# CONSIDERATIONS WHEN PRODUCING HEMP (*CANNABIS SATIVA*) FOR LOUISIANA COMMERCIAL CBD PRODUCTION

LSU AgCenter
Research · Extension · Teaching

# CONTENTS



***Cover photo of hemp plants growing in a greenhouse at the Plant Materials Center facility at LSU by Kaylee Deynzer.***

*Hemp flowers produce oils containing medicinal benefits. LSU AgCenter photo by Kaylee Deynzer*

## INTRODUCTION AND BRIEF HISTORY OF HEMP

Hemp (*Cannabis sativa*) is a versatile plant that can be grown for fiber, seed, oil and medicine. Hemp is defined as having low levels of the psychoactive component delta-9-tetrahydrocannabinol (THC) and high levels of other cannabinoids which are non-psychoactive compounds commonly used for therapeutic purposes. The 2014 Farm Act gave an opportunity for research entities to cultivate hemp to examine regional-specific best management practices before commercial hemp production was legalized.

The Agriculture Improvement Act of 2018 went several steps further and directed the U.S. Department of Agriculture to establish a national regulatory framework for hemp production in the United States. This authorized the production of hemp as an agricultural commodity for seed, fiber, grain and essential oils. The act also removed hemp from the Drug Enforcement Administration's list of controlled substances.

In 2019, the Industrial Hemp Law was signed by Governor John Bel Edwards, which recognized industrial hemp as an agricultural commodity in Louisiana. In February of 2020, the Louisiana Department of Agriculture and Forestry began the hemp licensing application process, making 2020 Louisiana's first year of hemp cultivation. Now that hemp is legal, the need for research is imperative for a successful local hemp industry, especially when growing in an environment which can present many challenges.

Hemp has multiple end uses, and certain cultivars are selected for specific products. Cultivars developed for cannabidiol (CBD) oil produce shorter, stockier plants and would not yield a desirable crop for fiber-end products, while fiber-type hemp plants produce tall, thin plants that produce extremely low concentrations of CBD.

**This publication is focused on production of cannabidiol oil hemp plants rather than hemp plants grown for fiber.**

A current listing of licensed Louisiana growers, seed producers, processors and handlers can be found at https://www.ldaf.state.la.us/faqs/2020-louisiana-industrial-hemp-licensees. Use these resources to familiarize yourself with local people also entering into the hemp industry.

For more economic information specific to Louisiana hemp production, visit https://lsuagcenter.com/topics/crops/industrial-hemp/economics

For more information regarding growing hemp in Louisiana from the perspective of LDAF, visit https://www.ldaf.state.la.us/industrial-hemp.

More details regarding the regulatory aspects of the industrial hemp industry are available from Centralized Louisiana Industrial Hemp at http://www.lahemp.net.

## OPPORTUNITIES AND PROFITABILITY

Growers and producers must consider if there is a market for their hemp products and if a profit can be made. Fortunately, CBD oil is in high demand nationally as well as internationally. However, potential producers should be aware of some nuances associated with selling this crop.

- CBD products require a licensed processing facility to extract the CBD from the harvested hemp. Extra steps and additional parties added to the production process can directly translate into an increase in production costs. This is further complicated by the relatively small number of licensed processing facilities in the state.
- The Louisiana hemp industry is a new market which means that a lot of the necessary infrastructure items such as processing, packaging and storage facilities are yet to be built. Once the infrastructure is in place, the level of production can increase.
- A new market also means new buyers and sellers may not likely have interacted with one another before. Members of the industry will need to build relationships before the current level of trading between commercial farmers and buyers can increase.
- Hemp is a globally traded product. The role of Louisiana hemp in the global market is yet to be determined given hemp has only been produced in the United States since 2018. In other words, being an early player in the market is risky, however, the potential rewards are high, and it does appear that the amount of risk will decrease as the industry develops.

## LICENSING

Other challenges are the considerable legal restrictions and regulations associated with farming hemp. Farmers risk their entire crop if it goes “hot” and tests over the legal limit for THC. In Louisiana, multiple agencies regulate different parts of the hemp industry, which can cause confusion and discourage farmers from growing the crop.

The 2018 Farm Bill mandates that producers cannot grow hemp without a license and must not produce a crop that exceeds 0.3% THC content. Failure to meet these protocols would be considered a violation of the law. License applications can be acquired through LDAF at https://form.jotform.com/213404159284050.

## PRODUCTION CONSIDERATIONS

Hemp can be a challenging crop to produce in Louisiana. This next section will address production practices hemp growers should consider when planting their first crop.

Please note, field studies were conducted in Louisiana in 2020 and 2021 in April, May, June and July with limited success. The main factors that negated heavy yields included excessive rainfall, poorly drained soil, high disease incidence and strong winds from tropical storms and hurricanes. More research is needed to make recommendations for the best management practices of hemp. However, the advice here will help you avoid some stumbling blocks that occurred in LSU AgCenter early trials.

## PLANTING DATES AND CONDITIONS

### *PLANTING DATES*

Hemp is an annual crop mainly cultivated in temperate regions. As hemp can be sensitive to frost and freezes, initial field, high tunnel and greenhouse studies were conducted by LSU graduate students in the 2020 and 2021 warm seasons. Anderson et al., (2019) indicates optimum daytime growing temperatures are between 77 F and 82 F. To date, researchers have not found an ideal time to plant hemp outdoors in Louisiana. While field studies with different planting dates in hot spring and summer months (April through July) did not yield the best crop, greenhouse studies conducted in more temperate months (January through May and September through January) were more successful, as the environmental factors were mostly controlled in this setting.

### *STARTING SEED*

Hemp seeds for high CBD varieties can be expensive, so determining the optimum germination conditions is critical. Optimum seed germination temperatures range greatly and are very dependent on hemp cultivars. However, Byrd (2019) found optimal soil temperatures for germination to be 59-68 F while higher temperatures (104 F) cause germination percentage to decline. In LSU AgCenter trials, seeds were started in the greenhouse with temperatures between 70 F and 83 F. Seeds were planted 6 millimeters deep in loose potting soil mixes into 4-inch “cow pots,” which are cow dung composted containers. Germination generally occurred three to seven days after seeding. Seeds were watered from 6 a.m. to 6 p.m., every two hours using mist nozzles at 30-second intervals, emitting 525 milliliters of water at each watering. Germination rate varied depending on the variety, but average success ranged from 80-95%. Due to hemp’s quick growth rate, it is not recommended to start seeds in smaller-sized containers. Fertilization of the seedlings did not occur until they had developed their first true leaf. Seedlings were fertilized after the first true leaf development using recommended rates of fish emulsion fertilizer twice a week (until transplanting in the field). Fish emulsion was used due to its relatively low levels of nitrogen to avoid burning newly sprouted plants.

**Louisiana optimum field planting dates have not been established. Future LSU AgCenter field studies will be conducted in the fall (September and early October planting dates) and high tunnel planting studies will be conducted in the early spring with planting dates in mid-January through mid-March to explore the effects of milder weather.**

**Germination rates using the methods described here ranged between 80-95%.**

**The preferred potting mix for germinating hemp seeds in the LSU AgCenter trial was FoxFarm Ocean Forest Potting Soil. Please note, formal media evaluations for seed germination were not conducted, therefore, other potting soils should be tested. (Potting soil tests were conducted for high tunnel trials.)**

**Hemp seeds had a tendency to pull themselves out of the potting soil immediately after germination. The entire plantlet — roots, and all — would be lifted out of the soil. Roots were pushed back into the potting mix and continued to grow. Check your seedlings daily to ensure they do not dry out or uproot.**

To submit a soil test, visit https://lsuagcenter.com/portals/our_offices/departments/spess/servicelabs/soil_testing_lab.

To learn more about adjusting soil pH, visit https://www.lsuagcenter.com/~/media/system/c/6/f/7/c6f7b63dafc311b01cd887345d1f313d/p3624bbb_lahomelawnsoilphpdf.pdf.

*FIELD SOILS*

Hemp is best suited to field soils with a pH between 6.0 and 7.0. Make sure your soil is loose with excellent drainage. To adjust pH, simply add lime to increase pH or sulfur to lower pH. Always make soil amendments based on soil testing. The Soil Testing and Plant Analysis Lab on LSU's campus can provide the pH and available nutrients for both hobby and commercial producers. Hemp grows best in soils that have good drainage. Clay soils and wet soils with poor drainage will negatively affect hemp growth. Make sure your soil is loose with excellent drainage.

*POTTING SOILS*

Preliminary trials are being conducted at the LSU AgCenter on preferred potting soils for growing hemp to flower in larger containers. Many hemp growers use FoxFarm Ocean Forest Potting soil. In LSU studies, Garden Greaux, which is formulated by LSU and currently on the market for use by home and commercial growers, is also being trialed. First year data indicates the Garden Greaux mix provides quicker, earlier growth, but as plants reach harvest, size and yields are comparable between both mixes.

## FERTILITY

*FIELD-GROWN HEMP FERTILITY*

The LSU AgCenter field trials were conducted in the 2020 season using organic fertilizer sources. The pre-plant fertilizer was Nature Safe feather meal (13-0-0) at a rate of 100 pounds nitrogen per acre. In the LSU trials, organic pre-plant fertilizer should have been applied earlier because organic sources of fertilizer are not always immediately available for uptake by plants. If organic sources of fertilizer are used for pre-plant application, do so several months prior to planting to allow for the fertilizer to become available to plants. Plants in the initial LSU field trials looked a bit pale until fertigation applications of fish emulsion (5-1-1) and Westbrook Organics (14-0-0) water-soluble OMRI-listed (Organic Materials Review Institute) fertilizers via drip irrigation. More research is needed to optimize field grown fertility requirements in Louisiana.

*CONTAINER-GROWN HEMP FERTILITY*

Preliminary container-grown hemp research at the LSU AgCenter indicates that daily fertilizer regimens should be implemented when growing hemp in containers. Daily fertigated plants grew taller and produced larger canopies with larger stem diameters than container-grown plants that were fertigated weekly. Additionally, weekly fertigated plants exhibited various nutrient deficiency symptoms, including chlorosis and purpling of leaves. This indicates that hemp is a heavy nitrogen and phosphorus feeder and should be supplied with more nutrients than traditional vegetable crops.

***Cannabis plants fertilized on a daily regime, left, had much darker foliage than cannabis plants, right, that were fertilized once a week. LSU AgCenter photos by Samuel des Bordes***

*LSU AgCenter research to date suggests cannabis plants grown in climate-controlled conditions reach maturity with less disease, insect and environmental damage compared to cannabis grown in field conditions. LSU AgCenter photo by Kaylee Deynzer*

## GREENHOUSE-GROWN HEMP FERTILITY

Greenhouse production of hemp in the 2020 and 2021 seasons was successful from seed to harvest. However, many of the varieties trialed at the LSU AgCenter were high in THC content. Flowers were harvested when the trichomes had an amber appearance, thus an earlier indication needs to be used to remain in compliance. Fertilizer used in the 2020 and 2021 greenhouse trials began with applications of fish emulsion (5-1-1) twice a week to seedlings beginning from the appearance of the first true leaf to transplanting into 5-gallon containers, approximately four weeks after seeding. The 5-gallon containers were filled with Miracle-Gro potting soil and fertilized weekly with Jack's Nutrients fertilizer (15-0-0) at a rate of 1 tablespoon of fertilizer per gallon of water. Each plant received 5 ounces of solution.

## IRRIGATION REQUIREMENTS

Plants absorb the majority of water and nutrients through their roots. As hemp is susceptible to disease, irrigating at the base of this crop is recommended to reduce spreading bacteria, fungi, yeasts and mold across the plant's surface. There are many methods of irrigation depending on the size of the plots and if hemp is produced in the field or in containers.

## IRRIGATION IN FIELD PRODUCED HEMP

In the LSU AgCenter field trials, hemp was planted with drip irrigation placed 2 inches beneath the soil slightly off center of each row, as seedlings were planted in a single line down the center of each row. The drip tape had emitters every 12 inches. As the crop grew, irrigation was increased to support the larger plants. In weeks with heavy rainfall, the irrigation was turned off. In fact, in the 2021 season, irrigation was rarely on because of the excessive rainfall. Producers typically plant into moist soils and maintain field moisture with drip irrigation. If the soil is particularly dry, water in each transplant on the day of planting, and then use the drip lines to maintain that moisture.

**Due to rising fertilizer costs and lack of availability, consider sourcing and obtaining fertilizer well ahead of the planting season.**

A recent LSU AgCenter trial showed that when fertilizing hemp in a high tunnel, daily fertigation resulted in improved plant health and more vigorous plants than weekly fertigation.

*Maintaining moist soil is critical to optimum plant growth. Soil should never dry out but also not be saturated. Watering at the base of the plant helps minimize disease incidence. Irrigation time depends on soil type, size of container, nozzle type and air temperature. Check irrigation at least three times a week to determine optimum irrigation times. Water requirements increase as the plants grow larger. LSU AgCenter photo by Alessandro Holzapfel*

## IRRIGATION IN LARGER CONTAINERS (HIGH TUNNEL STUDY)

There are many factors to consider when irrigating cannabis in large containers. Selecting the proper irrigation system is integral in producing healthy plants. Drip irrigation systems allow for container irrigation without wetting the foliage, which will help prevent disease. Drip emitters can be connected to “spaghetti tube” that circles the plants stem, allowing for delivery of water around the circumference of the container. This configuration will allow for uniform watering of the container and prevent dry and hydrophobic sections within the growing media. The amount of water delivered to each container will depend on the size of the plants, the weather and the media used. In general, irrigating 10-20% of the container volume daily is sufficient, but this should be monitored regularly to ensure uniform wetness within the media.

## IRRIGATION IN THE GREENHOUSE

In LSU greenhouse trials, hemp seedlings were transplanted into 5-gallon containers and fitted with irrigation including spaghetti tubing emitters. Irrigation was applied six times a day for three-minute intervals (releasing 48 milliliters of water at each irrigation event), with one hour and 30 minutes between each application. After two weeks, irrigation was increased to four-minute intervals (releasing 65 milliliters of water at each irrigation event) to accommodate for increased plant biomass. The goal is to maintain soil moisture in the container without excess leachate running out of the bottoms of containers to avoid nutrient loss.

## LIGHT REQUIREMENTS

Hemp can be categorized in two ways with respect to light response: day-length-sensitive (photoperiod sensitive) and day-length-neutral (auto-flowering).

- Day-length-sensitive hemp is a short-day plant, requiring more than 14 hours of light to remain vegetative. Decreasing light intervals to less than 14 hours will cause the plants to begin to flower and enter into the reproductive phase of their life cycle. Day-length-sensitive hemp allows producers to grow their plants until they reach a large size, subsequently increasing their yields. If plants become stunted because of environmental stressors (such as excess rainfall or high temperatures), growers can delay flowering to prevent yield loss.
- Day-length-neutral hemp does not respond to light, and will begin to flower after one to two months of vegetative growth. If an environmental stressor occurs, yields may also decrease. Supplemental lighting is not required for this type of hemp. The LSU AgCenter has yet to identify a day-length-neutral cultivar able to withstand Louisiana's outdoor climate.
- Lighting can be costly and difficult to install. Industrial hemp producers growing in the field need a nearby electrical source. The amount of light needed can trip breakers, require thousands of feet of extension cords and can become impractical in certain production areas. If the growing space does not have access to electricity or does not have adequate wattage to support the lighting infrastructure needed, auto-flowering hemp should be planted at a high density.

In a field setting constructed by the LSU AgCenter, halogen lights drew too much current, causing issues with the electrical outlets they were using. Switching to LED lights reduced the amount of electricity being drawn and solved the issue.

With any lighting in an open field, the light stands must be secured to withstand strong winds, tropical storms and hurricanes.

Waterproof connections for lights are imperative for outdoor field production. If using extension cords, be sure to avoid leaving them in the walkways so that thae cords do not become a tripping hazard.

Proof your electrical connections to avoid tripping hazards. Elevate any electrical connections to avoid electrocution in standing water or rain. Be sure to highlight the route of the electrical cords with caution tape or by spray painting so that maintenance teams do not trip or string-trim over them. In high grass or difficult to see places, flag electrical connections for ease of visibility.

## COMMON INSECTS IN LOUISIANA HEMP

Insects can damage the leaves, stems and flowers of hemp plants and subsequently reduce the yield and quality of the product. Scouting should occur daily, especially in the nooks of the flowers and in places where insects can hide on the plant. At this time, there are limited products that are labeled for insect control in a hemp crop. The insects most commonly seen in the LSU AgCenter hemp trials were fire ants, yellow-striped armyworms and corn earworms. Please note, many more insects can affect hemp growth.

Really interested in insects in Louisiana hemp? Check out this thesis by Nathan Arey in the Department of Entomology at LSU. https://digitalcommons.lsu.edu/gradschool_theses/5614/

For more information on controlling insect pests of hemp in Louisiana, please refer to the following Bug Biz Series LSU publications.

- Red Imported Fire Ant
- Hemp Russet Mite
- Yellow-striped Armyworm
- Red Banded Stink Bug
- Cannabis Aphid

To see approved pesticides for use on hemp, visit https://www.epa.gov/pesticide-registration/pesticide-products-registered-use-hemp.

## COMMON DISEASES IN LOUISIANA HEMP

In the 2020 and 2021 field and high tunnel hemp experiments, a number of diseases were recorded. The most commonly occurring diseases included southern blight (*Sclerotium rolfsii*), stem canker (*Botryodiplodia* sp.) and root rot (Phytophthora root rot). Limited fungicides are labeled for use in hemp fields. Using common best management practices for crops, one can reduce disease incidence in hemp.

Common best management practices to avoid disease include:

- Water at the base of the crop to prevent ideal conditions for pathogens. Avoid overhead irrigation and use drip irrigation in CBD hemp fields.
- Spread plants apart to improve airflow. Preliminary research suggests plants should be spaced 4 feet apart from one another in a single drill in rows.
- Plastic mulch can reduce soil splash to protect plants from soil-borne diseases moving into newly pruned areas.
- Keep the field free of weeds that can harbor disease, viruses and insects.
- Manage insects. Many insects are vectors for viruses and disease.

Table 1 displays the most challenging aspects of Louisiana hemp production from disease, insect pests, and cultural challenges.

**Table 1. Cultural and Pest Related Challenges of Growing Hemp (Cannabis sativa) in Louisiana**

| | | Field Grown | High Tunnel in Ground | High Tunnel in Container | Greenhouse | Indoor |
|---|---|---|---|---|---|---|
| Disease | Southern Blight | Y | Y | N | N | N |
| | Stem Canker | Y | Y | Y | N | N |
| | Phytophthora Root Rot | Y | Y | N | N | N |
| | Fusarium Head Blight | Y | Y | Y | Y | Y |
| Insect Pests | Armyworm | Y | Y | Y | N | N |
| | Corn Earworm | Y | Y | Y | N | N |
| | Spider Mites | N | N | N | Y | N |
| | Aphids | Y | Y | Y | N | N |
| Cultural Challenges | Requires Staking | Y | Y | Y | Y | N |
| | Adequate Drainage | Y | Y | N | N | N |
| | Natural Photoperiod Dependency | Y | Y | Y | Y | N |

*Y — This is a challenge in this location.*
*N — This is not a challenge in this location.*

Where you choose to grow your hemp crop can present varying degrees of challenges from high to low startup costs and even the overall ease of production and harvest. Location may even affect the quality of flowers that are harvested because of presence or lack of environmental challenges. Table 2 displays a ranking of lowest (1) to greatest (5) challenges in production from outdoor to indoor locations.

**Table 2. Location challenges when in Growing Hemp (*Cannabis sativa*) in Louisiana**

| | Field Grown | High Tunnel in Ground | High Tunnel in Container | Greenhouse | Indoor |
|---|---|---|---|---|---|
| Initial Startup Cost | 1 | 2 | 3 | 4 | 5 |
| Labor Requirement | 5 | 4 | 3 | 2 | 1 |
| Ease of Harvest | 4* | 4* | 3 | 1 | 1 |
| Quality of Flower | 1 | 2 | 3 | 4 | 5 |

**Ease of Harvest has two locations both ranked with a 4. Anytime you are growing in the ground and outdoors, weather will play a role in ease of harvest, with precipitation, wet field conditions and air temperature all influencing working conditions.*

## POSTHARVEST REQUIREMENTS

A postharvest facility is crucial for successfully completing the hemp production process. Hemp requires an environmentally controlled area for drying, trimming and storing the product until sale and distribution. Even though the product has been removed from the field, post-harvest diseases such as gray mold can occur rapidly. Optimum drying and storage conditions are 70-75 F with a 35% relative humidity. Adequate space between plants when drying is also important. All flower material must be dried to a moisture content below 12% as per 2018 USDA Farm Bill protocol.

**Louisiana is naturally very humid and using a properly sized dehumidifier can help reduce the humidity in the drying room.**

**Interested in reading all about Louisiana field hemp trials? Check out this thesis by Kaylee M. Deynzer in the School of Plant, Environmental and Soil Sciences at LSU. https://digitalcommons.lsu.edu/gradschool_theses/5608/**

*Postharvest conditions of hemp are critical. Store hemp plants where they can remain dry and at a constant temperature of 70 to 75 F with a relative humidity of 35%. If possible, have space between plants so air can naturally flow through the storage area to avoid mold. LSU AgCenter photo by Kaylee Deynzer*

## EXTRACTION AND PROCESSING CONSIDERATIONS

An important factor to consider is extraction and processing delays. With the rise in hemp production, there has been an influx of new producers with a shortage of extraction and processing facilities. Industrial hemp producers should be prepared to store their product for up to one and a half years for processing. Once the product is returned to the original producer, it can be marketed for sale to retailers or wholesalers. These delays can affect the timing of the return on your investment, so planning for unforeseen waiting periods is imperative.

- When dealing with a semi-perishable crop, it is always a good idea to have contracts with buyers prior to growing the crop. This may require growing a small subset of the greenhouse or field to provide samples to buyers to show them the quality and conditions of the product that you're able to grow. Then, you can begin full production the following year once you have contracts in place.

## MAJOR CONSIDERATIONS PRIOR TO ENTERING AN AGRICULTURE-BASED BUSINESS

Many farmers, despite the crops they grow, face the same issues — weather, salary, crop loans and more. Below are a few items to note when developing a budget for growing hemp.

- You must pay yourself. So many farmers, when considering if they are making a profit or not, look at input costs and then gross farm value. But remember you must earn a salary. Your time is worth money. Make sure you are budgeting for your labor, not just the labor you may or may not hire.
- Environmental considerations. The 2020-2021 hemp trials were planted in the spring and grown through the summer and fall when tropical storms and hurricanes are most common. Make sure you have a hurricane preparedness plan for your fields, high tunnels and even greenhouses. Consider light quality during any season you grow hemp both outdoors and indoors. Adding supplemental light affects hemp's ability to flower. Louisiana naturally receives an average annual rainfall of 55-65 inches depending on which part of the state you reside in. Rainfall is not evenly distributed throughout the year. Have a plan for flooded conditions. Also consider power outages, which can be a major problem if you use supplemental lighting, depend on a well to pump water or use electricity to cool environmentally controlled growing spaces. Electricity is also necessary for most drying facilities. Consider having a generator on hand for severe weather events.

## FORECASTING

It is difficult to predict the economic viability of industrial hemp in the United States due to a lack of historical data. This is especially true when trying to predict the sustainability and capability of the hemp industry in Louisiana in the long term. However, in the short term, the hemp industry has come a long way from 2018 to 2022. These are all indicators for a stable and robust industry, however, only time will tell if this trend continues. It should be noted that outside factors, such as the approval of recreational marijuana, could potentially impact the viability of hemp.

## CLOSING REMARKS

When considering hemp farming, weigh your options carefully with the knowledge that certain factors, although risky, are on your side.

- A new market with few players.
- A steady and high demand in both national and international markets.

There is still work to be done when it comes to the industry's infrastructure. Many relationships must first be established, and many structures built, however, one may also consider that it is easier stepping into an empty room rather than a full one. Another cause for concern is Louisiana's above-average risk of devastating storms that pose a threat to the financial wellbeing of the owner and their operation. While Louisiana suffers from hurricanes, states in the Midwest face tornadoes, and other parts of the country experience excessive droughts and floods.

More research needs to be conducted in Louisiana to create budgets and profit trends for this crop. Even with the pitfalls encountered since Louisiana's first crop in 2019, there is still a potentially bright future for hemp in Louisiana. Farmers can consider hemp a semi-safe bet, however, even the safest bet is still a gamble at the end of the day.

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P3863 (online) 11/22