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United States Department of Agriculture
Project Initiation

Project Data for Accession Number 1034932

Project Title

Demonstrating the yield and stress tolerance advantages of hybrid hemp, an emerging oilseed feedstock.

Project Details

Sponsoring Institution National Institute of Food and Agriculture	**Project Status** ACTIVE
Funding Source NIFA Non Formula	**Grant Year** 2026
Grant No. 2026-38624-46981	**Cumulative Award Amt.** $459,825.00
Proposal No. 2026-07921	**Multistate No.** (N/A)
Project Start Date Sep 15, 2026	**Project End Date** Sep 14, 2028
Program Code [HW] Supplemental and Alternative Crops	

Project Director

Fletcher, R.

Recipient Organization

NEW WEST GENETICS INC.

219 N TIMBERLINE RD UNIT 1

FORT COLLINS, COLORADO 805241465

Performing Department

(N/A)

Non Technical Summary

Approximately 166,000,000 acres of maize and soy are produced on US farmland annually, representing nearly 57% of all crops produced. This reliance on two crops puts farmers at risk due to 1) volatile market dynamics due to many factors which are out of their control, and 2) crop yield lossesdue to cyclical production which increases insectand disease severity and pressure. The proposed project will demonstrate the value of hybrid hemp as a new rotation crop wich provides farmers with a flexible and economically competitive cropping option that helps mitigatethe risks associated with the aforementioned factors. The major limitation to hemp adoption has been low grain yields which result in high production costs and poor supply chain economics. New West Genetics (NWG) has developed proprietary hemp hybrids that double grain yields. The goal of this multi-state collaboration is to demonstrate hybrid hemp as a new oilseed rotation crop and develop new methods for its production that improve production flexibility and land-use efficiency. This will be accomplished by three objectives:1. Determine the yield advantage of hybrid

hemp under alternative cropping cycles that enable double-cropping across diverse farming regions.2. Assess biotic and abiotic stress tolerance created by heterosis in hybrid hemp through induced drought and disease stress.3. Enhance farmer understanding of hybrid hemp as a rotation crop and strong economic potential through extension activities.These objectives will be addressed through field triald conducted in Colorado, Kansas, Illinois and North Carolina. The research addresses SAC focus areas (1.a.) by "breeding to develop superior performing alternative crop cultivars that increase productivity, profitability, and adaptation", (1.b.) "Conducting fundamental and applied research and extension activities to develop innovative planting... methods for use in production systems" and (2.a.) "Fundamental and applied research to develop production systems for industrial hemp grown for grain". Hybrid hemp will prove to be a reliable and flexible crop feedstock for existing and emerging oilseed applications.

Animal Health Component

Animal Health Component: 0%

Research Effort Categories

Basic	0%
Applied	40%
Developmental	60%

Classification

Knowledge Area (KA)	Subject of Investigation (SOI)	Field of Science (FOS)	Percent
203	1730	1020	20%
205	1730	1081	80%

Knowledge Area

[203] Plant Biological Efficiency and Abiotic Stresses Affecting Plants

[205] Plant Management Systems

Subject Of Investigation

[1730] Hemp

Field Of Science

[1020] Physiology

[1081] Breeding

Keywords

heterosis, stress tolerance, industrial hemp, hybrid crops, land-use efficiency

Goals / Objectives

This is a 2-year Integrated Research and Extension proposal for Funding Opportunity Number USDA-NIFA-OP-011756. This proposal focuses on industrial hemp and the proposed objectives directly address the following NOFO

areas of focus: "(1.a.) increase productivity, profitability, and adaptation to a range of U.S. growing environments", "(1. b.) applied research and extension activities to develop innovative planting...methods for use in production systems that include superior performing cultivars to improve input cost efficiencies and reduce producer and other supply chain participant risks" and "(2.a.) fundamental and applied research to develop production systems for industrial hemp grown for grain...including cultivar evaluation and development". The research and outreach will be conducted in Colorado, Kansas, Illinois and North Carolina by a multi-disciplinary team incorporating plant breeding, agronomy, entomology and pathology. The project will leverage the technical expertise and resources at Land Grant Universities and USDA-ARS labs in these states to assess the grain yield potential of proprietary hybrid industrial hemp created by New West Genetics (Fort Collins, CO) across a diverse range of geographies, production methods and stress from biotic and abiotic factors. The overarching goal is to demonstrate hybrid hemp as a reliable new oilseed crop option for farmers in the United States.The goals of the project are:Determine the yield advantage of hybrid hemp under alternative cropping cycles that enable double-cropping across diverse farming regions. Assess biotic and abiotic stress tolerance created by genetic resistance and heterosis in hybrid hemp through induced drought and disease stress.Enhance farmer understanding of hybrid hemp as a rotation crop and strong economic potential through extension activities.

Project Methods

Objective 1. Determine the yield advantage of hybrid hemp under alternative cropping cycles that enable double-cropping across diverse farming regions. Performance of hybrid hemp genotypes planted at alternative (non-traditional) planting dates will be assessed in trials in 2027 and 2028 conducted by NWG at the Colorado State University (CSU) Agricultural Research, Demonstration and Education Center in Fort Collins, Colorado along with sites cooperators who have provided Letters of Support at the Kansas State University (KSU, Griffin), the University of Illinois Urbana-Champaign (UIUC, Lee) and North Carolina State University (NCSU, Suchoff). As mentioned, each of these sites is in a distinct region as defined by USDA-ERS. Data will be collected on emergence/stand count, days to flower, percentage of female plants, days to maturity, height, and grain yield. Grain quality (oil, protein, etc) will be analyzed at the National Center for Agricultural Utilization Research. The goal of these trials is to understand the flexibility of hemp and its ability to create and/or fit into double-cropping production systems.The experimental design for these trials will be completely randomized complete blocks (RCBD) with four replications of 8 hybrid genotypes planted on 2 dates; the first as early as possible (February to April) and the second following a winter crop (wheat or canola) from approximately late June to mid-July. We will also include 2 dioecious genotypes planted from certified seed as checks. Thus, each experimental trial site will consist of 40 plots (10 genotypes x 4 plots). Each plot will be 7 rows wide measuring 11.2 meters in length on a 15 cm row spacing. Plots will be harvested when seed reaches physiological maturity using a plot combine.Statistical Analysis. Data will be analyzed using mixed model analysis in R (R Core Team, 2021). Replications within trials will be treated as random effects and genotypes will be treated as fixed effects. Comparisons of genotype means will be made from Least Significant Difference estimates when the F-test is considered significant ($p < 0.10$). Locations with a coefficient of variation greater than 20% will be removed. Objective 2. Assess biotic and abiotic stress tolerance created by genetic resistance and heterosis in hybrid hemp through induced drought and disease stress. The effect of heterosis on stress tolerance in hemp remains a major unanswered question. To test this, we will conduct trials of hybrid hemp cultivars and their inbred parent lines under managed stress trials focused on drought and BCTV infection. We will include hybrids of diverse genetic backgrounds and phenologies to understand the importance of the aforementioned drought tolerance strategies (escape and avoidance) along with hybrids made using genotypes demonstrated to be BCTV susceptible and tolerant as published in Hackenberg et al (2025).Objective 2a. Abiotic stress tolerance of hybrids to drought. To assess the yield advantage of hybrid hemp, we will conduct a managed drought stress trial on a diverse set of 10 hybrid cultivars and their 12 parent lines under well-watered (Yw) and drought (Yd) conditions by growing plots under a linear-move irrigation system at the Colorado State University ARDEC farm in Fort Collins, CO.The climate in Northern Colorado paired with the ARDEC irrigation scheme is ideal for managed drought trials (Fletcher et al, 2015). Irrigation will be managed so that the Yd treatment receives half of the available water of the Yw treatment. We will utilize an RCBD design with 3 replicates per genotype under each irrigation treatment. Yield sensitivity will be calculated as the difference between

the yield of a genotype in the wet environment and its yield in the dry environment (Yw - Yd). Relative yield will be calculated as a Z score to account for differences in mean yield and standard deviation between the Yw and Yd treatments. All other aspects of trial management and data analysis will be performed as described in Objective 1. Objective 2b. Biotic stress tolerance of hybrids to BCTV incidence and diversity. Plots in the Yw and Yd treatments will be used for collecting new/apical leaf tissue from 20 randomly sampled plants at the full flowering stage (approximately 50 days) for a total of 2640 samples per location (20 plants x 3 replications x 22 cultivars x 2 treatments). In addition, data will be collected on visual plant symptoms during the same time-points. Virus incidence will be assessed using ELISA. As mentioned, some of these hybrids will be derived from parents already shown to be susceptible and tolerant to BCTV, allowing us to determine the heritability and potential heterosis of the phenotype in hybrids.Statistical analysis. To determine differences in response of hemp cultivars to BCTV infection, we will analyze differences in virus incidence (% infected plants) and virus level (ELISA absorbance) using two-way ANOVA (PROC GLM) with cultivar and location as fixed effects and the interaction term. Treatment comparisons will be performed using Tukey's family error rate ($P < 0.05$). We will also examine the interaction of BCTV infection with Yw and Yd. Objective 3. Enhance farmer understanding of hybrid hemp as a rotation crop and strong economic potential through extension activities. Extension and outreach are fully integrated into our project at each step of development and execution of the objectives. All PIs will be involved in outreach and extension activities, and all will be carried out throughout the implementation of grant objectives (2027-2028). We will use the following Information Dissemination Plan:Meetings: Summer field days will be hosted in NC and KS to distribute information generated from this project as well as build the critical grower-Extension-research-industry networks. Results from this work will be shared at annual train-the-trainer Extension agent meetings, certified crop advisors meetings, and winter county production meetings in North Carolina. This work will also be shared at the annual S-1084 Hatch multistate hemp project meeting. Publications: Results from this work will be communicated via state-specific Extension factsheets, numbered publications, local popular press, and posters presented at local and national events.Online content: All content generated from this project (e.g., grower presentations, posters, fact sheets, and Extension publications) will be hosted on the NC State Extension Hemp Webportal. Additionally, project updates and highlights will be posted on NC State's hemp social media platforms.Interactive on-farm trials: We will work with growers in NC and KS to produce hybrid hemp crops of 5-10 acres under the proposed DC production cycles to demonstrate the feasibility of these approaches. NWG will provide seed and agronomy support which, along with the expertise of Professors Suchoff and Griffin, will equip our farmer collaborators with the support needed to ensure success. A field day will be held at the on-farm trials. Grain produced in these trials will be purchased from the growers and shipped for pilot scale oilseed processing tests to demonstrate the feasibility of hemp grain in crush (dehulling, cracking, flaking, and conditioning) and solvent extraction processes like those used for soy and other major oilseeds. While it has been demonstrated that solvent extraction of hempseed oil is feasible, this project will be the first pilot scale demonstration that hemp fits into a soybean-style supply chain.Evaluation: Success of project Extension efforts will be evaluated by the number of individuals reached via social media and Extension webportal site visits. Pre- and post-event surveys will be administered at all Extension activities to check grower knowledge gained and assess change in grower practices or adoption of project-related recommendations.