S1084 Meeting February 15-16, 2024, North Carolina State University, Raleigh, NC

Virtual attendees- Lesley Oliver- U. Kentucky (AA), Abdel Berrada- Colorado State, Bob Pearce- U. Kentucky, Calvin Trostle- Texas A&M, Chris Smart- Cornell, Larry Smart- Cornell, James DeDecker- Michigan State, Jacob MacWilliams- , Jason Griffin- Kansas State, Punya Nachappa- Colorado State, Tiziana Oppedisano- Montana State, Kimberly Gwinn- U. Tennessee, Xinhua Xiao, Macoon Bisoondat- USDA (NIFA rep), John Erickson- USDA (NIFA rep), Ann Hazelrigg- Virginia Tech, Steven Philpott- NC State

In-person attendees-

Kimberly Leonberger- U. Kentucky, Henry Smith- U. Kentucky, Nicole Gauthier- U. Kentucky, Misbakhul Munir- U. Kentucky, Babitha Jampala- Louisiana State, Daniel Pap- U. California Davis, Babu Valliyodan- Lincoln U., David Gang- Washington State, Hasip Ulas Ograk- U. Louisiana Monroe, Jon Botthoff- U. California Riverside, Emma Aronson- U. California Riverside, Phillip Alberti- U. Wisconsin, Benjamin Schwab- Kansas State, Zack Brym- U. Florida, Alyssa Collins- Penn State, Karla Gage- Southern Illinois U., Shuresh Ghimire- U. Connecticut, Marguerite Bolt- Purdue, Shelby Ellison- U. Wisconsin, Sonja Salmon- North Carolina State U., Terri Arsenault- State of Connecticut, Siyan Wang- North Carolina State U., Dana Landry- U. Illinois, Emily Febles- USDA, Ramesh Dhakal- Virginia State U., Saeid Zehtab Salmasi- New Mexico State, Tyler Mark- U. Kentucky, David Suchoff- Noth Carolina State U., Heather Darby- U. Vermont (chair)

Introduction from Project Leadership and Host Institution

Following a brief call to the meeting and welcome from the project chair and meeting host, Steve Lommel, Experiment Station director provided a welcome and an overview of NC Ag and the Plant Science Initiative building and how that interdisciplinary space will work- project based and expected to change over time.

NIFA update:

Chair Heather Darby introduced the NIFA reps, John Erickson and Bisoondat "Mac" Macoon of the Plant Systems Production Division to provide an update to the group from NIFA.

Following a general overview of NIFA, shared link to serve as a panelist. Internship opportunities available. Mentioned appointment of Manjit Misra as Director. Same strategic goals as last year.

Supplemental & Alt Crops-included hemp in 2018 Farm Bill- no RFA this year; program was run as continuation projects previously; last year's money awarded NOT as a continuation project and will be the same way going forward. So this year's allocation will go to continuation projects to finish them out.

Now the NPLs are required to review annual capacity (Hatch, Multistate) reports for accuracy and meaningful content. Reports are being returned for correction now.

Q&A- asked if they had heard anything about getting hemp labeled as a "specialty" crop. Mac had not heard any news about that.

USDA AMS Domestic Hemp Production Program Update

Angela Gidrey & Demeseh Cobb.

Thanked the group for the work they have done.

Rules & Regs- What USDA regulates: Production, cultivation sampling, sampling harvesting, etc.; state and tribal hemp programs and USDA licensed hemp growers. AMS does NOT regulate postproduction, inclusing processing or transportation.

DHPP status- 42 states and many tribal nations run their own program- 8 states 7 tribal nations use USDA hemp plan.

 National production stats- clarified that covers production converted and included in the stats.

Licensing for research use is allows for an alternative sampling plan ("performance based") when not going into commerce. DEA registered institutions can keep >0.3% total THC materials.

2024 update: Hemp eLearning Platform- Strongly recommended for federal licensees and sampling agents. Trying to close gap between hemp producers and FSA . Weekly Hemp Report started in 2023 to report market information.

Law Enforcement search tool to help ID legal hemp from illegal.

Q&A- asked about whether search tool was available for processors. No- outside of their purview.

Educational resources- focused on the licensing program, but looking at adding resources on certified seeds.

Could S1084 be an avenue for getting out more production practices information? AMS gets those questions, but they cannot really answer them.

Go to www.ams.gov/mnreports/fvhemp.pdf to sign up for the marketing report.

Clarified that the search tools are for all states.

Larry posted the Cornell webinar- https://hemp.cals.cornell.edu/2024/01/04/register-now-for-cornells-2024-hemp-webinar-series-starts-jan-24/

FSA acreage reporting course on how to report to FSA.

Farm Bill update from Tyler Mark and Zach Brym

Letter to legislators was develop in summer 2023 about research pain points to help get them addressed. 1% THC rule; separation of floral from grain and fiber- House and Senate bills out there. FDA still a hinderance. It was noted that raising limit to 1% for commercial production may cause trouble with trade.

PA only state using specialty crop block grant money for hemp. Didn't realise it was state determined. Must come from state funding.

AFCO looking to allow hemp seed for laying hens. SC banned CBD and others may follow suite.

Tyler asked about what regulatory issues people are seeing?

Zach wants to know what the permitting structure is across the states- Couple states operating under a commercial permit, some call them "producer" license that is the same for everyone; most have the

same license, but there is performance based or waived testing for researchers. Tyler is working on a document looking at the regulatory rules across states.

NY and MI are submitting non-compliant THC reports.

DOE- regional bioenergy feedstock crops call for proposals- Hemp does not appear to meet the definition of "purpose-grown energy crop".

State updates were provided as slides over lunch.

Updated Objectives for discussion- Reminder for everyone about what they were in the new 5 yr proposal and talk about potential overlaps between objectives.

Shelby Ellison: Breeding Genetics and Genomics:

Focusing on germplasm since very little is available publicly. There are roughly 600 samples in USDA germplasm collection right now, but only 100 available for distribution. Working with the USDA repository to make more publicly available. Feral hemp has 2,000 accessions to be added.   Looking at ways to evaluate some of the new materials available and need to look at how they may be included into the S1084 member cultivar trials. Looking at developing markers for genomic analysis and mapping- working with Agilent to develop custom probes. How can we better use genomic resources; developing a Gene Atlas. Discussing which database to use- Breeding Insight? Also talking about how to help develop pipielines for phenotyping analysis for characterizing GxE. Looking at the genetic basis for yield and quality and economic implications for breeding for specific traits in conventional and organic systems.

Zach Brym: Dual Purpose Trails:

Submission of paper summarizing previous year's data is imminent. Data from 8 locations. No clear variety that does well across all of the sites. The group needs to decide if they want to keep moving this forward. At least 4 seed companies have indicated an interest to participate which could bring in new cultivars. Cultivar evaluation is still part of the objectives for the project. More emphasis on agronomy (fertility, water needs) and sustainability in future trials is being considered.

Nicole Gauthier Plant Protection**:**

One objective is to develop a website for housing data and factsheets. Housed under blogs.cornell.edu/s1084hemp. It's free. Links to NIMSS for the list of participants. Could also link the field trial data to it. To upload something, there is a Box folder which anyone with a link can use to add something. Can upload data directly or link to the data.

One question is if others would like to use it or if they want to keep it just the Plant Protection group?

Pest and disease survey that layered into the Cultivar trials. Asked states to rate cultivars for disease resistance but wasn't consistent enough to do much with. Bob suggested including their ask with the data template for the trials, which have gotten much more consistent. Carla noticed that she didn't see much difference between cultivars in terms of weed pressures. There were differences among the states, but not among the cultivars within each one. Weed Science Society survey for hemp last year.

Feedback from the group is that it may be helpful to offer some training and resource guides in order to better complete data sheets. Pathology data was the most difficult to complete. There is value in doing the project again. Allow access to contact Nicole and Chris directly to confirm diseases. Interest in creating data sheets in field book app.

Product Quality, Market Development, and Economics:

Using the field trial data along with other cost surveys to determine regional costs and develop new versions of budgeting tools. The field data are also being use to help with crop insurance work being done by the group. Developing a dataset for companies that are involved in the hemp supply chain. May wish to add the common terms resource developed by this group to the website developed by the plant protection group.

Officer elections/transition:

- o Tyler Mark will move into the chair role
- o Zach Brym has been elected into the vice-chair role
- o David Suchoff has been elected into the Secretary role.

Minutes from Objective Breakouts:

Agronomy Working Group

Participants: Heather Darby, Zack Brym, David Suchoff (+4), Chengci Chen, Philip Alberti, Saeid Zehtab Salmasi, Emma Aronson, Bob Pearce (Virtual), Larry Smart (Virtual +1), Calvin Trostle (Virtual)

- Are the environmental impacts (and benefits) real?
  - o Takes a cropping system to allow that to happen
  - o How does it fit in with other crop rotation? Persistent Hemp residue
    - ▪ What is hemp's impact on soil and subsequent crop
    - ▪ Soil mircrobes
  - o Ecosystem service = care about carbon and soil health
    - ▪ Climate smart (nitrogen, cover crops, no till)
    - ▪ In season test for N (PSNT?)
  - o High water use helpful or harmful
  - o Root architecture by seasonal moisture / plant density
  - o Seasonal variability (moisture, clouds)

- o Growing Degree Days / Photoperiod response
- Dual-purpose purpose? Separate fiber and seed ("dual") trials??
    - o What timing for harvest? Maturity?
    - o Ensure plot level choices
- How do we decide on varieties for next year (n=12-15)?
    - o Poor performers to drop (e.g. Hleana)
    - o How long do we keep varieties consistent across years and sites?
    - o Keep varieties consistent across years and sites
    - o Seed source for each variety in each year??
- Tara transition requires Bob's help with communications.
    - o New trial leadership?
    - o Next step email response to participate
    - o Seed and/or fiber protocols
- Trial Coordination Details
    - o Decide what terminology should be used (i.e., grain vs seed, straw vs stalk, biomass?)
        - ▪ Dry stalk immediate from harvest (bast:hurd ratio; artificial retting scenario)
    - o Agree on measurement units (kg/ha)
    - o Centralized location for submitting raw data
        - ▪ Field Book
        - ▪ Midwest Database??
    - o Are we collecting THC content? Barrier because of MTA
    - o Are we interested in fiber (bast vs hurd) and seed quality?
        - ▪ Retting, total biomass, harvest time
    - o How should we calculate HI? (current variance in data protocols makes this risky to calculate and difficult to accurately interpret.) means harvest by hand
    - o What are we doing with hemp leaf tissue? Is this a background weight in stalk/straw yield?
    - o growing degree days
- Meta Data Improvements
    - o GPS coordinates
    - o soil type
    - o weather metrics (i.e., avg min/max/avg temp, precipitation, etc…)
    - o germination (standard) vs germination (on-site)
    - o management practices
        - ▪ land prep (i.e., conventional tillage, no-till)
        - ▪ density
        - ▪ harvest date

Economics & Marketing Working Group

Attendees: Tyler Mark, Ben Schwab, Ulas Ograk, and Terri Arsenault

We focused on three key areas during our discussion.

1) The impact of regulations on the economic viability of industry. This specifically focused on the CBD industry and the way that the THC level of 0.03% is implemented and what it means. We further went into the potential issues of lab shopping to search for labs with higher variances. This led to some potential common areas of research.

2) What is the potential impact of pollen drift? Utilizing greenhouse space at the University of Louisiana Monroe will set up an experiment to evaluate if pollen from outside plots will impact plants growing in the greenhouse. The University of Kentucky and Colorado State University have been developing economic models to evaluate this situation and this will help to populate the models.

3) Progress on the project objectives. The University of Kentucky is in the process of finalizing an updated production budget. We have made progress on the evaluation of hemp pricing. This work is underway. Development of economically viable markets with case studies are also being considered.

Genetics & Breeding Working Group

Attendees: Babitha Jampala, Daniel Pap, Bob Zemetra, David Gang, Babu Valliyodan, Shelby Ellison

- Collect and curate hemp germplasm
  - USDA GRIN collection (~600 samples with 100 for distribution)
  - Adding new material to cultivar trials?
  - Ways to collect and preserve pollen

Actions: reach out to public breeders/researchers in S1084 and beyond to ask if they are interested in adding material to the trial.

- Develop marker systems for genomic analysis for genetic mapping and to catalog genetic variation
  - Agilent SureSelect Custom Target Enrichment Probe Set
  - Pangenome efforts
  - Gene Atlas – tissue type/timing
  - Which database will we use? Breeding Insight

Actions: Develop a list of known genes and markers to add to the new S1084 website. Reach out to Breeding Insight team for training opportunities.

- Develop pipelines for phenotypic analysis for characterizing variation due to genetics and environment
  - Trait ontology needed and need to use for trials
  - Brym et al. Hort Science (2023)
  - USDA Hemp Descriptor and Phenotyping Handbook, Version 3

Actions: Plan session on genomic, phenomic, and germplasm resources at Cannabis Research Conference. Add resource links on S1084 website. Use Fieldbook traits for S1084 cultivar trial data collection.

- Investigate the genetic basis of yield and quality in floral, grain, and fiber hemp market classes
  - Survey growers/stakeholders for need – e.g. pest surveys
  - Conventional versus Organic
  - Economic implications
  - Improve gene editing technologies and regeneration efficiency

Actions: Develop a planning grant to survey stakeholders on needs, gather letters of support and form an advisory committee. Possible grant opportunities through NSF-PGRP, AFRI, OREI or SAS programs.

Sustainable Pest Management Working Group

Present:

Nicole Gauthier, Karla Gage, Alyssa Collins, Marguerite Bolt, Henry Smith, Kim Leonberger, Andrea Webb, Dana Landry, Chris Smart, Kim Gwin, Punya Nachappa, Lucia Vignale, Max Schmidtbauer, Jacob Withycombe

The Sustainable Pest Management Working Group's objectives for the 2023-2028 Project focus on aggregation of pest management data from collaborations and individual institutions to provide a resource hub for stakeholders. Cornell University (C. Smart) will host the website (https://blogs.cornell.edu/s1084hemp/) at no cost. In 2024, the working group will focus on adding resources to this website; in 2025, the site should be ready to promote.

Curated Image Database. The aforementioned website will host a curated image database for scouting and diagnostics. Images of validated diseases, arthropods, weeds, abiotic problems, and cultivars/traits will be submitted via upload to Box (https://cornell.box.com/s/xyadvngjjc4dwa0mzqb0vtaijh8sx8mj), which will be monitored by C. Smart. Solicitation for images will go out to S-1084 members and meeting participants (N. Gauthier). Submitted files should be named SciName_State_Photographer. If an image is housed on another site (e.g. Bugwood), put information and link in a Word document and upload to Box.

Aggregated research data. The website will also host links to individual and collaborative research from each discipline. These links will be to university sites, journals, etc. Contributors should put title/author/institution/state and link in a Word document and upload to Box (https://cornell.box.com/s/xyadvngjjc4dwa0mzqb0vtaijh8sx8mj). This website can also host research data files if needed; contact C. Smart.

Extension resources. Grower and producer resources (aka Extension pubs and videos) will be housed on the website. These resources will be organized by discipline and subcategorized by state. Contributors should put title/author/institution/state and link in a Word document and upload to Box (https://cornell.box.com/s/xyadvngjjc4dwa0mzqb0vtaijh8sx8mj). New resources (regional and national scope) will be developed in 2025 (possibly a series of scouting guides, TBD).

Pest Ratings for Multistate Cultivar Trials. Each participating state will select 4 of 6 cultivars (TBD) for rating of diseases, insects, and weeds. Cultivars will be based on lineage, architecture, and maturity group (A. Collins). All participants encouraged to use FieldBook (https://excellenceinbreeding.org/toolbox/tools/field-book; https://www.phenoapps.org/apps/) for data collection. Files for plot plans/data collection/pest ratings will be provided to trial participants by May 1 (A. Webb, K. Leonberger). Revised rating instructions (including videos and references) will be developed and distributed (K. Gage, N. Gauthier). There will only be minor revisions for disease and insect ratings. In 2024, states will

have flexibility in time of ratings. Select three growth stages approximately one month apart (at the discretion of the PI): seedling, vegetative, and preharvest. Beginning in 2024, weed ratings will be taken at harvest – biomass of hemp+weeds; weight of weeds; percent composition of dominant weeds. Detailed instructions forthcoming (K. Gage).