WEST-CENTRAL FORAGE ASSOCIATION

WCFA Hemp Variety Trial 2019

Final Report

Contents

Introduction

West-Central Forage Association (WCFA) is a non-profit, producer directed organization that provides leading edge, applied, innovative and unbiased research and extension to Alberta's West-Central region, which encompasses over 10 million acres within six counties. Our mission is to provide local, applied agricultural research and extension supporting sustainable agriculture. Operating since 1978, we bring together a network of agricultural producers, industry members and researchers to discuss methods of ensuring profitable and sustainable ways to move Alberta's agricultural industries forward.

In the last ten years the number of hemp producers has increased steadily in response to a growing hemp grain market (Alberta Agriculture and Forestry, 2017). As defined by the Government of Canada in the *Industrial Hemp Regulations*, industrial hemp includes Cannabis plants and plant parts, of any variety, that contains 0.3% tetrahydrocannabinol (THC) or less in the leaves and flowering heads (Government of Canada, 2018). Local hemp variety trials are highly informative for producers, as the performance of hemp varieties can vary from region to region. Hemp seed and oil are highly nutritious and hemp bast (skin/bark) and hurd (core) fibers can be used for a wide range of industrial applications including bio-composites, construction materials, textiles, insulation, bedding, paper production, ropes and twines and many others (Canadian Hemp Trade Alliance, 2020). Hemp can also be an excellent addition to crop rotations, as it has a large taproot, can scavenge soil nutrients left behind by previous crops, and can be used for carbon sequestration (Canadian Hemp Trade Alliance, 2020).

Generally, hemp requires 110 days for growth and 10-12" of rainfall throughout the season. Hemp is a sun-loving and warmth-loving crop, and does not tolerate excess soil moisture during establishment. Hemp should be seeded just 0.5-1" deep into a firm seed bed, and seeding should be avoided prior to heavy rainfall (Canadian Hemp Trade Alliance, 2020).

For more background information about industrial hemp, please visit the Canadian Hemp Trade Alliance website (http://www.hemptrade.ca) or download the Alberta Agriculture and Forestry Industrial Hemp Enterprise 2017 document (https://open.alberta.ca/dataset/153-830-1).

Growers are required to obtain an industrial hemp licence from Health Canada. For more information visit the Government of Canada's industrial hemp licensing application guide at: https://www.canada.ca/en/health-canada/services/publications/drugs-health-products/industrial-hemp-licensing-application-guide.html.

The 2019 WCFA Hemp Variety Trial was completed in partnership with the Canadian Hemp Trade Alliance (CHTA), Alberta Agriculture and Forestry, Manitoba Agriculture, Brazeau County and Bart Guyon. This is a three year trial taking place from 2018-2020. The 2019 trial year consisted of 12 varieties with four replicates in a complete randomized block design. Six grain varieties and six dual-purpose varieties were assessed (Figure 1).

Methods

Site was prepared with a herbicide pre-burn and rototilled. Soil test results were used to determine appropriate fertilizer application rates. Fertilizer was side-banded at seeding. Plots were seeded on June 12th into 15°C soil at a depth of one inch with a small plot Fabro disc drill in 5 rows at 22.5cm spacing (9 meters long by 1.14 meters wide). Prepared seed bed was fluffier than desired. Emergence occurred June 26th despite heavy rainfall following seeding. Initially, weed pressure was high, as wet conditions during establishment results in stunting of hemp seedlings. Plots were weeded by hand late July to remove weed pressure. Once plants were established further weeding was not required.

Data was collected for seedling mortality, plant vigour (relative), height, lodging, disease, male to female plant ratio, grain yield, and fibre yield (dual-purpose varieties only).

Seedling Mortality

Seedling mortality of approximately 30% is common during hemp seeding (Canadian Hemp Trade Alliance, 2020). Plant counts were conducted after 100% emergence and again once stem elongation had occurred. All plants within each plot were counted using a hand-held tally counter.

Vigor

Plant vigor was visually assessed by field staff approximately 45 days after seeding. Vigor was assessed on a relative scale of 1-10, the most vigorous plot in each grain/dual-purpose trial was regarded as a "10" and each subsequent plot was rewarded a rating in comparison.

Height

Plant height was assessed approximately one week prior to fibre harvest. Height was measured on five representative plants per plot from ground to the top of inflorescence using a measuring tape.

Lodging

Lodging was assessed approximately one week prior to fibre harvest on a visual scale of 1-5, (1= fully erect, 3=45 degree angle, and 5= laid flat on the ground).

Disease

Disease was recorded on incidence (number of plants affected in 2m of row at the front and back of plot staring 1m from plot end) and severity (visual rating on a scale of 0-5 and the % of heads infected for each identified incidence rating).

Male:Female Plant Ratio

Male-to-female plant ratios were assessed approximately one week prior to fibre and non-narcotic cannabinoid (NNC) harvest. The total numbers of male and female plants were counted in each plot using a hand-held tally counter.

Grain Yield

Ideally, grain sample collection for yield would have occurred when 70% of seeds were ripe. However, only about 50% of seeds had ripened when first frost occurred, and plants did not mature further. Seeds heads from the middle rows totalling three square meters were harvested by hand. Seed heads were dried, hand threshed, and weighed.

Fibre Yield

Fibre samples for yield were to be collected approximately 10 days prior to grain harvest. A total of one square meter of plants was hand-cut 3" above the ground from each plot. Wet weight, dry weight (with leaves), and dry stem weight (leaves stripped) were recorded per plot. Samples were bundled and transported to the WCFA shop where wet weights were measured and recorded. Bundles were laid flat and air dried for 10 days. Bundles were turned once daily to allow for even drying. Once dry, bundle weights were recorded with and without leaves.

Results and Discussion

A note about data quality: It is important to note that there were significant differences between replicates in the 2019 variety trial. As a result, the compiled data has large standard deviation values, meaning the range of data is wide, and imprecise. Therefore, the 2019 results are imprecise.

Crop Quality

Seedling Mortality

Seedling mortality counts occurred on July 9th (initial count) and Aug 7th (mortality count). Overall, the CRS-1 check varieties had the lowest mortality rates in both the grain and dual-purpose categories with average rates of 10% and 16%, respectively. Of the grain varieties Judy experienced the lowest mortality rate of 13%, while Grandi experienced the highest morality rate of 27%. Of the dual-purpose varieties, Rigel experienced the lowest mortality rate of 18%, while Altair experienced the highest mortality rate of 31% (Figure 2). A mortality rate of 30% is commonly accepted for dual-purpose varieties, as seeding rates are often increased to produce thinner stalks for higher quality fibre production (Canadian Hemp Trade Alliance, 2020). Adverse seeding conditions such as seeding too deep, poor growing conditions at seeding, cracking of the seed coat, toxicity from high rates of seed placed fertilizer, and residual herbicides from previous crops can result in seed mortality rates between 10-70% (Canadian Hemp Trade Alliance, 2020). It is likely that the cool, wet conditions following seeding greatly contributed to the 2019 trial mortality rates.

Vigor

Plant vigor was assessed July 29th. Averaged values for relative vigour resulted in low values of variation between varieties (Figure 3).

Height

Plant height was assessed September 27th. Of the grain varieties, Judy was tallest with an average height of 88cm (34”), and X59 was the shortest with an average height of 57cm (22”). Of the dual-purpose varieties, Petera was tallest with an average height of 157cm (62”), and CRS-1 was shortest with an average height of 93cm (36.5”) (Figure 4).

Lodging

Plant lodging was assessed September 27th. No notable lodging was observed in any plots.

Disease

Despite the cool, wet conditions throughout the growing season, no incidence of disease was noted in any plots.

Male:Female Plant Ratio

Male:female plant ratio was assessed on September 27th. Varieties can be either monoecious of dioecious. In monoecious plants, the plant population has both male and female plant parts on the same head. In Dioecious plants, the plant population is made up of pure female heads and up to 50% male heads (Canadian Hemp Trade Alliance, 2020). Of the grain varieties, CRS-1 had the highest male population of 42%, while Katani had the lowest male population of 25%. Dual-purpose varieties had low male populations, between 0.7-4.6%, with the exception of Petera with a male population of 38% (Figure 5).

Grain Yield

Grain samples were collected October 10th. Grain yield varied highly between replicates; therefore the accuracy of the resulting data is low. Of the grain varieties, CFX-2 produced the highest yield of 107 lbs/acre, while Judy produced the lowest yield of 36 lbs/acre. Of the dual-purpose varieties, CRS-1 produced the highest yield of 86 lbs/acre, while Petera produced the lowest yield of 5 lbs/acre (Figure 6). Petera is currently marketed exclusively as a fibre variety.

Fibre Yield

Fibre samples were collected October 2nd from dual-purpose varieties only. Fibre yield varied highly between replicates; therefore accuracy of the resulting data is low. Petera was the highest yielding variety, yielding 642 lbs/acre, while CRS-1 was the lowest, yielding 236 lbs/acre (Figure 7).

Environmental Records

All weather data was retrieved from the Violet Grove Alberta Climate Information Service (ACIS) weather station, which is nearest to the Brazeau County Plot Site, and will be referred to as “Brazeau” throughout this report.

Temperature

The average temperature of the growing season (May 1st to October 2nd) in Brazeau was 12°C (54°F) with a low of -2°C on May 4th and a high of 19.5°C on August 21st. First frost occurred on September 28th (Figure 8).

Precipitation

The 2019 growing season is the second wettest in the last ten years (Figure 11), with an accumulated precipitation of 413mm (16.3") (Figure 9). June received the most rainfall, 180mm, most of which occurred in the latter half of the month, following seeding (Figure 9 & Figure 10). Though 2019 was not the wettest year on record, the significant rainfall in June considerably affected plant development (Figure 10).

Summary

The 2019 WCFA hemp variety trial experienced less than ideal climatic conditions for growing hemp. The high amounts of rainfall and cool temperatures experienced throughout June and July, as well as the rest of the growing season, significantly affected the growth and maturity of the plants. Data collected from the trial was highly variable. This was year two of the three-year trial. The combined data from the Canadian Hemp Trade Alliance national trial will provide much more reliable data upon completion of the trial in 2020/2021. WCFA would like to thank our partners the Canadian Hemp Trade Alliance, Alberta Agriculture and Forestry, Manitoba Agriculture, Brazeau County and Bart Guyon.

Figures

Variety	Use
CFX-2	Grain
CRS-1 (check)	Grain
Grandi	Grain
Judy	Grain
Katani	Grain
X59	Grain
Altair	Dual-Purpose
Anka	Dual-Purpose
CRS-1 (check)	Dual-Purpose
Petera	Dual-Purpose
Rigel	Dual-Purpose
Silesia	Dual-Purpose

Figure 1 - Summary table of entries assessed in 2019 and their use as grain or dual-purpose varieties.

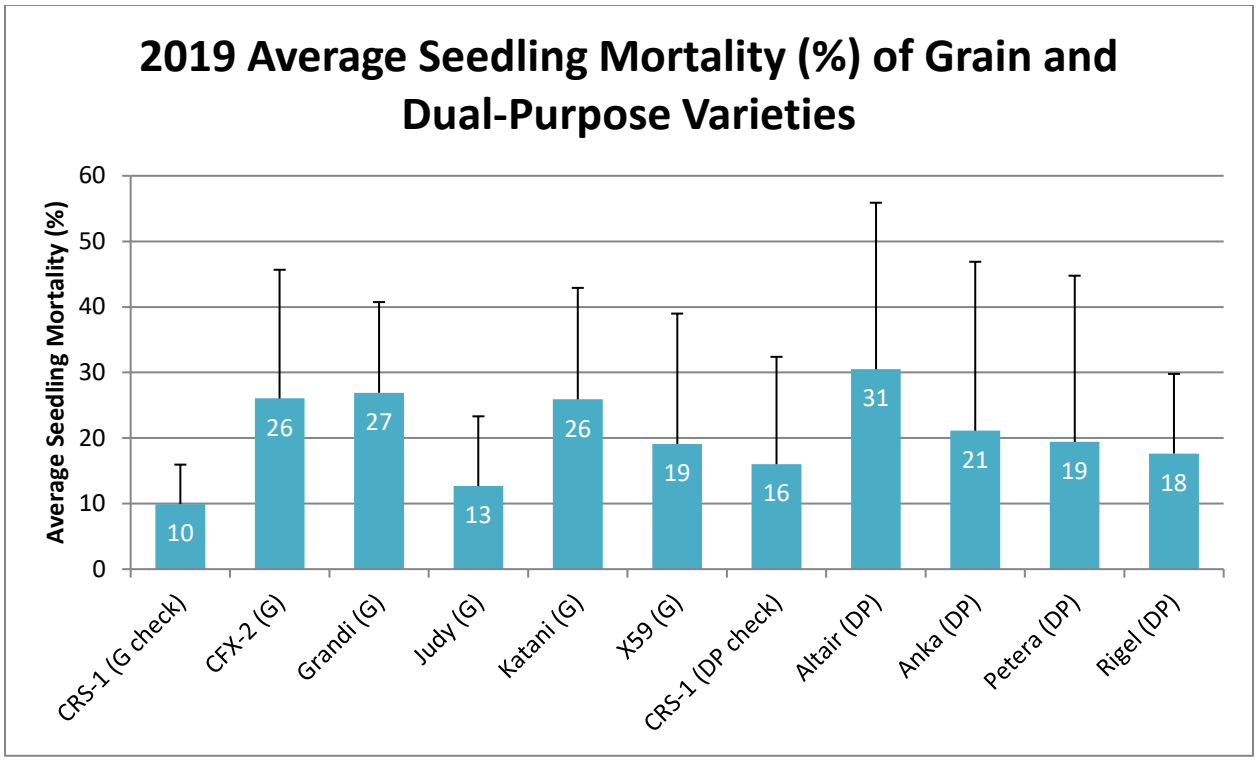

Figure 2 - 2019 Average Seedling Mortality (%) of grain and dual-purpose varieties (G= grain; DP= dual-purpose)

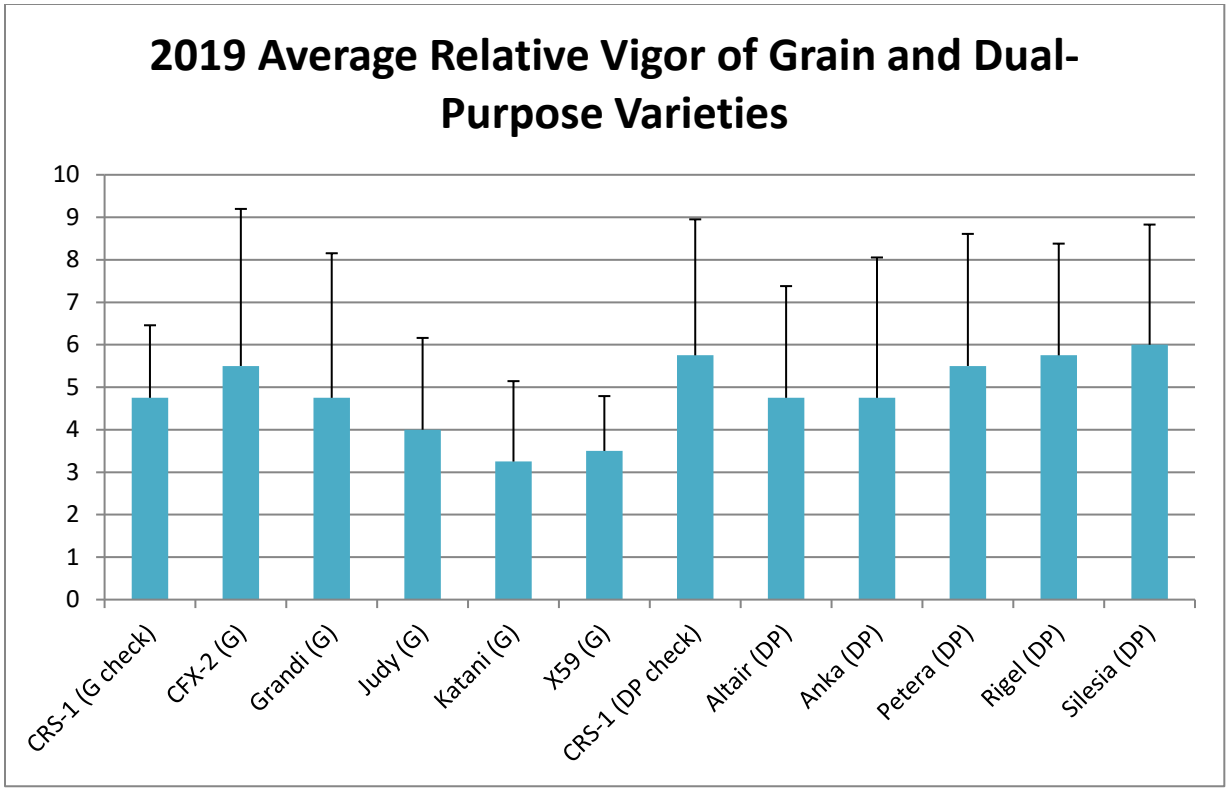

Figure 3 - Early vigour (relative) of 2019 grain and dual-purpose industrial hemp varieties.

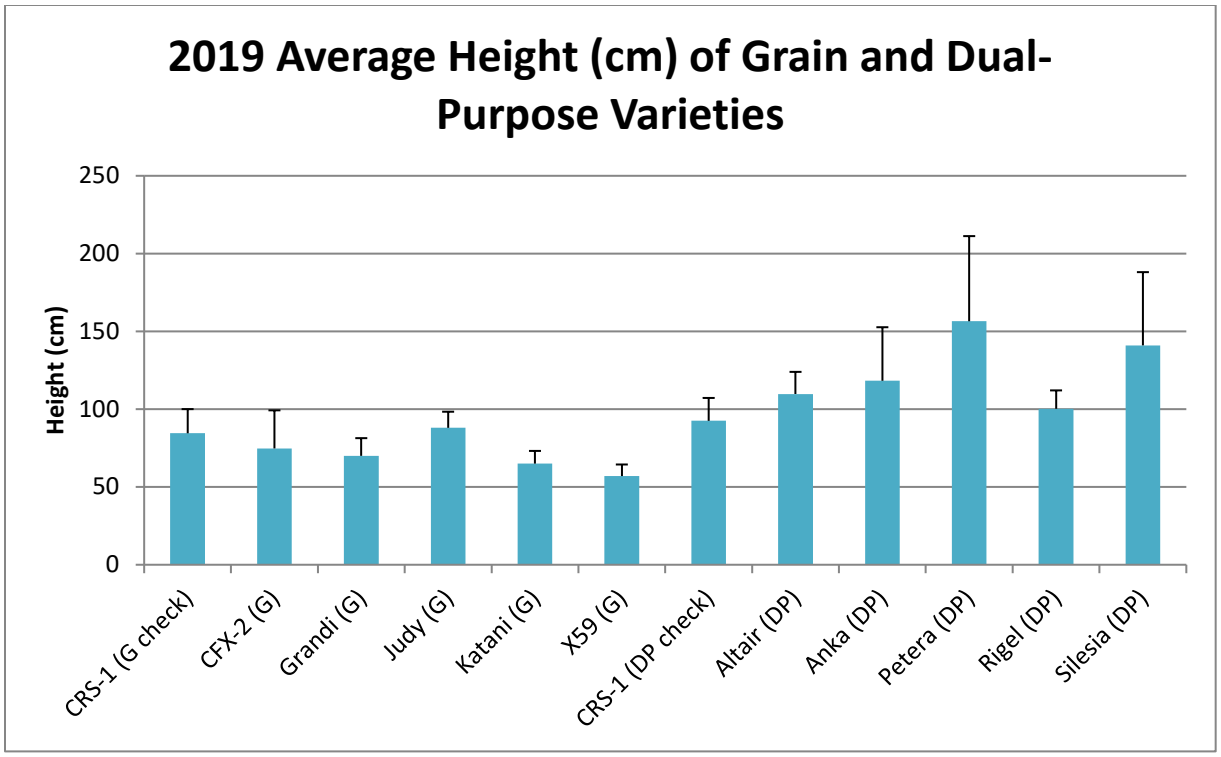

Figure 4 - 2019 Average height of grain and dual-purpose varieties.

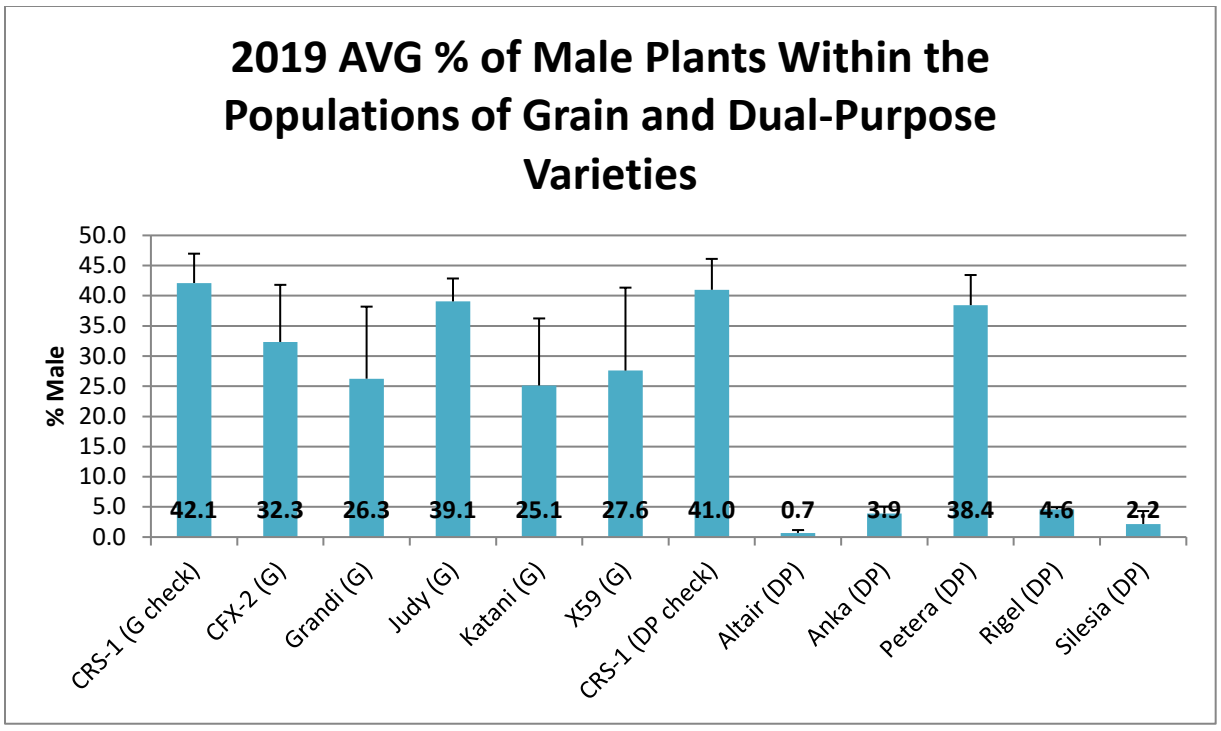

Figure 5 - 2019 Average percentage of male plant population for grain and dual-purpose varieties.

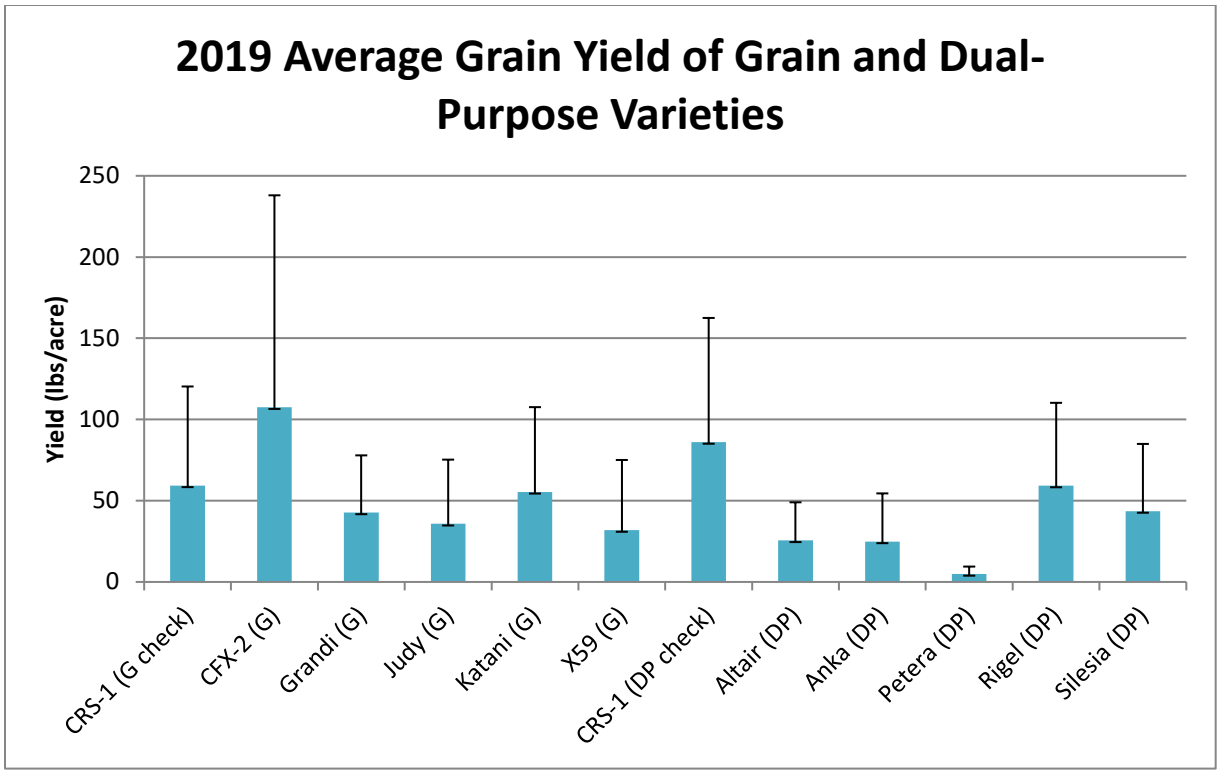

Figure 6 - 2019 average yield of grain and dual-purpose varieties (corrected to 10% moisture). Important: error is high for this calculation, note the large standard deviation bars.

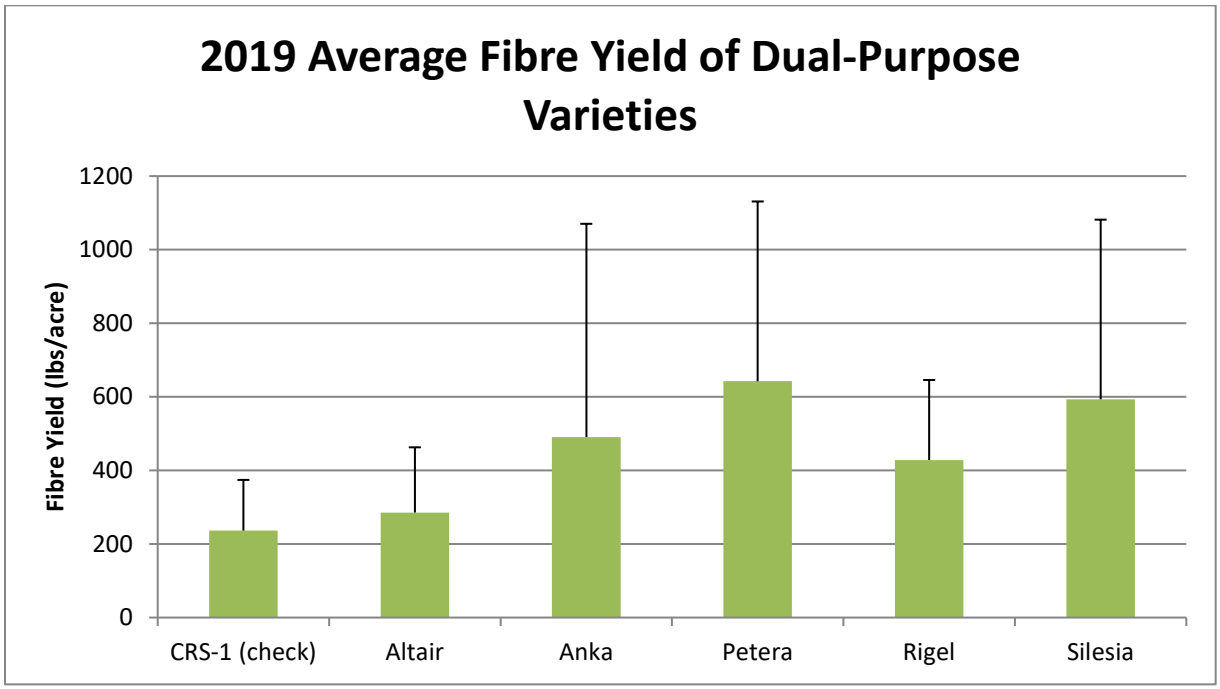

Figure 7 - 2019 Average fibre yield (dry) of dual-purpose varieties.

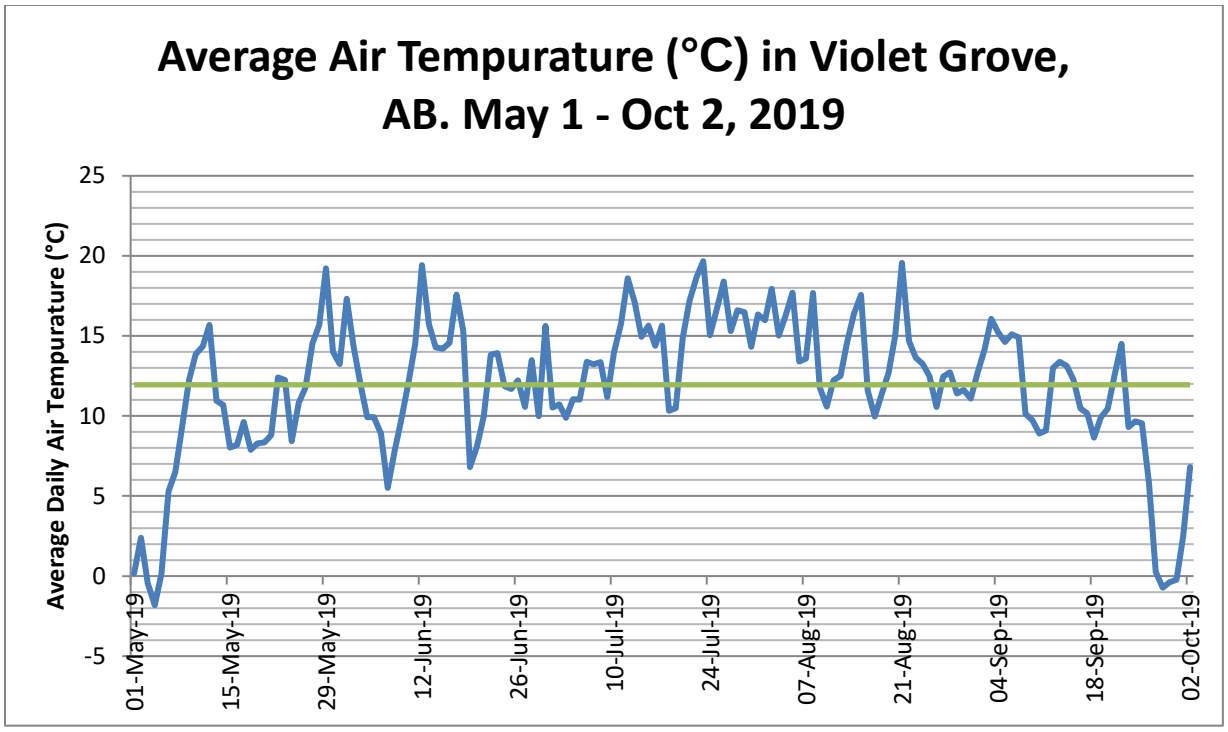

Figure 8- Daily temperature chart for the ACIS Violet Grove, AB weather station from May 1st to Oct 2nd, 2019. The horizontal green line represents the season average temperature of 12°C.

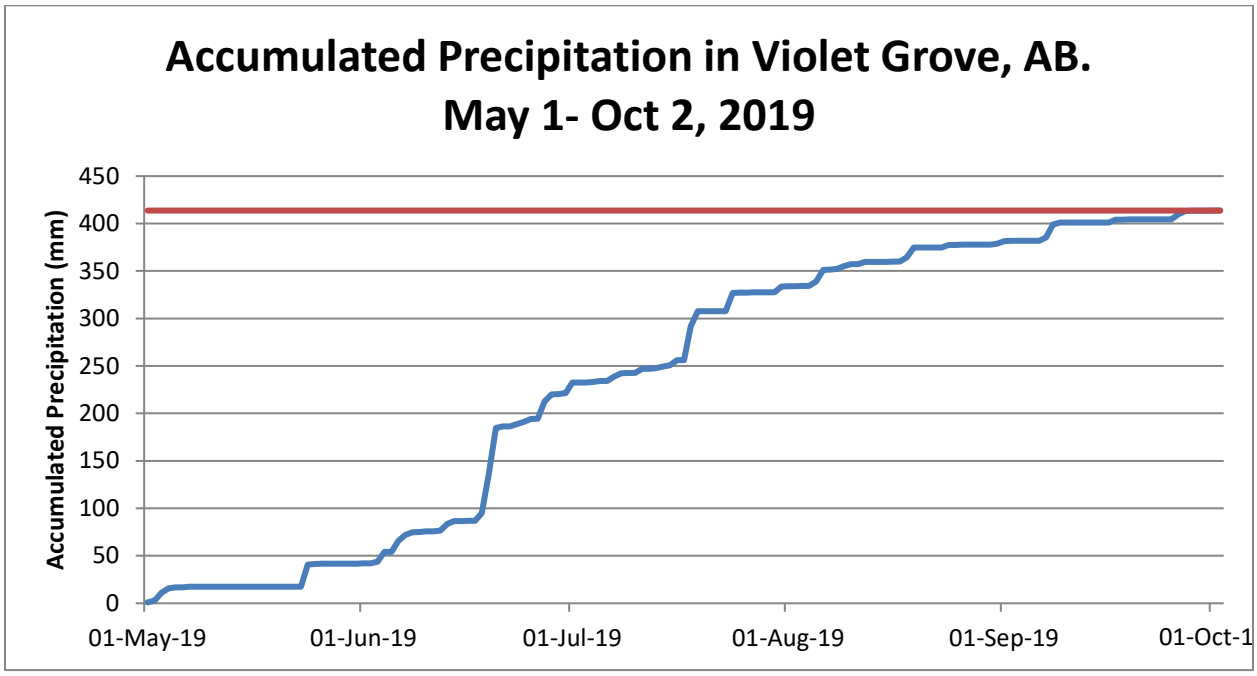

Figure 9- Accumulated Precipitation in Violet Grove, AB for the 2019 growing season. The red line represents the total precipitation accumulated, 413mm (16.3").

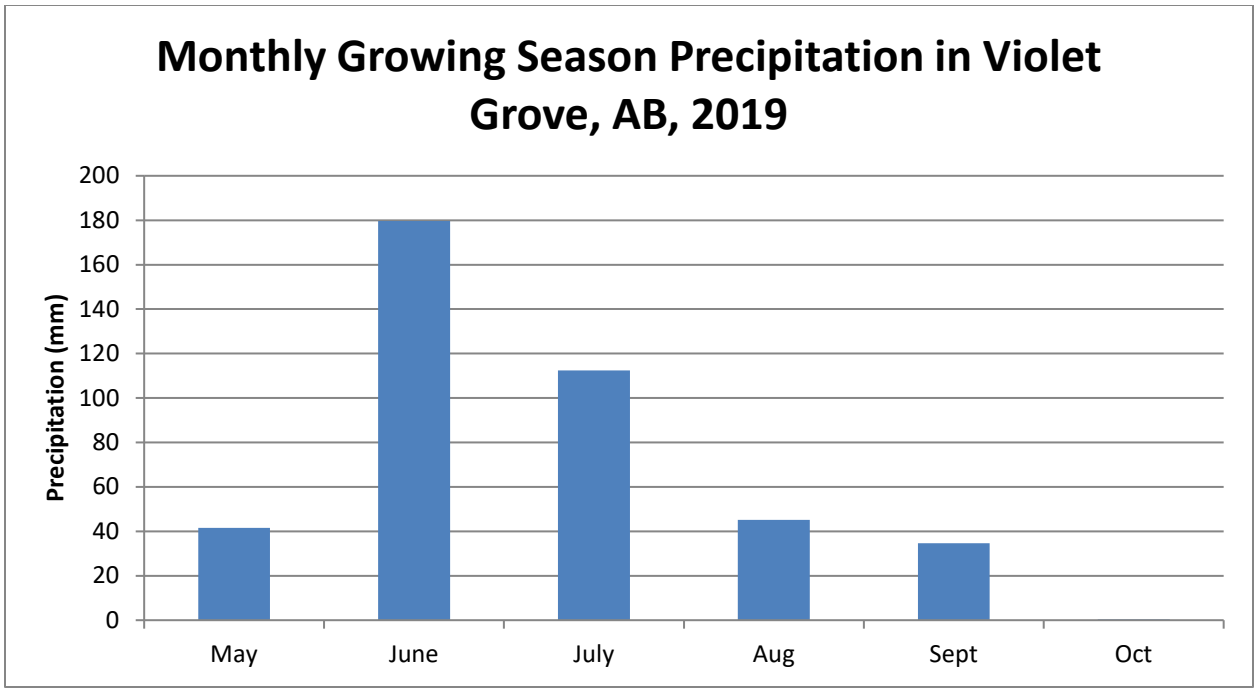

Figure 10- Monthly Growing Season Precipitation For Violet Grove, AB, 2019.

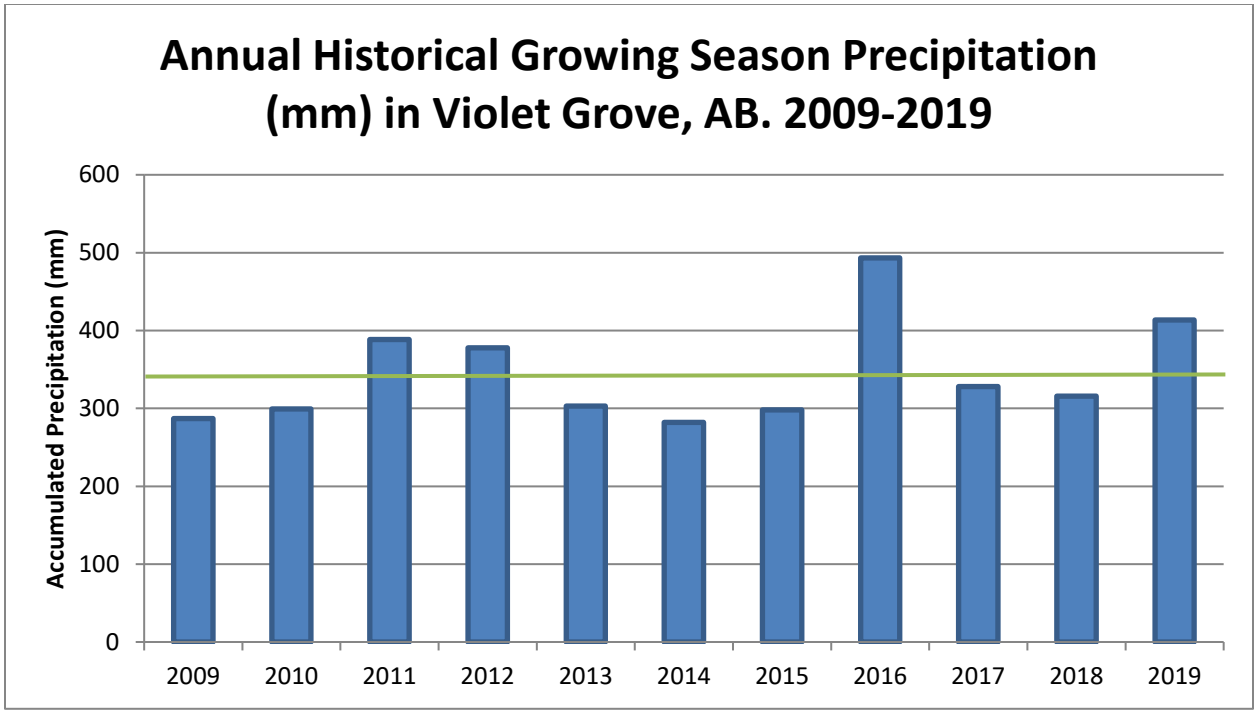

Figure 11- Annual growing season precipitation in Violet Grove, AB. from 2009 to 2019. The horizontal green line represents the ten-year average of 344mm (13.5").

References

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