

Hello interested parties in compost!

We wanted to send out a communication regarding our project looking at the effect of compost applications on irrigated pasture.

Background

As you know, we received a grant almost a year ago from WSARE to undergo this experiment, with the support of many of you.

The experimental goals are to test the capacity of compost to increase soil organic carbon in irrigated pasture. In addition, we will test how compost additions influence yield and soil salinity. This is a three-year experiment that will go through the end of 2023.

Last summer, we discussed with many of you how we should proceed with the experiment.

The decisions we needed to make were 1) where to apply compost (regions of western Colorado, pasture management type), and 2) what compost. Here we summarize the work we've done so far with your input.

Where: Testing Locations

In terms of where, we had willing collaborators near Ridgeway, and are able to use a pasture at the Fruita Research Station near Fruita. We have two sites, but each site will have 12 plots each, described below. This is so that we can isolate any effect of the compost, without conflating it with differences due to sites. We also felt it was important to test in pastures where the management history was fairly uniform (i.e., fertilizer applied uniformly) and one that is relatively flat. This again, helps it so the pastures are representative of 'typical' management in the area, and logistically, we are able to isolate the effect of the compost.

Compost Quality

One of the concerns brought up at our first meeting was quality of the compost. To this end, we sampled 4 large, industrial composters in the Montrose/Delta/Mesa County area for salts, nitrogen and other nutrients and chemical characteristics (results attached). Some of you were interested in Fungal:Bacteria ratio, which we also tested for. We had another meeting in September of last year to discuss these results. None of the composts tested were high in Fungi:Bacteria, but 2 of the 4 (those derived from chicken manure) were much higher in salts. Salts were a concern because of the high application rates, and prevalence of salt-affected soils in the Fruita area. We decided on using compost from 3XM because it was relatively low in salts, had the highest Fungal:Bacteria ratio, had relatively high nitrogen content, was relatively uniform and is available in industrial quantities.

What are we contrasting?

Many people are already using compost on pasture throughout the region. Where we can add value is in implementing controls, replication and copious amounts soil sampling so that we can understand the impact of compost compared to fertilizer, and compared to applying nothing. Replications and controls are important so that the data can be trusted and allow for the best decision making possible. To this end, at each site (Fruita and Ridgeway) we will have 12 plots. We will test 1) compost alone, 2) compost + fertilizer, 3) just fertilizer, and 4) no compost or fertilizer (control). Each of these 4 treatments will be

replicated 3 times at each site for a total of 6 times with the 2 sites. This will help us understand if compost does add to yields and soil organic matter compared to fertilizer, and compared to no amendment. It will also help us understand if compost does add to yields and soil organic matter, what is the magnitude of the effect compared to no compost and compared to fertilizer.

What rate are we using to apply compost?

We have found there isn't great guidance on this topic. Studies in California used $\frac{1}{4}$ to $\frac{1}{2}$ inch of compost in experiments, but this didn't speak to what would be appropriate for our soils. We ultimately decided to apply on a per ton basis, based on the nitrogen demand of crops relative to the available nitrogen in the compost. The amount of compost you need for this rate is quite expensive, ranging from 10 -16 tons per acre (compost was \$45/ton + delivery), with 6 tons per acre used in the fertilizer plus compost treatment. This would be cost-prohibitive for most farmers and ranchers. However, influence on carbon and other characteristics would likely be observable at such a high rate. As such, we decided to apply at these rates, because the goal of the study is to first answer the question 'does it work?' Further, one of the primary goals of the study is to test the practice in the context of emerging carbon markets. We would not assume farmers and ranchers would invest this much in compost without a payment for doing so in a carbon market framework.

How does carbon get into soils in the first place?

There are two main factors that contribute to a soil's ability to increase soil organic matter, much of which is comprised of soil organic carbon. Vegetative growth of plants is the engine that drives below ground soil organic matter, and clay in the soil binds to the organic matter so that it stays in the soil. On a purely sandy soil, even if you have lots of production, you will not see accumulation of organic matter.

In our region, we certainly have the clay. Compost application hypothetically affects the first factor needed to increase soil organic matter below ground by increasing production. In short, the dominant pathway to increased soil organic matter belowground is production aboveground, and this is the basic assumption behind using compost. To a lesser degree (though still significant), compost may also allow microbes to more efficiently integrate carbon if the chemistry of the compost more closely matches that of their bodies (stoichiometry). However, the main driver would be through increasing production.

What's next?

Last week, we calibrated the spreader we are using to apply at the aforementioned rate, and had compost delivered to Fruita. We will apply it to fields in late March. Later this spring, we will do the same at the Ridgeway site. We'll clip pastures before hay is cut to assess yields each year of the study, as well as species composition (2021-2023). Soil sampling will take place in 2022 and 2023.

We'll be looking to have more meetings in the future to discuss the experiment more with all of you, and get your input on the results as they come in.

Thanks for your support of the compost experiment, and please contact any one of us if you have further questions.

Best,

Retta

Seth

Megan