Ferrington Vineyard Field Trial Highlights

By: Erica Lundquist, USDA-NRCS

October 2022

In California, most precipitation occurs in the winter, and in the North Coast region, vineyard managers frequently plant cover crops or allow naturalized vegetation to grow in vine middles (strips between vine rows) during winter months. Vineyard managers choose these plant cover systems based on many factors including cost, convenience, and the potential for competition with vines for water and soil nutrients. These systems also have the potential to change soil health, impacting the soil's organic matter content, structure, nutrient cycling, water infiltration and storage, and erosion potential. In Boonville, in California's North Coast vineyard region, a replicated field demonstration compared commonly used plant cover systems (PCS) that differ in tillage requirements and plant cover. The PCS used were; a high biomass cereal/legume green manure cover crop, incorporated in the spring (GMCC), a no-till annual reseeding grass/legume cover crop (NTCC) managed with mowing, an alternate row system with the above two systems in every other row (ARCC), naturalized vegetation managed no-till with mowing (NTNV), and naturalized vegetation tilled annually (TNV). The systems with tillage; GMCC, TNV, and every other row of ARCC, were mowed once and required 3-4 annual passes with a disc to incorporate the cover crop in spring and prepare the fall seed bed. The no-till systems, NTCC, NTNV, and every other row of ARCC, were mowed four times annually.

Figure 1. Cover crop seeding, fall 2015.

The vineyard in this trial had been managed with an annually incorporated green manure cover crop for the seventeen years since planting at the time the trial was initiated. Vine water status was monitored using a

pressure chamber, and vine yields and pruning weights were measured three times during the six-year demonstration. Compaction to 24" was measured in two of the PCS treatments 6 and 18 months after the trial start. Water infiltration rates were compared for the different PCS 2 and 3.5 years after the trial started. Infiltration rates were also compared spatially, in the vine row, tire tracks, and middles within one plot on two dates. Sampling (0-6") for soil health properties, including water stable aggregates, bulk density, total carbon and nitrogen, permanganate oxidizable carbon (POX C), mineralizable carbon (min C), and potentially mineralizable nitrogen (PMN) was conducted 2.5 and 5.5 years after starting the demonstration. Soil samples from the vine rows, which are maintained bare using herbicides, were also collected on the later sample date.

Trial Results Highlights

- The plant cover systems did not have a differential influence on vine water status, yield, and pruning weights.
- Soil compaction occurred in tractor tire tracks. It is not known whether the measured level of compaction impacts vine root growth, and compaction is likely to be vineyard specific, depending on soil texture, traffic patterns, and other factors.
- Water infiltration rates were lower under the vines and in the tire tracks compared to the middles.
- Soil health tests with the greatest sensitivity to plant cover systems after five years were:
    - water stable aggregates, showing a trend toward greater water stable aggregates in no-till than tilled plant cover systems, and
    - mineralizable carbon, 96 hour rate, with higher rates in tilled than no-till plant cover systems.
- After 20 years of herbicide use and no-till in the vine rows compared to cover crops in the middles, soil health and function were impacted in several ways:
    - Vine rows had reduced soil organic matter (measured as total carbon), water stable aggregates, and infiltration rates, indicating a reduced capacity for water entry and storage compared to middles.
    - The combination of reduced water stable aggregates, slow infiltration, and lack of plant cover contribute to a greater risk of soil erosion in vine rows compared to middles.
    - Biological activity, nutrient cycling, and nitrogen supply from organic matter were reduced in vine rows to a greater extent than total soil organic matter. While total soil carbon was reduced approximately 20% in vine rows compared to middles, mineralizable C and potentially mineralizable nitrogen were 40-45% lower in vine rows than middles.