

able skirts allows for a variety of colors and fabrics, and to meet existing adverse conditions, e.g. 3.6 g rattan stiffener threaded through one skirt for wind resistance.

Tail photo technique. TOM WOODS and SHERI WILLIAMSON

No abstract

Physical and chemical properties of various sugar water ratios for hummingbird feeders. ROSS DAWKINS, Dept. Chem. & Biochem., Angelo State University, San Angelo, TX.

Most people using sugar water for hummingbird feeders use a recipe ratio involving volumes of water (solvent) to volumes of dry granular sugar (solute) or they measure the final volume of the solution instead of added solvent. In either case it is not easy to compare one recipe to another as far as energy content or total amount of sugar. We have made up a series of sugar (sucrose, Imperial Pure Cane granulated) solutions using the percentage volumes of water and dry sugar. We have then measured the density, molarity, molality, calories/gal and freezing point of various ratios. Density (or the similar specific gravity) is measured easily in the field. The molarity (M) is a normalized method of measuring the moles of solute per volume of final solution. This makes comparisons between solutions easy. The molarity (m) measured the moles of solute per kilogram of solvent. This helps calculate colligative properties such as freezing point or boiling point of any solution. From the molarity, the number of calories/gal can be calculated. This can be converted to calories or to joules easily. The results are in tabular form and interpolated into graphic form.

Table of Characteristics						
V% water/ V% sugar	Molarity M	Molarity m	Freezing Point (F)	Density g/mL	kCal/gal	
33/67 (1:2)	2.31	4.97	15	1.256	11.96	
50/50 (1)	1.58	2.485	24	1.174	8.18	
60/40 (1.5:1)	1.20	1.66	26	1.132	6.21	
67/33 (2:1)	0.965	1.24	28	1.107	5.00	
75/25 (3:1)	0.695	0.828	29	1.077	3.60	
80/20 (4:1)	0.543	0.621	30	1.058	2.81	

Sugar preferences of Black-chinned Hummingbirds at a mega feeding station in Texas. ROSS DAWKINS, Dept. Chem. & Biochem., Angelo State Univ., San Angelo, TX.

At Dan Brown's ranch near Christoval, TX, approximately 3,000 Black-chinned Hummingbirds regularly feed during the breeding season. Dan feeds more than 800 lb of cane sugar (sucrose) during the year. At this location, we tested various sources and types of sugar and different concentrations of sugar to see if preferences existed. The sugars tested were sucrose from beet sugar (Albertson's Granulated Sugar), cane sugar (Imperial Pure Cane Sugar), fructose (Eastman Organic Chemicals), glucose (Reagent Grade), and high fructose corn syrup (Betty Crocker Corn Syrup). One cane sugar solution was 80.0 ml of deionized water (80.0 g) added to 20 ml of dry, granular sugar (17.7 g sucrose) and this was designated as CS4. A second cane sugar solution was 90.0 ml of deionized water (90.0 g) added to 30 ml (26.5 g sucrose) of cane sugar. This was designated as CS3. The other solutions were like CS4 with 80.0 ml of deionized water added to 17.7 g. of sugar. These solutions were BS (beet sugar), G (glucose), F (fructose), and K (Karo-type high fructose corn syrup). 70.0 ml of each solution were placed in clear, new Perky Pet single port feeders with a bee guard. A six feeder array was assembled in oak (*Quercus fusiformis*) shade in a 2x3 arrangement. Feeders were 2 m above the ground and 1.5 - 2 m apart. A second six feeder array was set up under the back eaves of Dan's house in a linear arrangement. Again, feeders were 1.5 - 2 m apart. After each sample period, volumes were measured and feeders switched with higher and lower usage feeders exchanged to zero out positional variables. In addition, sampling periods were varied as to time of day from 8 Jul - 11 Jul. Dan's normal complement of about 20 two-liter feeders were also available the whole time. Results were tallied by place of finish in each time period. The places of finish were then averaged over the four-day period. The results were fructose (average place 1.7) slightly preferred to beet sugar (average place 1.8). Next were Cane Sugar 3 (CS 3) (average place 2.8) followed by Cane Sugar 4 (CS 4) (average place 3.8). Last were glucose (average place 5) and high fructose corn syrup (average place 5.9). A second method of comparison was by total volume of solution

consumed over all trials. Beet sugar was preferred with 177 ml consumed. Next came fructose with 134.5 ml consumed. Cane Sugar 3 (CS 3) with 117.5 ml and Cane Sugar 4 (CS 4) at a 104.5 ml follow. Least preferred were glucose at 36 ml and high fructose corn syrup with only 19 ml consumed. The preference of fructose was surprising in light of other studies that rarely show a preference for fructose. It might be explained by the fact that fructose is about 170% as sweet as sucrose and more than twice as sweet as glucose. Any preference of beet sugar over cane sugar is surprising because both are very pure sucrose with only slight traces of other sugars or salts. If any preference really exists it must be due to trace impurities and their taste. The preference of 3:1 cane sugar over 4:1 cane sugar is expected and has been shown by others. The discrimination against glucose is in accord with some other studies and possibly due to its lack of sweetness. The rejection of high fructose corn syrup is most puzzling, especially in light of the preference for fructose. A second study was done with CS4 solutions. Three feeders had a drop of red food coloring added and three remained colorless. In a second run, all red and colorless solutions were positionally switched. No preference at all was observed.

Black-chinned Hummingbird sugar water consumption rates at four ranches in the Edward's Plateau Ecoregion in Texas during 2005. BRENT ORTEGO, *Texas Parks & Wildl. Dept., Victoria, TX,* and ROSS DAWKINS, *Chem. Dept., Angelo State Univ., San Angelo, TX.*

Black-chinned Hummingbird (BCHU) sugar water consumption were studied at four rural ranch banding sites in the Edward's Plateau during the 2005 breeding season. Dan Brown Ranch, Tom Green Co., was located at the edge of the S. Concho River floodplain in the western Edward's Plateau in a forested park-like yard with 19 48-oz hummingbird feeders. Due to livestock grazing and high white-tailed deer densities, there were few hummingbird nectar producing plants. In the southeastern Edward's Plateau, Bob and Sudie Burditt Ranch, Real Co., was at the edge of the Frio River floodplain with park-like deciduous yard with 12 96-oz hummingbird feeders. Few hummingbird nectar producing plants were present for the same

reasons as the Brown Ranch. Annie and Corky Matter Ranch, Kendall Co., was on top of a hill about ½ mi (0.8 km) from the small Flat Rock Creek in a cedar/hardwood savannah with 10 32-oz hummingbird feeders. Numerous hummingbird nectar plants were available in the residential yard of the banding site, but not in the rest of the ranch because of livestock and deer grazing. Egon and Sue Wiedenfeld Ranch, Kendall Co., was at the edge of the floodplain of Big Joshua Creek in a park-like hardwood setting with 10 32-oz hummingbird feeders. Many hummingbird nectar plants were available in the 10-acre (4 ha) residential yard as well as regular occurrence in the surrounding pastures because of lower livestock and deer numbers. 1850 BCHU were captured during visits once per month from April through June using modified Russell traps, and sugar water consumption was recorded daily and summed weekly. Banding was discontinued after June because of the beginning of migration. The Lincoln's Index was used to calculate hummingbird densities in May and June (80 recaptures from birds previously banded) and compared to sugar water consumption for the week of the banding. Sugar to water ratios of 1:4 was used at two ranches, and 1:5 and 1:3 at other ranches. All sugar water consumption was converted to 1:4 equivalents because this is the rate used at most hummingbird feeders. Sugar water consumption at each ranch is graphed below in gallons consumed per week. Sugar consumption typically started increasing in late March as migrants arrived, reached a peak in late April and then started declining in May, except the Brown Ranch with the larger hummingbird population did not peak out in sugar consumption until July. BCHU estimates per site varied from a low of 1542 at the Matter Ranch to 6350 at the Brown Ranch. Highest consumption rate by hummingbirds was at the Burditt ranch and lowest at the Matter Ranch. Availability of nectar-producing plants and suitable insect prey are suspected to influence consumption rates, but data from this study are not conclusive.

Table 1. Sugar Water Consumption and the Lincoln's Index BCHU Estimated Population

Site	Lincoln's Index	Hummers/gall/d
Brown	6350	1411
Burditt	2251	855
Wiedenfeld	2016	1275
Matter	1542	1610