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FORUM

Agronomy, Soils, and Environmental Quality

A call toward a consistent terminology of “cover crops” in agroecological literature

Jay Ram Lamichhane¹  | Wopke van der Worf² | Lionel Alletto¹ |
Humberto Blanco-Canqui³ 

¹University of Toulouse, Toulouse INP, EIP, INRAE, AGIR, Castanet-Tolosan, France

²Centre for Crop Systems Analysis, Wageningen University, Wageningen, The Netherlands

³Department of Agronomy and Horticulture, University of Nebraska Lincoln, Lincoln, Nebraska, USA

Correspondence

Jay Ram Lamichhane, University of Toulouse, Toulouse INP, EIP, INRAE, AGIR, Castanet-Tolosan, France.
Email: jay-ram.lamichhane@inrae.fr

Abstract

Cover crops (CCs) are increasingly recognized for their multifunctionality in provisioning, regulating, and supporting ecosystem services. CCs are characterized by different functional groups, which deliver distinct benefits, such as N fixation, nutrient scavenging, or pest suppression. Research on CCs has expanded rapidly over recent decades, yet this growth has also been accompanied by significant semantic inconsistencies in the terminology used to describe CCs, including terms such as “green manure,” “catch crops,” “trap crops,” “service plants,” “service crops,” “living mulch,” and “companion plants.” This variability is more than linguistic. It hinders literature searches, biases meta-analyses, impedes standardization, complicates policy development, and obstructs effective cross-disciplinary collaboration and knowledge transfer. Furthermore, terminological ambiguity creates inefficiencies in research and challenges for educational and algorithmic tools. To address these issues, we argue for harmonization in CC terminology, proposing that the phrase “cover crops” be systematically included in titles, abstracts, or keywords of all CC publications while allowing complementary terms to highlight specific functions of CCs. Greater consistency in language will enhance the clarity, comparability, and impact of CC research, supporting both scientific advancement and practical implementation of CCs in agroecological systems.

Cover crops (CCs) have re-emerged as a potential tool to provide many provisioning, regulating, and supporting services (Blanco-Canqui et al., 2015; Lamichhane & Alletto, 2022; Schipanski et al., 2014). CCs are grouped according to their dominant ecological functions or traits, namely, functional groups. All CCs are multifunctional (Table 1), but some CCs provide specific services (Schipanski et al., 2014). For example, a valued function of legume CCs is N fixation and contribution to N supply (supporting service), while

grass CCs are mainly valued for scavenging nutrients and thus reducing nutrient leaching (regulating services). Crucifers are, among other things, valued for providing pest and pathogen control (regulating services).

A search in Web of Science reveals that CC research has increased exponentially in recent decades, with over 794 articles published in the literature in 2024, compared to only 70 articles in 2000 and eight in 1980. This striking increase in the number of articles published in recent years and excitement about CC research also resulted in an important and often overlooked inconsistency in the use of terms surrounding

Abbreviation: CC, cover crop.

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CCs in scientific literature. Indeed, CCs are inconsistently defined and are frequently conflated with other terms, including “green manure” (Lou et al., 2024), “catch crops” (Valkama et al., 2015), “trap crops” (Shelton & Badenes-Perez, 2006), “service crops” (Garcia et al., 2018), “service plants” (Moreau et al., 2025), “living mulch” (Bhaskar et al., 2021), and “companion plants” (Verret et al., 2017; Table 2). This semantic variability extends beyond mere linguistic curiosity. It carries significant implications for the comparability of research findings among studies, the design of policy frameworks, and the practical implementation of agroecological principles. The use of different terms or phrases could dilute the true meaning and implications of CCs. Indeed, some of the terminology refers only to one or a few services from CCs. For example, the use of “catch crops” does not reflect the role of CCs in managing weeds. Here, we aim to draw attention to these issues and call for the use of consistent wording while publishing CC research.

Core Ideas

- Cover crops (CCs) have re-emerged as a potential tool to improve or maintain soil ecosystem services.
- The number of articles published on CCs has exponentially increased in recent years.
- The terminology used to describe CCs is inconsistent.
- This inconsistency is disadvantageous to the research and implementation of CCs.
- A need exists to harmonize CC terminology in all publications.

Using different terminologies to refer to the same concept in scientific literature can lead to six major disadvantages, as summarized below.

TABLE 1 Key services provided by cover crops.

General service	Specific service	References
Provisioning	Biomass for livestock	(Blanco-Canqui et al., 2023)
	Biomass for biofuel/bioenergy	(Yang et al., 2023)
Regulating	Pest, disease, and weed management	(Moreau et al., 2025)
	Carbon cycling	(McClelland et al., 2021)
	Climate regulation (e.g., increase in albedo)	(Lugato et al., 2020)
	Pollinator support	(Mallinger et al., 2019)
Supporting	Soil erosion control	(Blanco-Canqui et al., 2015)
	Soil compaction alleviation	(Zhang et al., 2024)
	Nutrient cycling	(Scavo et al., 2022)
	Water quality improvement	(Christianson et al., 2021)
	Soil health improvement	(Obour et al., 2021)
	Soil productivity	(Marcillo & Miguez, 2017)

Note: The same cover crops can provide multiple services.

TABLE 2 Key terms used to define cover crops in scientific literature, focus, and the number of publications (Web of Science, Accessed on August 9, 2025).

Term	Definition/focus	Number of publications
Green manure	Denotes crops grown for their biomass, which is then incorporated into the soil to increase organic matter and nutrient cycling.	5054
Catch crops	Refers to plants that capture residual nutrients—especially nitrogen—to prevent leaching, often after the main crop is harvested.	1062
Trap crops	Denotes plants that attract and concentrate insect pests or pathogens away from the cash crop.	566
Living mulch	Refers to plants grown to improve weed and erosion control.	490
Companion plants	Indicates plants that are grown simultaneously with a cash crop (grown for its yield) to provide benefits such as pest suppression and attraction of beneficial organisms.	250
Service plants	Denotes plants delivering pollinator support and biological pest regulation services (pest <i>sensu lato</i>).	171
Service crops	Refers to plants delivering multiple services depending on the cash cropping system.	81

- Hindrance to literature searches. This is especially true when aimed at systematic reviews and meta-analyses. This is because inconsistent terminology makes it difficult to find all relevant studies in literature databases. It may lead to incomplete reviews, biased meta-analyses, or missed insights due to fragmented or overlooked research. Indeed, some of the published meta-analysis manuscripts about CCs did not, unfortunately, include all CC articles because their search terms only included “cover crops” or “cover crop.” The lack of terminological precision dilutes the interpretive power of the literature and complicates the development of regionally appropriate agronomic recommendations. An inclusion of all terminologies such as “CCs,” “green manure,” “catch crops,” “trap crops,” “service crops,” “service plants,” “living mulch,” and “companion plants” may alter the conclusions made in previous CC reviews or meta-analysis manuscripts using only the phrases “cover crops” or “cover crop” (Table 2).
- Barriers to standardization and consensus. In a given scientific field, precise terminologies and definitions matter (especially in medicine and chemistry), and divergent terminology undermines the development of shared standards and guidelines. This can affect policy-making and technological development.
- Obstacles to cross-disciplinary collaboration. Different fields may use distinct terms for the same concept, creating communication barriers between disciplines. This limits the integration of knowledge and impedes collaborative research efforts.
- Duplication of effort. Researchers may unknowingly replicate work already done under a different name, wasting time and resources. A lack of awareness of related findings under alternate terms slows progress and innovation.
- Challenges in education and knowledge transfer. Teaching becomes more difficult when multiple terms with overlapping meanings are used interchangeably and inconsistently. Students and new researchers may struggle to grasp core concepts due to terminological ambiguity.
- Limitations in algorithmic and machine learning applications. Natural language processing tools and AI systems may fail to link synonymous terms, limiting their ability to aggregate, summarize, or analyze scientific data effectively. This affects automated literature reviews, semantic search, and knowledge extraction.

Coining a new term to define CCs, based on their only one function, is not very judicious because the same CC delivers many services (Table 1). While we do not advocate “a one-size-fits-all term and definition,” we propose that the term “cover crops” be included systematically in the title, abstract, or keywords of all publications about CCs, while other terms could still be used in the paper, if desired, to emphasize particular functions. For instance, catch crops can

be used to stress the role of CCs in preventing N leaching, while green manure could stress the value of CCs for building soil organic matter via biomass incorporation. Such a consistent terminology could improve clarity in both research and practice, enabling better communication among researchers, policymakers, extension agents, and farmers, as well as help overcome the drawbacks reported above. We call on researchers, journal editors, and agricultural organizations to harmonize CC terminology. Addressing this semantic inconsistency by the scientific community will advance a more precise, functional, and globally coherent understanding of agroecological practices such as CCs.

AUTHOR CONTRIBUTIONS

Jay Ram Lamichhane: Conceptualization; investigation; writing—original draft; writing—review and editing. **Lionel Wopke van der Worf:** Writing—review and editing. **Lionel Alletto:** Writing—review and editing. **Humberto Blanco-Canqui:** Investigation; writing—review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

ORCID

Jay Ram Lamichhane  <https://orcid.org/0000-0001-9780-0941>

Humberto Blanco-Canqui  <https://orcid.org/0000-0002-9286-8194>

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