

Industrial Hemp Performance in North Dakota

Bryan K. Hanson¹, Burton L. Johnson², Anndrea Hermann³, Travis W. Hakanson¹, Lawrence E. Henry¹, Venkat Chapara¹, Marisol T. Berti², and Paula J. Petersen²

¹North Dakota State University Langdon Research Extension Center, Langdon, ND; ²North Dakota State University, Plant Sciences, Fargo, ND; ³The Ridge International Cannabis Consulting, Kleefeld, MB, Canada
 bryan.k.hanson@ndsu.edu, burton.johnson@ndsu.edu

Introduction and Objective

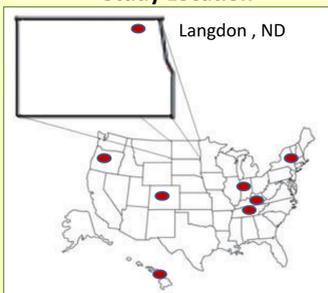
After a 70-plus year absence in production, industrial hemp (*Cannabis sativa* L.) is being grown in university research trials in several states across the U.S. Our effort begins the process of defining the basic guidelines for production that will aid in crop commercialization in North Dakota.

The objective of this study was to screen genotypes from various sources, observe and record plant growth, determine grain yield, fiber yield and other agronomic traits.

Materials and Methods

- Five Canadian, one Finland, five French, and one Australian industrial hemp cultivars were grown (Table 1).
- Seeding dates varied as to when the seed was received.
 - Canadian/Finland-May 27; French-June 5, replant June 9 due to heavy rain resulting in soil crusting; Australian-June 16
- Seeding rate was 12 pure live seeds/ft².
- Separate trials were conducted for each seeding date.
- Experimental design was a RCBD with four replications.
- Plot size was four rows at a 12 inch row spacing and a row length of 21 feet.
- Fiber harvest: Canadian/Finland-Aug. 4, French-Aug. 29.
- Grain harvest: Finland-Aug. 27, Canadian-Sept. 3; French-Sept. 28; Australian was late maturing and did not flower.
- Traits reported include stand establishment and mortality, plant height and growth progression, grain yield, and fiber yield.

Study Location



Langdon, ND
 Location: 48.760° N -98.345° W
 Elevation: 1616 feet

U.S. Industrial hemp research in 2015

HI, OR, CO, ND
 TN, IN, KT, VT



Industrial hemp seed

Table 1. Industrial hemp cultivars.

Cultivar	Country	Type	Purpose	Maturity (d)
Alyssa	Canada	Monoecious	Dual	110+
Canda	Canada	Monoecious	Dual	110+
CFX-1	Canada	Dioecious	Dual	105+
CFX-2	Canada	Dioecious	Grain	103+
CRS-1	Canada	Dioecious	Grain	110+
FINOLA	Finland	Dioecious	Grain	100+
Fedora 17	France	Monoecious	Fiber	120+
Felina 32	France	Monoecious	Fiber	120+
Ferimon	France	Monoecious	Fiber	120+
Futura 75	France	Monoecious	Fiber	120+
Santhica 27	France	Monoecious	Fiber	120+
CHG	Australia	Monoecious	Fiber	120+



Fig. 1.

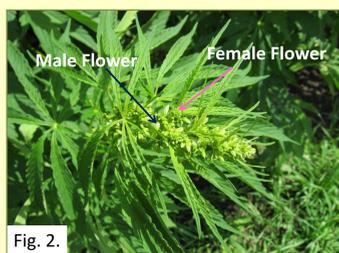


Fig. 2.

- Fig. 1. Dioecious - separate male and female plants
- Fig. 2. Monoecious - male and female flowers on the same plant
- Dual purpose cultivars are bred to be used for both grain and fiber production.



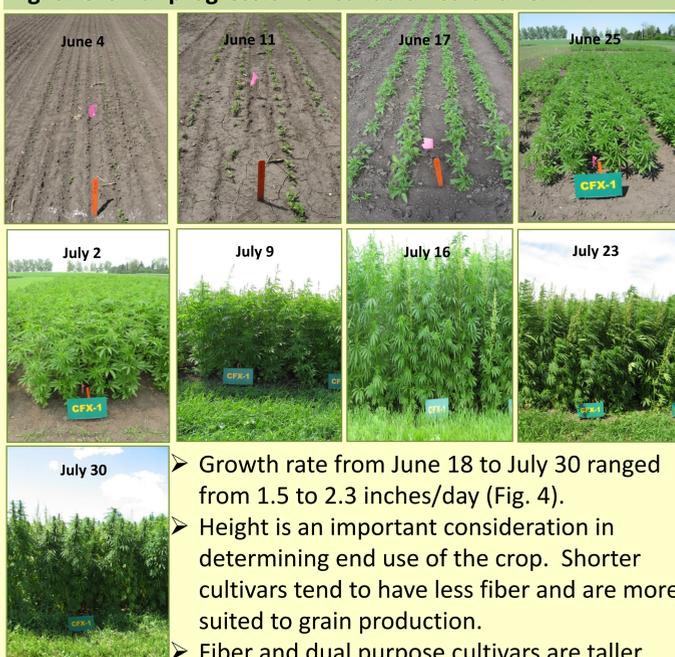
Results

- Rainfall on June 6 dictated replant of the French hemp.
- Seed mortality is an important issue in hemp production and not well understood.
- Seed mortality ranged from 34 to 97% (Table 2).

Table 2. Mean plant stand and mortality of industrial hemp cultivars grown at Langdon, ND, in 2015.

Canadian/Finland cultivar	Plant Stand Plts/ft ²	Mortality %	French cultivar	Plant Stand /Mortality % June 5 Plts/ft ²	Plant Stand /Mortality % June 9 Plts/ft ²
Alyssa	2.2	82	Fedora 17	1.0 / 93	5.7 / 52
Canda	4.7	61	Felina 32	1.2 / 90	6.3 / 48
CFX-1	5.7	53	Ferimon	1.1 / 91	6.3 / 48
CFX-2	6.2	48	Futura 75	0.7 / 94	5.3 / 56
CRS-1	3.0	75	Santhica 27	0.4 / 97	5.6 / 53
FINOLA	4.9	59	LSD 5%	NS / NS	NS / NS
LSD 5%	1.0	8.6	Australian CHG	Plts/ft ² 7.9	Mortality 34

Fig. 3. Growth progression of Canadian cultivar CFX-1.



- Growth rate from June 18 to July 30 ranged from 1.5 to 2.3 inches/day (Fig. 4).
- Height is an important consideration in determining end use of the crop. Shorter cultivars tend to have less fiber and are more suited to grain production.
- Fiber and dual purpose cultivars are taller.

- The French and Australian cultivars averaged 10 and 19 inches taller, respectively, compared with the Canadian/Finland cultivars (Fig. 6).

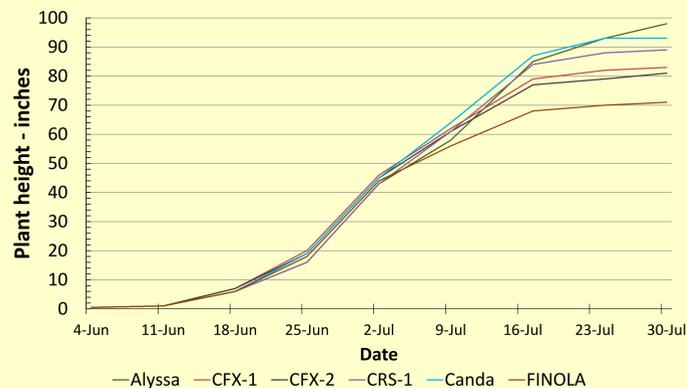


Fig. 4. Canadian/Finland industrial hemp cultivar plant height progression grown at Langdon, ND, in 2015.



Fig. 5. Industrial hemp growth stages: 1st leaf pair (A); 2nd leaf pair (B); 4th leaf pair (C); and harvest maturity (D).

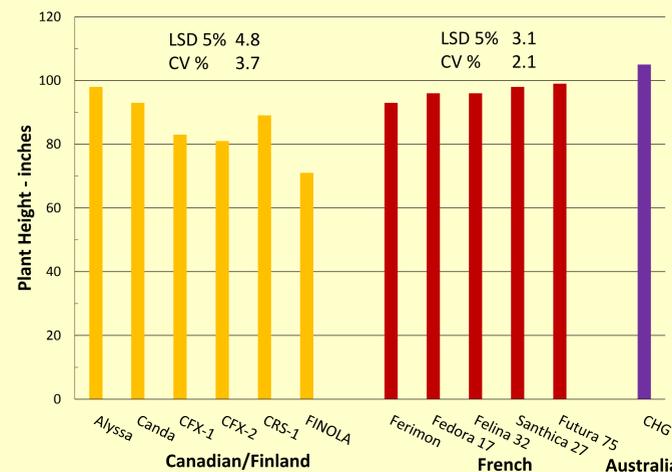


Fig. 6. Mean plant height of Canadian, Finland, French, and Australian industrial hemp cultivars grown at Langdon, ND, in 2015.

- Dual purpose cultivars Alyssa and Canda had significantly higher fiber yield (Fig. 7).
- FINOLA had significantly lower grain yield, which may have resulted from bird damage, even though it was harvested earlier.

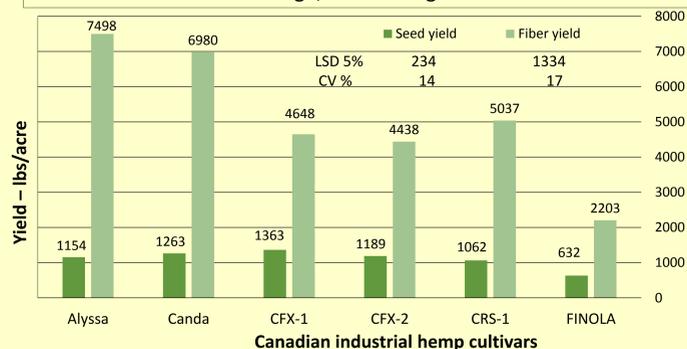


Fig. 7. Mean seed and fiber yield for Canadian and Finland industrial hemp cultivars grown at Langdon, ND, in 2015.

- Grain yield of Santhica 27 was significantly less than all other cultivars (Fig. 8).
- Fiber yields did not differ significantly.

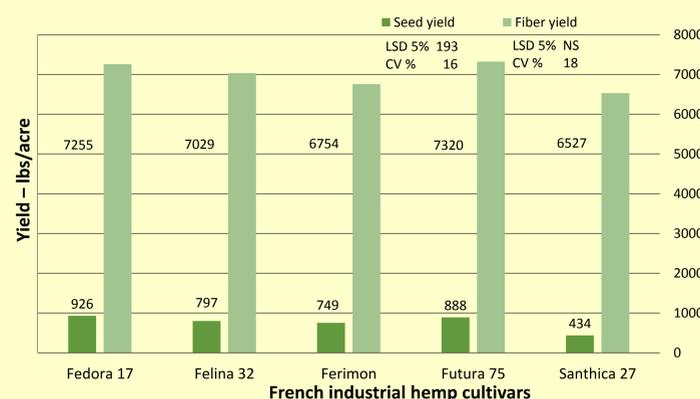


Fig. 8. Mean seed and fiber yield for five French industrial hemp cultivars grown at Langdon, ND, in 2015.

Conclusions

- Most industrial hemp cultivars tested appear to be suitable to Langdon region of North Dakota.
- Grain and fiber yields were comparable to research data from Southern Manitoba, Canada.
- French cultivars, planted 10 days later, had lower grain yields, but higher fiber yields than Canadian/Finland cultivars.
- Additional studies to identify superior cultivars plus other crop production practices are needed.

Acknowledgements

Appreciation is extended to Hemp Genetics International Inc., Canada; Parkland Industrial Hemp Growers, Canada; Hemp Oil Canada, Inc; Cooperative Centrale des Producteurs de Semences de Chanvre, France; and Ecofibre Industries Operations Pty, LTD, Australia; for their interest in the study and providing the seed.



Fig. 9. A, B, C, D, E, F, and G: industrial hemp development and research activities during the growing season.