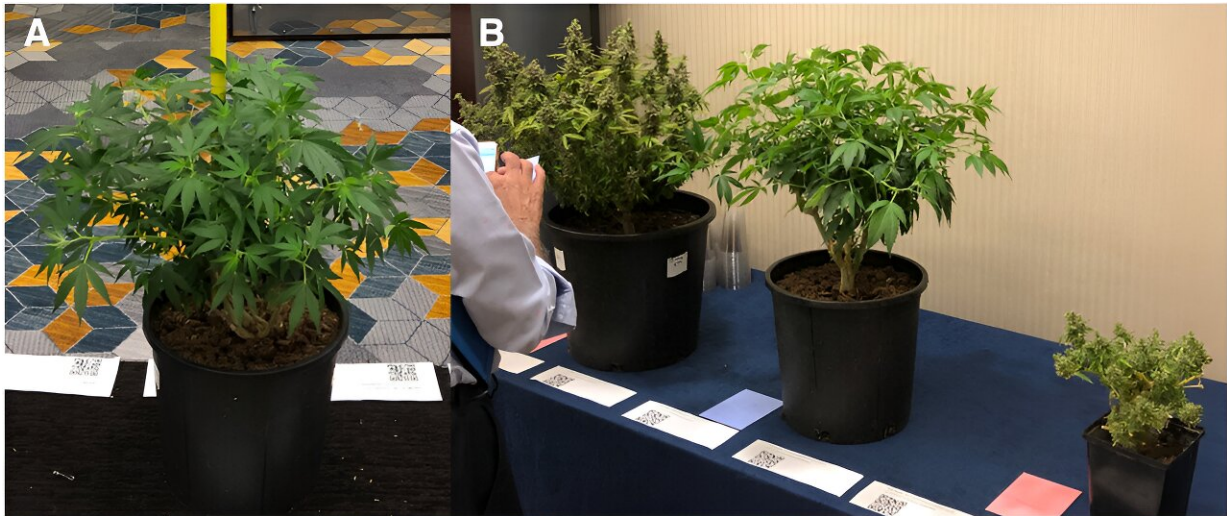


New hemp standards for research and industry

August 8 2024



Hemp plants presented to workshop participants upon arrival with questions and electronic codes to provide answers for (A) height and (B) flowering. Credit: Zachary Brym.

Hemp (*Cannabis sativa* L.) research and commercial production has recently experienced a global revival motivated by passage of laws reversing long-standing prohibitions and by development in markets.

Coordinated research efforts and public–private partnerships have begun to generate and synthesize knowledge related to plant physiology, [genetic variability](#), and [crop management](#) for [hemp](#) crops. These efforts should

include the establishment of standards, descriptions, and procedures that facilitate collaborative knowledge and discovery.

The study is [published](#) in the journal *HortScience*.

The revitalization of hemp research and industry efforts has awaited standard definitions, descriptions, and procedures related to plant morphology, physiology, and crop quality. The ASHS Hemp 2022 workshop sought consensus from participants to define attributes such as plant height, flowering time, and crop quality.

Through the workshop, the group proposed a standard for plant height and flowering time, including visual keys for reference.

The consensus definition for "plant height" was the vertical distance between the root crown and the stem node (or tip) of the apical meristem of the tallest branch. In practice, height is measured from the [soil surface](#) to the apical meristem of the highest branch above the soil, common for crop measurements of individual plants.

Participants suggested that if the tallest leaves were included in the measurement of height, the result should be termed "canopy height" rather than [plant height](#), also common for crops but for groups of plants.

The critical research-relevant determination for "flowering time" or "date of flowering," with somewhat unique flowering behavior to hemp, was defined as a [single point](#) in time marking the visible initiation of inflorescence development corresponding to "terminal flowering."

Flowering time is a critical phenological milestone used to estimate harvest timing. The relationship between flowering and harvest timing will be influenced by crop type, genetics, and environment. In controlled environments, flowering time may be manipulated with supplemental

lighting, with some time lag between lighting transition and the appearance of inflorescences.

Markets define crop quality in ways that affect research priorities and relevant features to quantify, especially in breeding programs. As a general research approach, hemp yields should be reported on a dry weight basis normalized to an agreed standard moisture content.

Some flower crops will be harvested for smokable flower, and others will be processed as total biomass. Thus, specific crop quality parameters will be measured and prioritized based on different intended uses, supply chains, or market outlets.

Efforts continue to expand the scope of methods standardization, although the features contained herein represent a first attempt at developing a minimum reporting standard for modern hemp production and processing data. Additionally, a coordinated effort to define marketing and [quality standards](#) is of critical importance to the development of the hemp industry. This requires a level of organization of the industry that has yet to be realized and could be led by the USDA if codified by federal law as it has been for well-established crops.

In the meantime, hemp professionals are encouraged to adopt these proposed standards at a minimum and to detail reported procedures in methods and metadata.

The authors propose continued review and development of hemp standards for research and industry applications to motivate collaboration and consistency during the current adoption and innovation phase for hemp production.

According to Dr. Brym, "My [research](#) on hemp was in response to the 2017 laws in Florida and the development of a responsive

Research/Extension program for the state. UF/IFAS initiated our Hemp Pilot Project in 2019 seeking to trial available genetics, develop cropping systems, and monitor economic and environmental impact."

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More information: Zachary T. Brym et al, Hemp Morphology and Physiology Standards for Research and Industry Applications, *HortScience* (2023). [DOI: 10.21273/HORTSCI17093-23](https://doi.org/10.21273/HORTSCI17093-23)

Provided by American Society for Horticultural Science

Citation: New hemp standards for research and industry (2024, August 8) retrieved 9 August 2024 from <https://phys.org/news/2024-08-hemp-standards-industry.html>

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