

S1084 Annual Meeting

Attendees (in person):

Lesley Oliver, U. Kentucky, lesley.oliver@uky.edu
Jason Griffin, Kansas State, jgriffin@ksu.edu
Kurt Thelen, Michigan State, thelenk3@msu.edu
Jeffrey Steiner, USDA-NIFA, jeffrey.steiner@nifa.usda.gov
Randy Little , Mississippi State, randy.little@msstate.edu
Shelly Thomas, James Madison U., thomas3sl@jmu.edu
Zachary Brym, U. Florida, brymz@ufl.edu
Jared Nelson, SUNY New Paltz, nelsenj@newpaltz.edu
Avat Shekoofa, U. Tennessee, ashekoof@utk.edu
Eric Walker, U. Tennessee, ewalke22@utk.edu
David Williams, U. Kentucky, david.williams@uky.edu
Jen Gilbert Jenkins, Morrisville State College, gilberjk@morrisville.edu
Larry Smart, Cornell U.- Geneva, lbs33@cornell.edu
Taylor McNamara, SUNY Morrisville, taylor.elaine07@gmail.com
John Fike, Virginia Tech, jfike@vt.edu
Christine Smart, Cornell U., [cgs14@cornell.edu](mailto:cds14@cornell.edu)
Rebecca Wilk, Cornell U., rlw284@cornell.edu
Craig Carlson, Cornell U., chc89@cornell.edu
Renyuan Mi, Cornell U., rm974@cornell.edu
Steve Briod Amoor, Cornell U., sb843@Cornell.edu
Jay Noller, Oregon State U., jay.noller@oregonstate.edu
Jamie Crawford, Cornell U., jln15@cornell.edu
Kevin Meyers, Cornell U., klm25@conrell.edu
Jen Starr, Cornell U., jkk26@cornell.edu
Jaime Cummings, Cornell U., jc2246@cornell.edu
Jacob Toth, Cornell U., jat363@cornell.edu
Julie Hansen, Cornell U., jch14@cornell.edu
Steve Wood, Research Foundation for SUNY, steve.wood@rfsnuy.org

(Joining remotely):

Helen Chen UC Riverside, helen.chen@ucr.edu
Jeff Skousen- U West Virginia, Jeff.Skousen@mail.wvu.edu
Bob Hutmacher- UC Davis, rbhutmacher@ucdavis.edu
Gerry Berkowitz, U Conn, gerald.berkowitz@uconn.edu
Jeanine Davis, NC State, jeanine_davis@ncsu.edu
Ted Gauthier, LSU, TGauthier@agcenter.lsu.edu
Heather Darby, U Vermont, Heather.Darby@uvm.edu

Following introductions of the attendees, the group was welcomed by Dr. Jan Nyrop, Director of the NY State Ag Experiment Station and Cornell University Ag Experiment Station. Then Dr. David Williams, chair of the proposal writing committee, called the meeting to order and provided and brief overview of

the day's agenda. Comments were then provided by the NIFA representative and Administrative Advisor for S1084 (comment summarized below).

Jeff Steiner, NIFA- Provided some background about the current focus on fiber and grain; highly dependent on the Farm Bill- each state will have to continue due diligence in working with state and university officials. Keep a supply chain focus- there are lots of potential uses and products, but there are larger issues related to the economics and supply chains. Have to use the resources available wisely. Validation of industry claims will also be key.

USDA resources- \$200M is programs that could be relevant to IH so critical to put together compelling and well devised. Proposals will have to compete with those focused on other commodities. :

AFRI Foundational Programs (Plant Health and Production and Plant Products; Bioenergy, Natural Resources and Environment; Food Safety, Nutrition & Health; Animal Nutrition, Growth and Lactation), IR-4, Crop Protection & Pest Mgmt Program (one already funded), Conservation Innovation Grants, SARE, eExtension

Lesley Oliver, Administrative Advisor- Provided an overview of joining the project in NIMSS and completing a Project Initiation in REEport in accordance with individual land-grant policies. Reminded those who have not yet done the Project Initiation that the following language needs to be included along with a specific description of how your project complies with the specific hemp laws of your state, or does not violate the federal law in the absence of a state pilot program.

Certification Regarding Industrial Hemp: When signing the application (electronic submission through Grants.gov), the Authorized Organizational Representative is providing certification that if they grow, cultivate, or market industrial hemp under the proposed project, the organization will comply with all terms and conditions set by the applicant's State agency regarding industrial hemp growth, cultivation, and marketing. For this purpose, the term "industrial hemp" includes the plant Cannabis sativa L. and any part or derivative of such plant, including seeds of such plant, whether growing or not, that is used exclusively for industrial purposes (fiber and seed) with a tetrahydrocannabinols concentration of not more than 0.3 percent on a dry weight basis. The term "tetrahydrocannabinols" includes all isomers, acids, salts, and salts of isomers of tetrahydrocannabinols.

Next, David Williams, chair of the proposal writing committee provided an overview of the project's leadership structure and lead a discussion regarding the election of officers. Briefly, the group will elect officers serving as Chair, Vice-Chair, and Secretary. Each officer will serve a two-year term, with the Vice-Chair automatically moving up to the position of Chair after two years.

Officer nominations were made and accepted by the members as follows:

Chair: Larry Smart, Cornell

Chair Elect: John Fike, Virginia Tech

Secretary- Heather Darby, Vermont

Participant reports:

Connecticut- In process of getting a pilot program established with the State Dept of Ag. Hired an attorney to do the legislation. Submitted for 2019 session. Connecticut Farm Bureau and State are supportive; many dairy farmers interested in alt crops & diversification (alfalfa hard to grow). There are proposals to deal with fiber processing infrastructure. Surrounding states are already growing seed for CBD, so fairly limited interest among investors in CT. Gerry working on hemp couple of years and has had 12 undergraduate independent research projects- reported at Am Society Plant Bio from 8 UG co-authors. Has DEA controlled substance registration and planning to expand work looking at pathogens in controlled environment ag (downy mildew, multiple species? Powdery mildew also common) looking at genes being upregulated on plants with downy; interested in molecular biology related to phytochemistry, pathogen & insect resistance; translating NSF funded work on cell signaling to cannabis. Currently has a 2 acre test plots on research farm. Has established a system where the growers supporting this work formed a LLC separate from the medical cannabis businesses. Going to offer a hemp horticulture course- 400 students enrolled.

West Virginia- Pilot program has been active about 3 years; only at research institutions. State Dept. of Agriculture is the control point for seeds. A co-op has been developed with the 20-30 growers in the state who have been growing (seeds of unknown origin). There is interest in looking at possibilities for reclaimed mine land remediation using hemp; have not had sufficient support to test that yet, mostly some greenhouse studies done. Fact sheets for farmers developed for converting pasture to hemp.

U Tennessee- State laws essentially reiterate the Farm Bill. Lots of grower excitement; will have spoken to over 1000 people this fall/winter at farmer meetings. Started in 2015 looking at fiber and grain. Weed control continues to be an issue. TN started this year allowing noncertified hemp genetics to be grown and the stands have been much better- geared toward high CBD production. Processors are paying by percentage point of CBD in TN- up to \$32 per pound, but some contracts go up to \$80 per pound. There are associated high labor costs (higher than tobacco). UT growing some varieties and looking at row crop scale economics. Prob 98% growers licensed are doing CBD. Plans: continuing to look at fiber and grain, phytochemicals as allowable; weed & insect control, drought tolerance/ water mgmt.; fertility & other agronomics; post harvest economics.

Side discussion- Larry Smart's group looking at plant-to-plant variation of THC content as well as the variation over the growing season. Have shown some spatial variation also.

David Williams mentioned the proficiency testing being led by Ky's Division of Regulatory Services is doing to examine variation in analysis, but complicated by interstate transfer restrictions. Duane Sinning, Colorado Dept. of Ag. is highly knowledgeable of the laws involved related to interstate transfer. Regional DEA offices overlay the state regulations and can serve as a resource for facilitating activities.

NC State- Started in 2017; pretty wide open programs without restrictions on number of growers and acres. Currently 450 licensed growers, 10,000 A; 196 registered processors. Started with focus on grain and fiber; plots under irrigation in western NC during the first year had good results. Previous harvest was impacted by hurricanes but growers continue to be optimistic. Plasticulture systems seemed to

have worked well (tobacco systems had much more difficulty than the vegetable farmers who transitioned). There are currently two products labeled in the state (fungicide & insecticide). Doing soil fertility work in conjunction with the state agronomist; expect to have assistance for growers during the critical time of transition into budding. State goes by testing at time of flowering. NC also seeing lots of variation in THC content. NC State has done a lot of outreach related to hemp. Offering a class in 2019 (already full). NC Agricultural Foundation has provided funding and putting in proposal for southern IPM. Grain & fiber work focuses on varieties; work related to phytochemicals looking at varieties and cultural practices. Have an economist coming on board.

Side discussion- Jeff Steiner of NIFA suggests that land-grants need to establish a firewall to separate time paid on federal funds from time spent on CBD related work.

Michigan State- New to an industrial hemp program; state passed law reflecting Farm Bill in 2015 but the Dept of Ag chose to not apply for DEA registration. Kurt has applied directly for registration but have not been able to get it finalized with a lot of back and forth with DEA. Indiana chose a similar path and are consulting with contacts in that state as they proceed.

Kentucky- Pilot program established since 2014. Lots of state support. State program open to commercial growers and processors as well as higher education institutions. State Dept of Ag completely administers the program which has made it easy. Across the state: 14,600 acres approved, 6700 planted. 61.5% for CBD (mostly clonal systems). Remainder mainly dual purpose (seed and chaff used for CBD), small percentage for fiber only, smaller for grain only. One certified seed producer in state. Broad number of efforts; about to release new economic models which will be on UK's hemp website (<https://hemp.ca.uky.edu/>). Collaborating with pharmacy and neurology researchers; evaluating the FDA-approved CBD for treatment of headache following stroke. Research also being conducted on seed oil chemistry- pathways, molecular biology looking at gene regulation. Mechanical harvesting research taking place in engineering. Horticulture looking at seedling vigor. Plant pathology work in absence of labeled chemicals; Nicole Gauthier discovered and is describing a new disease. Hemp feed coalition working toward approvals to test in animal feed. Other smaller colleges in the state also working on predominantly agronomics. A pollinator survey is planned for next year.

Results from fiber trials indicate that growers need 5 ton dry matter/A to be competitive with corn & soybeans. In 2018 made 5.2 tons/A with cultivar provided by Sunstrand. Worked on how best to manipulate plant populations to be optimal for fiber processing. Grain: went from 1000 lb/A to 1722 lbs/A this year with a European variety (Felina 32). Some dual-purpose trials were conducted. The next field day will be in August 2019 (had several in past but skipped 2018).

Virginia Tech- Started in 2011 before the 2014 Farm Bill. Four state universities involved in hemp under the Dept of Ag's umbrella. Changes in the state law will make it easier for producers; state law currently indicates the state itself will have a research program. Largely growing grain and fiber initially. More recently began growing varieties for other applications. VT entomologist and plant pathologist also working on this. Potentially researchable issues include looking at impact of insect pressure on grain yields. Several diseases have been identified in VA. Collaborating to work on livestock feeding research. Had challenges with importing seed that impacted planting date, so hard to do planting date comparisons. Also interested in looking at no-till vs. with tillage. There is a new specialty crops breeder who may be interested in working with hemp- seed dormancy and seed shatter are two potential

targets for improvement. There has been some talk of a fiber processor coming to VA. Some industry interest in controlled environment horticulture.

James Madison- started in 2016 (in Shenandoah Valley). No processors in Va, so most farmers are just looking at growing for experience. Doing some trials and working with farmers in multiple locations across the state. Had issues with precipitation and pressure from caterpillars that devastated the grain yields.

Oregon State- Long history of intercropping timber and Cannabis; tried to start an industrial hemp program in 1988. Legal since 2009 to grow hemp in OR. Some breeders in state have been doing so for 20 years. State legislation pushed the university to get the registration for hemp following the 2014 Farm Bill. Expect 70,000-75,000 acres to be permitted in 2019. Climate in OR means there is generally not a germination issue. The current market is focused mostly on extractable phytochemicals. State laws are very liberal and OR does not have limits on growers, producers, imported seed, etc. Interest in potentially looking at terpenes and other aromatics not just CBD.

OR State initially looking at grain and fiber as well as seed for propagation elsewhere. Previous three years the research program was moved overseas and includes studies on soil fertility (banding), row spacing, seeding method, pests, and dual harvest. Moved to on-farm trials this year. Issues to be addressed: navigating the legal framework, biomass considerations (8000 tons produced in the state over the next month; torched by most), sources of research support.

University of Florida- Zach at the Tropical Research Center serves as the State Program Coordinator for hemp. State passed industrial hemp laws in 2017. Florida Dept of Ag took about a year to set the guidelines, so UFL is still working on getting things in line to participate. UFL and FL A&M will be responsible for overseeing the pilot program. Currently no clear path for how industry will establish in the state. The law requires the universities conduct a 2 year study, report to the state, and then the state will evaluate to determine a way forward to commercialization of hemp.

Research interests at UFL include understanding the potential for hemp at the system level including understanding the potential environmental impacts, particularly related to how to operate hemp cultivation under a high potential for invasion. They have identified an industry partner and their first planting is planned for this spring. Studies will include a cropping system assessment, variety evaluations and assessment of invasion risk. Multiple sites will be used across the state.

Mississippi State University- Mississippi does not currently have a hemp program, though legislation is proposed annually. They are interested in understanding the economics of hemp, including production costs and budgets, in support of the discussion regarding a potential industry. The kenaf industry in Mississippi may be a potential collaborator in research as they are interested in fiber production.

Cornell University- Legislation was passed to approve a program in 2015 and limited participation to universities. In 2016 Cornell registered with the DEA and conducted initial planting studies. Ramped up in 2017 with significant investment from the state and began evaluating pests and pathogens as well as seed quality. NY State committed \$10 M toward hemp- \$5M for agronomics and \$5 in matching grants to processors. The state invested additional funding to significantly increase the acreage (to 2000 total A) and expanded to commercial growers who were paid \$350/A to participate. There are now 150 licenses, though the state caps the number available for CBD production & processing.

Activities at Cornell include development of long-term breeding program, variety trials, and investigations of the microbiome, plant pathology, controlled environment cultivation, metabolites, pests & pollinators. Collaborators outside of ag also testing cannabinoids on pain reception.

2018 field trials had some challenges in the planting season due to lack of water and included 30-35 entries and 6 sites. Seed yields ranged from 675lbs/A dry dirty to 1315 lbs/A dry dirty. Disease issues were investigated and included Pythium wilt botrytis & 5 Bipolaris species. Seed germination and quality experiment shows that day temps of 25C and night temps of 15 C worked best. Have an IR-4 project to look at biological and potentially pesticide treatments to control pathogens. Also conducted a pollination distance study.

Investigations of culinary uses include use of baby leaf hemp as a culinary microgreen used for salads and nutritional drinks; other emerging markets include culinary oils, flour, hemp “milk” products. Have had some interaction with Sunstrand regarding fiber applications.

Cornell has also participated in some extension activities and field days. More info available at <http://hemp.cals.cornell.edu>.

UC Riverside- The dean is working on setting up legal counsel regarding what can be done with respect to industrial hemp. Currently researchers cannot possess any plant materials but can take soil and pest samples from hemp fields cultivated by others. Faculty either currently work on hemp or interested in developing projects include: Houston Wilson- characterization of key pests and ways to manage them; Peggy Mauk- chemical profiles and the influence of production environment on them; and Emma Aronson- hemp associated soil microbial communities and biogeochemical implications of large-scale production (GHGs, etc.)

U. Vermont- The state has open hemp laws- registration very easy, state does not confirm acres actually cultivated, nor testing required and there are no restrictions on CBD production. Work at UVM includes variety evaluations, studies on weed control, spacing, seeding, etc. Also looking at the impact of frost, drying and storage on hemp oil. Field trial data are online: <http://www.uvm.edu/extension/cropsoil/hemp>

SUNY New Paltz- Conducting engineering work related fiber applications and trying to understand why natural variation exists in hemp fiber; partnering with agronomic studies as a way to understand how to potentially deal with that variation. Looking to establish a project at the nexus of the producer, processor and end user.

Breakout reports for collaborative activities for the coming year:

Objective 1: Will work toward a coordinated trial among the states who can participate. Have access to same seedlot of certified European varieties and will try to evaluate; will ask participants to assay for insects (pollinators and pests), fungal (saprophytic and pathogenic), and treat as dual use- grain and straw. John will ret them and get the final retted yields. Cultivars targeted: 5-8 available from David Williams. TN may also test irrigation.

2nd trial- N response in Futura75 with 3 levels (0, 100 units, 200units/A) with dual purpose yield reported out.

Objective 2: Partnership with variety trials from Obj 1 (stem quality assessed as part of the samples from Obj 1) John suggests maybe splitting the sample doing retting vs drying at harvest.

Kurt offered to test the oil and fatty acids; Cornell can assess protein, amino acids (David to look into), terpene panel (possibly by IR?- Cornell working on it). Top yielding variety at each site (not included in the common trial).

Objective 3: Three ideas evolved from the discussion:

Participatory breeding program that picks a population and pick a trait, send out seeds and then return to the common pool. Possible: early seedling vigor, germination temp traits.

Gain basic genetic info about GxE interactions by picking clones, plan at multiple sites and do a standard evaluation of that genotype.

Create a hemp germplasm collection as state laws allow for participation from regionally-adapted (feral) populations; redistribute to do a common garden experiment. Would need a pound of seed for each feral population. Seemed to be the preferred one to start with. Others may be looked at later.

Objective 4: Connected to Objective 1; using data collected to develop enterprise budgets with ties to production economic theory. Marketing infrastructure- need to work on how to define it and what the structure will look like. What should a contract look like and what infrastructure is needed to support the market- can we look at either grain and fiber producing regions internationally as potential models. This will likely evolve as the federal laws change and more states get experience with a pilot program. Larry points out we need data to help sort out the usefulness of the dual use crop or how to manage the dual use crop toward the most profitable end use. Bob H. points out that one question they have been dealing with is the issue of economics for organic vs nonorganic- also the labor issue needs more analysis.

Discussion of plans for next meeting and outside participation

Involving industry participants: John F. moved that the group invite industry to participate in future meetings, acknowledging that they may not need or want to take part in all parts of the meeting. Jay suggested using the model of co-meeting with other groups that could include an industry or other stakeholder element and have a breakout of just the university participants.

Possible conventions/meeting to coincide with the next meeting: HIACON, ASA

Next meeting: There was interest in holding the next meeting during the growing season and including a field day with tour and presentations, possible some additional discussion and meetings with industry. The group decided on an August meeting in Lexington, KY to include a half-day field trip plus meeting. The group could then have a follow up Zoom meeting after the growing season. Smaller groups may meet virtually and report out to the larger group. Results would be compiled for the overall annual report submitted through NIMSS. This will be discussed further among the new Chair, host institution and administrative advisor and additional information will be provided to the participants.