C1819-0274-Y4 Industrial Hemp Variety Trial

The highlight of the 2021 research trials included the evaluation of 1 new grain (Henola) and 4 new dual-purpose varie-ties (Bialobrzeskie, Angie, Maureen, & Quida).
Henola was the top grain yielding variety while Bialobrzeskie was the most vigorous, tallest, and top fibre yielding vari-ety (Table 1). Three of the new dual-purpose varieties (Bialobrzeskie, Angie & Quida) averaged over 2m in cane height while providing the top grain yields within the dual-purpose group. These three new varieties would likely make excellent candidates for fibre production in the Maritimes but we need to wait for the fibre analyses to be completed by Innotech Alberta before making our final decision on fibre quality.
Concurrently, because of their cane height, they were also the most impacted by Hurricane Ida and thus resulted in hav-ing the highest incidence of lodging (Table 1). Also, if Ida had not caused some seed loss to these varieties, it would have been interesting to see how much greater their grain yields would have been. Nonetheless, some trends are emerg-ing to suggest that choosing a DP variety that is both optimal for fibre production without sacrificing too much grain yield may provide the greatest economical sustainability for growers.

C1819-0274-Y4 Essai de Variétés de Chanvre Industriel

Le point culminant des essais de recherche de 2021 a inclus l'évaluation de 1 nouveau grain (Henola) et de 4 nouvelles variétés à double usage (Bialobrzeskie, Angie, Maureen et Quida).
Henola était la variété produisant le meilleur grain tandis que Bialobrzeskie était la variété la plus vigoureuse, la plus haute et la plus riche en fibres (tableau 1). Trois des nouvelles variétés à double usage (Bialobrzeskie, Angie et Quida) mesuraient en moyenne plus de 2 m de hauteur de canne tout en offrant les meilleurs rendements en grains du groupe à double usage.
Ces trois nouvelles variétés seraient probablement d'excellentes candidates pour la production de fibres dans les Mari-times, mais nous devons attendre que les analyses des fibres soient terminées par Innotech Alberta avant de prendre notre décision finale sur la qualité des fibres.
Parallèlement, en raison de leur hauteur de canne, ils ont également été les plus touchés par l'ouragan Ida et ont donc en-traîné la plus forte incidence d'hébergement (tableau 1). De plus, si l'Ida n'avait pas causé de pertes de semences à ces variétés, il aurait été intéressant de voir à quel point leurs rendements en céréales auraient été supérieurs. Néanmoins, certaines tendances émergent pour suggérer que le choix d'une variété DP qui est à la fois optimale pour la production de fibres sans sacrifier trop de rendement céréalier peut offrir la plus grande durabilité économique aux producteurs.

Industrial Hemp Variety Trial
CAP-EARI C1819-0274-Y4

Jean-Pierre Privé,Ph.D.

The primary objective of the project in 2021 was to assemble, establish and evaluate 3 grain and 8 dual purpose (DP) industrial hemp varieties for New Brunswick and the Maritimes as part of a larger national 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. As the Cocagne site is part of a large national multi-site study, the statistical analyses from all sites in 2021 will be contracted by the CHTA (Canadian Hemp Trade Alliance) and will only be available later in 2022. However, as this is likely the last year of the Hemp Variety Trials, documents from National Trial in 2020 comparing the NB results to other national sites are included in this year's report. Additionally, two peer reviewed scientific articles are also annexed to this report. These publications examined the results of the combined analyses of our results from 2017-2020 and was also the gist of a MSc. student program at the université de Moncton. This student will graduate in early 2022. 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 2021 were realized: 1) to assemble, establish and evaluate 3 grain and 8 dual purpose industrial hemp varieties for New Brunswick and the Maritimes and 2) to monitor and record the quantitative and qualitative characteristics of plant growth and development, seed, fibre, and non-narcotic cannabinoids. Peer reviewed scientific publications (one is pending) by Nada Hammami, J-P Privé and Gaëtan Moreau. These publications add to the scientific literature in helping to further our understanding of the hemp plant (documents attached).

Another bonus deliverable is the examination of hemp as an extractor of heavy metals in our soils. Samples from 3 NB sites, as part of a national study, have been sent to Innotech AB for analysis.

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 all aspects of the trial, including land preparation, fertilisation, seeding, data collection, bird and pest control, harvesting,

drying, cleaning, laboratory sample preparations and the compilation, verification, and the primary analysis of the data.

Comparing 2020 NB results with other CHTA national sites

As a request from last year, documents have been included to provide readers with some documentation examining the hemp growth & development differences (i.e., genotype X environment interactions) across the different research sites in Canada. Readers can peruse through the "2020 National Hemp Variety Field Trials" document as well as the French and English versions of last year's NBSCIA summaries (in French & English) for comparison purposes. Please refer to the attached documents:

2020 National Hemp Variety Trials.docx

Hemp article for NBSCIA newsletter English.docx

2020 Hemp article for NBSCIA newsletter Francais.docx

As you may recall from our 2020 report, that growing season was the worst on record (2017-2021) for germination, growth and productivity in the 5 years of running the trials. This was largely due to the 3 week drought we experienced at planting. This delayed everything from emergence to yield and hence the attached results should be taken lightly. National hemp variety trial results from other years are available at the Canadian Hemp Trade Alliance website: https://www.hemptrade.ca/

Bonus deliverables

Two peer reviewed scientific articles have been submitted and accepted thanks to the funding and support from EARI & NBSCIA over the years. The funding for this research has indirectly (through all the collected data and doing field trials) assisted Nada Hammami, a MSc. student from l'université de Moncton in her development and in her gained expertise in the physiology of the hemp plant. She is expected to graduate in early 2022. The two publications are also included in this year's report and are entitled:

1) Associations between cannabinoids and growth stages of twelve industrial hemp cultivars grown outdoors in Atlantic Canada (published)

2) Spatiotemporal variability and sensitivity of industrial hemp cultivars to four years of variable weather conditions (pending publication

The first article optimized the targeted production of cannabinoids at specific growth stages and identified the chemical phenotypes of different hemp cultivars while the second, suggested that hemp performance (grain, fibre or CBD production) is more sensitive to temporal variability of climatic conditions and intra-field variability than to cultivar effects. Yet, despite this spatiotemporal variability,

some cultivars repeatedly show best performance, demonstrating excellent adaptation to local NB conditions.

2021 Summary of Results (Table 1)

Growing conditions in 2021 couldn't have been better. Unlike 2020, precipitation and growing temperatures during the 2021 season were considered optimal for most crops. The one caveat in the growing season was Hurricane Ida (Sep 2) with her heavy winds and rain causing lodging and some yield loss.

The highlight of the 2021 research trials included the evaluation of 1 new grain (Henola) and 4 new DP varieties (Bialobrzeskie, Angie, Maureen, & Quida). Henola was the top grain yielding variety while Bialobrzeskie was the most vigorous, tallest, and top fibre yielding variety (Table 1). Three of the new DP varieties (Bialobrzeskie, Angie & Quida) averaged over 2m in cane height while providing the top grain yields within the DP group. These 3 new varieties would likely make excellent candidates for fibre production in the Maritimes but we need to wait for the fibre analyses to be completed by Innotech Alberta before making our final decision on fibre quality. Concurrently, because of their cane height, they were also the most impacted by Hurricane Ida and thus resulted in having the highest incidence of lodging (Table 1). Also if Ida had not caused some seed loss to these varieties, it would have been interesting to see how much greater their grain yields would have been. Nonetheless, some trends are emerging to suggest that choosing a DP variety that is both optimal for fibre production without sacrificing too much grain yield may provide the greatest economical sustainability for growers.

Unlike marijuana, pollen is required when growing hemp to permit the fertilization of the female flowers and produce grain. Grain varieties are mostly dioecious while most DP varieties are monoecious but both usually have large amounts of pollen to guarantee optimal grain production. Noteworthy in 2021 was the very dioecious habit for Bialobrzeskie and Vega reporting less than 1 and 3% male plants, respectively (Table 1). This is the reason that these varieties are predominantly grown solely for fibre. If growers would like some seed production as well from these 2 varieites it may be best to intersperse some male plants, similar to what is done in NB apple orchards with pollinator plants.

The days to maturity also known as the number of days from plant emergence to physiological maturity is 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 on average 5-8 days earlier than the DP varieties.

Pests in 2021 were much less detrimental in 2021 than in 2020. Other than a mild infestation of cutworm in the spring (controlled by a soil treatment of Alias 240SC) and some minor cane and leaf fungi (Table 1), the plants remained healthy throughout the growing season.

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

Conclusion

In summary, the growing season in 2021 was optimal for plant growth and development, except for Hurricane Ida in September which played havoc on lodging and some yield loss. Nonetheless, some very interesting and very promising new cultivars were tested. Of these, Henola was the best for grain yield while Bialobrzeskie was exceptional for fibre yield. These results added to the plethora of data we have collected over the past 5 years for numerous varieties and some of this information can be found in the attached scientific articles. Our cumulative knowledge from all these years provides the necessary information to assist in determining the most promising Grain and Dual Purpose varieties for NB. This in turn will help our growers decide which varieties are best for grain, fibre, oil, protein, and non-narcotic cannabinoid production according to their needs.

Table 1. Summary results for the 2021 CHTA National Hemp Variety Trial in Cocagne, New Brunswick.

Grain Varieties	Plant Vigour[z] (1-10)	Days to Maturity	Plant height (cm)	Male-female ratio[y] (%)	Grain yield (kg/ha)	Fibre yield (kg/ha)	Lodging[x] (1-5)	Disease Rating[w] (0-5)
CRS-1 (check)	6.0	92.3	170.3	67	1712	N/A	1.5	0.8
Katani	5.3	92.3	133.3	53	628	N/A	1.0	1.8
Henola	5.8	92.3	172.0	60	2469	N/A	2.3	0.5
Dual Purpose Varieties								
CRS-1 (check)	8.3	97.8	157.7	59	348	4465	1.3	1.3
CFX-2	6.8	99.3	143.0	67	446	2487	1.5	1.8
Bialobrzeskie	9.5	99.3	238.2	1	977	11430	2.8	0.5
Angie	8.8	99.3	216.4	74	1032	9607	3.0	0.8
Judy	8.5	100	191.3	71	554	6655	1.5	1.5
Maureen	7.5	100	175.8	54	525	5930	2.5	1.3
Quida	9.0	100	207.9	59	948	8585	2.8	0.0
Vega	8.5	99.3	196.3	3	434	5447	1.3	0.3

[z] Early vigour: At canopy closure, values relative to the most vigorous plot (1-10, 1=low)

[y] Male to female ratio: number of male and female plants from 1 full row per plot, 1 week before harvest

[x] Lodging at harvest (1-5, 1=no lodging; 3=45-degree angle; 5=flat)

[w] Disease rating: Visual estimate of total percentage of plants showing disease symptoms (0-5, 0=0% disease, 1=20%, 2=40%, 3=60%, 4=80%, 5=100%)