

# SUGAR PROFILES OF MAPLE SYRUP GRADES

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Although many analyses of the chemical composition of maple syrup have been conducted, relatively little information exists on the differences in composition of the individual syrup grades. For example, although it is generally accepted that the amount of invert sugar increases with decreasing syrup light transmission (from lighter to darker grades), the composition of sugars within different grades has not been adequately characterized. Determination of the characteristic chemical composition of each grade will strengthen the existing basic knowledge of maple syrup chemistry and potentially provide a tool which can be used in the detection of syrup adulterated by artificial decolorization. As a first step in acquiring this information we performed a study to determine the characteristic sugar composition of each maple syrup grade.

## METHODS

During 2004, we collected 55 unblended syrup samples from individual producers across a wide geographic area. Each sample was graded using a Hanna C219 maple syrup transmittance analyzer. The concentrations of glucose, fructose and sucrose in each sample were determined by a commercial food analysis laboratory via high-performance liquid chromatography (HPLC). The total percentages of sugars and invert sugar (glucose + fructose) as well as the ratio of glucose to fructose in each sample were calculated. For each grade, the mean and standard error of each sugar were calculated.

## RESULTS

Fancy syrup contained relatively low amounts of fructose relative to the other grades (Table 1). However, in general, the different grades of syrup contained

**Table 1.** Mean (+ standard error) percent glucose, fructose, sucrose, total sugars, total invert sugars and ratio of glucose to fructose for each syrup grade from 55 unblended syrup samples collected from a wide geographic area in 2004. n = the number of samples for each grade.

Grade	n	%Fructose	%Glucose	%Sucrose	%Total sugars	%Total invert	Glucose:Fructose
Fancy	9	0.1+/-0.0	0.7+/-0.1	65.9+/-0.6	66.8+/-0.6	0.9+/-0.1	5.6+/-1.3
A Medium	12	0.7+/-0.1	0.6+/-0.1	65.1+/-0.5	66.3+/-0.4	1.2+/-0.1	3.1+/-2.4
A Dark	11	0.3 +/-0.1	0.7+/-0.1	66.2+/-1.1	67.2+/-1.0	1.0+/-0.2	5.3+/-1.9
B	15	0.5+/-0.1	0.4+/-0.1	67.1+/-0.5	67.9+/-0.5	0.9+/-0.0	2.9+/-1.6
Comm.	8	0.6+/-0.1	0.6+/-0.1	65.4+/-1.3	66.5+/-1.1	1.1+/-0.2	1.5+/-0.7

similar amounts of fructose, glucose, sucrose and total invert sugars. The ratio of glucose to fructose, however, appeared to vary between the grades, with commercial having the lowest and fancy having the highest values.

There are two main highlights of these results. First, the amount of glucose and fructose in syrup is often assumed to be equal. However, the ratio of glucose to fructose in these syrup samples was highly variable between the grades and not consistently equal. This suggests that the level of glucose in syrup may not always be an accurate predictor of the total level of invert and that this may need to be taken into consideration when using commercial glucose tests to determine the invert level of syrup.

In addition, the total level of invert is often assumed to be higher in darker than in lighter syrup. However, the total invert in these syrup samples was not consistently greater in darker than in light grades. In fact, the highest average invert levels were found in medium-amber samples. These results may reflect the natural variation expected to be found in a large group of samples collected from a wide geographic range. However, these results could also be indicative of the increased use of technology in syrup production, such as air injection, pre-heaters and reverse osmosis. These processes might influence the chemical changes which occur during the production process, potentially leading to lighter-colored syrup produced from late-season sap, which is generally higher in invert level than early-season sap. Further investigation is necessary to determine if any relationship exists between invert levels and the use of production technology, and current research ongoing at PMRC will attempt to address this question. With the analysis of sugar composition complete, further work will characterize the mineral composition of each syrup grade.

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