



2020 Hemp Program Annual Report

Plant Protection Division
Prepared January 2021

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Minnesota Hemp Program

The 2014 Farm Bill contained a provision to allow state departments of agriculture to administer pilot programs to study the growth, cultivation, and marketing of hemp. In 2015, the Minnesota Industrial Hemp Development Act (IHDA) (MINN. STAT. 18K) became law. This allowed the Minnesota Department of Agriculture (MDA) to create a hemp pilot program. The Minnesota Hemp Pilot Program operated from 2016 through 2020.

The 2018 Farm Bill officially legalized hemp cultivation for commercial purposes and removed it from the Controlled Substances Act. On October 31, 2019, the U.S. Department of Agriculture (USDA) released the Interim Final Rule (7 CFR part 990), which formed the regulatory framework for all hemp cultivation nationwide. Each state and tribal authority had to submit a plan to the USDA to regulate hemp at the state/tribal level. The Minnesota state plan was approved in July 2020 and became effective January 1, 2021. The Minnesota plan can be viewed in its entirety on the USDA website.¹

On January 15, 2021, the USDA released the Final Rule (86 FR 5596). The Final Rule contains key changes from the Interim Final Rule based on comments from states, growers, and others in the hemp industry. The MDA will be amending the Minnesota plan to incorporate the changes in early 2021.

This report only covers the activities included under the MDA Hemp Pilot Program. To view hemp plans for tribal entities in Minnesota, please visit the USDA website.²

Background

Hemp Program applicants must register their specific growing and processing locations and pay the annual program fees. Table 1 provides an overview of the Minnesota Hemp Program since it began in 2016.

Table 1. Minnesota Licensing and Acreage Statistics 2016-2020

Statistic	2016	2017	2018	2019	2020
Applicants	7	47	65	505	586
Licensed Growers	6	33	43	353	461
Licensed Processors³	0	5	21	214	232
Outdoor Acreage Planted	38	1,202	709	7,353	4,690
Indoor Square Footage Planted	0	0	54,618	403,304	282,790

¹ www.ams.usda.gov/sites/default/files/media/MinnesotaIndustrialHempPlan.pdf

² www.ams.usda.gov/rules-regulations/hemp/information-state-departments-agriculture-and-tribal-governments

³ Some licensees hold both Grower and Processor license categories; they are double counted in these stats.

THC Testing

Hemp is defined under state and federal law as the plant *Cannabis sativa* L. with a delta-9 tetrahydrocannabinol (THC) concentration of no more than 0.3% by dry weight. The 2018 Farm Bill specified that delta-9 THC must be determined post-decarboxylation (Total THC).

Growers are required by law to report the location of each variety/lot of hemp that they plant to the MDA for regulatory sampling by a trained inspector no more than 30 days prior to harvest. To sample a hemp lot, the inspector takes a cutting from 30 different plants randomly selected throughout the population. The top two inches of the female flower are cut from each of the 30 plants, and the cuttings are placed in a single paper bag. The plant material is dried and homogenized by grinding prior to the laboratory analysis for Total THC. Lots which have less than 30 plants are sampled proportionally. All planted varieties are sampled and tested separately.



Figure 1. An MDA inspector taking a sample of a hemp plant.

In 2020, the MDA collected 762 samples. Of those, 77 tested above the 0.3% THC threshold, which is a 10% failure rate. In 2019, the failure rate was 13%. That downward trend is promising. Improved breeding and seed production efforts may be creating more consistent varieties that are lower in THC. Also cannabigerol (CBG) varieties are naturally lower in THC, which is bringing down the average THC levels. The average THC concentration for each hemp type grown in 2019 and 2020 is listed in Table 2.

**Table 2. Average percentage THC concentration for 2020 hemp samples by crop type
(Total Delta-9 THC post-decarboxylation)**

	All Samples	CBD	CBG	Grain	Fiber
2019	0.24%	0.29%	N/A	0.10%	0.22%
2020	0.26%	0.32%	0.11%	0.06%	0.22%

High-cannabidiol (CBD) varieties accounted for 94% of the total failed samples in 2020. Research from Cornell University has shown that 33 of the 35 high-CBD varieties they tested eventually went above the 0.3% THC threshold if allowed to reach maturity.⁴ Many times the Certificate of Analysis (COA) that the seed seller provides does not accurately represent the hemp lot when sampled according to the MDA's sampling protocol,

⁴ <https://hemp.cals.cornell.edu/docs/2018-cannabinoid-production-analysis/>

which has been reviewed and approved by USDA. In order for growers to have useful information to choose good genetics, they need access to COAs that reflect the true Total THC level of the variety at the point of maturity that the MDA will sample.

In an effort to help growers make better choices when selecting varieties, the MDA will publish a spreadsheet each year which summarizes the following information about each hemp variety grown in Minnesota. The spreadsheet can be found on the MDA Hemp Program's webpage.⁵

- Number of samples collected
- Average Total THC level
- Lowest and highest recorded Total THC level
- Number of samples that have results in the following ranges:
 - $\leq 0.300\%$
 - 0.301- 0.500%
 - 0.501- 0.999%
 - $\geq 1.000\%$

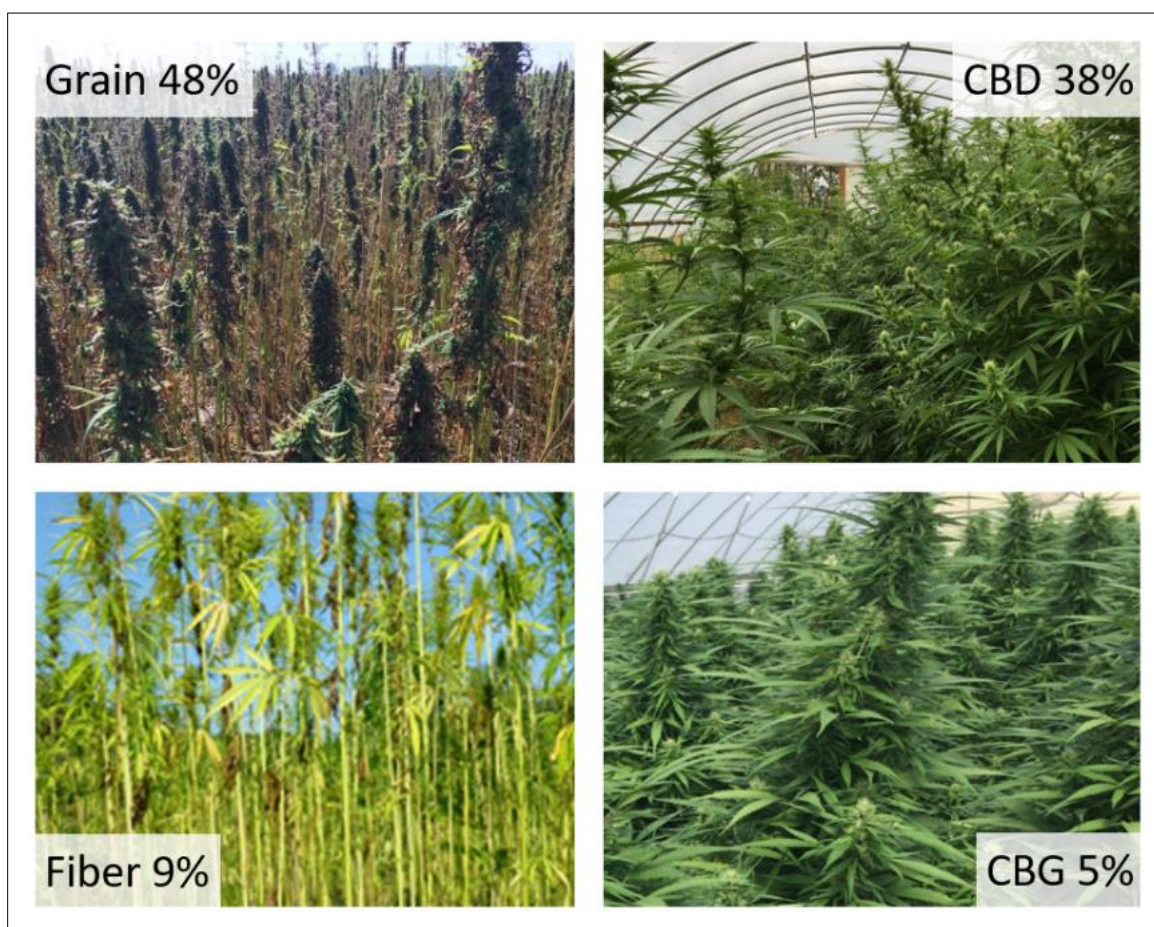


Figure 2. Percentage of acreage grown in each crop type in 2020.

⁵ www.mda.state.mn.us/plants/hemp/industhempquestions

Variety Information

As previously stated, important considerations for hemp growers are variety and seed source. In 2020, 72% of the CBD/CBG growers grew their crop from seed, 17% from clones, and 11% used both seed and clones. Clones are more expensive, but they are generally more uniform and predictable than plants from seed, since all the plants have identical genetics.

Growers must use caution when sourcing genetics. Despite assurances from the vendor claiming that a variety is guaranteed to be low in THC, there is always the possibility of the plants testing above the THC threshold. There are many factors that affect THC production, including nutrients, light regime, genetics, and crucially, length of time under cultivation. Correctly timing testing and harvesting is essential. In Minnesota, there have been hemp crops grown from the same seed source, planted in different fields, in which one failed and the other passed the THC test. Many factors go into the realized THC level of a population, and the factors are not well-understood yet.

It is also important to plant seed that has been produced under controlled conditions. Hemp plants that have been open-pollinated are unpredictable. There have been several growers in Minnesota that saved and grew seed harvested from their previous production, without controlling the cross-pollination, and the offspring were much higher in THC than the parent plants.

Most growers obtained seed from Colorado, Oregon, Wisconsin, and Minnesota sources. Hemp was grown specifically for CBG production for the first time in 2020. CBD and THC production in the hemp plant are very closely related and they will rise at the same rate over time.⁶ CBG is not as closely linked to THC and, therefore, CBG levels can be high without a corresponding THC increase. This fact, coupled with the relatively high price point of CBG, has made it attractive to growers.

The MDA Hemp Program does not test for CBD or CBG concentration during the regulatory testing, only Total THC. The MDA does not have comprehensive data on these other cannabinoids. The limited data available shows a wide range in CBD levels in harvested hemp, 3.6% on the low end and 19% on the high end. The average final CBD levels for varieties grown specifically for CBD production was 9%. One important point to note is that seed companies will often provide their buyers COAs of the varieties at full maturity to show the highest potential CBD levels. However, the THC levels are almost certainly above 0.3% at that maturity level, so it is not realistically possible to achieve those yields.

⁶ A physical and genetic map of *Cannabis sativa* identifies extensive rearrangements at the THC/CBD acid synthase loci. *Genome Res.* 2019 Jan; 29(1): 146-156

Pests

The most common pests reported on hemp were aphids, Eurasian hemp borer, and corn borer. Also reported in less significant levels were spider mites, thrips, flea beetles, and cutworms. Spider mites and thrips were only an issue in indoor hemp growing locations.

The most common hemp diseases encountered included Septoria leaf spot and Sclerotinia white mold. Botrytis gray mold, bud rot, powdery mildew, and fusarium wilt were also observed in lesser frequency. Hemp growers continue to struggle with disease management as they are not sure where to find more information.

All pesticides must be approved by the Environmental Protection Agency (EPA) and also by each state. There are a small number of pesticides, mostly minimum risk FIFRA-exempt 25(b), that are approved by the EPA, but none that are approved for use in Minnesota.⁷ Proper spacing and air movement helps to control pests, especially in indoor settings. Keeping the grow areas clean and sanitary is essential, as well as removing and destroying infested plant material.

Weed management is a huge issue with hemp production. Since there are no herbicides currently registered for use on hemp in Minnesota, the only options are prevention and physical control. When growing for industrial grain or fiber production, the fields are seeded at a high pounds per acre, in tight row spacing, allowing the hemp crop to shade out any weeds. For CBD/CBG production, growers mow between rows and weed between plants by hand. Some growers use plastic mulch or cover crops to control weeds.

Harvest

Grain harvesting was done by combine with a draper head. Hemp grown for fiber was cut with a disc mower, dried in the field to approximately 15% moisture, and baled.

Many CBD/CBG growers hand-harvested by cutting the plants and hanging them indoors to dry. After drying, they would “buck and shuck” the plants, removing stalks, stems, and leaves. A smaller percentage of growers used a modified combine, which harvests a mixture of stem, leaf, and floral material, referred to as hemp biomass. This material is of lower quality when compared to selective hand harvesting of flowers. The two significant issues reported regarding harvest for CBD/CBG growers was lack of space for drying and lack of suitable labor.

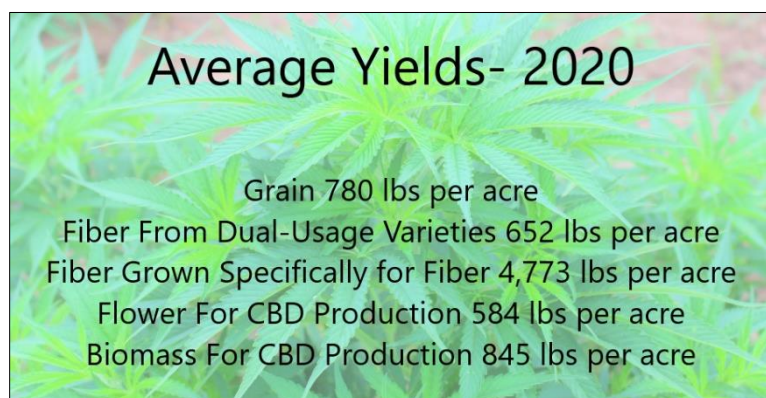


Figure 3. The average yields for grain, fiber, CBD flower, and CBD biomass in 2020.

⁷ Hemp Pesticides in Kentucky: Working through the Confusion - <https://hemp.ca.uky.edu/grower%20resources#AE> (YouTube)

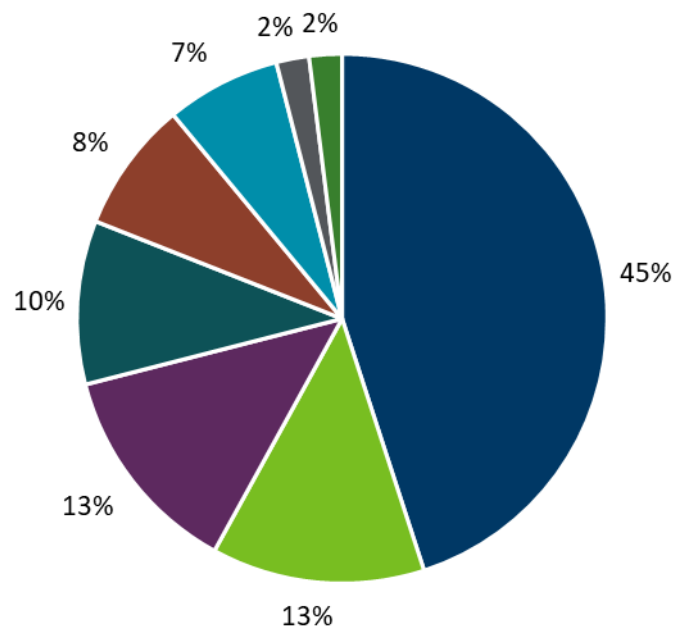
Markets

Accessing markets and buyers remains the most important and difficult issues facing all Minnesota hemp growers. In July 2020, the University of Minnesota (UMN) conducted a survey of Minnesota farmers, those that have grown hemp and those that have considered it, asking them a range of questions about their experiences and barriers they encountered. Of the farmers that had first-hand experience with hemp cultivation, 66% cited lack of value chains and markets as the most important barrier to profitable production of hemp.

Table 3 shows the end use of hemp grown in 2020, as reported by growers in the MDA Hemp Program's final report survey. Almost half of the respondents reported that they had no buyer for their crop as of December 2020. Many growers had not sold their 2019 hemp crop either. The majority of those who had sold their crop for profit had done so through their own product line or direct to consumer marketing.

Table 3. Reported End Use of Hemp Grown in 2020

Reported End Use	Percentage of Reports
Unknown / No buyer as of December 2020	45 %
Processed into oil and will formulate their own products	13 %
Biomass processed into oil, buyer unknown	13 %
Selling smokeable flower	10 %
Sold seed / grain	8 %
Still in research and development	7 %
Selling biomass	2 %
Personal use	2 %



It is essential for any prospective hemp grower to carefully investigate their sales options before they obtain a grower license or plant seed. If they do find a buyer, it is highly recommended to enter into a contractual agreement, reviewed by an attorney that understands cannabis law and the industry. In any new industry, there are growing pains that occur before it becomes established and normalized. The hemp industry is no different. Some Minnesota growers have reported that they have been taken advantage of by unscrupulous processors and buyers. In the UMN survey, “trust and transparency between buyers and sellers/contract reliability” was ranked as the most important factor in hemp marketing considerations. Both buyers and sellers must be aware that all agricultural contracts executed in Minnesota are subject to the requirements laid out in Minnesota statute (MINN. STAT. 17.90).⁸

The University of Kentucky (UK) has a publically accessible, interactive tool called the Hemp and Enterprise CBD Budget Model.⁹ Pricing information is provided by Kentucky-based growers and processors and is regularly updated. As there is not a Midwest-based economist doing this type of research at this time, this is the best source of information for Minnesota growers at this time. According to data provided by UK, in February 2019, the price for CBD biomass was \$5.00 per pound per percentage point of CBD concentration. At this price, UK estimated a potential return of \$14,237 per acre. The 2020 price point of CBD biomass was \$1.00 per pound per CBD point, dropping the potential return to \$4,000 per acre. There are many variables that can affect these numbers on each individual farm; yield, cost of inputs such as seed and fertilizer, and labor costs are just a few. The interactive tool provided by UK allows the grower to adjust those variables to see how it will affect the bottom line.

Contract prices for hemp grain in Minnesota in 2020 were \$0.50 - \$0.60 per pound. Contract prices for fiber in Minnesota in 2020 were \$0.15 per pound. The cost of hemp production is considerable, especially for first-time, small-scale CBD- or CBG- type hemp growers (Table 4).

Table 4. Cost of Hemp Production Statistics

Cost of Production Statistics	Minnesota
Average cost of CBD-type clones per acre	\$3,749
Average cost of CBD-type seed per acre	\$2,674
Average cost of industrial-type seed per acre	\$134
Average labor cost per acre	\$6,229

⁸ Minnesota Office of the Revisor of Statutes website: <https://www.revisor.mn.gov/statutes/cite/17/pdf>

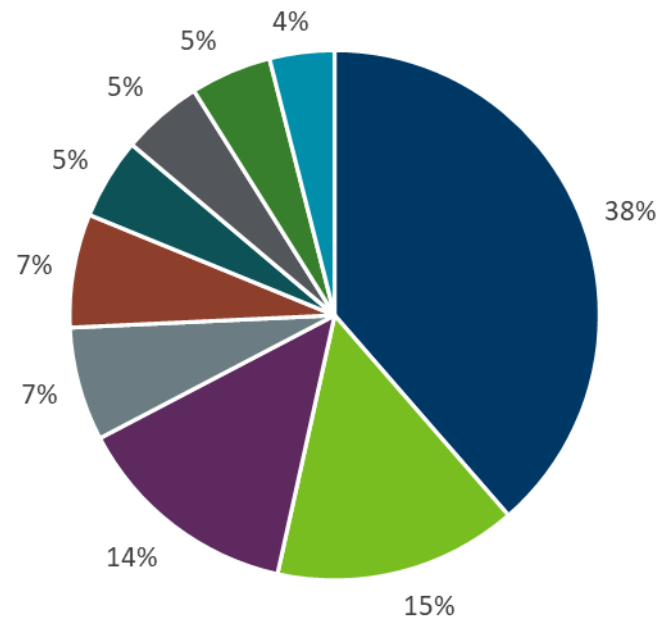
⁹ University of Kentucky Industrial Hemp Agronomic Research website: Grower Resources
<https://hemp.ca.uky.edu/grower%20resources#AE>

Processors

There were 232 hemp processors licensed in Minnesota in 2020. A processor is defined as any person or business that converts raw hemp into a product. An MDA Hemp Program license is not required for hemp product manufacturing after it is processed out of its raw form, nor for retail sales. Approximately 40% of licensed processors did not end up using the license. Table 5 provides a breakdown of the different processing methods utilized by Minnesota hemp processors in 2020.

Table 5. Processing Methods Employed by Minnesota Hemp Processors in 2020

Reported Processing Methods	Percentage of Reports
Did not process	39%
CO ₂ CBD extraction	15%
Packaged flower for smoking	14%
Ethanol CBD extraction	7%
Rosin press for CBD extraction	7%
Cold water / dry ice CBD extraction	5%
Seed press for oil	5%
Rolling into cigarettes	5%
Fiber decortication	4%



Summary

The results of the MDA Hemp Program final report survey and the UMN survey indicate that there remains much uncertainty in the industry. Growing and processing hemp have certainly provided good opportunities for some in the MDA Hemp Program but have also resulted in crop and financial loss for others. Regulatory uncertainty was cited as the second-most important barrier to hemp production in the UMN survey.

The federal Final Rule has key changes which ease the regulatory burden on hemp growers. It will take time for Minnesota, other states, and tribes to implement the changes. Once they are in effect nationwide, the industry will benefit from having uniform standards with more flexibility.

The hemp industry is in need of agronomic support from local universities. Growers need some way of connecting with trustworthy buyers and help with marketing their product. Proper plant breeding and genetic selection will be extremely important for the hemp industry to flourish moving forward. Until more transparency, consistency, and stability comes to the hemp marketplace, growing hemp will remain a risky proposition.

When looking back over the past five years of the Minnesota Hemp Pilot Program, hemp has dramatically increased in popularity, public awareness, and acceptance, and the overall program has expanded significantly. More investment in processing infrastructure, demand for products, and new innovations continue to foster a brighter future. In order to build a sustaining industry, it will also be important for regulations to stabilize and work to the benefit of farmers and processors while creating a level playing field.

For More Information

Minnesota Hemp Program

651-201-6600

hemp.mda@state.mn.us

www.mda.state.mn.us/plants/hemp