Tuning Soil Recipes for Water Retention and Drainage

by Brian Heltsley, Ithaca, NY

Soil preparation for bonsai can present unwelcome obstacles for the hobbyist: individual ingredients can be hard to find and/or too costly in quantities one person would need, and commercial mixes are not always optimal or affordable. And then there's the screening process, which is tedious at best and a physical strain at worst. It makes sense, therefore, for regional groups to assist their memberships in this endeavor, harnessing economies of scale and specialized interests for the benefit of all. To this end, as a service to members of the Finger Lakes Bonsai Society (FLBS), located in central New York State, I am providing, at-cost, soil ingredients and mixes. The table below is based on the water retention and drainage measurements appearing in these pages[1] recently, and offers individual ingredients[2] and suggested mixes. Mix prices are generated automatically from a spreadsheet, based on individual ingredient costs.

The volumetric soil concepts of field capacity (fractional water retention after saturation and draining), FC, and saturation porosity (fractional air after saturation and draining), SP, are illustrated in the adjacent figure. Together, the listed values of FC and SP allow each bonsaiist to select or design a mix appropriate to the species and microclimate for a particular specimen. High-FC mixes would be ap-

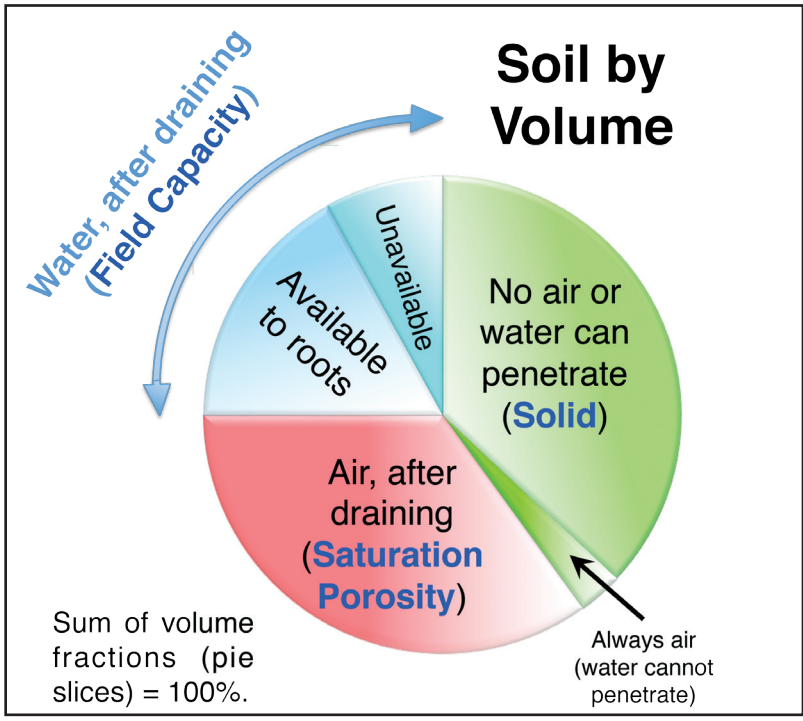

Figure 1: Top right, Illustration of soil volume concepts

Figure 2: Bottom right, Soil Amendment Inventory

Bonsai Soil Offerings

FC=Field Capacity (water retention)
SP=Saturated Porosity (air after draining)
Subject to change

Amendment	Abbr	Density (lb/qt)	FC (%)	SP (%)	Price (US$/qt)	Double screened 2-6 mm (except sand). Biochar inevitably has some powdery fines.
Calcine Clay	Cla	1.31	41	28	1.34	Water retention & mineral sources
Perlite	Per	0.24	28	36	0.95	
Red Lava	Lav	1.60	22	43	4.00	
Pumice	Pum	1.27	19	32	3.13	
Akadama	Aka	1.46	21	36	3.05	
Kanuma	Kan	0.73	17	40	3.15	
Granite Grit	Grt	2.79	20	31	0.92	Inert & dense for drainage & ballast
Pea Gravel	Pea	3.42	10	28	0.64	
Silica Sand	San	3.03	26	19	3.11	
Pine Bark	Brk	0.40	30	37	0.69	Nutrient, microbe, & water retention
Composted Hardwood	CHw	0.85	16	49	0.93	
Charged Biochar	CBc	0.26	48	27	1.75	
Basic Gritty	**Bas**	**1.6**	**22**	**37**	**0.98**	**1 Cla : 1 Grt : 1 Brk**
General Purpose w/Bark	**GeB**	**1.5**	**22**	**33**	**1.15**	**2 Cla : 1 Per : 1 Pum : 2 Pea : 2 Brk : 1 CHw**
General Purpose w/Biochar	**GeC**	**1.3**	**25**	**32**	**1.22**	**1 Cla : 1 Per : 1 Pum : 2 Pea : 1 Brk : 2 CHw : 1 CBc**
One of Each	**One**	**1.4**	**25**	**34**	**1.97**	**1 Cla : 1 Per : 1 Lav : 1 Pum : 1 Aka : 1 Kan : 1 Grt : 1 Pea : 1 San : 1 Brk : 1 CHw : 1 CBc**
AkaChar	**AkC**	**1.5**	**24**	**33**	**2.76**	**2 Lav : 2 Pum : 3 Aka : 1 Pea : 2 CBc**
Maple-1	**Ma1**	**1.4**	**23**	**37**	**2.41**	**2 Lav : 1 Pum : 3 Aka : 1 Pea : 2 Brk : 1 CBc**
Maple-2	**Ma2**	**1.3**	**22**	**36**	**2.06**	**1 Cla : 1 Per : 1 Lav : 1 Pum : 3 Aka : 1 Pea : 2 Brk**
Azalea	**Aza**	**1.2**	**22**	**35**	**2.20**	**4 Aka : 2 Kan : 1 Grt : 2.5 Brk : 0.5 CBc**
Redwood	**Red**	**1.2**	**27**	**33**	**1.66**	**2 Cla : 3 Aka : 1 Grt : 3 Brk : 1 CBc**
Jade	**Jad**	**1.6**	**18**	**38**	**2.33**	**2 Lav : 3 Pum : 1 Aka : 2 Pea : 1 Brk : 1 CHw**
Wet	**Wet**	**1.2**	**26**	**36**	**1.57**	**1 Cla : 1 Per : 1 Lav : 1 Pum : 1 Grt : 1 San : 2 Brk : 2 CBc**
Dry	**Dry**	**1.5**	**18**	**39**	**2.45**	**2 Lav : 4 Pum : 2 Pea : 1 CHw : 1 CBc**
Custom	**Cus**	**1.0-1.7**	**18-28**	**30-40**	**Per Selections**	**Your Choice: strive for ranges shown**

propriate for thirstier species or for a drier or sunnier location, and high-SP mixes for those species susceptible to root rot or a shadier or rainier location. Note that the wetter (high-FC) mixes still have SP in excess of 30% to mitigate against water-logging, and that drier (high-SP) mixes still have some ability to retain water (FC of 18% or larger). The table reminds those designing their own soil to try to compose a mix with FC=18-28% and SP=30-40%, which is not as easy as it may seem, especially if one has a preference or quota for certain ingredients. More than half the mixes shown had to be adjusted after a first guess at what recipe would provide acceptable properties.

1. Brian Heltsley, "Water Retention and Drainage in Bonsai Soil", *Journal of the American Bonsai Society*, Volume 48, Number 4 (2014): 18.
2. Ingredients provided are: Turface MVP (calcine clay), Mount Airy Gran-I-Grit Crushed Granite (Grower size), Whittemore Horticultural Perlite Super Coarse Medium Grade, and Pine Bark Mulch from Agway Farm and Garden; EarthEssentials by Quickrete Pea Gravel and Gardenscape Black Pearl Shredded Hardwood Mulch from Home Depot; Ryusen Akadama (5 mm) and Dragon Spring Kanuma (1/8-5/8") from Hollow Creek Bonsai; Red Lava and Coarse Silica Sand from Calibonsai/Amazon via internet; Green Planet Pumice via internet; and Black Owl Biochar via internet.