

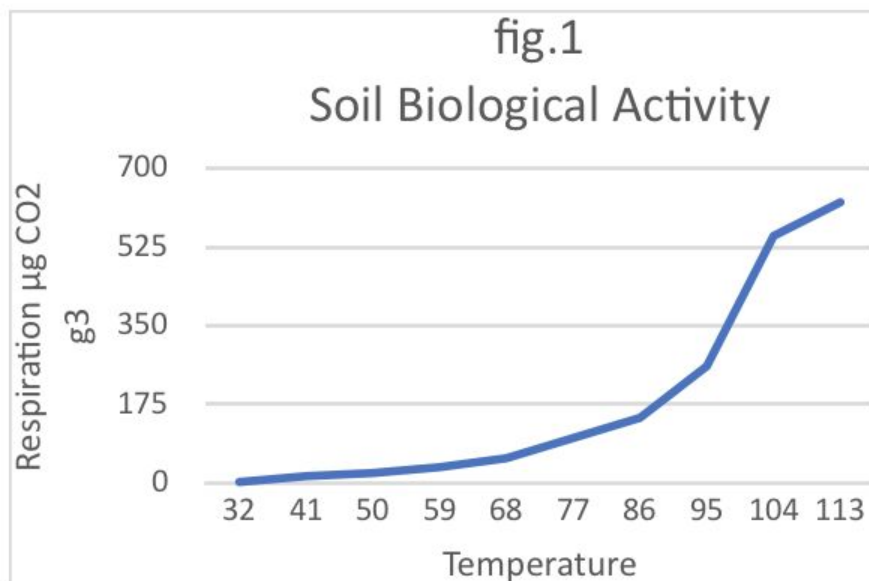
## Soil Temperature: February 2021

by Robert Smith, Agronomist

It is fitting that I am writing about soil temperature as Spring has arrived. Almonds are beginning to bloom throughout the Valley, strawberries are being harvested on the southern and central coast, and other crops are soon to follow. As of the day of this writing, the soil temperatures are about 45° F. With warmer spring temperatures in the forecast, this will begin to change.

It is a good reminder of why understanding soil temperature, and how it relates to your farm, is so vital. No matter what the weather is doing, the soil temperature can determine a lot. Having a bit of knowledge about the topic is useful for any farmer.

Soil temperature plays a central role in all soil processes. Soil temperatures are powerful “bio-controllers.” Throughout most California growing areas, the transition from the “nongrowing” to the growing season occurs when temperature rises above a base temperature, ( $T_b$ ).



A factor that is often not considered when looking at soil temperature is that temperature drives microbial function, which in turn drives plant growth. This is an area where farmers can impact the whole system. With optimum microbial activity, you will have improved soil physical conditions, which in turn influences the four main functions of plant growth (temperature, water, nutrients, light), leading to better water movement, air movement, and nutrient movement. These optimal conditions work to buffer high temperature as well. A soil with good air and water movement, high root biomass, will not overheat to the same extent as a poor soil.



The bare minimum soil temperature for soil microbes to be active is about 55° F. That is the temperature required before any significant activity takes place in the soil... any colder, and extraordinarily little is taking place (Fig.1). The microbial activity in the soil is very temperature dependent.

Microbes make nutrients and minerals in the soil available to plants, produce hormones that spur growth, stimulate the plant immune system, trigger or dampen stress responses, influence rate constants of chemical reactions, water content, and nutrient transport in soil, but it simultaneously affects plant physiological aspects of ion uptake, root growth, and the composition and function of soil microbial communities. In fact, virtually all processes occurring in soil, from the weathering of primary minerals to plant nutrition and storage of organic carbon, are strongly influenced by soil temperature.

Plants absorb P as Orthophosphate ions. Polyphosphates (10-34-0) are a chain link polymer molecule of orthophosphate and are not available to the plant until conversion. Conversion occurs when Polyphosphates are added to soils, the polyphosphate unit combines with soil water and breaks down, and the orthophosphate units are the result. This is a chemical reaction affected primarily by soil temperature. The speed of the conversion increases as soil temperature increases. Conversion is usually completed in 7 to 10 days when soil temperatures are above 75° F. However, when the soil temperatures are below 60° F this process can take over 28 days.

Soil biological processes are responsible for supplying approximately 75 percent of the plant-available nitrogen and 65 percent of the available phosphorus in the soil.