2020 CHTA Industrial Hemp Variety Trial

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Jean-Pierre Privé,Ph.D. & MHI

ABSTRACT/RÉSUMÉ:

The primary objective of the Industrial Hemp Variety Trial project in 2020 was to assemble, establish and evaluate 13 promising industrial hemp varieties for New Brunswick and the Maritimes as part of a larger national hemp variety trial. Quantitative and qualitative characteristics monitored included plant growth and development, seed, fibre, oil, protein, and non-narcotic cannabinoids. The results indicate that the drought in the 2020 growing season, consisting of minimal to no rain for long stretches of time and many hot nights, reduced the growth of the trials. Emergence and days to maturity also both took longer than expected. The varieties varied in emergence from 15 plants/m2 to 75 plants/m2. Grain varieties have been bred for an earlier harvest than the Dual Purpose (DP) varieties, hence their earlier harvest date. Grain varieties averaged <1 m in cane height, while DP varieties averaged between 1.3 and 1.8 m in cane height. The DP varieties were bred for fibre production. Petera, Silesia and Anka, which are DP varieties, have all shown reliability in fibre production. Notable pests were goldfinches, mourning doves, starlings, and aphids. Attempts were made to control them with nets, insecticidal soap and natural occurrence of ladybeetles. Grain yields were predictably low overall, though there were differences between the varieties. Correlations between emergence and yield were not found. Results for non-narcotic cannabinoid samples are still pending. These findings, despite the drought, will be useful when added to the last 4 years of data. Producers will use this information and the recommended varieties from these trials to determine which varieties will be most useful.

L'objectif principal du projet d'essai sur les variétés de chanvre industriel de 2020 était de réunir, d'établir et d'évaluer 13 variétés de chanvre industriel prometteuses pour le Nouveau-Brunswick et les Maritimes dans le cadre d'un essai national plus vaste sur les variétés de chanvre. Les caractéristiques quantitatives et qualitatives suivies comprenaient la croissance et le développement des plantes, les graines, les fibres, l'huile, les protéines et les cannabinoïdes non narcotiques. Les résultats révèlent que la sécheresse de la saison de croissance 2020, caractérisée par des précipitations minimales ou nulles pendant de longues périodes et de nombreuses nuits chaudes, a réduit la croissance des cultures testées. La levée et la précocité de maturation ont également duré plus longtemps que prévu. La levée des variétés variait de 15 à 75 plantes/m2. Les variétés à grains ont été sélectionnées en vue d'une récolte plus précoce que les variétés à double fin, d'où leur date de récolte plus hâtive. La hauteur moyenne de tige des variétés à grains était inférieure à 1 m, tandis que celle des variétés à double fin se situait entre 1,3 et 1,8 m. Les variétés à double fin ont été sélectionnées en vue de la production de fibres. Les variétés Petera, Silesia et Anka, considérées à double fin, ont toutes démontré leur fiabilité dans la production de fibres. Parmi les ravageurs, citons les chardonnerets, les tourterelles, les étourneaux et les pucerons. Des tentatives de contrôle ont été faites avec des filets, du savon insecticide et la présence naturelle de coccinelles. Les rendements en grains ont été, comme il fallait s'y attendre, globalement faibles, bien que des divergences aient été constatées entre les variétés. Aucune corrélation n'a été établie entre la levée et le rendement. Les résultats des

échantillons de cannabinoïdes non narcotiques n'ont toujours pas été dévoilés. Ces résultats, malgré la sécheresse, se révéleront pertinents dans le contexte des données des 4 dernières années. Les producteurs pourront exploiter ces informations et les variétés recommandées à partir de ces essais afin de déterminer les variétés qui leur seront les plus utiles.

Report:

The primary objective of the project in 2020 was to assemble, establish and evaluate 13 promising industrial hemp varieties for New Brunswick and the Maritimes as part of a larger national hemp variety trial. Quantitative and qualitative characteristics monitored included, plant growth and development, seed, fibre, and non-narcotic cannabinoids. All records were maintained according to license specifications and the production data was sent to James Frey, Diversification Specialist, Manitoba Agriculture and Resource Development for analysis. All plant material was destroyed after the plant data was collected. Hemp seed, fibre and non-narcotic cannabinoid samples were collected and sent to InnoTech Alberta, 250 Karl Clark Rd NW, Edmonton, AB for analyses. Although these results are pending, a basic summary of the data collected from the Cocagne site in 2020 is provided below. As the Cocagne site is part of a large national multi-site study, the statistical analyses from all sites will be contracted by the CHTA (Canadian Hemp Trade Alliance) and will be available in 2021. This year-end summary satisfies the requirements of both our Health Canada license and those of the government of NB EARI program.

The project deliverables for 2020 were realized: 1) to assemble, establish and evaluate 12 or more grain and dual purpose industrial hemp varieties (final tally was 13) for New Brunswick and the Maritimes and 2) to monitor and record the quantitative and qualitative characteristics of plant growth and development, seed, fibre, oil, protein, and non-narcotic cannabinoids.

An additional deliverable was added this year when a Master's student, Nada Hammami, her Université de Moncton supervisor, Gaëtan Moreau, and I (co-supervisor) wanted to further understand all the results from our hemp trials over the years. To do so, the hemp data from the past 4 years (including 2020) will be analyzed with the objective of publishing these results in a scientific journal next year.

The research protocol and project details were outlined in the license application and indicated in the EARI application document. These were followed exactly as indicated therein. In summary, all varieties were replicated and randomized so that their attributes could be analyzed objectively. Data collected included: plant emergence counts, vigour, plant height, harvested grain yield, grain test weight and quality, harvested fibre yield and quality, lodging, insect and disease incidence, days to maturity, male/female ratios, and non-narcotic cannabinoid levels during the growing season. Dr. Privé contributed research expertise on experimental design and analyses and oversaw the land preparation, fertilisation, seeding, data collection, bird control, harvesting, drying, cleaning, laboratory sample preparations and the compilation, verification, and the primary analysis of the data.

Results

Weather

Drought was the most noticeable factor of the 2020 season and from early on this strongly influenced the result at the end of the season. Initially, the soil was dry when the trial was seeded on May 25 and the first rain occurred only 11 days after sowing. Concurrently, during this interval, the

average daily maximum temperature maximum was 24C. This wave of drought was neither the first nor the last to occur, as from June 16, there were another 11 successive days without rain, and again from July 16, there were 13 successive days with only 0.5 mm of rain and this time it had 11 days where temperatures were greater than or equal to 29C. From the 1st to the 23rd of August, the field received only 1.2 mm of rain combined with 12 days with a temperature equal to or greater than 30C. There were also hot nights (Table 1), with temperatures greater than or equal to 20C and we know that during the sensitive vegetative stages, high plant respiration rates associated with warm nights, would have mitigated the photosynthetic gains and thus reduced growth. Warm day and night temperatures caused our growing Degree Days (base 5C) to be very high for 2020. Their averages were 1581 and 1617 for the grain and dual purpose varieties, respectively. If only we would have had sufficient precipitation this season, a bumper crop in yield and fibre production would have easily been realized.

Table 1 : Days with warm nights and their respective day temperatures according to their phenology in 2020

Days with night temperatures equal or above 20C	Mean day temperature (C)	Phenology
19/06/2020	27,3	Germination stage
20/06/2020	15,5	
22/06/2020	22,7	
24/06/2020	24,5	
25/06/2020	22,4	
02/07/2020	21,3	Flowering stage
11/07/2020	23,4	
12/07/2020	24,1	
13/07/2020	22,6	
20/07/2020	25,6	
21/07/2020	21	
22/07/2020	19,9	Seed filling stage
26/07/2020	20,5	
28/07/2020	22,4	
29/07/2020	22,4	
31/07/2020	20	
02/08/2020	23,9	
03/08/2020	24,8	
04/08/2020	24,3	
06/08/2020	22,2	
08/08/2020	23,4	
11/08/2020	26,1	
12/08/2020	25,8	
13/08/2020	24,2	
14/08/2020	20,9	Maturity stage
04/09/2020	20,8	

*The data used in this report originates from the Environment Canada (EC) weather website for Bouctouche, as this was the nearest EC location to Cocagne. It is important to note that precipitation levels were even lower in Cocagne than Bouctouche, noted by Dr. J-P. Privé.

Seedling Emergence & Days to Maturity

The grain varieties (colored bars in Fig. 1) fared better than the dual purpose (DP) varieties for seedling emergence. Picolo, the top grain variety, had a seedling count of 75 plants/m^2 while the lowest emergence came from the DP variety Silesia at a mere 15 plants/m^2. One thing that this result does not account for is the time it took for seed emergence to occur. Because of the drought in 2020, instead of taking a week to determine plant emergence under good growing conditions, it took well over a month in 2020 to record this trait. This demonstrates the importance of having good field soil moisture prior to seeding if good emergence is to be obtained. However, we will see later for grain yield whether seedling emergence was correlated to grain yield.

The days to maturity, also known as the number of days from plant emergence to physiological maturity, are linked closely to the genetics of the variety. As such, most Grain varieties have been bred for an earlier harvest and as expected were harvested 1 week sooner than the DP varieties in 2020 (117 vs 124 days, respectively).

Cane Height

Naturally, all the tallest varieties came from the DP plots as these varieties were bred for their fibre and hence should produce the longest stems for economical reasons (Fig. 2, Fig. 5A). All our grain varieties (colored bars in Fig. 2) averaged < 1 m in height whereas most of the DP varieties averaged between 1.3 to 1.8m in height. Petera and Silesia were the 2 varieties with the tallest stems, and this was true in other years as well, although they were taller in those other years. However, other DP varieties such as Anka, Altair and Rigel also produced canes only slightly shorter than Petera or Silesia and should be fine candidates for fibre production.

Fibre Yield

Only DP varieties were examined for fibre yield as grain varieties typically have short stems that are not economically feasible for fibre production as was seen from our cane height results in Figure 2. Most of the DP varieties that resulted in tall canes naturally had high fibre yields (Fig. 3 and 5A). This includes Petera, Silesia, Anka, and Altair. The exception to this correlation is Rigel and CRS-1 which produced relatively tall canes (Fig. 2) but had a poor fibre yield (Fig. 3). Because emergence for these 2 varieties was similar to the other varieties, their poor fibre production may lie in their inability to tolerate drought and thus grew many tall slim stems with less fibre. More studies are required to confirm these findings. One thing is certain; Petera, Silesia and Anka have continued to show good fibre production over the years and would make a good choice for growers wishing to grow hemp for fibre production. Fibre samples of all DP varieties were sent to Innotech Alberta for fibre analyses and their results are pending.

Pests

Although the hemp plant is resistant to many pests, we need to discuss a few of them as these may have influenced the yields in 2020. It has come to our attention that in NB, or at least in SE NB, the hemp plant seems to be a candidate for aphid infestations (Fig. 5C). The plants were sprayed 3 times in 2020 with insecticidal soap as a biological agent to suppress them. However, control was not optimal as the shipment for our product was delayed before we could put our 2nd timely application and so the

aphid populations flourished again. We did manage to put a 3rd application but by this time, much of their damage was already evident. How much of a factor these pests play on reducing plant growth and ultimately grain yield is not known and would lead to a very interesting study in the future. On a positive note, these infestations were controlled somewhat by the natural predation from our little friend the ladybeetle (Fig. 5D).

A second pest worth noting was birds. All types of birds were present in the hemp field but the most destructive and abundant was the American goldfinch (*Spinus tristis,* Fig. 5B). This was followed by swarms of mourning doves and Starlings. Even with an electronic "Bird Scarer" in full operation and humans working in the plots, these gregarious birds would feed like there was no tomorrow. In the end, netting was installed prior to harvests, to mitigate this feeding behaviour but nonetheless, some still found a way to fly below the nets to get their meal.

Thankfully the disease pressures were much less pronounced they had no effect on plant growth or development in 2020.

Grain yield

Yields in 2020 were very very low as compared to other years (Fig. 4) and this was likely due to the drought and high temperatures (see Weather above). Concurrently, the aphid infestations and bird feedings also negatively impacted grain yield. Additionally, it was thought that good seedling emergence may be positively correlated to grain yield but upon closer examination, no clear correlations could be determined. Picolo, for example, had the highest seedling emergence (Fig. 1), but one of the poorest grain yields (Fig. 4); NWG2730 had average emergence but high yields and Silesia had both poor emergence and yield. Interestingly, the top 3 grain yielding varieties for 2020 (Fig. 4) included 2 DP varieties (NWG2730 & Petera) and one grain variety (X59). However, for most other varieties yields were approximately 1/10 of past years. Consistent with other years however was the fact that some of the DP varieties continue to out yield many of the grain varieties in our area. Because of this variability, comprehensive statistical analyses using data from the past 4 years are being run to mitigate these inconsistencies and provide a clear statement to our growers as to which varieties would be wisest to choose according to their end use. Nonetheless, some trends are emerging to suggest that choosing a DP variety that is both optimal for fibre production without sacrificing much grain yield may provide the greatest economical sustainability.

Non-narcotic cannabinoids

Non-narcotic cannabinoid samples were taken 1 week before harvest for all varieties in this trial. They were dried and sent to InnoTech Alberta for analyses and like fibre, their results are pending.

Conclusion

In summary, the exceptionally dry and hot weather during the 2020 growing season proved to be the strongest contributing factor to the decline in growth and yield compared to previous years. Although conditions were not conducive for good production, these results nonetheless added to the plethora of data we have collected over the past 4 years. The cumulative knowledge from all these years of data will provide the necessary information to determine the most promising Grain and Dual Purpose varieties for NB which in return will help our growers decide the best varieties for grain, fibre, oil, protein, and non-narcotic cannabinoid production for New Brunswick.

Fig. 1 Seedling emergence. Colored bars indicate grain varieties

Seedling emergence

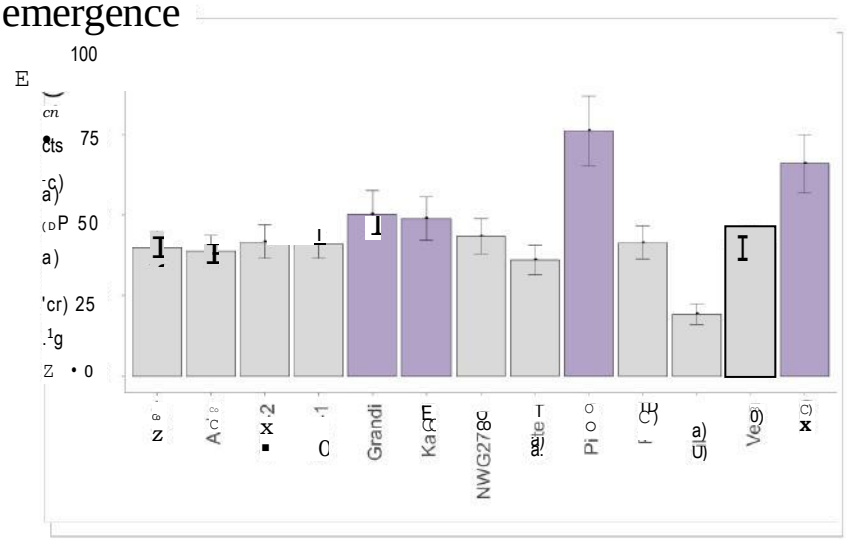

Fig. 2 Cane height. Colored bars indicate grain varieties

Cane height

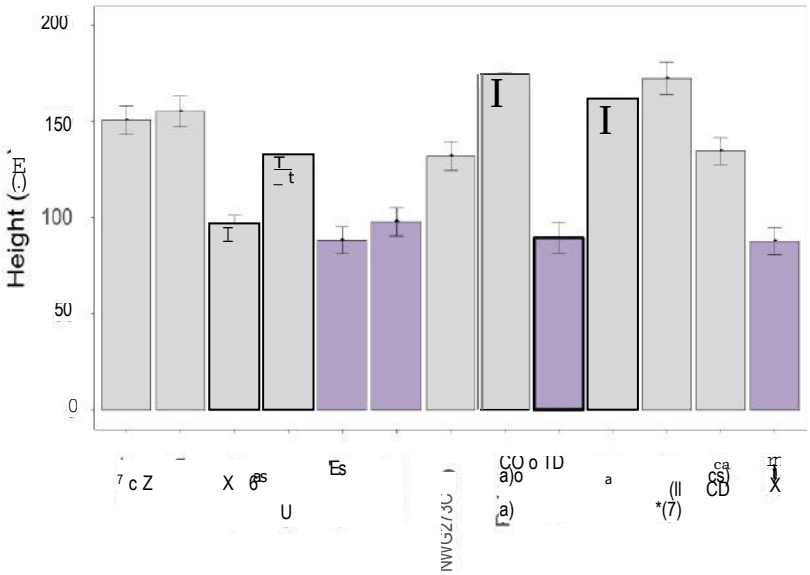

Fig. 3 Fibre yield for dual purpose varieties only.

Fibre Yield

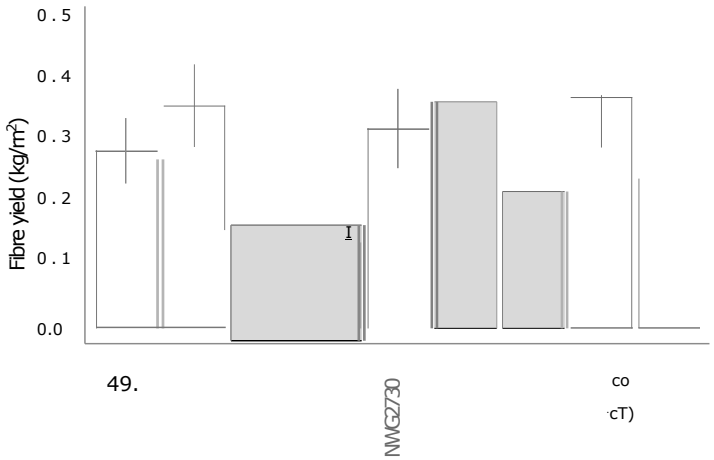

Fig. 4 Grain yield. Colored bars indicate grain varieties

Grain Yield

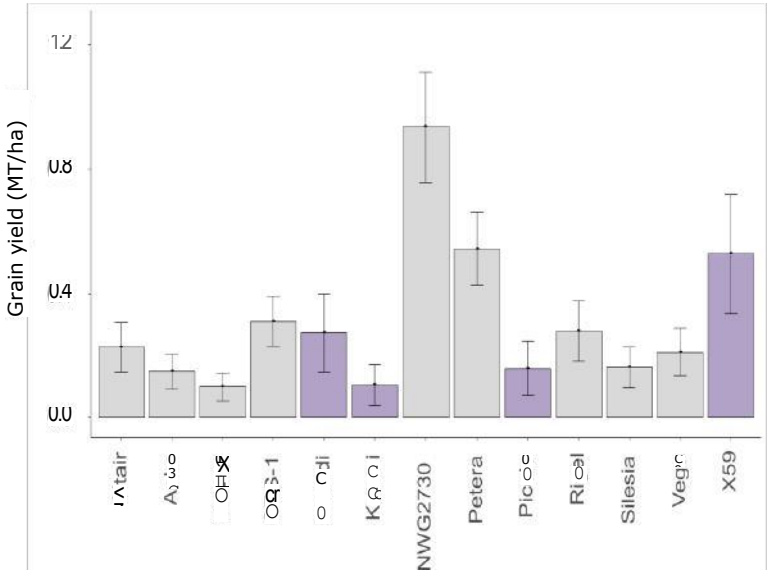

Figure 5. A-Fibre samples from the field, **B-** “American goldfinch”,

C-Aphids on the underside of the leaves and **D-**lady beetles.

A

B

C

D