The Effect of Seeding Date on Three Varieties of Industrial Hemp in Manitoba

Project duration	May 2017 – September 2018
Objectives	To understand the effect of seeding date by variety on industrial hemp grain yields.
Collaborators	Hemp Genetics, Parkland Industrial Hemp Growers, Manitoba Harvest

Adjusting Agronomic Practices in Industrial Hemp to Maximize CBD production

Project duration – *2018*
Objectives – *Gain a better understanding on the most economic way to produce CBD under field conditions in Manitoba.*

- Identification of stable, high CBD varieties adapted to Manitoba conditions.
- Identify optimal harvest timing for CBD production/extraction & yield.
- Quantify relationship between plant population and CBD content related to Genetics and Environment in Manitoba.

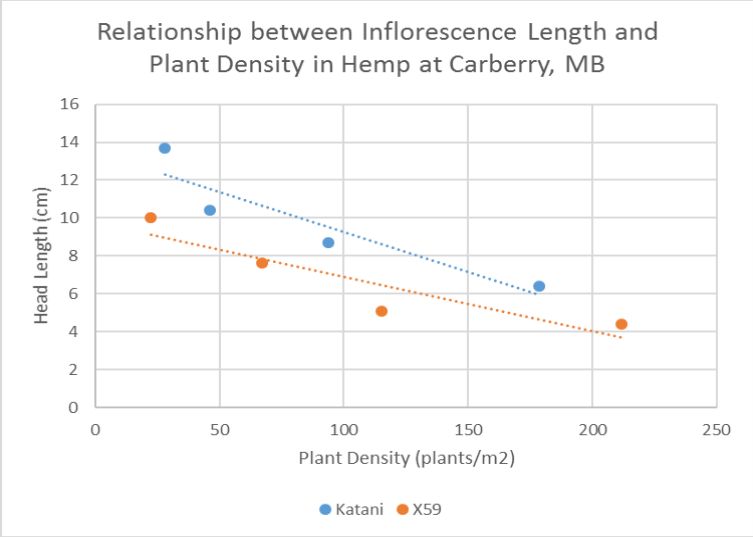
Collaborators – *Green Sky Labs, Canadian Isolates, HGI*

Results

Seeding Rate

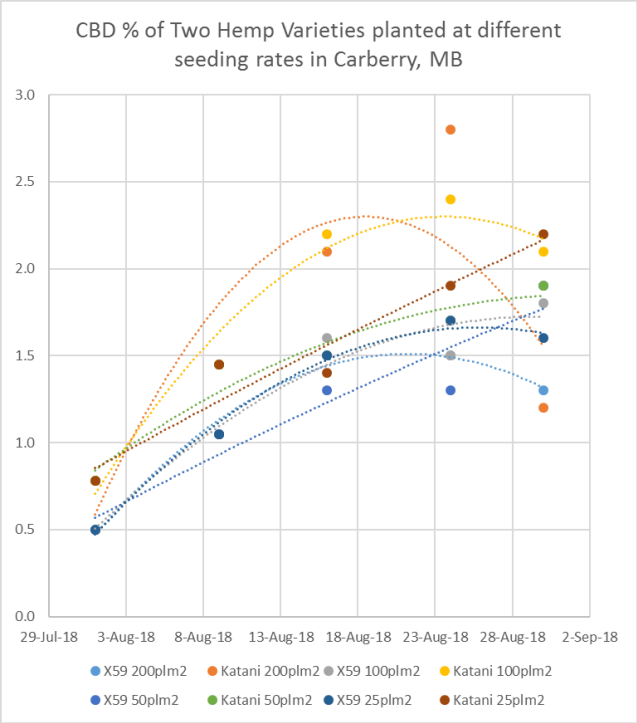
- Targeted planting densities were achieved for each variety.
- X59 was significantly taller than Katani.
- There was a reduction in canopy height as seeding rate increased although this was not significant.
- Average inflorescence length significantly decreased as seeding rate increased.

Figure 1: Relationship between Inflorescence, Length and Plant Density



The highest CBD contents were observed in the greatest seeding rates; however, levels also decreased for the highest seeding rate earlier in the fall than lower seeding rates. This is possibly due to slightly earlier or more consistent dry down.

Figure 2: Relationship between Inflorescence, Length and Plant Density



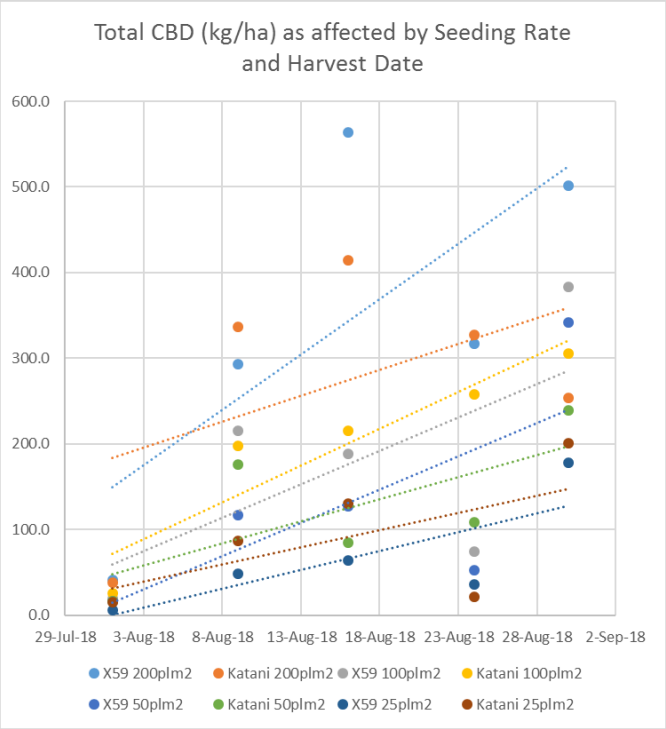
Arborg was different from Carberry with only the lowest seeding rate at the August 15 sampling date having a greater content than all other sample dates.

CBD levels sampled from increasing plant densities at Arborg, 2018

Katani		**02-Aug**	**15-Aug**
Average		1.11%	1.22%
Plant Density (pl/m2)	25	0.93%	1.83%
	50	1.02%	1.07%
	100	1.37%	1.03%
	200	1.08%	1.11%

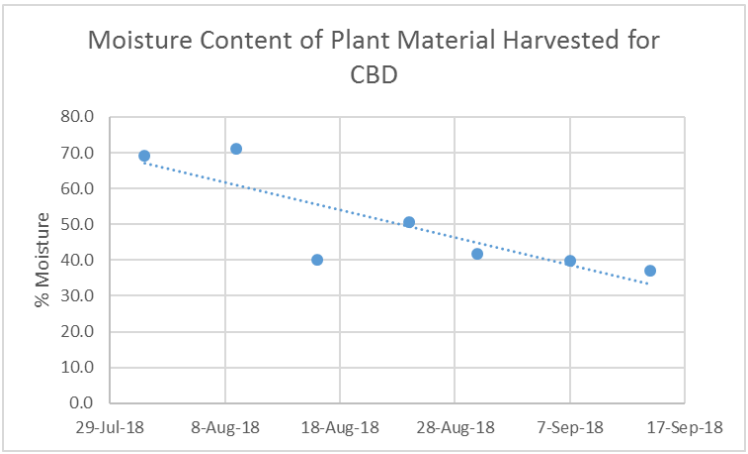
When adjusted for moisture and plant density, the two highest seeding rates still resulted in the greatest amount of CBD on a kg/ha basis.

Figure 3: Variety Seeding Rates and Dates affect on CBD



Later season harvest would increase harvest efficiency with regard to biomass hauling/handling due to lower moisture content. There would also at this time be an opportunity to recover a percentage of grain.

Figure 3: Relationship between Moisture content and CBD

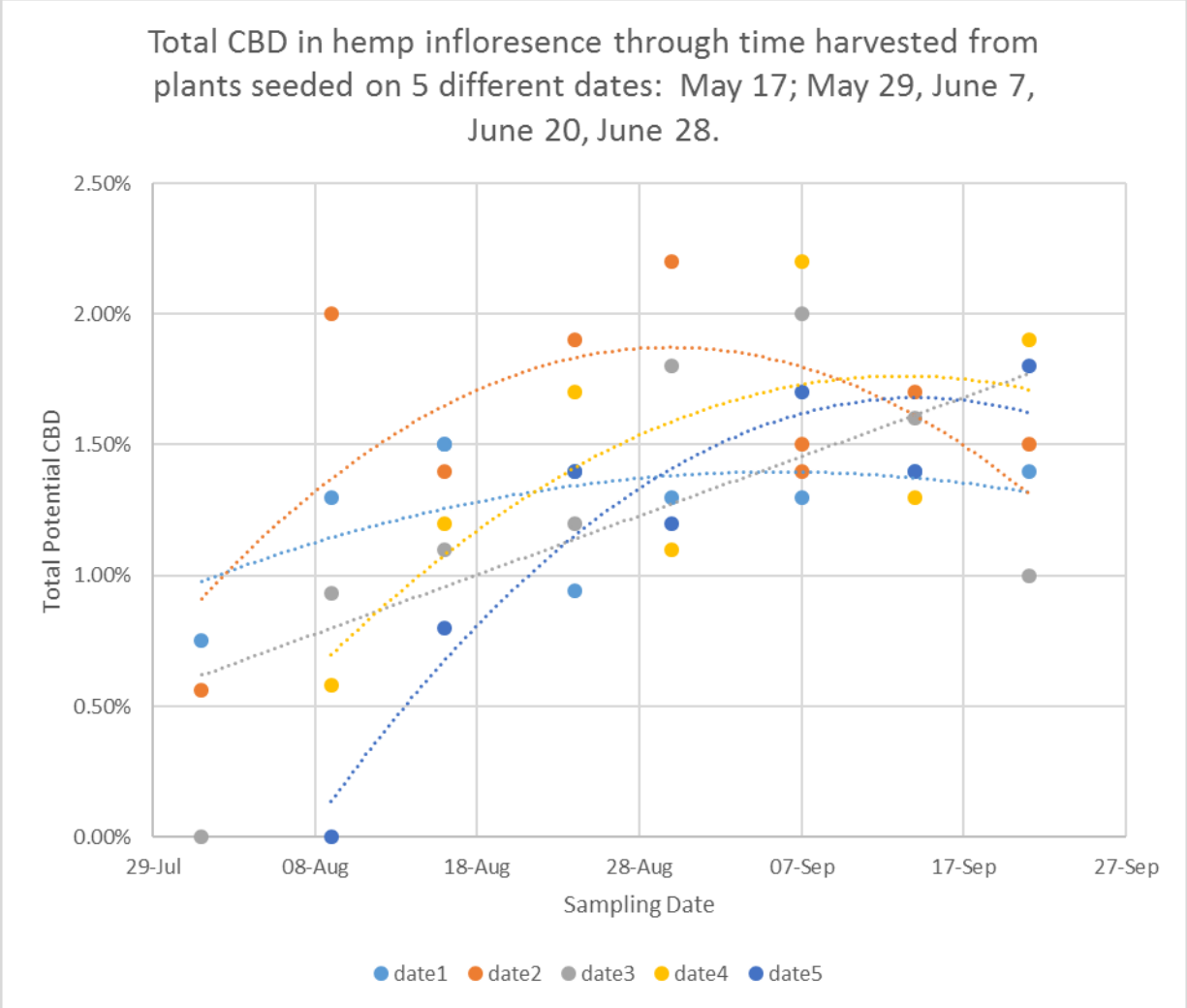


At the August 16th sampling date some additional plants were harvested. Additional testing (lowest seeding rate – large inflorescence) was performed on the inflorescence partitioning it into 1/3s. The top 1/3 of the plant had the highest CBD content (2.5%); followed by the mid 1/3 at 1.4% and the lower third at (0.89%) – overall average 1.6%.

Seeding Date

- Seedling recruitment (final plants/m2) was greater for the earliest seeding dates and declined slightly from seeding date 3 – date 5 (not significant); however, plant density was still in acceptable range (average 110 plants/m2).
- Mid June and late June seeding dates were also shorter by 10cm (p 0.1).
- Total CBD was the lowest for all studies at early August; increasing until grain harvest in early September; although there was evidence of a small peak the final week of August. The seeding date trial showed a shift in peak CBD content with later seeding dates further supporting the tie to physiological maturity; however, due to the lower biomass production maximum yield was still the lowest for the later seeding dates.

Figure 4: Relationship between CBD content in hemp inforesence and and harvest dates

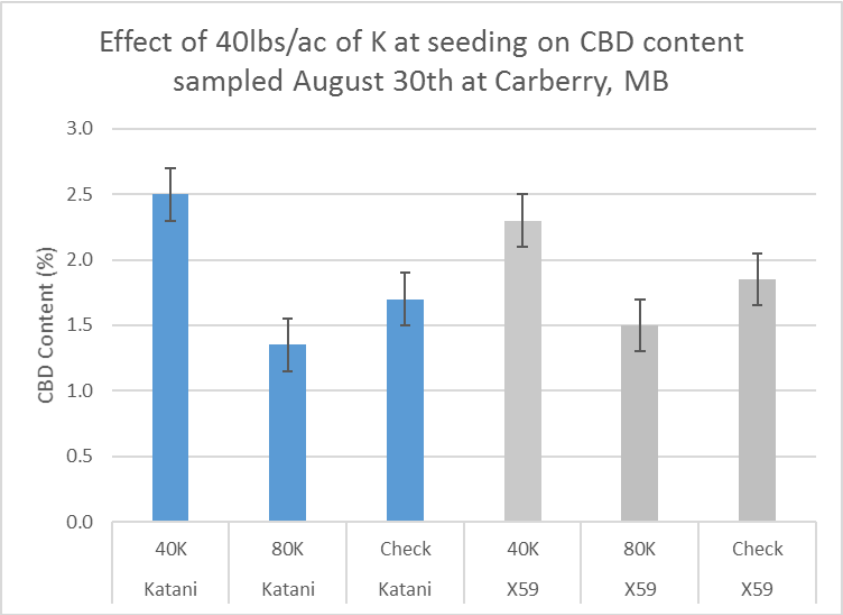


Potassium

- Additional potassium had no effect on height (Katani – 131cm; X59 – 138cm) or plants/m2 (average 160 pl/m2).

- Additional potassium at seeding had no effect on total CBD levels until the last sampling date (August 30). At this date the highest 80K rate had the lowest CBD content overall. This may suggest there is an upper limit for which additional K may have a negative effect or alternatively, some additional potassium may extend the maximum CBD content period later into the fall; more research is required, especially under potassium deficient conditions. The Carberry site typically tests high for K; the hemp site was no exception testing 396ppm.

Figure 5: Relationship between K application at seeding and CBD content



Project findings:

- Katani out performed X59 in most situations with regard to overall CBD content; however, X59 produced more biomass. Variety selection would therefore depend on extraction efficiencies.
- Maximum CBD content related directly to the level of maturity of the plant.
- CBD concentration increases as you move from bottom to the top of the inflorescence.
- CBD concentration seems to reach a maximum faster in higher seeding rates possibly due to a more rapid and even maturity.
- Greater seeding rate result in small heads but more of them (greater density/m2) resulting in the greatest amount of CBD harvested per hectare.
- Optimal harvest timing for CBD content is during last week of August, but may be extended into early September, especially for late seeded crops. The lower biomass associated with later seeding negates any content gains; however, later seeding may slightly extend harvest harvest window to spread logistical risk.
- Additional Potassium did not impact CBD levels.
- More research is required.

Background/References/Additional Resources

With the October 17th legalization of recreational marijuana and deregulation of industrial hemp, CBD, a cannabinoid found in both marijuana and hemp has become a sought after agriculture commodity. This is mainly due to the perception that CBD can be more economically produced in the field while, for various quality control (hemp and marijuana) and security reasons, high THC marijuana varieties are currently best grown indoors. At present, CBD levels in the industrial hemp varieties commercially available range from 0.5-2%. Understanding how to maximize CBD production has not been a focus until now; preliminary information suggests large environmental and genetic variability exists.

Materials & Methods*:*

Experimental Design: RCBD

Treatments:

Seeding Date Trial: 5 Seeding Dates - May 17, May 29, June 7, June 19, June 28
Plant Density Trial: Target population - 25pl/m2, 50pl/m2, 100pl/m2, 200pl/m2
Added Potassium Trial: Actual K added at Seeding: 0, 40 & 80lbs/ac

Data collected and date collected:

Plant Density
Height
CBD – content
10 heads from each plot were cut weighed, leaves and stems separated, leaves/flowers air dried at less than 35C to 10% moisture then homogenized using a food processor and refrigerated at 8C. Samples were evaluated on an Orange Photonics light analyzer using a custom method consisting of 200mg sub-samples, 10ml of solvent.

Sample Dates for CBD:

Arborg Plant Population: August 1, 15
Carberry Plant Population: August 1, August 9, August 16, August 24, August 30
Carberry Potassium Rate: August 1, August 9, August 16, August 24, August 30
Carberry Seeding Date: August 1, August 9, August 16, August 24, August 30, Sept 7, Sept 14, Sept 21.

Agronomic info

Carberry/Arborg were both seeded into Wheat Stubble
Fertilizer applied:
Nitrogen and Phosphorus Fertility: for all trials a baseline of 130lbs/ac of Nitrogen was side banded with 30lbs of seed placed Phosphorus at seeding. For potassium trial, K was banded just prior to seeding.
Pesticides applied
Edge was applied at label rate on May 6th at the Carberry site.
Assure II was applied at label rate.