

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 devising 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., Dystrochrepts, Fragiudalfs, Medisapristis, 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: $\mu\text{mol m}^{-2} \text{s}^{-1}$.
- *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.
- *CO₂ 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: $\mu\text{mol cm}^{-2} \text{s}^{-1}$. (Use this term instead of *net CO₂ 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/fungalatabases/> 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, germplasm, 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 *HindIII* (for enzyme III from strain d of *H. influenzae*) or *BamHI* (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, NH₄, NO₃, SO₄, and PO₄). 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 (\pm).
- 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).