

Effect of Extended Fermentation with Starter Culture on cup quality in Washed & Natural Processed Coffees in Huatusco, Mexico

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Introduction

Huatusco is a large coffee growing areas within Mexico's Veracruz region. Green coffee is typically produced using washed processing method. Significant amount of water is used during pulping, fermentation and washing. Fermentation time is 12-16 hours is used and mostly the fermentation is done using indigenous microbiome. We used commercially available starter cultures in both washed and natural processing conditions. Coffees were processed in 2 different mills with varying scale and water usage levels during wet processing. In the case of the larger mill, the wet processed coffees were mechanically dried. Our objective was to understand the effect of starter cultures, type of processing & wet mill (based on water usage) on the aroma and cup quality of green coffees. Aroma volatiles and cup scores were enhanced with lower water usage. Natural processed coffees had higher levels of alcohols and esters and relatively higher cup scores.

Materials/Methods

Arabica cherries were procured from designated farms at the peak of ripeness. The farms were instructed to keep the green less than 1% of the cherries. Colombia and Costa Rica varieties were used. Two wet mills were chosen for the study as the amount of water used in the washed processing method varied widely. The mill designated as K was a larger scale where more quantity of water was used through pulping, fermentation and washing. Starter was added to pulped wet parchment in the case of wet processing at 1 kg/MT of pulped coffee. The mill designated P was a smaller scale wet mill where less water was used in the washed process. Fermentation was done for 48 hours in submerged condition with minimal water usage. The coffees were washed and machined dried in the mill designated K and sun dried in the mill designated P.

In the case of natural process, starter culture was sprayed at approx. 1kg/MT as the bags of cherries were dumped into a tank and then closed the tank for 48 hours fermentation time. Post fermentation, the cherries were spread on patio for drying. Green and roasted coffees were analyzed for aroma profile using HS-SPME GC/MS to quantify aroma compounds and SCA cupping protocol using five Q graders was used to evaluate cup quality.

Results/Discussion

Figure 1 illustrates Total Ion Chromatogram (TIC) for one of the samples. The chromatographic data set was subjected to a principal component analysis (PCA). The PCA is shown in Figure 2. As indicated in Figure 2, in the washed processing at K mill, where larger quantity of water was used, use of starter culture did not bring in significant difference in the aroma volatiles and cup score improvement was lower. In the P mill, with lower scale and less water was used, we observed higher concentration of alcohols, esters and higher cup scores. In the case of natural process at P mill, we observed a significant increase in alcohols and esters which are all linked to sweet, fruity and floral aroma. This variation we believe is due to significant loss of sugars present in the coffee pulp by using high amount of water during pulping, transfer to fermentation tank and draining excess water from the fermentation tank. Another reason could be that the post fermentation washing could be diluting the metabolites that were produced during fermentation. Drying conditions of mechanical vs sun drying could also have played a role.

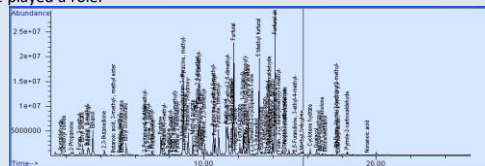


Figure 1: Total Ion Chromatogram of Natural with Starter Culture – 48 hrs.

Treatment	Fragrance / Aroma	Flavor	After taste	Acidity	Body	Balance	Overall	Average SCA Scores	
Washed w/Starter Culture P mill 48 hrs	PNW48	7.63	7.67	7.54	7.83	7.83	7.79	7.79	84.08
Washed Control P mill 16 hrs	PWC	7.63	7.63	7.63	7.75	7.75	7.71	7.87	83.95
Natural w/Starter Culture P mill 48 hrs	PNY48	7.92	7.79	7.71	7.88	7.67	7.42	7.88	84.25
Natural Control P mill	PNC	7.67	7.54	7.42	7.67	7.54	7.50	7.54	82.88
Washed w/Starter Culture K mill 48 hrs	KWY48	7.79	7.63	7.58	7.67	7.54	7.58	7.67	83.46
Washed w/o Starter Culture K mill Ex 48 hrs	KWEx	7.71	7.67	7.50	7.58	7.79	7.46	7.67	82.71
Washed Control K mill (16 hrs)	KWC	7.58	7.29	7.46	7.46	7.50	7.46	7.46	82.04

Table 1: Mean SCA Cupping Scores from Various Treatments.

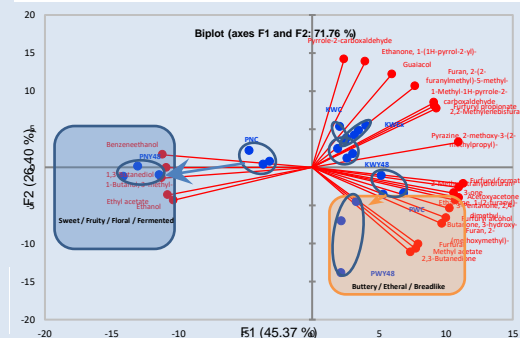


Figure 2: Principal Component Analysis of the GCMS Aroma Analysis.

Treatment	Treatment	Cupping Notes
Washed w/Starter Culture P mill 48 hrs	PNW48	Floral, Sweet, Bright citrus acidity, Plum, Strawberry, Clean, and Dry finish.
Washed Control P mill 16 hrs	PWC	Berries, Medium acidity, Peach, Caramel, and Chocolate.
Natural w/Starter Culture P mill 48 hrs	PNY48	Overripe fruit, Juicy medium acidity, Dry fruit, Winey, Intense, and Dry finish.
Natural Control P mill	PNC	Berries, Medium acidity, Sweet, Caramel, Chocolate, and Dry finish.
Washed w/Starter Culture K mill 48 hrs	KWY48	Molasses, Milk chocolate, Citrus acidity, Dry finish, and Good body.
Washed w/o Starter Culture K mill Ex 48 hrs	KWEx	Cherry, Herbal, Medium acidity, Citrus, Nutty, and Dry finish.
Washed Control K mill (16 hrs)	KWC	Caramel, Juicy medium acidity, Dark chocolate, Berries, and Dry finish.

Table 2: Compiled Cupping Notes during SCA Scoring from Various Treatments.

Conclusion/Perspectives

Use of starter cultures in wet processing of coffee should be considered based on the scale and amount of water used in the wet mill. In typical wet processing, significant water is used in pulping, which dilutes the sugars available for fermentation and later during fermentation, the fermentation water is drained hampering the fermentation process and metabolite concentration. If starter cultures are used, water quantity used in wet processing should be minimized and the fermentation water should not be drained from the fermentation tanks. This is a critical scale up condition that will enable improved effect of the starter cultures in wet processing of coffee.

References:

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