

Sustainable Hemp Production

Hemp is back again.

Historically, hemp was grown throughout the U.S. and used to in products like rope and canvas sails for ships, but production, use, and research were banned in 1937.

In 2014, the Farm Bill permitted pilot research programs on industrial hemp; in 2018, the Farm Bill broadly legalized hemp cultivation. As restrictions lifted, interest in hemp increased among consumers and farmers, but there was a lack of research-based information for production, processing, or marketing.

Hemp and marijuana are the same species, but hemp has less than 0.3% of the psychoactive component THC—not enough for a “high.”



Hemp has a lot of potential.

Industrial hemp is an attractive crop for many reasons:

- Hemp can be grown in a wide variety of environmental conditions.
- Hemp can be raised successfully in low-input or organic cropping systems.
- With fast growth and high biomass yields, hemp sequesters a lot of carbon.
- With deep roots, hemp has high potential to remediate contaminated soil and prevent erosion.
- The stalks, which are long and fibrous, and the seeds, which are high in protein and healthy oils, can be used in a wide variety of ways. In addition, unfertilized female hemp flowers can be produce CBD, which is marketed in many ways.



Researchers at land-grant universities nationwide are working together to provide much-needed information about hemp cultivation and use.

In order to meet demand and make hemp production viable, farmers need more information about appropriate variety selection, optimal agronomic practices, pest and disease management, production economics, and markets.

Since 2019, this team of researchers has collaborated to:

- Determine the effects of various agronomic practices and environmental conditions on hemp grain, fiber, and oil yield; hemp quality; and suitability for various uses.
- Identify genes and germplasm for traits like yield, quality, pest resistance, cold tolerance, drought tolerance, and low THC.
- Assess crop value and develop production budgets for hemp grown in different cropping systems and for different uses.

A multistate approach is critical.

This project brings together multidisciplinary researchers and Extension specialists from land-grant universities, including five historically Black land-grant institutions. Collaboration allows researchers to share resources like knowledge, seed, and germplasm and conduct research across a wider range of conditions than would be possible by a single state or institution. With the multistate approach, researchers can respond quickly to the needs of specific states, but also have a greater impact on hemp research and production at the national level.

This work supports a viable, sustainable hemp industry.

With many possible uses, broad adaptation, and potential environmental benefits, hemp could support sustainable, climate-smart agriculture and provide diversified production options to many farmers, including new and disadvantaged farmers.

Research Highlights

Evaluating Hemp Performance



Researchers developed new harmonized hemp research protocols and conducted field trials in multiple states to determine the best hemp varieties for different uses and assess tolerance to environmental conditions, pests, and diseases.

Trial results guide hemp breeding and help farmers select hemp varieties for their conditions and needs.

Breeding Hemp Varieties



Project members collected hemp samples across the country and contributed to a national repository. Researchers also investigated which genes are connected to certain traits and how expression of those genes is regulated. For example,

researchers identified a gene associated with CBD production and showed that its expression is regulated by hormones during flower development. Researchers also developed breeding tools, including molecular markers for low THC and other traits. This work helps breeders develop enhanced varieties that are adapted for different regions, resistant to disease, optimized for certain end uses, and compliant with regulations for THC levels.

Hemp Management Strategies



Studies shed light on best practices for growing, harvesting, and storing hemp. Findings give farmers more confidence about growing hemp. Understanding optimal management practices will help hemp compete with other grain crops.

Through scouting, surveys of farmers, and other methods, the team cataloged hemp pests and diseases in multiple states. This information provides a baseline for future field and greenhouse scouting and will help farmers and scientists identify and address issues before they become economically significant. Findings are also steering the development of pesticides, herbicides, and fungicides for use in hemp.

Researchers are also investigating proper storage practices for hemp grain to prevent development of off flavors and other issues.

Hemp Economics & Industry



Researchers used surveys and other data to understand the hemp industry's structure.

Project members developed a glossary of terms for standard use across the hemp industry and by government agencies.

Using results from field trials, researchers began creating local production budgets. Project members also helped the USDA's Economic Research Service produce a report on the economic viability of industrial hemp in the U.S.

This project's research has led to more standardized contracts between hemp farmers and processors or other buyers and facilitated access to crop insurance, grant programs, and credit lending for hemp farmers.

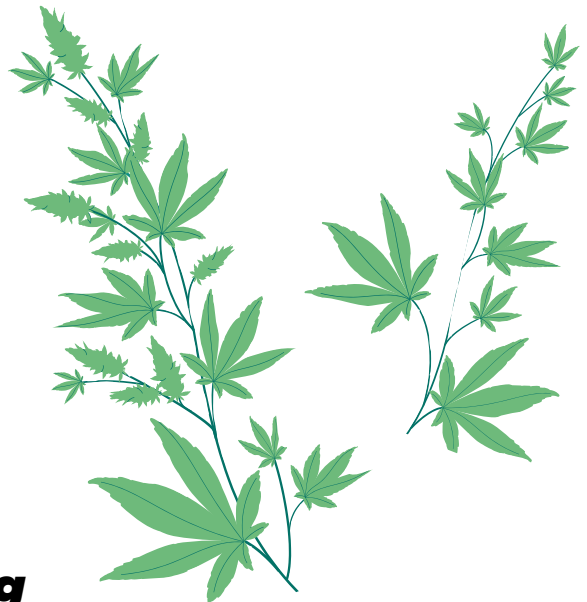
Outreach & Education



Project members produced hundreds of fact sheets, peer-reviewed publications, and other outreach and education materials that provided critical guidance for researchers, state and federal agencies, and farmers.

To help guide national funding priorities as well as research and extension activities, project members organized the National Hemp Research and Education Conference.

Researchers contributed science-based information and farmer insights to the Hemp Production Program's Final Rule, ensuring that it is compatible with continued university research.



Project Participation & Funding

S1084: Industrial Hemp Production, Processing, and Marketing in the U.S. is funded in part by the Multistate Research Fund through the USDA-NIFA and by grants to project members at the following institutions: Alabama A&M University, Auburn University, University of California, Central State University, Colorado State University, University of Connecticut, Cornell University, University of Florida, University of Illinois, Kansas State University, University of Kentucky, Kentucky State University, Louisiana State University, University of Maryland, University of Maryland- Eastern Shore, Michigan State University, University of Minnesota, Mississippi State University, Montana State University, University of Nebraska, North Carolina State University, Oregon State University, Pennsylvania State University, Purdue University, Rutgers University, Southern Illinois University, University of Tennessee, Utah State University, University of Vermont, Virginia Polytechnic Institute, Virginia State University, Washington State University, West Virginia University, University of Wisconsin, and the USDA-ARS Plant Genetic Resources Unit.

Learn more: bit.ly/S-1084

This Impact Statement was produced by the Multistate Research Fund Impacts Program, July 2023.

Learn more: mrfimpacts.org