KPU-AGC

2020 Hops Terroir Report

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Introduction

The hop plant (*Humulus lupulus*) is a key component of beer production. South-western British Columbia (BC), particularly the Fraser Valley and Pemberton Valley, have historically been excellent agricultural areas for hop production as they provide the appropriate growing climate for hops[1]. BC has the most diverse physical geography and biological diversity of all provinces in Canada[2], and the Fraser Valley and Pemberton regions have their own unique climate and geographical features to influence terroir, or the special characteristics of a place or the land that impart unique qualities to a crop[3]. These characteristics can include climate, geology, soil composition, local management/processing practices, but can also include biotic variables such as microorganisms in the soil or on the plants themselves[4–6]. Terroir is often associated with grape production in wine; however, many recent studies are looking into the effect of the terrain and environment in different agricultural sectors. This project will evaluate the terroir effect on hop quality on farms located in the Fraser Valley and Pemberton Valley in SW British Columbia.

Current and prospective hop cultivators are increasingly looking for more sophisticated data to market and match their hop products to breweries and for specific beer styles. In order to understand terroir-driven variation in the accumulation of aroma and flavor compounds in hops, Myrtle Meadows Hop Farm (Myrtle Meadows), located in the Pemberton Valley, and the KPU-Applied Genomics Centre (AGC) have partnered up for the current study. The KPU-AGC will use its expertise to provide metabolomic support to characterize the hops grown by Myrtle Meadows in the 2020 growing season and compare those to other farms in the Fraser Valley and commercial hops grown in the Yakima Valley in Washington State.

Materials and Methods

UPLC/DAD metabolic analysis using its Agilent UPLC 1290 Infinity II system was used to quantitatively measure alpha-acids (n+adhumulone, cohumulone) and beta-acids (n+adlupulone, colupulone). The accumulation profiles of volatile, aromatic compounds such as terpenoids (myrcene, beta-caryophyllene, humulene, and trans-beta-farnesene) was performed using an Agilent 5977B GCMS.

Dried samples (t-90 pellets and dried cones) were obtained from Myrtle Meadows for six different hops varieties: Cascade, Centennial, Chinook, Comet, Fuggle, and Sorachi Ace (Table 2). Samples were stored in vacuum sealed bags at -20°C until sample extraction. Similarly, the same varieties were also obtained from three different Fraser Valley hops farms (FV1, FV2, FV3) as well as pellets and dried cones that were purchased commercially in individually sealed, nitrogen flushed 28g packages (Table 1). These three commercial brands were from three US based hop producers located in the Yakima Valley (C1).

All samples were extracted as two independent replicates with alpha/beta acid extraction being performed as described in ASBC method 14 where methyl tert-butyl ether (MTBE) is used instead of di-ethyl ether. The terpene extraction procedure was also performed using MTBE as the main solvent and samples were subsequently diluted and injected in the GC-MS for analysis.

Residual moisture was calculated based on loss on drying methods using a ventilated oven at 50ºC. Representative aliquots from the hop samples (10 g for fresh samples, 20 g for dried/pellets) were weighed and subsequently reweighted after incubating in the oven for up to 72 hours. Preliminary tests showed 72 hours at 50°C would completely dry the samples. Once the dried sample weights had stabilized and were no longer changing, the sample was deemed to be at 0% moisture.

Table 1. List of hop products sourced from hop producers located in the Fraser Valley hop (FV1, FV2, FV3) and other commercial hops grown in the USA (C1, YCHHOPS; C2, BSG; C3, Artisan). C1 (YCHHOPS) is specifically from Yakima Valley in Washington, USA.

Fraser Valley (FV) and Commercial (C) Dried Cones / t-90 Pellets Sample List

Sample Name	Sample Source	Sample Type	Residual Moisture (%)
Cascade	FV1	Dried Cones	9.2
Cascade	FV2	Dried Cones	6.3
Cascade	FV2	t-90	7.4
Cascade	C1, YCHHOPS	Dried Cones	7.9
Centennial	FV1	Dried Cones	12.5
Centennial	FV2	Dried Cones	7.8
Centennial	C1, YCHHOPS	Dried Cones	4.8
Centennial	C2, BSG	t-90	7.5
Chinook	FV1	Dried Cones	14.6
Chinook	FV2	Dried Cones	10.2
Chinook	C3, Artisan	t-90	6.6
Comet	FV1	Dried Cones	13.4
Comet	FV3	Dried Cones	5.7
Comet	C1, YCHHOPS	t-90	6.4
Fuggle	FV1	Dried Cones	6
Fuggle	C3, Artisan	t-90	5.2
Sorachi Ace	FV1	Dried Cones	7.6
Sorachi Ace	C1, YCHHOPS	t-90	9

Evaluating flavour (bitter acid) and aroma (terpenes) profiles from hop products harvested in different growing regions.

The results of dried cones and t-90 pellets were compared between Myrtle Meadows and various Fraser Valley farms and commercial source (Table 1). The results of the alpha and beta acids accumulation profiles between MM to FV and commercial hops are shown in Figure 1.

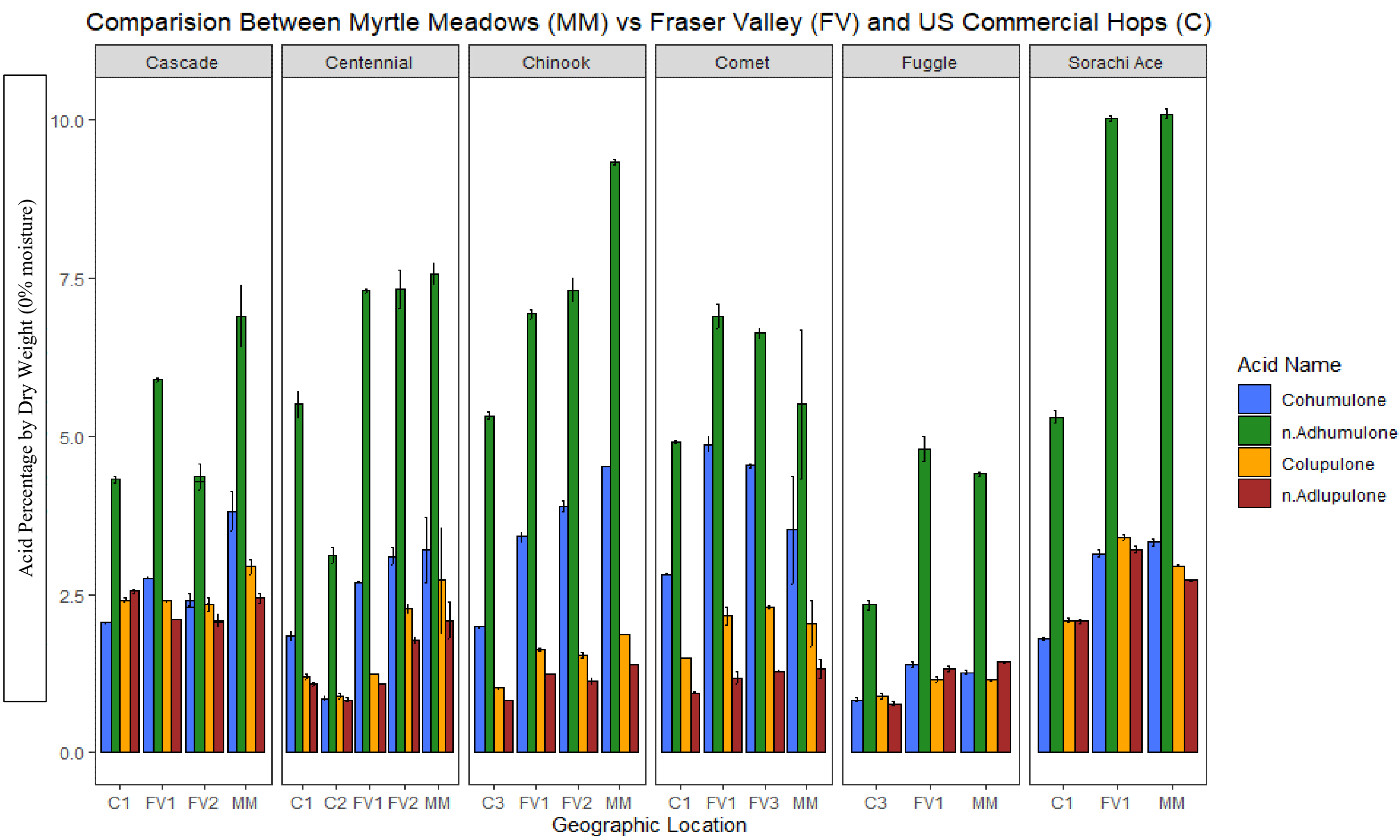

Figure 1. Comparison of alpha and beta acids of dried cones and t-90 pellet samples of six varieties: Cascade, Centennial, Chinook, Comet, Fuggle, and Sorachi Ace, between Myrtle Meadows (MM) compared to the same varieties of hops from three Fraser Valley farm (FV1-3) and three commercial hops brands (C1-3).

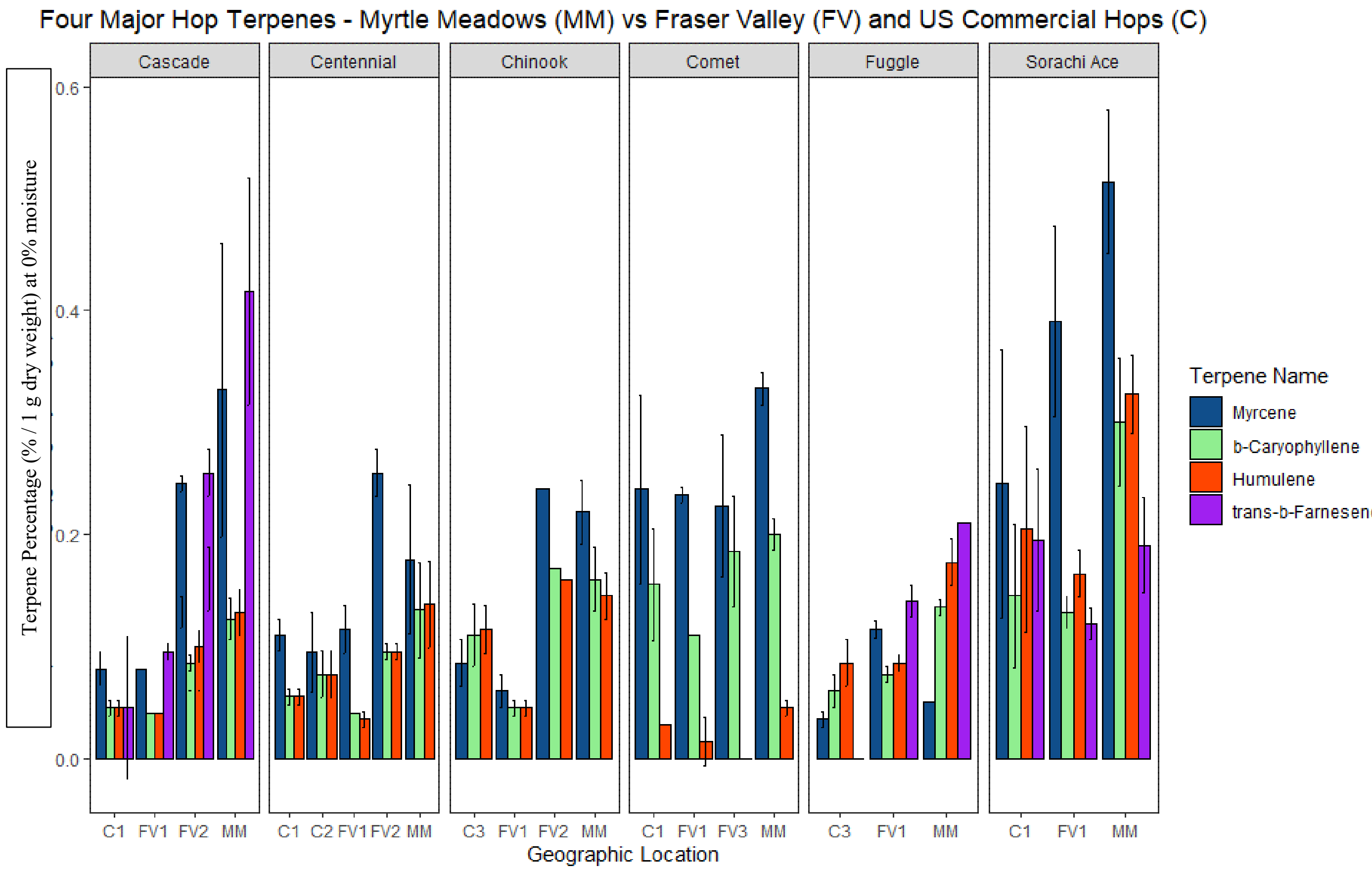

Figure 2. Comparison of four major terpenoids of dried cones and t-90 pellet samples of six varieties: Cascade, Centennial, Chinook, Comet, Fuggle, and Sorachi Ace, between Myrtle Meadows (MM) compared to the same varieties of hops from three Fraser Valley farm (FV1-3) and three commercial hops brands (C1-3)

These results show that all commercial hops tested had lower values for alpha acids than the samples from BC (Myrtle Meadows and Fraser Valley) thus demonstrating a higher quality of locally produced hops (Figure 1). The same is true for the accumulation of the aroma compounds where locally produced hops always contained more terpenes compared to hops produced by other commercial producers (Figure 2). This could be due to poor storage conditions and older hops represented by the commercial hop samples used in this study. Subsequent analysis of the 2020 hops after one year of storage will provide important insight into the stability of locally produced hops. However, these results demonstrate the superior quality of locally produced hops which is an advantage for local brewers that can tap this local hop market over inferior quality hops from other sources. The inherent logistical challenges for optimal storage and supply chain management will always introduce more risk to imported hops and this study clearly shows that locally produced hops are of higher quality using the important metrics of bitter acid and terpene content in the final hop products.

References:

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