# BLENDING SYRUP — PART II

## BLENDING HEAVY SYRUP WITH WATER OR SAP TO LOWER ITS DENSITY — DETERMNING HOW MUCH I NEED

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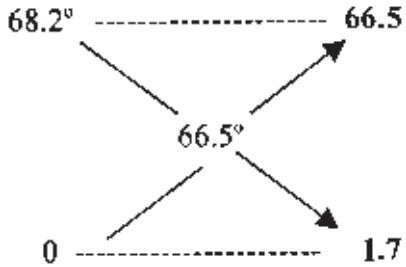
This article is Part II of a two part series discussing adjusting off-density syrup by blending it with syrup, sap, or water. Part I, which appeared in the last edition of the Maple Syrup Digest, introduced the method of alligation and discussed using it to determine the combining proportions of two syrups to obtain a desired density. If you aren't familiar with the method of alligation, you may want to take a moment and read Part I before proceeding. This article will demonstrate how to determine the amount of sap or water to add to heavy syrup to reduce its density to the desired level.

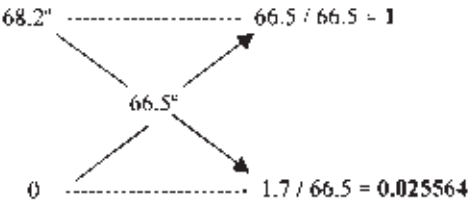
When blending syrup with water or sap on a weight basis, the proportions to mix can be determined using the method of alligation in the same way it was used when blending syrup with syrup. When blending on a volume basis, the proportions must be adjusted because of the differences in the weights of syrup and water or sap.

### WEIGHT BASIS

Let's first look at blending on a weight basis, and determine how much water to blend with 68.2$^{o}$ Brix syrup to reduce its density to 66.5$^{o}$ Brix. The procedure is the same as blending syrup with syrup, but in this case we place the density of the syrup and that of water (0$^{o}$ Brix) in the upper and lower left-hand corners of the diagram, the desired density of the syrup in the center, and subtract across the diagonals as follows:




Again, since we are asking the question: "How much water should I blend with the syrup?" let's set the proportion of syrup equal to "one" in the ratio by dividing both numbers by 66.5 resulting in:

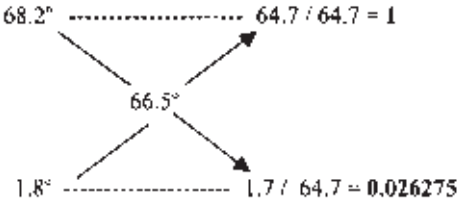



If we wished to lower the density of 350 pounds of 68.2o Brix syrup to 66.5o Brix by adding water, we would add:

(350 pounds syrup)
(0.025564 lbs. water/lb. syrup) =
8.95 pounds water

The process for determining how much 1.8o Brix sap to mix with the 350 pounds of 67.9o Brix syrup to lower its density to 66.5o Brix is exactly the same:

Converting the ratio to a more useable form by dividing both numbers by 64.7:



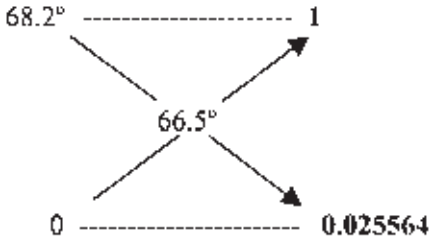

If we wished to use 1.8$^{O}$ Brix sap to lower the density of 350 pounds of 68.2$^{O}$ Brix syrup to 66.5$^{O}$ Brix , we should add:

(350 pounds syrup)
(0.026275 lbs. water/pound syrup) =
9.2 pounds sap

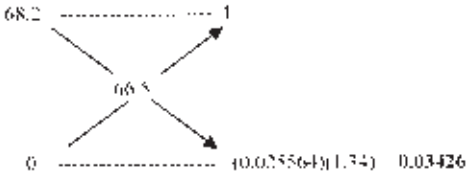
**VOLUME BASIS**

When blending syrup with syrup we observed that although the proportions determined by the method of alligation were, strictly speaking, weight proportions, they could be interpreted as volume proportions with relatively little error because the difference in weight between syrups of different densities was very small. This is not true when blending syrup with water or sap. Depending on its density, a gallon of syrup generally weighs between 11 and 11¼ pounds, a gallon of water or sap between 8 and 8½ pounds. When combining syrup with water or sap, the weight proportions determined by the method of alligation must be adjusted for these differences in weight.

Again, this is best understood by example. Let's look again at the example above blending water with 68.2$^{O}$ Brix syrup to reduce its density to 66.5$^{O}$ Brix. The weight proportions determined were:




A gallon of 68.2$^{O}$ Brix syrup weighs approximately 11.15 pounds; a gallon of water weighs approximately 8.33 pounds. By multiplying the proportion of water (0.25564) by the weight of a gallon of the syrup divided by the weight of a gallon of water (11.15 divided by 8.33 = 1.34) we convert the weight ratio to a volume




ratio as follows:
0.03426 gallons (4.4 fluid ounces) of water should be blended with one gallon of 68.2$^{O}$ Brix syrup to reduce the density of the blend to 66.5$^{O}$ Brix.

Now, let's see if we got the same answer using weight and volume. In our first example above (using weight) we determined that 8.95 pounds of water should be added to 350 pounds of 68.2$^{O}$ Brix syrup to reduce its density to 66.5o Brix. We have now determined that 0.03426 gallons of water should be added to 1 gallon of 68.2$^{O}$ Brix syrup to reduce its density to 66.5$^{O}$ Brix. Since 350 pounds of 68.2$^{O}$ Brix syrup has a volume of 31.4 gallons (350 divided by 11.15), 1.076 gallons of water (31.4 times 0.03426) must be added to

reduce the density to 66.5° Brix. That much water weighs 8.96 pounds (1.076 times 8.33). Using the method of alligation to determine the weight proportions and applying the weight to volume correction factor of 1.34 to determine the volume proportions produced equivalent answers (except for rounding error).

Fortunately, the determination of the correction factor can be greatly simplified. If the density of the syrup to be diluted is between 66.5° and 70.0° Brix and water or sap with a density of 4° Brix or less is used, 1.33 can always be used as the correction factor. If this is done, the maximum error in the desired density will be around 0.02° Brix. Again, this is far more accurately than most of us will ever measure.

**SUMMARY**

**What You Really Need To Know**

The method of alligation provides a quick and easy way to determine the proportion of syrup, sap, or water that should be combined with an off-density syrup to obtain a blend of the desired density.

**BLENDING SYRUP WITH SYRUP (FROM PART I)**

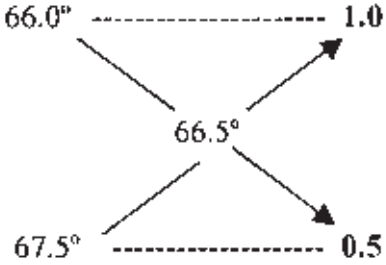
When blending syrup with syrup the proportions determined by alligation may be applied to either weight or volume measurements. To determine the proportions:

• Utilize a diagram resembling the five side of a die.

• Place the density of the two syrups to be blended in the upper and lower left-hand corners of the diagram and the desired density of the blend in the center.

• Subtract across the diagonals to obtain the proportions of syrup to mix. Always subtract the larger number from the smaller. The proportion of each syrup to blend is directly across from it in the diagram.

As an example, how much 67.5° Brix syrup should be mixed with 10 gallons or 110.4 pounds of 66.0° Brix



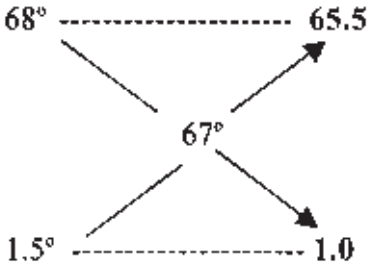

syrup raise its density to 66.5° Brix.

Five gallons of 67.5° Brix syrup should be mixed with 10 gallons of 66.0° Brix syrup to produce 15 gallons of 66.5° Brix syrup, or 55.2 pounds of 67.5° Brix syrup should be mixed with 110.4 pounds of 66.0° Brix syrup to produce 165.6 pounds of 66.5° Brix syrup.

**BLENDING SYRUP WITH WATER OR SAP**

When blending syrup with water or sap the proportions determined by alligation may be applied to weight measurements but must be adjusted when applied to volume measurements because of the relatively large difference between the weights of syrup and water or sap.

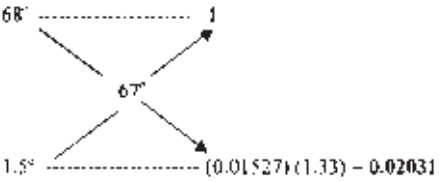
When using weight measurements, determine the proportion of syrup and water or sap as summarized above for blending syrup with syrup. As an example, how much 1.5° Brix sap should be blended with 55.7 pounds of 68° Brix syrup to




reduce its density to 67$^{o}$ Brix.

Dividing both numbers by 65.5 indicates that 0.01527 pounds of 1.5$^{o}$ Brix sap should be combined with each pound of 68$^{o}$ Brix syrup to produce a blend with a density of 67$^{o}$ Brix. In our problem, 0.85 pounds of 1.5$^{o}$ Brix sap (0.01527 times 55.7) are required to reduce the density of 55.7 pounds of 68$^{o}$ Brix syrup to 67$^{o}$ Brix.

When using volume measurements, determine the proportion of syrup and water or sap as if using weight and then adjust the proportion of sap or water using the Rule of 1.33. Using the above example of blending 1.5$^{o}$ Brix with of 68$^{o}$ Brix syrup to produce a blend with a density of 67$^{o}$ Brix, the volume mixing proportions would be




0.02031 gallons of 1.5$^{o}$ Brix sap should be mixed with each gallon of 68o Brix syrup to produce a blend with a density of 67$^{o}$ Brix. In our problem, 0.102 gallons or 13 fluid ounces of 1.5$^{o}$ Brix sap should be mixed with 5 gallons of 68$^{o}$ Brix syrup to produce a blend with a density of 67$^{o}$ Brix.