# NYC Survey of Agricultural Soils | Notes from 2018

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In order to better understand the unique soils used in New York City's urban farms, Cornell Cooperative Extension's (CCE) urban agriculture program launched the NYC Survey of Agricultural Soils in 2018. At each of ten participating urban farms, farmers and a CCE Urban Agriculture Specialist chose one bed or row which was to be planted into tomatoes or peppers. Nine out of the ten growing sites used imported/constructed soils—typically purchased topsoil or straight compost—rather than the underlying soil. We collected soil samples at the beginning and end of the season (May/June and November) and sent them to Agro-One for soil chemistry analysis. During the growing season, we collected plant tissue samples twice, in July and August, from the tomatoes and peppers in these beds/rows and sent them to Waters Agricultural Lab for plant tissue analysis.

Our findings from 2018 are very preliminary, given the small sample size, and largely brought up more new questions than answers. We are continuing the survey in 2019 to hopefully draw some more definitive conclusions. In the meantime, the 2018 data suggests some general themes applying to the sites sampled, and perhaps to other NYC urban farms, especially those growing in imported/constructed soils.

**Compost** –Nearly every site amends heavily with compost, and for many sites, mature compost is the primary growing medium. This contributes to high organic matter percentages and very high levels of some nutrients; other implications are a central inquiry going forward.

**Organic matter** – Presumably due to heavy use of compost, organic matter levels are consistently higher than one would expect from most agricultural soils in the region, ranging from 6.9 to 33.2% and averaging 15.6%. Four of the ten sites averaged over 19% organic matter; for these sites especially, the soil might be best approached as organic rather than mineral soil, meaning organic matter (rather than clay, silt, or sand) is the primary parent material. Half of the sites averaged 8 to 12.5% organic matter (by mass) despite appearing to be mostly organic matter by volume; whether these are best managed as mineral or organic soils is an open question.

**Soil calcium, magnesium, and phosphorous** – Nearly every sample showed very high levels of calcium (Ca), magnesium (Mg) and phosphorous (P), in many cases dwarfing what the Agro-One soil test would consider "high" levels. Ca, Mg and P levels corresponded strongly with each other and very strongly with OM%, suggesting compost as a uniting factor. Levels of Ca, Mg, and P also dropped substantially between spring and fall samples at some sites, far beyond expected levels – another open question which will hopefully become clearer with more data.

**pH** – Many of the soils tested are somewhat alkaline compared to standard recommendations for vegetable crops, with an average pH of 7.2 and all samples falling

between 6.8 and 7.5. Recommended pH levels are often considerably lower in agricultural soils with very high organic matter levels, and we are in the process of investigating target pH levels for these soils.

**Nitrogen availability/uptake** – Plant tissue analysis showed that most plants sampled (tomatoes and peppers) had taken up more nitrogen than typically desired for these crops, even in sites where no nitrogen fertilizer had been added. This most likely relates to a flush of nitrogen becoming available to plants as organic matter decomposes, although we have more questions than answers at this point. Excess nitrogen can be problematic for fruiting crops (reduced yields, fruit quality issues, excessive vegetation, higher disease incidence).

**Manganese uptake** – Although soil samples all showed sufficient levels of manganese (Mn), every plant tissue sample showed low or deficient Mn levels. This suggests an uptake issue; for Mn, this is commonly a result of high pH and potentially a complication of high levels of organic matter. Mn is not a top priority presently, especially because we saw few visual symptoms in the plants, but it is worth watching.

**Other nutrient uptake** – Despite very high levels of Ca, Mg, and P in the soil test results, the plants showed no significant uptake issues with these nutrients; in other words, so far we have no evidence that these cations competed with each other. We did see low potassium uptake in some plants, which studies have suggested can be caused or exacerbated by excessive levels of P/Ca/Mg, but no clear correlation in our small sample size.

**Important caveats:**

- We have only tested 10 beds/rows so far, a total of 20 soil samples and 20 plant tissue samples; it is too early to make specific recommendations based on this data.
- The survey has emphasized imported/constructed soils, where typically the base growing medium is purchased topsoil or straight compost, since these make up the majority of NYC growing spaces – and because we know the least about them. Operations growing in native soils may reference the NRCS Web Soil Survey for more information, and we will be gathering more samples from those sites for comparison against imported/constructed soils.
- Our soil testing results so far are limited to soil chemistry and do not directly measure soil biology, an important factor and an area for future survey work.
- Our plant tissue results so far are limited to tomatoes and peppers.

We will be gathering more samples in 2019 and will continue to share results. For any questions about the NYC Agricultural Soil Survey, please contact Sam Anderson at **swa39@cornell.edu**.