

Ask Proctor

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The leaves on the trees are still mostly green and few have fallen. Does this indicate anything for the upcoming sugar season?

There are a great number of factors that influence the rate of photosynthesis (the “engine” that captures atmospheric carbon and fixes it into sugar), the storage and distribution of the produced carbohydrate (sugar) and its use. Although many times such a clear-cut relationship makes good intuitive sense, trying to understand them all and separate out the effects of one single-factor is extremely difficult.

Maple trees change color and then drop their leaves in response to the environmental cues of cold temperatures in combination with bright light along with decreased daylength. In the case of prolonged leaf retention, presumably this means that leaves could continue to produce sugars longer, that any additional sugars produced will be stored, and that these sugars might be available to be collected by maple producers the next year. However, it is important to remember that if the leaves are still producing sugars beyond the normal time for leaf drop, then it is likely to also be warm enough for other tree physiological processes to be continuing as well, so there will be continuing use of those carbon resources for tree maintenance (respiration, growth, etc). Just keeping that engine (the leaves) running requires some energy, and the efficiency of the photosynthetic process is not likely to be as high at that time of

year as it was earlier.

Does this additional stored carbohydrate translate into higher sap sugar in the spring? Perhaps a little, but not as much as you might think. Think of the amount of carbohydrate (starch and sugar) as what the tree puts into its cupboard to use later. Just because there is more food in the cupboard doesn't necessarily mean that the tree is going to take more of it out (remobilize more that sugar) when it comes time to initiate growth of roots, stem, and twigs in the spring. It will remove what is necessary and leave the rest in case it is needed later. Beyond what is required, the rest will remain fixed as starch for longer-term storage. This unused amount can remain there for years to be used later in times of need, or perhaps might never be used during the lifetime of the tree.

At the University of Vermont Proctor Maple Research Center, we have been investigating the interplay of environmental (including weather) and biological factors on sap yield and sugar content. Although this work is ongoing, the approach has been to examine which of a wide array of individual variables are correlated (linearly) with either an increase or decrease in sap yield and sugar content. This includes a mix of well over 100 individual variables (monthly avg/hi/low temperature, precipitation, drought indices, snowfall, snow depth, growing degree days, etc.) which occur both during the sap flow season as well as those that occur over the year lead-

ing up to the sap flow season.

One of those variables we examined was the effects of growing degree days (GDD) over 50°F. For our study site in Underhill, Vermont, increasing GDD in October (our leaves normally drop early-mid October) had no statistical relationship with sap sugar content (SSC) in the following spring. However, increasing GDD in the November (following leaf drop) preceding the sap flow season had a strong NEGATIVE effect on SSC the following spring. Presumably this is because trees had to consume some of their stored carbohydrates to maintain physiological processes later into the year. We also found that higher annual GDD also was associated with statistically lower springtime SSC, which is not surprising given that sugar maple grows best in cool, moist locations. In general, this can be interpreted as hotter weather over the preceding year reduces SSC the next spring.

Teasing out the multiple relationships in these variables and their effects on maple SSC and yield is very complicated, but we gain a better understanding with each year that passes. Our next step is to try to combine what we know about individual factors into a multi-factorial model that encompasses a more realistic picture of which environmental factors are most important and how weather and biological factors affect sap sugar content and sap yield in order to make better predictions of what maple producers might expect in an upcoming season.

Thanks to Dave Hamilton for posing this question. Got a question you'd like answered in a future issue? Email it to editor@maplesyrupdigest.org.

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