Hemp Growing Blueprint
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Introduction: Why Hemp? Why Shift Your Farm?

We believe that farmers hold the key to better food, a safer planet, and a sound future. By working with farms, the true source of our food, we have the opportunity to “farm our future.”

We want to disrupt the food system for the better, while improving social welfare for farmers, ensuring animal welfare and contributing to a positive environmental impact for our future. Part of this shift is propagating the incredible crop that is hemp.

U.S. Congress legalized industrial hemp in December 2018. With it, they also legalized hemp-derived CBD, short for cannabidiol, a cannabis compound that delivers the calming effects of marijuana without the high from THC. Besides CBD, hemp fibers are used to make a variety of commercial and industrial products, including rope, textiles, clothing, shoes, food, paper, bioplastics and insulation.

CBD is being lauded as an all-natural way to alleviate ailments including pain, inflammation, anxiety, and insomnia. It has become a coveted ingredient in a host of consumer products, from skin lotions to vitamin water to tinctures to dog biscuits. The surge in demand is fueling a global “Green Rush” and researchers estimate the market for CBD in the U.S. alone could be worth almost $24 billion by 2023. In Canada, sales of legal cannabis may reach $4.7 billion by that time, up from about $570 million in 2018, according to BDS Analytics.
The global industrial hemp market has already been witnessing expansion in production capacities. The supply and consumption of industrial hemp for the aforementioned applications will continue to increase in the next decade. The rising demand for industrial hemp-based products is compelling producers to expand their production capacities and build new manufacturing centers, and the Farm Transformation Institute is committed to supporting farmers throughout this growth period.

YouTube has countless talks and videos about the benefits of hemp for human health and the environment and hemp's market potential. A great introductory video is the Tedx Talk “Industrial Hemp: transformation for NC agriculture?” by Jack Whitley.
## Hemp 101: Where, When, How to Grow Hemp

Note: Click on the subtitles in the left column or hyperlinks in the right column for more information on each topic.

| Optimal climate | Warm-weather areas with well-drained soils rich in organic material  
|                 | Excessively heavy rainfall areas are not optimal  
|                 | High mountain regions are also sub-optimal |
| Optimal U.S. states | Almost all states, except Alaska, parts of Washington, parts of Oregon, and parts of New York and Ohio that experience much rainfall each year  
|                 | Top states producing hemp right now, but mainly for CBD: Colorado, Oregon, Kentucky, Tennessee, North Carolina  
|                 | More arid and dry places would have to rely on intense irrigation. |
| Best types of soils to grow | Loose, well-aerated loam soil with abundant organic matter  
|                           | Ideal soil temperature: 50° F  
|                           | pH 6.0-7.5 |
| **Best season/time of year for planting** | Well-drained or tiled clay soils can be used, but poorly-drained clay or poorly structured soils often results in establishment failures, as seedlings and young plants are prone to damping-off. |
| **Best time of the year for harvesting** | After the average date of the final frost when soil temperatures achieve at least 50°F (between late April and June in most U.S. zones): ensures seeds germinate and emerge quickly and grow into taller plants with greater yield potential. |
| **Best agricultural practices** | Best usually in early October when the plants are ~ 16 weeks old, and the flowers ripe and full of seeds. 
Seeds mature at different rates on different plants, and sometimes even at different times on the same plant. 
When the lower seeds near the stalk are mature and have split open, the seeds near the top are not yet mature. 
Harvest at a time when a minimal loss of seed will occur. |
| | Till the soil before planting. 
Prepare a firm, shallow bed for uniformity in seeding depths. 
Sow hemp seeds directly in the soil, rather than starting them in pots and then transplanting. 
Sow seeds relatively closely together, as close as 4 inches. 
Plant seeds at a depth of ~ 1/2 to 3/4 inch. |
- Seed in 15-inch to 30-inch rows at a rate of 25 to 35 pounds per acre.
- Once seeds are planted, it is recommended to roll and pack the soil.
- Irrigate planted seeds sufficiently (if needed), especially during their first 6 weeks.
- Seeding rates: between $20 and 50 pounds per acre
- Seed costs between $35.00 and $70.00 per pound

**Machinery and equipment required for seeding and harvesting**
- For sowing: a grain drill or a corn planter.
- Harvested with a combine tractor and, almost immediately, clean to remove any stocks, leaves, and immature seeds
- The National Hemp Association lists sellers of farm equipment and hemp dryers.
- **Industrial Hemp Farms**: Services for production, transport, processing of industrial hemp and CBD hemp

**Best crops to rotate with hemp**
- Hemp can be grown continuously for several years on the same land, but this comes with the risk of pest buildup (mainly rootworms, borers, and rots).
- Hemp can be used to diversify rotations of bean, wheat, or alfalfa; hemp can
  - suppress weeds and decrease outbreaks of insects
  - add organic matter to the soil
  - providing aeration to the soil through its extensive root system
- Recommended that hemp does not follow canola, soybeans or sunflowers to avoid the risk of white mold and other pests and diseases.
| **Suggested companion plants** | • Lavender  
• Basil  
• Lemon balm  
• Peppermint  
• Chamomile  
• Yarrow  
• Dill  
• Coriander  
• Marigold  
• Corn or sunflower to avoid cross-pollination |
|---|---|
| **Fertilizer and/or other soil additives required for optimal growth** | • Test soil for sulfur, potassium sulfate, and rock phosphate levels, to make sure these are not too high (for the most reliable readings, perform tests in autumn or early spring). Cornell University lists a few [soil testing labs](http://www.soiltestinglabs.com).  
• Add compost or a seed starting solid fertilizer (NPK 4-4-4) the year after hemp has been planted for the first time to return minerals to the soil  
• Till up the ground to add compost or fertilizer, which also adds oxygen to the soil. |
<p>| <strong>Disease, pest and weed control</strong> | • Soilborne fungi: Aphanomyces cochlioides, Rhizoctonia solani and various Pythium species - try minimizing risk by improving <a href="http://www.soildrainage.com">soil drainage and practicing crop rotation</a> |</p>
<table>
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<th><strong>Powdery mildew (caused by the fungus Erysiphe betae)</strong> - control with sulfur fungicides or Bayleton</th>
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<td><strong>New York State pesticide usage database</strong> (likely applicable to all U.S. states)</td>
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**Expected yield**

- 1 acre of hemp can yield:
  - ~700 pounds of grain - can be pressed into about 22 gallons of oil & and 530 pounds of meal
  - ~5,300 pounds of straw - can be transformed into ~1,300 pounds of fiber

**How to store hemp**

- If selling seed, dry to ~12% humidity content shortly after harvest; otherwise it can combust due to its high oil content. Drying to 12% will also avoid mold and mildew growing on it.
- Package in an air-tight container.
- Hemp seed consumers are always advised to keep seeds in the fridge once the bag/container is opened.
- The National Hemp Association lists sellers of [farm equipment and hemp dryers](#).
- **Industrial Hemp Farms**: Services for production, transport, processing of industrial hemp and CDB hemp
Hemp Farming Timeline

Source: Hemp Farm Academy
Organic Hemp Farming

Hemp is an ideal crop for organic farming because hemp:

- requires minimal inputs
- is fairly resistant to pests and diseases
- grows so fast it outcompetes most weeds - no need for herbicides, pesticides, weeding – a major labor cost for most other organic crops.

If practicing organic hemp farming, it is important to add compost and till to add oxygen to the soil. And ideal compost will be a 50:50 mix of brown material (dried leaves, stalks, etc.) and green material (fresh leaves, stalks, etc.). Avoid adding plants or soil with pests or diseases to the compost mix.

Mulch composed of the shredded pieces of stalk, leaves, and roost decreases evaporation and allows the soil to hold moisture more effectively. A micro-biome is also created when mulch is applied to the ground. This creates an environment for beneficial bugs, bacteria, and other wildlife to grow and thrive.

The United States Department of Agriculture (USDA) currently doesn’t allow marijuana to be certified organic in the states where it is legally grown, but hemp farming is exempt from that rule. The market for certified organic hemp seeds is quite strong.
Uses of Hemp

There are 25,000 uses derived from hemp that fall into different subcategories:

- Foods and beverages
- Cosmetics
- Paper
- Bioplastics
- Textiles, including clothing
- Building materials
- Fuel

A few qualities of hemp worth noting:

- 1 acre of hemp produces twice as much oil as 1 acre of peanuts and almost 4 times as much fiber pulp (for paper) as 1 acre of trees.
- Hemp oil pressing is fairly easy because the infrastructure is already there, e.g. canola oil press can be used for hemp. However, there is a need for much more investment for fiber production- governmental support, grants, tax incentives, angel investors.
- Hemp paper is naturally acid-free and does not yellow as quickly as tree pulp-based paper.
- Hemp has the strongest (and longest) plant fiber in the world, resistant to rot and abrasion, and was in long use before DuPont patented nylon in 1937. It was used for ship rigging, military uniforms, parachute webbing, baggage and more.
Because of its strength, hemp fiber can be used for composite materials that could be used to make anything from skateboard decks to car and stealth fighter bodies.

A hemp composite material (with limestone and water) forms a type of concrete (hempcrete) that can be used for home building, at 1/9th the weight. It also acts as insulation and repels some vermin.

Potential Use of Hemp Byproducts

Leaves can be used to make tea or oils. Roots can be used to make tea, ointments and salves. Stalks can be used in the textile industry or mulched and used as compost i.e. organic material for hemp production the next year or even for other crops.


The stalks sequester [more carbon](#) from the atmosphere than the carbon emissions required to produce them, making hemp an ideal crop for carbon credit and carbon offset programs.
Market Potential of Hemp

Currently, the main hemp buyers of raw hemp seeds are food and ingredient companies and personal care product companies. Most hemp seeds are processed to make different products and only a small part is being sold as raw seeds to the public. Hemp seeds are not a product to be sold on a small scale, as farmers market’s for profit since at least 50 acres are needed to be profitable. However, most income for hemp/marijuana producing farmers is still CBD at the US

In the U.S., hemp is currently grown in 24 states and on 78,176 acres total. In 2019, the Department of Agriculture approved more than 42,000 acres for hemp, based on applications from 1,035 farmers and 130 processors, with expectations that 20,000 acres will ultimately be planted. Many tobacco farmers are thinking about shifting to hemp, especially in Kentucky.

According to 2018 data, U.S. hemp production produced $1.1 billion in revenues, a number estimated to more than double by 2022 to $2.6 billion.

The following websites list job openings in the hemp industry that consequently represent a number of companies that are buying raw hemp seeds from farmers.

1. CareerBuilder
2. Indeed
3. ZipRecruiter
4. CannabizTeam
5. Viridian Staffing
6. HempStaff

Financial Modelling and Financial Support for Hemp Farming

The **highest market value** lies in food products, industrial applications, and personal care products. Profits from hemp range from ~ $130 to $1000 per acre or ~ $5 per pound. Upfront costs for hemp cultivation by acre are ~$450 per acre including seeds, fertilizers, fuel, etc. Seed costs only lie between $35 to $70 per pound.

It is highly recommended to contract - in writing - with a processor first to secure that the processor will pay a fair amount per acre (ideally at least $1,000 an acre). If the customer/processor isn’t going to provide the farmer with the genetics (seeds or clones) the seeds can cost up to $0.8 per piece and clones around $4 per plant.

**Budget planning tools:**
1. Sample [industrial hemp financial plan](#): cost and expenses breakdown
2. [Sample Industrial Hemp - Grain Production Budget](#) - follow the hyperlink and scroll down to “Sample Budget Worksheets” to download the PDF.
3. [Sample Industrial Hemp - Fiber Production Budget](#) - follow the hyperlink and scroll down to “Sample Budget Worksheets” to download the PDF.

**Other funding opportunities:**
4. [Cannabis Investment Fund](#)
5. [Hemp Capital Fund](#)
6. [Hemp loans and grants](#)
Hemp Farming Experts and Supportive Farm Affiliates

1. National Hemp Association
2. Hemp Industries Association
3. Rodale Institute
4. First Crop: Subsidizes farmers to lower costs, provides them with high-quality hemp seeds, and educates them on best practices for organic cultivation and harvest. Farmers are guaranteed the purchase of their hemp crops at fair market prices and share in five percent of the profits. The company also gives back to the communities it empowers: 10% is donated to the First Crop Foundation, which supports sustainable farming and efforts to fight hunger and homelessness.
5. American Hemp Seed Genetics
6. Hemp Genetics International
7. Hemp Genomics
8. South Carolina Hemp Farmers
9. Canadian Hemp Trade Alliance
10. Hemp Genetic Testing Services
Online Hemp Growing Courses

1. Norquest College: Hemp farming and hemp processing courses.
   Contact: continuinged@norquest.ca

2. The Hemp University: various courses

3. The University of Vermont:
   a) Introduction to Hemp Production (this is the fall 2019 course but it will likely be offered again in spring)

   b) Professional Certificate in Cannabis Plant Biology. Cannabis chemicals, genetics, agricultural best practices, post-harvest handling, processing, as well as how cannabis affects the human body through learning basic pharmacology and examining the different modes of administration.

   Contact: Learn@uvm.edu

4. Hemp Farm Academy
   Contact: farmertom@hempfarmingacademy.com
5. Chimney Rock Hemp: To check our open enroll periods click on this link

Chimney Rock Seed Catalog

Membership Brochure

Chimney Rock offers online intern courses and the option of a 2-4 week onsite hands-on Capstone work-study program. The Capstone work-study events happen at planting and harvest time each year and are a prerequisite to their art time Apprentice and Journey Person programs each summer. The online courses are available as a video-on-demand series leading to a certificate in Chimney Rock Profitable Hemp Farming. They also offer one-on-one virtual and physical consulting services for start-up ventures, product entrepreneurs and farmers worldwide. They host on-farm conferences and events once or twice a year for those looking for a farm tour and introduction to hemp farming. For their consulting clients, they offer an intensive one week Hemp Boot Camp for Farm Managers using their Train-the-Trainer approach.

Contact: rich@chimneyrockfarms.com
Additional Relevant Articles and Resources

Hemp Farming 101

1. Cornell University Hemp Growing Guide - very in-depth guide with many resources, including hemp genetics, soils testing labs, pesticide information, and state laws.
2. So, You Want to Be a Hemp Farmer? - Why you should become a hemp farmer and what does it take.
3. Purdue University Hemp Project - Agricultural practices and business planning tools.

Market potential, financial planning, contracts

4. Industrial Hemp Farms

State Laws

5. State Industrial Hemp Status - Laws and the Farm Bill surrounding hemp.
8. New York State hemp regulations