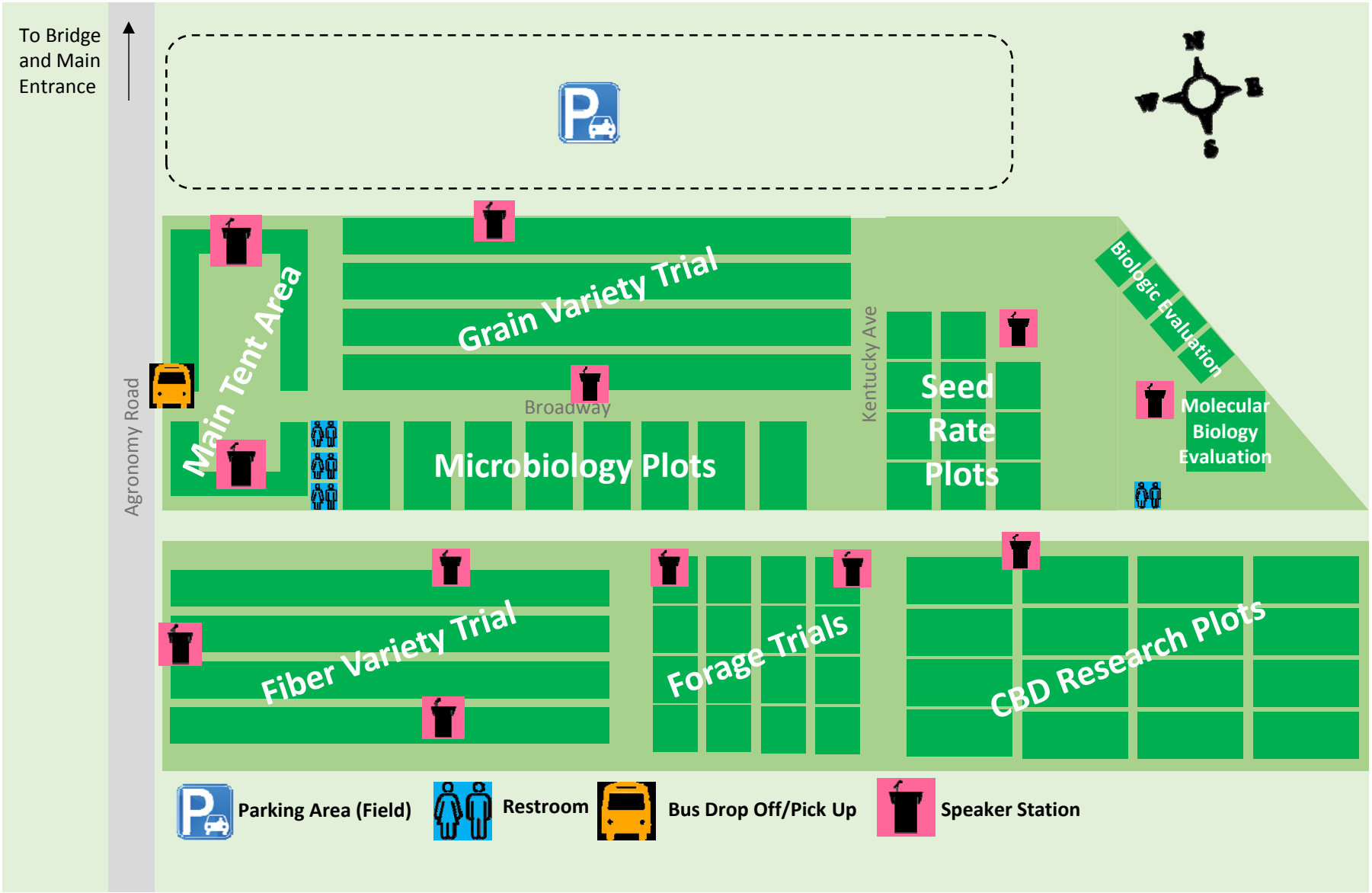
To Bridge and Main Entrance
Agronomy Road
Main Tent Area
Grain Variety Trial
Broadway
Kentucky Ave
Seed Rate Plots
Biologic Evaluation
Molecular Biology Evaluation
Microbiology Plots
Fiber Variety Trial
Forage Trials
CBD Research Plots
Parking Area (Field)
Restroom
Bus Drop Off/Pick Up
Speaker Station

Field Day Stations

1 Nicole Ward Gauthier	West End Fiber Variety
2 Bob Pearce & Sara Carter	Northeast Corner Seed Rate Plots
3 Leah Black & Bob Pearce	North End CBD Research Plots
4 Tyler Mark	North End of Tent
5 Craig Schluttenhofer & Perry	South Middle of Grain Variety Trial
6 D Williams & Perry	North End Fiber Variety Trials
7 D Williams & Perry	North End Grain Variety Trials
8. Landon Gibbs	South End of Tent
9 Carol Stringer	Northeast Corner of Forage Trial
10 Alyssa Culpepper	South End Fiber Variety Trial
11 Ben Goff	Northwest Corner of Forage Trial
12 Luke Moe	Southwest Corner Molecular Biology

2017 UK Industrial Hemp Research Field Day

Abstracts of Research Projects/Efforts

Kentucky Hemp Disease: Up Close and Personal

UK pathologists will present a series of common diseases from field and greenhouse hemp. This stop will include examination using hand lenses and microscopes, as well as an opportunity for growers to discuss disease threats, symptoms, and a bit of biology that will help them prevent and manage disease. Current research results and management recommendations will also be discussed. Handouts and references will be available for growers.

Contact: Dr. Nicole Ward Gauthier (nicole.ward@uky.edu)

Tolerance of Transplanted Hemp to Selected Pre-Plant and Post-Emergence Herbicides.

Bob Pearce and Sara Carter.

Currently there are no labelled herbicides for hemp production in the U.S. and little is known about the tolerance of hemp to the active ingredients in herbicides labelled for other crops. Potential production models which utilize hemp transplanted at relatively low plant populations would be especially vulnerable to weed competition due a longer time to reach canopy closure. Hand weeding is a labor intensive and costly solution. The objective of this study is to screen several herbicides currently labelled for other crops to identify those to which hemp exhibits tolerance for further study. Preliminary observations on weed control efficacy and injury to hemp will be reported.

Contact: Bob Pearce, rpearce@uky.edu

Evaluation of a tobacco production model for growing industrial hemp for CBD extraction.

Leah Black and Bob Pearce

Current and former tobacco growers in Kentucky have a specific skill set for growing and managing a high value transplanted crop. The objective of this study is to evaluate the potential to use this unique skill set to produce high value products from industrial hemp. The tobacco production model involves growing hemp plants from seed in a greenhouse to produce transplants which are transplanted to field. Plant populations in the field can be manipulated by changing the row and between plant spacing. In this study 3 transplanted populations were compared a direct seeded population at 3 rates of nitrogen application. Preliminary results will be reported.

Contact: Bob Pearce, rpearce@uky.edu

The Industrial Hemp Industry in Kentucky 2017: Preliminary Financial Projections for Grain and Fiber

Tyler Mark

As Kentucky's Industrial Hemp Pilot program continues to grow in 2017, it becomes increasingly important that our financial and economic understanding of hemp keep pace. Of key concern for the state of Kentucky is developing an understanding of how hemp will perform financially relative to other major rotation crops. The following simulation and accompanying graph illustrates the probability of returns above variable costs for industrial hemp grown for the purposes of grain and fiber. To evaluate hemp in

the wider context of its potential economic feasibility, corn and soybeans have been included in the simulation and overlaid in the same graph. The underlying data for corn and soybeans is well established, and has been drawn from the University of Kentucky's Extension Budgets and Decision Tools.

Contact: Tyler Mark, tyler.mark@uky.edu

Accelerating the Domestication Process to Develop Industrial Hemp Resistant to Shattering

Craig Schluttenhofer, J. Patrick Perry, and Ling Yuan

Cannabis sativa L. produces a diverse array of agricultural commodities including seed, oil, fiber, and medicine. High in ω-3 and ω-6 fatty acids and proteins, hemp seed is a nutritious food for humans and animals. Pressed seeds release an oil which is suitable for cooking, biofuels, and industrial applications. However, as a semi-domesticated crop, production of hemp seed is hampered by a trait called shattering. Shattering is an ancestral trait where mature seeds detach from the mother plant. In the wild shattering of seeds aids reproduction of future generations. However, as seeds falling to the ground contributes to yield loss, shattering has been domesticated out of most crops (e.g. barley, maize, sorghum, rice, and wheat). In hemp, the extent of grain yield loss due to shattering remains poorly studied. A preliminary study conducted in 2016 suggests shattering directly contributed to an estimated grain loss of 350 to 700 lbs/A (392 to 785 kg/ha). Additionally, shattering also indirectly contributes to yield loss by necessitating harvesting prior to plant maturity and during the mechanical harvesting process. Further data collection to better estimate yield loss due to shattering is being conduct in 2017. Overall, our ongoing studies seek to 1) quantify yield losses due to shattering, 2) identify varietal differences in shattering, 3) select for lines with improved shattering resistance, and 4) mutagenize hemp plants to generate new sources of shattering resistant alleles. Understanding the process of shattering and its contribution to yield loss will help develop improved hemp varieties for economic and sustainable production of hemp seed.

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2017 Fiber-only Hemp Variety Trials

D.W. Williams and Patrick Perry

Data from replicated, science-based evaluations of varieties are imperative for informed decisions by farmers to optimize yields from hemp crops. One key point in these evaluations is biomass (fiber) production as a function of planting date. Nine fiber-only varieties were planted on 1 May, 1 Jun, and 1 Jul (all +/- 5 days) at two locations; Lexington and Quicksand (central and eastern Kentucky, respectively). The May planting at Lexington suffered from a malfunction of the plot drill. The Quicksand trial planted in May produced useful data, but indicated that the top yielding variety was approximately 3.6 tons DM/A, which is far less than needed for profitable returns from fiber crops. Excessive precipitation at Quicksand was likely the reason for reduced yields. Eight of the nine varieties produced viable yields at Quicksand with one variety failing. Approximate DM yields at this writing ranged from 1.82 to 3.6 tons DM/A. Harvests from subsequent harvest dates are ongoing, but it is already clear that the Jun and Jul planting dates will result in significantly lower yields. There are still two entries to be harvested from the May planting as well.

Contact: D.W. Williams, david.williams@uky.edu

2017 Dual-Purpose Variety Trials

D.W. Williams and Patrick Perry

Data from replicated, science-based evaluations of varieties are imperative for informed decisions by farmers to optimize yields from hemp crops. One key point in these evaluations is grain and biomass (fiber) as a function of planting date. Eleven or twelve dual purpose varieties were planted on 1 May, 1 Jun, and 1 Jul (all +/- 5 days) at two locations; Lexington and Quicksand (UK farms in central and eastern Kentucky, respectively). Most of these trials have been harvested, but seed has not yet been thrashed or dried to determine grain yields. Fiber yields from these varieties will also be determined. We can report that several varieties failed at both locations. This was mainly due to flowering very soon after emergence which did not allow for canopy closure which consequently did allow for weed pressure to cause crop failure. To date, we can report that 4 of the 11 or 12 entries probably produced viable grain and fiber yields, and one additional entry will produce far more fiber than the other 4.

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Cover Crops and Hemp: A Microbial Perspective

Landon Gibbs, Soil Microbiology, Ecology, and Biochemistry Lab

While industrial hemp (*Cannabis sativa)* reappears as a Kentucky agricultural commodity, few studies have evaluated hemp integration with cover crops and no studies have evaluated basic underlying soil biological properties in such systems. This study (1) evaluated if differing cover crops and cover crop mixes containing grasses (cereal rye) and legumes (Austrian pea, clover, vetch) stratified nitrogen, carbon, and phosphorus with soil depth; (2) determined the change in microbial community in soils planted with individual cover crops and cover crop mixes; (3) examined if hemp affected the microbial community structure and nutrient stratification; (4) tested if cover crop use with oil seed hemp production affected yield and quality.Baseline soil samples were collected at depths of 0-15 and 15-30 centimeters following a seasonal fallow and a summer annual maize crop. Yield and chlorophyll content of maize, nutrient analysis, and labile carbon of soil showed no significant differences between prior treatments. Cover crop mixes were planted in Fall 2016. After cover crop termination in May 2017, soils were sampled (0-7.5 cm, 7.5-15 cm, and 15-30 cm) and the plots were planted with hemp variety Santhica 27 at a rate of 45 kg/ha (40 lbs/ac). Soil samples will be collected post harvest to assess changes in treatment variables. Predictions are that rye treatment will stratify carbon deeper in the soil profile than legumes. Total residual and mineralizable nitrogen will be stratified deeper in mixes. Mixes will diversify microbial community structure more than single species. Oil yield and quality in summer hemp will benefit from treatments containing cover crop legumes and suggest potential for reducing N fertilization rates.

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Does Industrial Hemp Have Potential As a Forage?

Carol Stringer

The recent legalization of industrial hemp (*Cannabis sativa*) in many states has led to many questions among producers about its suitability as a forage. Evidence of its potential is virtually nonexistent in the literature and the goal of this research was to quantify the relationship between yield and forage nutritive value for industrial hemp and kenaf (*Hibiscus cannabinus*). As with most forage crops, CP and IVDMD declined as the season progressed while yield increased until the initiation of flowering. Harvest of kenaf and industrial hemp grown for fiber must be made shortly after planting to preserve forage nutritive value due to their fibrous nature. While this may preclude their use as a traditional forage, these may have potential as a short-season "emergency" forage. The presence of grain helped buffer the loss in forage nutritive value that occurs with plant maturity. However, grain varieties of industrial hemp were limiting in forage yield. Future research is planned to increase the yield of grain in industrial hemps used as a forage through optimization of its agronomic management.

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Effects of Moisture Stress on Germination of Fiber Crops Utilized As Forage

Alyssa Culpepper

The recent legalization of industrial hemp (*Cannabis sativa* L.) on a limited basis has led to a considerable research on its use in alternative markets. One area in which it may have potential is its use as a forage crop. In University of Kentucky variety trials hemp was capable of produced more forage over a 48 day period than warm-season annual grasses. However, these annual grasses had greater total yields due their ability to produce regrowth from tillers that resulted in multiple harvests. Since the growth habit of fiber crops allows for less regrowth, multiple crops may be required to produce equivalent forage yields, but here is little information about the establishment of hemp and other fiber crops during the dry conditions that are common during the summer months. This study examined the ability of fiber and forage crops to germinate over a range of osmotic potentials to simulate water stress that may occur during an establishment late in the growing season. The germination of three fiber crops (kenaf, hemp, and sunn hemp) and two annual forage species (sorghum-sudangrass and cowpea) over five levels of osmotic potentials (ψs). Polyethylene glycol was used to simulate osmotic potential that covered the approximate range of a soil at field capacity (~0.33 Atm) to permanent wilting point (~15 Atm) . As expected, the germination potential for all species declined with greater ψs and appeared to be correlated with seed size. Cowpea had the lowest germination rate across all ψs, whereas hemp and sorghum-sudangrass had the highest. Hemp seed showed the greatest potential to germinate under dry conditions and had 57% germination at 10 Atms compared to < 20% for the other crops. This suggest hemp may have potential as a late season crop but more research is needed focusing on plant development inter these conditions.

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Topping of Industrial Hemp to Improve Forage Nutritive Value

Ben Goff

Preliminary research with Kenaf (*Hibiscus cannabinus*) has shown that defoliation by insects led to greater lateral growth (i.e. branching) from axillary buds, which increased the dietary energy content in the forage later in the growing season and will likely improve its acceptability to livestock. The goal of this experiment was to evaluate the effect of topping (i.e. removing the apical bud) of kenaf and industrial hemp at different times of the season (i.e. 30, 60, and 90 days after planting) compared to these crops harvested at the end of the growing season. The experiment also incorporated a treatment to determine the yield and nutritive value of hemp and kenaf harvested under regular forage schedule.

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Microbiology of Hemp Retting

Luke Moe, Audrey Law, Ruth McNees, and Adrienne Arnold

Industrial hemp fiber production relies on a microbially mediated process called “retting” which is necessary for the mechanical separation of plant fibers from the internal core (hurd) of the hemp stalk. The degradation of pectin, a polysaccharide which binds the fibers to the hurd, is carried out by bacteria and fungi, and occurs over several weeks in the field after cutting. In order to better understand this process we are investigating the microbiology of hemp retting using both culture dependent and independent methods as well as greenhouse and field studies to determine ideal retting conditions and practices which can improve the efficiency and consistency of the process.

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