For example, plus and minus signs have a space on both sides when indicating a mathematical operation but no space between the sign and the number when indicating positive or negative position on the number line (e.g., $5 - 2 = 3$; a range from −15 to 25 kg).

No space is left between variables and their quantities or between multiplied quantities when the multiplication sign is not explicitly shown. No space is left between an expression and its power (or any superscripted or subscripted modifier). No space is left after trigonometric functions.

Special Characters

Letters, including Greek letters, that denote mathematical constants, variables, and unknown quantities in text and in equations are set in italic. Vectors and matrices are set in boldface roman type.

Special characters should be treated the same in the text, equations, tables, and figures.

Call attention to unusual symbols and modification of symbols that may be lost or distorted during file conversion or exchange. Carefully distinguish between primes and apostrophes; the uppercase letter O and the numeral zero; the lowercase letter l, uppercase letter I, and the numeral 1; the degree symbol and a superscripted zero or letter o; and rho (ρ) and the letter p.

Simplifying Equations

Use in-line fractions (i.e., with a solidus rule, as in *x*/*y*) as much as possible, especially in the text. Show the necessary aggregation by using fences (i.e., parentheses, brackets, and braces). Use the sequence {[( )]}.

In display fractions, align the rules with the main signs of the equation or formula. In complex equations, use horizontal rules for the main fractions and slant rules in numera-

tors, denominators, and exponents. Some display equations can be reformatted as in-line equations. Thus, $a/(bcd)$ and $a/(b - c)$ and $(a/b) - (c/d)$ can easily substitute for

$$\frac{a}{bcd} \text{ and } \frac{a}{b-c} \text{ and } \left(\frac{a}{b}\right)-\left(\frac{c}{d}\right)$$

Use the same techniques to simplify a complex display equation.

For large numbers in text, tables, or figures, standard scientific notation is preferred instead of computer exponentials (e.g., 7.0×10^{-3} instead of 7.0 E-03). Computer exponentials may be used for presentation of software-generated data in tables and figures. SI prefixes are usually preferable to scientific notation when expressing units.

Integrals, Summations, and Limits

With single integral signs, the upper and lower limits should always be placed to the right of the integral sign, never above and below. In text, this can be accomplished by stacking supers and subs ($\int_{\infty}^{0}$). For summations, the limits above and below are customary in display equations; in text, however, and in the numerator and/or denominator of display equations, the right-side position is required.

Roots

As practical, use negative exponents or the solidus instead of display fractions and fractional powers instead of the radical sign. For example,

$$\frac{\cos \frac{1}{x}}{\sqrt{a+\frac{b}{x}}}$$

is better written as

$$\frac{\cos (1/x)}{[a + (b/x)]^{1/2}}$$

However, considerations of space should not override clarity. The previous equation can be further condensed to fit within the text line as $[\cos(1/x)]/\{[a + (b/x)]^{1/2}\}$, but this is not necessarily the best presentation. Consider your readers.

Numbering Equations

It is not necessary to number all displayed equations, but they are usually numbered in articles that have a substantial number of equations or if more than one is referred to within the text. If equations are numbered, place the numbers in parentheses at the right margin. Cite equations in text in the form Equation (1), Equations (4) and (5), and Equations (7–19), but (Equation 1).

Exponential Functions

For lengthy or complex exponents, the symbol exp is preferred, particularly if such exponentials appear in the body of the text. Thus, $\exp(a^2 + b^2)^{1/2}$ is preferable to $e^{(a^2 + b^2)^{1/2}}$. The larger size of symbols permitted by this usage also makes reading easier.

UNITS OF MEASURE

The SI system (Système International d'Unités) of reporting measurements is required in the majority of ASA, CSSA, and SSSA publications. Other units may be reported parenthetically if this will clarify interpretation of the data.

The National Institute of Standards and Technology maintains online resources for SI (http://physics.nist.gov/cuu/) and has published a comprehensive guide (Thompson & Taylor, 2008) that includes a concise checklist of style requirements. Table 7–6 at the end of this chapter gives selected conversion factors.

Base and Derived Units

The SI system is based on seven base units (Table 7–1). Derived units (Table 7–2) are expressed algebraically in terms of the base units. Some of these have been given special names and symbols, which may be used to express still other derived units. An example of a derived unit with a special name is the newton (N) for force; the newton is expressed in basic units as m kg s^{-1}. Another unit with a special name is the pascal (Pa), which is one newton per square meter.

Using SI Units

ASA, CSSA, and SSSA publications impose less-stringent requirements in style than the full formal SI system as published by the National Institute of Standards and Technology (Thompson & Taylor, 2008; Taylor & Thompson, 2008), and new developments in SI may take time to win adoption by the editorial boards. For example, this style manual allows molar concentration but disallows normal concentration, whereas strict SI usage declares both to be obsolete (Thompson & Taylor, 2008, 8.6.5). For certain papers or publications, traditional English counterparts may be used along with the SI units. (If in doubt, check with the editor to whom you are submitting your work.)

The prefixes and their symbols listed in Table 7–3 indicate orders of magnitude in SI units. They reduce the use of nonsignificant digits and decimals and provide a convenient substitute for writing powers of 10. With some exceptions (notably tonne, liter, and hectare; see the discussion of non-SI units, below), for ease of understanding, base units (kg, m, s) should be used in the denominator of combinations of units, while appropriate prefixes for multiples (or submultiples) are selected for the numerator so that the numerical value of the term lies between 0.1 and 1000. Values outside this range may be used instead of changing the prefix to keep units consistent across a single presentation or discussion.

A digit is significant if it is required to express the numerical value of the quantity. In the expression l = 1200 m, it is not possible to tell if the last two zeros are significant or only indicate the magnitude of the numerical value of l. In the expression l = 1.200 km, the two zeros are assumed to be significant; otherwise, the value of l would have been written l = 1.2 km.

TABLE 7–1 Base SI units.

Quantity	Unit	Symbol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd

TABLE 7–2 Derived SI units with special names.

Derived quantity	Name	Symbol	Expression in terms of other SI units	Expression in terms of SI base units
Absorbed dose, specific energy imparted, kerma	gray	Gy	J kg^{-1}	m^2 s^{-1}
Activity (of a radionuclide)	becquerel	Bq		s^{-1}
Capacitance	farad	F	C V^{-1}	m^{-2} kg^{-1} s^4 A^2
Celsius temperature	degree Celsius	°C		K
Dose equivalent	sievert	Sv	J kg^{-1}	m^2 s^{-2}
Electric charge, quantity of electricity	coulomb	C		s A
Electric conductance	siemens	S	A V^{-1}	m^{-2} kg^{-1} s^3 A^2
Electric potential, potential difference, electromotive force	volt	V	W A^{-1}	m^2 kg s^{-3} A^{-1}
Electric resistance	ohm	Ω	V A^{-1}	m^2 kg s^{-3} A^{-2}
Energy, work, quantity of heat	joule	J	Nm	m^2 kg s^{-2}
Force	newton	N		m kg s^{-2}
Frequency	hertz	Hz		s^{-1}
Illuminance [a]	lux	lx	cd sr	cd sr
Inductance	henry	H	Wb A^{-1}	m^2 kg s^{-2} A^{-2}
Luminous flux [a]				
Magnetic flux	weber	Wb	V s	m^2 kg s^{-2} A^{-1}
Magnetic flux density	tesla	T	Wb m^{-2}	kg s^{-2} A^{-1}
Plane angle [b]	radian	rad		m m^{-1} = 1
Power, radiant flux	watt	W	J s^{-1}	m^2 kg s^{-3}
Pressure, stress	pascal	Pa	N m^{-2}	kg s^{-2}
Solid angle [b]	steradian	sr		m^2 m^{-2} = 1

[a] Photometric units are not allowed in ASA–CSSA–SSSA publications. [b] The class of supplemental units was eliminated and the radian and steradian were reclassified as derived units in 1995 (Thompson & Taylor, 2008).

An exponent attached to a symbol containing a prefix indicates that the unit with its prefix is raised to the power expressed by the exponent. EXAMPLE: 1 mm^3 = $(10^{-3}$ m$)^3$ = 10^{-9} m^3.

Use a space to show multiplication of units and a negative exponent to show division; these are preferred to the otherwise acceptable center dot (•) and solidus (/). Thus, m s^{-1} is preferred to m/s, but be consistent. Only one solidus may be used in combinations of units, unless parentheses are used to avoid ambiguity. Thus, µmol m^{-2} s^{-1} is preferred, and µmol/(m^2 s) is acceptable, but µmol/m^2/s is not allowed. Where the denominator unit is modified by a quantity, the negative exponent goes after the unit, not the number. EXAMPLE: g 1000 $seed^{-1}$.

When reporting the value of a quantity, under strict SI usage, the information defining that quantity should be presented so that it is not associated with the unit (Thompson &

TABLE 7–3 SI prefixes.

Order of magnitude	Prefix	Symbol	Order of magnitude	Prefix	Symbol
10^{24}	yotta	Y	10^{-1}	deci	d
10^{21}	zetta	Z	10^{-2}	centi	c
10^{18}	exa	E	10^{-3}	milli	m
10^{15}	peta	P	10^{-6}	micro	µ
10^{12}	tera	T	10^{-9}	nano	n
10^{9}	giga	G	10^{-12}	pico	p
10^{6}	mega	M	10^{-15}	femto	f
10^{3}	kilo	k	10^{-18}	atto	a
10^{2}	hecto	h	10^{-21}	zepto	z
10^{1}	deka	da	10^{-24}	yocto	y

Taylor, 2008, 7.5). EXAMPLE: "the water content is 20 mL kg^{-1}" not "20 mL H_2O kg^{-1}"; however, such expressions are acceptable in ASA, CSSA, SSSA publications.

Punctuation with SI units is only as required by the English context. In particular, SI unit symbols take a period only at the end of a sentence. Abbreviate SI units in numeric expressions; SI unit symbols do not end in a period.

Non-SI Units

Some non-SI units may be used in ASA, CSSA, SSSA publications, but these units are limited to those that are convenient for crop and soil scientists. The quantity of area can be expressed as hectare (1 ha = 10^4 m^2). The use of liter (1 L = 10^{-3} m^3) in the denominator of derived units is permitted, but cubic meters is encouraged. Soil bulk density can be expressed as g cm^{-3}, but Mg m^{-3} is encouraged and t m^{-3} is allowed (see below). Angstroms are allowed for atomic spacing, and wave number can be reported as reciprocal centimeter (cm^{-1}).

The SI base unit for thermodynamic temperature is kelvin (K); however, the Celsius scale is usually used to express temperature. The degree sign is used with Celsius temperature (°C) but not with the kelvin scale.

The base unit second (s) is the preferred unit of time. Other units (e.g., minute, min; hour, h; week; month; year) are acceptable. Spell out week, month, and year. Periods of time shorter than 182 days (26 weeks) should not be expressed in months without a qualifying word such as "about" or "approximately." The unit "month" may be used for periods of 6 months or greater in text, tables, or figures; the word "month" may be used to mean calendar month. Named units (e.g., July rainfall) are also acceptable.

In SI, a tonne (t) equals 10^3 kg, or 1 Mg and is understood to mean metric ton. When expressing yields or application rates, the term Mg ha^{-1} is preferred; t ha^{-1}, widely used outside the United States, is acceptable. For a million tonnes, use Tg (not Mt).

Radian (rad) is the derived unit for measurement of plane angles, but degree is also acceptable. Other acceptable non-SI units are dalton (Da), electron volt (eV), poise (P), Svedberg units (S), degree (°), minute (′), and second (″). Use decimal values for minutes, degrees, and seconds (both are allowed for geographic coordinates; see Chapter 2).

Specific Applications

Special attention is required for reporting concentration, exchange composition and capacity, energy of soil water (or water potential), and light. Table 7–4 summarizes the appropriate units for society publications. Prefixes (Table 7–3) should be used to modify units in Table 7–4 so that numerical values fall between 0.1 and 1000.

Concentration

SI defines a mole (mol) as the amount of a substance of a system that contains as many elementary entities as there are atoms in 0.012 kg of ^{12}C (Taylor & Thompson, 2008, 2,1,1,6). With this definition, the elementary entities must be specified and may be atoms, molecules, ions, electrons, other particles, or specified groups of such particles. The substance may be a mixture, such as air.

Express concentrations on a molar basis (mol L^{-1}). Using M is acceptable although not preferred. Equivalencies include

1 mol L^{-1} = 1 M = 1 mmol mL^{-1}
1 mmol L^{-1} = 1 mM = 10^{-3} M = 1 μmol mL^{-1}
1 μmol L^{-1} = 1 μM = 10^{-6} M = 1 nmol mL^{-1}

TABLE 7–4 Preferred (P) and acceptable (A) units for quantities most likely to be used in ASA, CSSA, SSSA publications (concentration, exchange parameters, light, and water potential).

Quantity	Application	Unit	Symbol
Concentration	known molar mass (liquid or solid)	mole per cubic meter (P)	$mol\ m^{-3}$
		mole per kilogram (P)	$mol\ kg^{-1}$
		mole per liter (A)	$mol\ L^{-1}$
		gram per liter (A)	$g\ L^{-1}$
	unknown molar mass (liquid or solid)	gram per cubic meter (P)	$g\ m^{-3}$
		gram per kilogram (P)	$g\ kg^{-1}$
		gram per liter (A)	$g\ L^{-1}$
	known ionic charge	mole charge per cubic meter (P)	$mol_c\ m^{—3}$
		mole charge per liter (A)	$mol_c\ L^{-1}$
	gas	mole per cubic meter (P)	$mol\ m^{-3}$
		gram per cubic meter (A)	$g\ m^{-3}$
		gram per liter (A)	$g\ L^{-1}$
		liter per liter (A)	$L\ L^{-1}$
		microliter per liter (A)	$\mu L\ L^{-1}$
		mole per liter (A)	$mol\ L^{-1}$
		mole fraction (A)	$mol\ mol^{-1}$
Exchange parameters	exchange capacity	mole charge of saturating ion per kilogram (P)	$mol_c\ kg^{-1}$
		centimole charge of saturating ion per kilogram (A)	$cmol_c\ kg^{-1}$
	exchangeable ion composition	mole charge of specific ion per kilogram	$mol_c\ kg^{-1}$
	sum of exchangeable ions	mole charge of ion per kilogram	$mol_c\ kg^{-1}$
Light	irradiance	watt per square meter	$W\ m^{-2}$
	photosynthetic photon flux density (400–700 nm)	micromole per square meter per second	$\mu mol\ m^{-2}\ s^{-1}$
Water potential	driving force for flow	joule per kilogram (P)	$J\ kg^{-1}$
		kilopascal (A)	kPa
		meter of water in a gravitational field (A)	m

$$1\ nmol\ L^{-1} = 1\ nM = 10^{-9}\ M = 1\ pmol\ mL^{-1}$$

Solutions containing ions of mixed valence should also be given on the molar basis of each ion. Molality ($mol\ kg^{-1}$ of solvent) is an acceptable term and unit; it is the preferred unit for precise, nonisothermal conditions. Moles of charge per liter ($mol_c\ L^{-1}$) is also acceptable in some ionic situations. Do not use normality, N, the amount of substance concentration based on the concept of equivalent concentration. The relationship between normality and molarity is expressed by

$$N = nM$$

where n is the number of replaceable H^+ or OH^- per molecule (acids and bases) or the number of electrons lost or gained per molecule (oxidizing and reducing agents). A useful reference is Segel (1976).

In some instances, it is convenient to report concentrations in terms of their components—either weight to volume or volume to volume. Do not use percentage.

Gas concentration can be expressed as $mol\ m^{-3}$, $g\ m^{-3}$ partial pressure, or mole fraction. The denominator of the mole fraction needs no summation sign, because the mole is defined as Avogadro's number of any defined substance, including a mixture such as air.

An O_2 concentration of 210 mL L^{-1} is therefore 21×10^{-2} mol mol^{-1} or 0.21 mol fraction. A CO_2 concentration of 335 μmol mol^{-1} equals 335 μmol fraction.

Nutrient concentration in plants, soil, or fertilizer can be expressed on the basis of mass as well as the amount of substance. For example, plant P concentration could be reported as 180 mmol kg^{-1} P or 5.58 g kg^{-1} P. Extractable nutrients in soil should be expressed as mg kg^{-1} when soil is measured on a mass basis, or g m^{-3} when soil is measured on a volumetric basis. Exchangeable ions determined by the usual acetate procedure on weighed samples should be expressed as $mmol_c$ kg^{-1} or $cmol_c$ kg^{-1}.

Water content of plant tissue or plant parts can be expressed in terms of water mass per unit mass of plant material (e.g., g kg^{-1} H_2O). State whether reported plant mass is on a dry or wet basis.

Exchange Composition and Capacity

Exchange capacity and exchangeable ion composition should be expressed as moles of charge per kilogram (e.g., 5 $cmol_c$ kg^{-1}). Omit the sign of the charge (+ or –); it should be apparent from the text. If the cation exchange capacity is determined by the single-ion saturation technique, the ion used should be specified in the text as it can affect the cation exchange capacity measured. If Mg^{2+} were used for the soil, and specific ion effects were nonsignificant, the cation exchange capacity would be expressed as 8 $cmol_c$ (½-Mg^{2+}) kg^{-1}. Milliequivalents (meq) per 100 g is not an acceptable unit in the SI system and should not be used in ASA, CSSA, SSSA publications.

Energy of Soil Water or Water Potential

Soil water potential refers to its equivalent potential energy; it can be expressed on either a mass or a volume basis. Energy per unit mass has units of joules per kilogram (J kg^{-1}) in SI. Energy per unit volume is dimensionally equivalent to pressure, and the SI pressure unit is the pascal (Pa). One joule per kilogram is 1 kPa if the density of water is 1 Mg m^{-1} and, since 1 bar is equal to 100 kPa, 1 J kg^{-1} is equal to 0.01 bar at this same density. Energy per unit mass (J kg^{-1}) is preferred to the pressure unit (Pa). The use of the non-SI unit bar is accepted for use with SI, although it is not preferred.

The height of a water column in the Earth's gravitational field, energy per unit of weight, can be used as an index of water potential or energy. The potential in joules per kilogram (J kg^{-1}) is the gravitational constant multiplied by the height of the water column. Since the gravitational constant (9.81 m s^{-1}) is essentially 10, hydraulic head in meters of water is approximately 10 times the water potential expressed in joules per kilogram or kilopascals.

Light

Accepted SI notation for total radiant energy per unit area is joule per square meter (J m^{-2}). Energy per unit time or irradiance is expressed in watts per square meter (W m^{-2}). Alternative units, based on calories or ergs for energy and square centimeter for area, are not acceptable. Also, photometric units, including lux, are not acceptable.

Plant scientists studying photochemically triggered responses (e.g., photosynthesis, photomorphogenesis, and phototropism) may quantify radiation in terms of number of photons rather than energy content. Express photon flux density per unit area in moles of photons per square meter per second (mol m^{-2} s^{-1}). The photosynthetic photon flux density (PPFD) is photon flux density in the waveband 400–700 nm. For studies involving other wavebands, the waveband should be specified. See Shibles

(1976) and the summary under Light Measurements and Photosynthesis in Chapter 3 of this manual.

Use of Percentage in SI

Whenever the composition of some mixture is being described and it is possible to express elements of the mixture in SI base or derived units, the use of percentage is unacceptable. In such cases the percentage should be replaced by appropriate SI units. For example, plant nutrient concentration must be expressed in SI units based on either amount of substance or mass.

The use of percentage is acceptable when the elements of an event cannot be described in SI base or derived units, or when a well-known fractional comparison of an event is being described. The following are examples where use of percentage is acceptable.

- Coefficient of variation.
- Botanical composition, plant stand, and cover estimates.
- Percentage of leaves (or plants) infected.
- Percentage increase (or decrease) in yield.
- Percentage of applied element(s) that are recovered by plants, extractants, etc.
- Fertilizer grades.
- Relative humidity.
- As an alternative unit of soil texture. This is allowed because each component is well defined and is a fraction on a mass basis.
- As an alternative unit to express fractional base saturation. This is permissible because each component is a fraction on a chemical basis.
- Atom percent abundance of a stable isotope (e.g., ^{15}N, ^{18}O). This is determined on a mass basis.

Parts per Thousand

The term *parts per thousand*, used in some mineralogy and oceanography references, is acceptable. This term is widely accepted for reporting isotope ratios relative to a standard and is dimensionless. Its symbol is ‰.

Parts per Million

Parts per million (ppm) is an ambiguous term. To avoid ambiguity, authors are required to use preferred or acceptable SI units. Depending on the type of data, authors could use $\mu L\ L^{-1}$, $mg\ L^{-1}$, or $mg\ kg^{-1}$ in place of parts per million. The exception to the use of ppm is when associated with nuclear magnetic resonance (NMR) measurements. Parts per million is the official term used to express the relative shift of a NMR line of a given nucleus from the line associated with the standard for that nucleus. The term is dimensionless.

Cotton Fiber

Official standards for cotton staple length are given in terms of inches and fractions of an inch, generally in gradations of thirty-seconds of an inch. Stapling is done by a classer in comparison with staple standards. Measurement by instrument has shown unequal increments between consecutive staples in these standards. Because the classer is the authority on length, these unequal increments have been maintained. When staple length is determined by a classer, it may be reported as a code number, with the code being the number of thirty-seconds of an inch called by the classer.

Instrument measurements are preferable in experimental work because of equal incremental differences between successive fiber lengths. Report these values using appropriate SI units (Table 7–5). Fiber fineness determined by the micronaire instrument should be reported as *micronaire reading*.

Recommended Units and Conversion Factors

Tables of recommended units (Table 7–5) and conversion factors (Table 7–6) are included to aid in the use of SI units. See also Thompson and Taylor (2008, Appendix B).

TABLE 7–5 Preferred (P) and acceptable (A) units for other quantities.

Quantity or rate	Application	Unit	Abbreviation
Angle	X-ray diffraction pattern	radian (P)	θ
		degree (A)	°
Area	land area	square meter (P)	m^2
		hectare (A)	ha
	leaf area	square meter	m^2
	surface area of soil	square meter per kilogram	$m^2\ kg^{-1}$
Interatomic spacing	crystal structure	nanometer (P)	nm
		Angstrom (A)	Å
Bulk density	soil bulk density	megagram per cubic meter (P)	$Mg\ m^{-3}$
		gram per cubic centimeter (A)	$g\ cm^{-3}$
Electrical conductivity [a]	salt tolerance	siemen per meter	$S\ m^{-1}$
Elongation rate	plant	millimeter per second (P)	$mm\ s^{-1}$
		millimeter per day (A)	$mm\ day^{-1}$
Ethylene production	N_2–fixing activity	nanomole per plant per second	$nmol\ plant^{-1}\ s^{-1}$
Extractable ion	soil, mass basis	centimole per kilogram (P)	$cmol\ kg^{-1}$
		milligram per kilogram (A)	$mg\ kg^{-1}$
	soil, volume basis	mole per cubic meter (P)	$mol\ m^{-3}$
		gram per cubic meter (P)	$g\ m^{-3}$
		centimole per liter (A)	$cmol\ L^{-1}$
		milligram per liter (A)	$mg\ L^{-1}$
Fertilizer rate	soil	gram per square meter (P)	$g\ m^{-2}$
		kilogram per hectare (A)	$kg\ ha^{-1}$
Fiber strength	cotton fiber	kilonewton meter per kilogram	$kN\ m\ kg^{-1}$
Flux density	heat flow	watt per square meter	$W\ m^{-2}$
	gas diffusion	mole per square meter per second (P)	$mol\ m^{-2}\ s^{-1}$
		gram per square meter per second (A)	$g\ m^{-2}\ s^{-1}$
	water flow	kilogram per square meter per second (P)	$kg\ m^{-2}\ s^{-1}$
		cubic meter per square meter per second (A)	$m^3\ m^{-2}\ s^{-1}$
Gas diffusivity	gas diffusion	square meter per second	$m^2\ s^{-1}$
Grain test weight	grain	kilogram per cubic meter	$kg\ m^{-3}$
Growth rate	plant growth	gram per square meter per day	$g\ m^{-2}\ day^{-1}$
Hydraulic conductivity	water flow	kilogram second per cubic meter (P)	$kg\ s\ m^{-3}$
		cubic meter per second per kilogram (A)	$m^3\ s^{-1}\ kg^{-1}$
		meter per second (A)	$m\ s^{-1}$
Ion transport	ion uptake	mole per kilogram (of dry plant tissue) per second	$mol\ kg^{-1}\ s^{-1}$
		mole of charge per kilogram (of dry plant tissue) per second	$mol_c\ kg^{-1}\ s^{-1}$
Leaf area ratio	plant	square meter per kilogram	$m^2\ kg^{-1}$
Length	depth, width, and height	meter (P)	m
		centimeter (A)	cm
		millimeter (A)	mm
Magnetic flux density	electronic spin resonance (ESR)	tesla	T
Nutrient concentration	plant	millimole per kilogram (P)	$mmol\ kg^{-1}$
		gram per kilogram (A)	$g\ kg^{-1}$
Photosynthetic rate	CO_2 amount of substance flux density (P)	micromole per square meter per second (P)	$\mu mol\ m^{-2}\ s^{-1}$
	CO_2 mass flux density (A)	milligram per square meter per second (A)	$mg\ m^{-2}\ s^{-1}$
Precipitation	rainfall	millimeter	mm
Radioactivity	nuclear decay	becquerel (P)	Bq
		curie (A)	Ci

TABLE 7–5 Continued

Quantity or rate	Application	Unit	Abbreviation
Resistance	stomatal	second per meter	$s\ m^{-1}$
Soil texture composition	soil	gram per kilogram (P)	$g\ kg^{-1}$
		percent (A)	%
Specific heat	heat storage	joule per kilogram per kelvin	$J\ kg^{-1}\ K^{-1}$
Thermal conductivity	heat flow	watt per meter per kelvin	$W\ m^{-1}\ K^{-1}$
Transpiration rate	H_2O flux density	gram per square meter per second (P)	$g\ m^{-2}\ s^{-1}$
		cubic meter per square meter per second (A)	$m^3\ m^{-2}\ s^{-1}$
		meter per second (A)	$m\ s^{-1}$
Volume	field or laboratory	cubic meter (A)	m^3
		liter (A)	L
Water content	plant	gram water per kilogram wet or dry tissue (P)	$g\ kg^{-1}$
	soil (acceptable for plants)	kilogram water per kilogram dry soil [or plant matter] (P)	$kg\ kg^{-1}$
		cubic meter water per cubic meter soil [or plant matter] (A)	$m^3\ m^{-3}$
Wave number	infrared (IR) spectroscopy	reciprocal centimeter	cm^{-1}
Yield	grain or forage yield	gram per square meter (P)	$g\ m^{-2}$
	mass of plant or plant part	kilogram per hectare (A)	$kg\ ha^{-1}$
		megagram per hectare (A)	$Mg\ ha^{-1}$
		tonne per hectare (A)	$t\ ha^{-1}$
		gram (gram per plant or plant part, such as kernel)	g ($g\ plant^{-1}$ or $g\ kernel^{-1}$)

[a] The term *electrolytic conductivity* has been substituted for electrical conductivity by the International Union of Pure and Applied Chemistry (IUPAC). Use of the SI term electrolytic conductivity is permissible but not mandatory in ASA, CSSA, SSSA publications.

Chapter 8. Journal Procedures

GENERAL PROCEDURES

All ASA, CSSA, SSSA journals are submitted via an online submission service and undergo peer review. Each journal has an online instructions page, where authors can find up-to-date information on the journal's scope and paper types, as well as submission information. Authors can access the journal instructions via this page: https://www.agronomy.org/publications/journals.

All papers, whether invited or volunteered, are subject to review. After submission, the editor checks the manuscript for scope and general clarity. If the manuscript fits the scope of the journal, the manuscript enters the review process.

Authors asked to revise a paper are given a certain number of days to complete the revision (which varies by journal and type of revision, major or minor), after which time the paper is subject to rejection by the editor. Once a paper is accepted, headquarters staff oversee its production (copyediting, typesetting, proofs) and publication.

See the section "Anonymous Review" in Chapter 1 for information on special preparations required for submitting papers to ASA, CSSA, and SSSA journals. Papers not prepared according to this format will be returned to authors for revision before the paper will be reviewed.

Manuscripts that are rejected by a journal may be resubmitted after revision to the same or another ASA, CSSA, or SSSA journal.

See the document "ASA-CSSA-SSSA Editorial Policies" online for information on the decision appeals process.

AGRONOMY JOURNAL

Agronomy Journal (AJ) is published by ASA and is the official publication of ASA. Papers submitted to AJ undergo a double-anonymous review process.

AJ publishes original research in agriculture, natural resource sciences, soil science, crop science, agroclimatology, agronomic modeling, production agriculture, and instrumentation.

Manuscripts are submitted to AJ via its online submission system. For further details, see its online instructions to authors. The editor assigns the manuscript to a technical editor on the basis of the subject matter. The technical editor, in turn, assigns the manuscripts to an associate editor, who obtains a minimum of two reviews. The associate editor recommends acceptance or rejection of the paper to the technical editor, who makes the final decision and notifies the author.

CROP SCIENCE

Crop Science (CS) is published by CSSA and is the official publication of CSSA. Papers submitted to CS undergo a single-anonymous review process.

CS publishes research in crop breeding and genetics, crop physiology, and crop production and is a critical outlet for articles describing plant germplasm collections and their use.

Contributions to CS are submitted via its online submission system. See its online instructions to authors for further details. The editor assigns the manuscript to a technical editor on the basis of the subject matter. The technical editor, in turn, assigns the manuscript to an associate editor, who obtains a minimum of two reviews. The associate editor recom-

mends acceptance or rejection of the paper to the technical editor, who makes the final decision and notifies the author.

SOIL SCIENCE SOCIETY OF AMERICA JOURNAL

Soil Science Society of America Journal (SSSAJ) is published by SSSA and is the official publication of SSSA. Papers submitted to SSSAJ undergo a double-anonymous review process.

SSSAJ publishes basic and applied soil research in soil chemistry, soil physics, soil pedology, and hydrology in agricultural, forest, wetlands, and urban settings SSSAJ supports a comprehensive venue for interdisciplinary soil scientists, biogeochemists, and agronomists.

Manuscripts are submitted to SSSAJ via its online submission system. For further details, see its online instructions to authors. The editor assigns each manuscript to the technical editor supervising the topic area in which the paper will be reviewed. The technical editor then assigns the manuscript to an associate editor according to field of specialization. The associate editor obtains a minimum of two reviews. Associate editors have the authority to accept manuscripts for publication. Technical editors make the decision to reject manuscripts.

AGRICULTURAL & ENVIRONMENTAL LETTERS

Agricultural & Environmental Letters (A&EL) is an open-access journal published by ASA, CSSA, and SSSA. Papers submitted to A&EL undergo a single-anonymous review process.

A&EL publishes communications-length, broad-reaching, transformative, and timely articles on major scientific, policy, and economic issues that span the entire range of the agricultural and environmental sciences.

Manuscripts are submitted to A&EL via its online submission system. For further details, see the online instructions to authors. All papers, whether invited or volunteered, are subject to review. The editor assigns the manuscript to a technical editor on the basis of subject matter. The technical editor, in turn, assigns the manuscripts to an associate editor, who obtains a minimum of two reviews. The associate editor recommends acceptance or rejection of the paper to the technical editor, who makes the final decision and notifies the author.

AGROSYSTEMS, GEOSCIENCES & ENVIRONMENT

Agrosystems, Geosciences & Environment (AGE) is an open-access journal published by ASA and CSSA. Papers submitted to AGE undergo a single-anonymous review process

AGE published studies limited in geography or time, confirmatory articles, and reports of negative results, focusing on all aspects of agriculture, plant, environmental, and soil sciences.

Contributions to AGE are submitted via its online submission system. For further details, see its online instructions to authors. The editor assigns each manuscript to a senior editor on the basis of the subject matter. The senior editor, in turn, assigns the manuscript to an associate editor, who obtains a minimum of two reviews. The associate editor recommends acceptance or rejection of the paper to the senior editor, who in turns makes the final decision and notifies the author.

CROP, FORAGE, & TURFGRASS MANAGEMENT

Crop, Forage & Turfgrass Management (CFTM) is published by ASA and CSSA. Papers submitted to CFTM undergo a single-anonymous review process.

CFTM covers all aspects of applied crop, forage and grazinglands, and turfgrass management. The journal serves the professions related to the management of crops, forages and grazinglands, and turfgrass by publishing research, briefs, reviews, perspectives, and diagnostic and management guides that are beneficial to researchers, practitioners, educators, and industry representatives.

Contributions to CFTM are submitted to the journal via its online submission system. See the online instructions to authors for further details. The editor assigns each manuscript to a technical editor on the basis of the subject matter. The technical editor, in turn, assigns the manuscripts to an associate editor, who obtains a minimum of two reviews. The associate editor recommends acceptance or rejection of the paper to the technical editor, who in turn makes the final decision and notifies the author.

JOURNAL OF ENVIRONMENTAL QUALITY

Journal of Environmental Quality (JEQ) is published by ASA, CSSA, and SSSA. Papers submitted to JEQ undergo a single-anonymous review process.

Contributions to JEQ address anthropogenic impacts on water, soil, and the atmosphere and pertain to some aspect of environmental quality in natural and agricultural ecosystems.

Contributions to JEQ are submitted via its online submission system. See the online instructions to authors for further details. The editor assigns each manuscript to a technical editor on the basis of the subject matter. The technical editor, in turn, assigns the manuscript to an associate editor, who obtains a minimum of two reviews. The associate editor recommends acceptance or rejection of the paper to the technical editor, who in turns makes the recommendation to the journal editor. The journal editor makes the final decision and notifies the author.

JOURNAL OF PLANT REGISTRATIONS

Journal of Plant Registrations (JPR) is published by CSSA and is the official registration publication of CSSA. Papers submitted to JPR undergo a single-anonymous review process.

JPR publishes cultivar, germplasm, parental line, genetic stock, and mapping population registrations, as well as articles characterizing accessions held within plant germplasm collection systems and descriptions of plant genetic materials.

Contribution to JPR are submitted via its online submission system. See the online instructions to authors for further details. All papers, whether invited or volunteered, are subject to review. The journal editor assigns the manuscript to an associate editor on the basis of the subject matter or crop. The associate editor obtains a minimum of two reviews and recommends to the journal editor acceptance or rejection of the paper. The journal editor makes the final decision and notifies the author.

NATURAL SCIENCES EDUCATION

Natural Sciences Education (NSE) is published by ASA. Papers submitted to NSE undergo a single-anonymous review process.

NSE covers many academic disciplines, publishing articles for educators in the areas of natural resources, plant science, entomology, animal science, ecology, and the environment. Several cooperating institutions are involved in its publication.

Manuscripts are submitted to NSE via its online submission system. For further details, see the online instructions to authors. The editor assigns the manuscript to an associate editor, who obtains a minimum of two reviews. Associate editors make their recommendations for acceptance or rejection to the journal's editor. The journal editor makes the final decision and notifies the author of the decision.

THE PLANT GENOME

The Plant Genome (TPG) is an open-access journal published by CSSA. Papers submitted to TPG undergo a single-anonymous review process.

TPG publishes advances and breakthroughs in plant genomics research, with special attention to innovative genomic applications that advance our understanding of plant biology that may have applications to crop improvement.

Manuscripts to TPG are submitted via its online submission system. See the online instructions to authors for further details. The editor assigns the manuscript to a technical editor on the basis of the subject matter or crop. The technical editor, in turn, assigns the manuscripts to an associate editor, who obtains a minimum of two reviews and recommends to the technical editor acceptance or rejection of the paper. The technical editor makes the final decision and notifies the author.

THE PLANT PHENOME JOURNAL

The Plant Phenome Journal (TPPJ) is an open-access journal published by ASA and CSSA. Papers submitted to TPPJ undergo a single-anonymous review process.

TPPJ is a transdisciplinary journal focusing on original research, interpretations, and data sets investigating all aspects of plant phenomics.

Contributions to TPPJ are submitted via its online submission system. See the online instructions to authors for further details. All papers, whether invited or volunteered, are subject to review. Papers are assigned by the editor to a technical editor on the basis of scope. The technical editor, in turn, assigns the manuscripts to an associate editor, who obtains a minimum of two reviews. The associate editor recommends acceptance or rejection of the paper to the technical editor, who makes the final decision and notifies the author.

URBAN AGRICULTURE & REGIONAL FOOD SYSTEMS

Urban Agriculture & Regional Food Systems (UA) is an open-access journal published by ASA and CSSA. Papers submitted to UA undergo a double-anonymous review process.

UA is multidisciplinary journal focusing on urban and peri-urban agriculture and systems of urban and regional food provisioning in developing, transition, and advanced economies.

Manuscripts are submitted via its online submission system. See the online instructions to authors for further details. Papers are assigned by the editor to an associate editor, who obtains a minimum of two reviews, followed by a recommendation for decision to the editor, who makes the final decision.

VADOSE ZONE JOURNAL

Vadose Zone Journal (VZJ) is an online-only open-access, continuously published journal published by SSSA. Geological Society of America is a journal cooperator. Papers submitted to VZJ undergo a single-anonymous review process.

VZJ publishes interdisciplinary research and assessments of the vadose zone, the portion of the critical zone that comprises the earth's critical living surface down to groundwater.

Manuscripts are submitted to VZJ via its online submission system. For further details, see the online instructions to authors. The editor assigns the paper to a co-editor, who in turn assigns the paper to an associate editor, who obtains a minimum of two reviews . The associate editor recommends acceptance or rejection of the paper to the co-editor, who makes the final decision to accept or reject the paper.

Chapter 9. Books and Other Publications

In addition to journals, ASA, CSSA, and SSSA publish Agronomy Monographs, the SSSA Book Series, the ASA, CSSA, and SSSA Special Publication Series, other books, educational materials, multimedia, glossaries, and miscellaneous publications. Development of new publications is handled by the ASA, CSSA, SSSA Book and Multimedia Publishing Committee.

SERIES

Agronomy Monographs

A monograph is a detailed, scholarly treatise written by experts on a single topic.

SSSA Book Series

A book in the SSSA Book Series is a detailed, scholarly treatise written by experts on a single topic.

Methods of Soil Analysis

The *Methods of Soil Analysis* books, published by SSSA, are a staple in labs and soil science departments. As new methods are written, they are initially published as individual articles on the *Methods of Soil Analysis* web page, as part of the *Soil Science Society of America Journal*. These method articles may be eventually included in a future volume of the *Methods of Soil Analysis* book series.

Special Publication Series

Special Publications often result from symposia on timely topics but may also be developed from an idea for a specific topic not associated with a symposium.

OTHER BOOKS

The subject matter of other books published by the Societies includes any topic within the publishing goals of the Societies. Generally, topics cover a broader aspect of a particular subject than a Special Publication. Appropriate book projects also include audience-specific publications such as textbooks and professional guides.

MULTIMEDIA

The Societies encourage proposals for books that include complementary multimedia materials. The Societies also publish stand-alone multimedia publications, the subject matter of which includes any topic within the publishing goals of the Societies

DUTIES OF CHAPTER AUTHORS

Authors are responsible for preparing and submitting (a) detailed chapter outlines, (b) a first draft of the manuscript, and (c) a final draft of the manuscript incorporating all changes requested by the editor. Authors are also responsible for correcting proofs.

Authors must secure and submit to the editor written permission from the owners to use any copyrighted material, including figures published elsewhere (see Chapter 10). Correspondence from publishers granting permission should be forwarded to the book editor.

Manuscripts should be submitted via the online submission system according to deadlines agreed upon with the editor. The editor may replace authors who do not meet deadlines or who provide unsatisfactory manuscripts.

Authors should prepare complete, up-to-date, definitive chapters covering the assigned subject matter. They are responsible for the interpretation they place on the published literature and should make critical analyses of reported research results. Authors should obtain in-house institutional or agency reviews of their chapters and institutional clearance before submitting manuscripts. Chapters are peer reviewed.

Authors are responsible for the costs involved in preparation of their manuscripts, including illustrations. They must agree that material in the manuscript will be published first by the Society(ies) and that the Society(ies), as publisher(s), will control its subsequent distribution via transfer of copyright (see Chapter 10).

Authors should use this manual as the official guide for preparing the manuscripts. The editor should inform authors of any special procedures to ensure uniformity in style of writing for text, units of measurements, scientific names, literature references, illustrations, and other details.

STYLE

The standard journal article format outlined in Chapter 1 is usually not used in other publications, but certain sections, such as references, follow the same format as for journal articles. Book editors may determine their own preferences, but manuscripts generally follow the same scientific and editorial requirements as journal articles, as should tables and figures.

When a project is nearing completion, authors should contact the books manager for assistance in submitting the final materials for production. The following is a checklist for submission:

- Indicate a corresponding author for each chapter, and provide a complete list of contact information.
- Submit chapter text and tables in Microsoft Word.
- Include all figure captions and tables after the text of each chapter.
- Supply all figures when submitting each chapter. Whenever possible, authors should supply figures as individual files. Make all type and line thicknesses large enough to withstand reduction to a final figure size of about 11 by 17 cm (~4 1/4 by 6 1/2 inches). Resolution should be 300 dpi for photos and 600 dpi for line art. Check the final files to verify the quality and legibility. Contact Headquarters staff for the latest file preferences.
- Provide scientific names, with authorities, for all crops and other organisms mentioned; identify soils; provide chemical names for all pesticides (see Chapter 3); and supply a list of preferred abbreviations if desired.

Chapter 10. Copyright and Permission to Publish

To comply with the provisions of the US Copyright Act of 1976 (P.L. 94-553), ASA, CSSA, and SSSA handle copyright and permissions in the following ways.

1. A Permission to Publish and Republish statement is used when the Societies do not intend to copyright an individual article in a publication.
2. A Transfer of Copyright form is used for publications where the individual articles are copyrighted by ASA, CSSA, and/or SSSA. Details of the transfer agreement are given on the form.

For journal articles, copyright is addressed at the time of acceptance via a license agreement form. The permission to publish and republish statement is part of the online submissions process. The specific license may depend on whether the author(s) are a US government employee, an employee of certain non-US governments, or a nongovernment author. Generally, work done by government employees on government time is in the public domain and cannot be copyrighted; the form certifies how the work was done. All authors of an article must be US government employees at the time the work was done for the article to be in the public domain in the United States. Authors of accepted works receive instructions for signing their article license, which includes a section on copyright ownership. For more information on understanding copyright and licensing, see https://authorservices.wiley.com/author-resources/Journal-Authors/licensing/index.html.

The copyright law also requires that permission be obtained to use copyrighted material that was published elsewhere. It is the author's responsibility to obtain permission from the owner of material not in the public domain. Correspondence should be sent to the appropriate copyright holder requesting permission. The permission statement(s) should be sent to headquarters to become part of the manuscript documentation.

Many of our journals are open access. For our non-open access (hybrid) journals, authors may make their articles open access for an additional charge, as noted in the journal's online instructions to authors.

For more information on permissions, see https://acsess.onlinelibrary.wiley.com/usage-permissions.

Appendix A. Online Resources

NOMENCLATURE: PLANTS, PESTS, SOILS, AND CHEMICALS

Animal index by species name
www.animalinfo.org/spec_ind.htm
APS fungal, bacterial, and viral disease search by plant species
https://www.apsnet.org/edcenter/resources/commonnames/Pages/default.aspx
Common names of insects database
https://www.entsoc.org/common-names
Chemical name lists and databases
http://chembiofinder.cambridgesoft.com
www.alanwood.net/pesticides
Composite list of weeds
https://wssa.net/wssa/weed/composite-list-of-weeds/
http://www.wssa.net/Weeds/ID/PhotoGallery.htm
Entomological taxa and field guide
https://texasinsects.tamu.edu/
GRIN fungal database site
https://nt.ars-grin.gov/fungaldatabases/
International Committee on Taxonomy of Viruses
https://talk.ictvonline.org/
International Plant Names Index
https://www.ipni.org/
Prokaryotic nomenclature up-to-date
https://www.dsmz.de/bacterial-diversity/prokaryotic-nomenclature-up-to-date.html
USDA National Official Soil Series Descriptions
https://soilseries.sc.egov.usda.gov/osdname.aspx
USDA National Plant Germplasm System (GRIN)
https://www.grin-global.org/
USDA-NRCS Plants Database
https://plants.usda.gov
USDA plant taxonomy, GRIN database of crop registrations & PVPs
https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysimple.aspx

PATENTS AND PLANT VARIETY PROTECTION

U.S. Patents, including plant patents: https://www.uspto.gov/patents
U.S. Plant Variety Protection: https://www.ars-grin.gov/PVP

REFERENCES

Acronyms and abbreviations: www.acronymfinder.com
Merriam-Webster OnLine dictionary: https://www.merriam-webster.com/

SI AND UNIT CONVERSION

Metric Internet links: https://www.nist.gov/pml/weights-and-measures/metric-conversion-software

National Institute of Standards and Technology reference on constants, units, and uncertainty: http://physics.nist.gov/cuu
Online conversions: www.onlineconversion.com

SOCIETY AND JOURNAL LINKS

Publication information
- https://acsess.onlinelibrary.wiley.com/
- https://www.agronomy.org/publications
- https://www.crops.org/publications
- https://www.soils.org/publications

ASA, CSSA, and SSSA International Annual Meetings
- https://www.acsmeetings.org/

CSSA Glossary of Crop Science Terms
- https://www.crops.org/publications/crops-glossary

SSSA Glossary of Soil Science Terms
- https://www.soils.org/publications/soils-glossary

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