Research Summary: Creating Blended Soils with Bloom

BLOOM GOOD SOIL,® BETTER EARTH.

Executive Summary

In 2020, Bloom engaged horticulturalist and recycled organics expert Ron Alexander of R Alexander Associates, Inc. to design and conduct research to track changes in the pH and soluble salt content of Bloom amended soil over time. These parameters can not only impact plant selection and soil modification procedures, but also affect whether a soil amendment will meet standard specifications. The key finding: the slightly elevated pH and EC of Bloom has been shown to drop quickly as ammonia in the product is converted to other forms of nitrogen or bound to soil particles, while organic matter, another important parameter of most soil specs, increases.

Background

Organic (carbon-rich) amendments have been used with great success in the greater DC area to improve soil quality before landscape planting and turf establishment. Research has been conducted by the University of Maryland, Virginia Tech and other local institutions to test the efficacy and optimal use of compost and biosolids-based products, including DC Water's Bloom product, to this effect. Bloom has also been successfully utilized in regional topsoil manufacturing projects. In this application, lower quality mineral soils (or sand, reclaimed materials, etc.) are blended with soil conditioners, rich in organic matter and slowly releasing plant nutrients. This technique has been employed using other recycled organic products in the past, but the use of biosolids processed through thermal hydrolysis in this application is relatively new. It should be noted that other ingredients (e.g., sand, bark) are sometimes used as a component to these soil mixes, and blending can be done in-situ (on-site) or ex-situ (off site).

The goal of the Bloom soil blending trial was to track changes in the pH and soluble salt content of Bloom amended soil over time. This is important information for Bloom's potential use on large-scale landscaping and soil reclamation projects, as it can impact plant selection and general soil modification procedures. Further, the pH and electrical conductivity (EC) content of Bloom can fall outside the standard specifications for a soil conditioner used in these types of applications. The slightly elevated pH and EC of Bloom has been shown to drop quickly as ammonia in the product is converted to other forms of nitrogen or is bound to soil particles.

Blending mixes during set-up

Mixes in staging area, exposed to elements

The blending trial utilized regionally obtained ingredients and compared four soil blends. The trial used standard soil conditioning ratios and took place over a 6-month period. The blended soils were stored outdoors (exposed to the elements) and were not vegetated (as planting could impact changes in ammonia content).

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Blended Soil Formulations

Blend	Ingredients and Ratio (v/v)	Context / Rationale for Inclusion
1	Base Soil #1 80% / Fresh Bloom 20%	Typical regional soil, blended at a typical ratio with Bloom
2	Base Soil #2 80% / Fresh Bloom 20%	Alternative soil, for comparison to Soil #1
3	Base Soil #1 80% / Bloom Woody Blend 20%	Typical regional soil, blended at a typical ratio with Bloom Woody (Bark) Blend
4	Base Soil #1 80% / Yard Waste Compost 20%	Typical regional soil, blended at a typical ratio with compost

All inputs used in the trial were analyzed for select characteristics; the blends studied in the trial were also analyzed at the start and throughout the trial. Results are illustrated in the table below.

Input Ingredients and Select Characteristics

Characteristic	Base Soil #1 (Sandy Clay Loam)	Base Soil #2 (Loam)	Fresh Bloom	Bloom Woody Blend (Bark/Bloom blend)	Yard waste compost
Soil pH	6.9	5.4	8.44	8.32	7.04
Soluble Salts (dS/m)	0.38	0.06	6.5	4.6	1
Organic Matter (% dm)	4.7	2.2	54.8	56.1	29.4
Ammonia (NH4-N) (ppm)	3	4	1,200	1,000	<6.1
Cation Exchange Capacity (CEC) (meq/100g)	7.4	11.2	Not tested	Not tested	Not tested
Carbonates (lbs/ton)	40	44	5.5	7.7	2.6
Background information	Northern Virginia soil. Texture: clay 22%, sand 55%, silt 23%	Central N. Carolina soil. Texture: clay 24%, sand 33%, silt 43%	Digested, un-aged, 66% moisture	Blend of fresh Bloom & bark fines (3:7 v:v)	Stable and mature

Input Ingredients and Select Characteristics Findings ⟶

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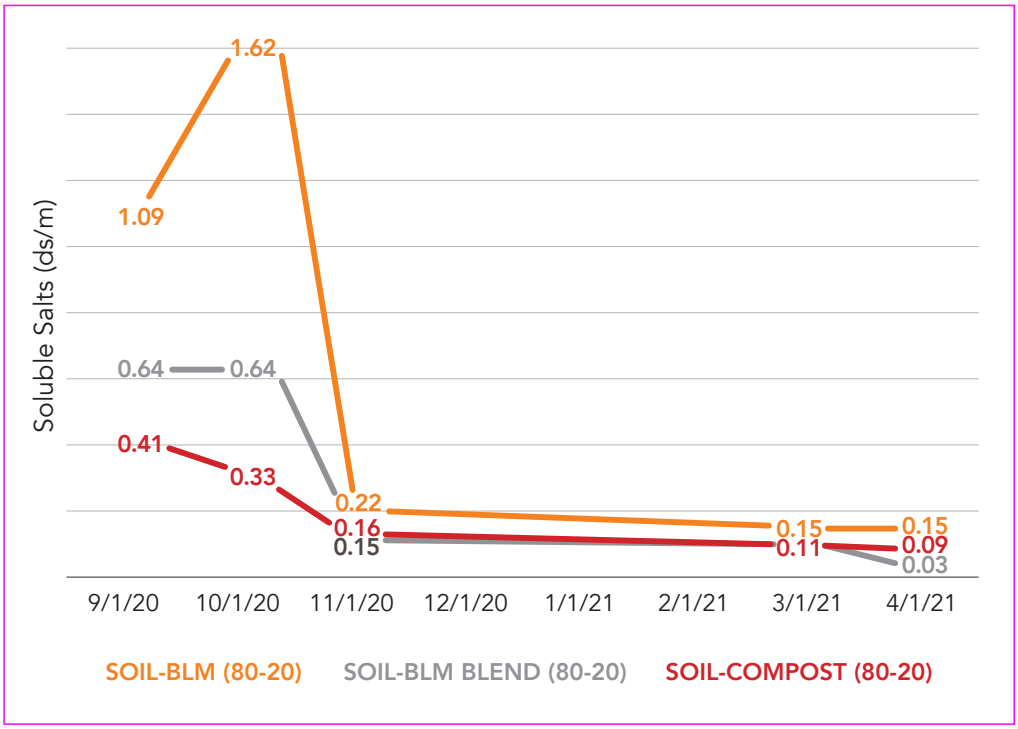
Input Ingredients and Select Characteristics Findings

- Soil pH, electrical conductivity and ammonia-N content increases in soils where Bloom is added.
  - Soil pH and electrical conductivity content quickly reduces (2 months) to levels similar to that of the native soil. Reductions in soil pH illustrate that Bloom and Bloom Woody Blend do not strongly buffer soil pH (increase soil pH).
  - Compost provided a stronger pH buffering capacity and increased soil pH to a small degree.
- Soil ammonia stayed elevated during the entire trial, illustrating that Bloom provides soil fertility. That stated, soil ammonia decreased during the trial, along with soil EC, illustrating that Bloom has a limited (short-term) effect on soil EC.
  - The data also illustrates that increasing soil ammonia content can elevate soil pH and EC and that its effects are only short-lived.
- The organic matter content of the soil mixes increased with the addition of Bloom, Bloom Woody Blend and compost, and they stayed elevated to a similar degree during the trial.
  - This data suggests that the Bloom products do not readily degrade in the soil.
- The addition of carbon-rich soil conditioners increased soil CEC, and levels generally stayed elevated.
- All soil blends possessed a mid to low electrical conductivity and carbonate content.

The 6-month soil blending trial illustrates that Fresh Bloom and Bloom Woody Blend can be successfully utilized as soil conditioners and in soil manufacturing projects. More importantly, it illustrates that the early elevated levels of pH and EC in Bloom blended soils will be short-lived and should not be a concern to landscapers and contractors interested in using the product in soil blending projects.

Change in Soluble Salts Upon Blending



An immediate increase in soluble salt content occurs upon incorporation, then quickly reduces to background soil levels.

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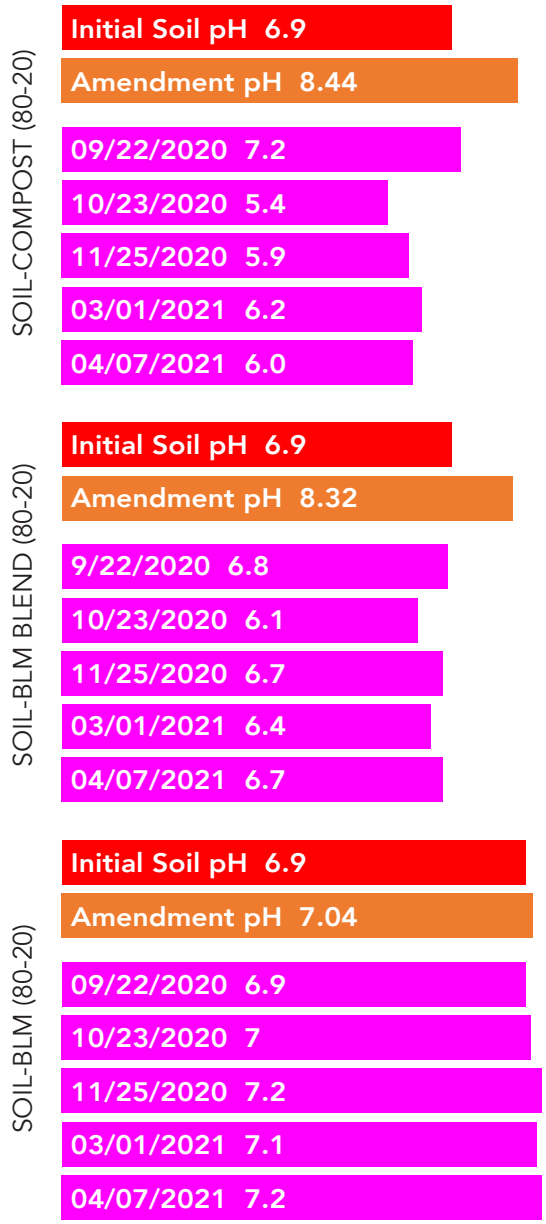
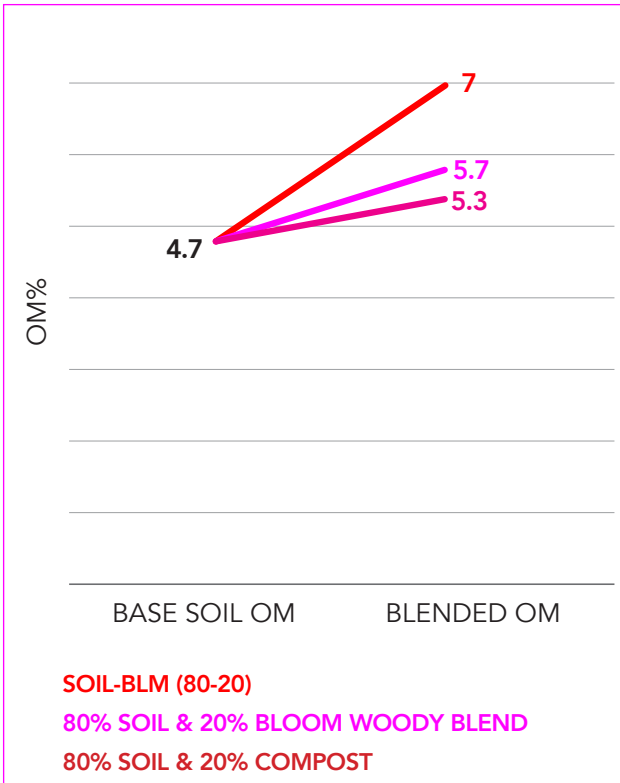
Soil pH over Time



Bloom had little to no effect on soil pH, which illustrates that while possessing a higher pH, it possesses little buffering capacity.

Change in Organic Matter Percentage (OM%)



Bloom products increased soil organic matter (OM) throughout the trial, elevating OM content by up to 2.5% immediately and staying elevated after six months. Compost also increased soil OM but to a lesser degree as it possessed lower OM content than Bloom.

Raw Data

date recorded	9/22/20	9/17/20	9/22/20	10/23/2020	11/25/2020	3/1/2021	4/7/2021
Characteristics	Soil 1	Bloom	Blend 1	Blend 1	Blend 1	Blend 1	Blend 1
80% sandy clay loam soil & 20% Bloom							
Soil pH	6.9	8.44	7.1	5.4	5.9	6.2	6
Buffer pH	Not tested	Not tested	Not tested	7.52	7.8	7.85	7.83
Soluble Salts (dS/m)	0.38	6.5	1.09	1.62	0.22	0.15	0.15
Organic Matter (% dm)	4.7	54.8	7	8	6.9	5.9	7.2
NH4-N (ppm)	3	1,200	324	18	12	4	8
CEC (meq/100g)	7.4	Not tested	8.5	14.4	8.2	6.9	6.9
Carbonates (lbs/ton)	40	5.5	38	44	74.6	58	46
date rec'd	9/22/20	9/17/20	9/22/20	10/23/2020	11/25/2020	3/1/2021	4/7/2021
Characteristics	Soil 2	Bloom	Blend 2	Blend 2	Blend 2	Blend 2	Blend 2
80% loam soil & 20% Bloom							
Soil pH	5.4	8.44	5.1	5.5	5.3	4.9	4.7
Buffer pH	7.61	Not tested	7.41	7.54	7.44	7.1	7.1
Soluble Salts (dS/m)	0.06	6.5	0.59	0.6	0.25	0.15	0.15
Organic Matter (% dm)	2.2	54.8	3.5	5.2	3	3.7	4.1
NH4-N (ppm)	4	1,200	193	217	198	65	23
CEC (meq/100g)	11.2	Not tested	13.6	14.9	15.8	19.4	18.4
Carbonates (lbs/ton)	44	5.5	32	38	48.3	94	68
date rec'd	9/22/20	9/17/20	9/22/20	10/23/2020	11/25/2020	3/1/2021	4/7/2021
Characteristics	Soil 1	Bloom	Blend 3	Blend 3	Blend 3	Blend 3	Blend 3
80% soil & 20% Bloom Woody Blend							
Soil pH	6.9	8.32	6.8	6.1	6.7	6.4	6.7
Buffer pH	Not tested	Not tested	Not tested	7.78	7.9	7.86	7.9
Soluble Salts (dS/m)	0.38	4.6	0.64	0.64	0.15	0.11	0.03
Organic Matter (% dm)	4.7	56.1	5.7	7.9	5.9	6	7
NH4-N (ppm)	3	1,000	136	13	5	4	8
CEC (meq/100g)	7.4	Not tested	9	10.8	8.2	8.2	6.7
Carbonates (lbs/ton)	40	7.7	34	44	66	82	56
date rec'd	9/22/20	9/17/20	9/22/20	10/23/2020	11/25/2020	3/1/2021	4/7/2021
Characteristics	Soil 1	Compost	Blend 4	Blend 4	Blend 4	Blend 4	Blend 4
80% soil & 20% compost							
Soil pH	6.9	7.04	6.9	7	7.2	7.1	7.2
Buffer pH	Not tested	Not tested	Not tested	7.93	7.93	7.93	7.93
Soluble Salts (dS/m)	0.38	1	0.41	0.33	0.16	0.11	0.09
Organic Matter (% dm)	4.7	29.4	5.3	6.1	5.7	4.9	6.1
NH4-N (ppm)	3	6.1	10	4	3	3	6
CEC (meq/100g)	7.4	Not tested	8.9	9.5	8.5	9.1	8.2
Carbonates (lbs/ton)	40	2.6	30	36	79.6	66	48