Temperature and Moisture Sensitivity of Soil Microbes in Adjacent Irrigated and Non-Irrigated Soil

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Global climate change coupled with a growing population will increase the need for intensive agricultural management practices, particularly irrigation, in order to meet food demand. The environmental impacts of intensification need to be considered as recent research has shown a decrease in soil carbon in temperate soils under irrigation. Soil microbes use soil carbon as an energy source and their activity is determined by measuring their respiration rates which increase with temperature until a temperature optimum (Topt) is reached, after which the rates begin to decrease. The relationship between respiration and temperature has been explained by the Macromolecular Rate Theory (MMRT). MMRT also allows calculation of the temperature at which respiration is most sensitive to temperature change (Tinf - the temperature inflection point). Respiration rates also increase with increasing moisture content until saturation occurs and availability of oxygen decreases. We hypothesised that the increased moisture content of irrigated soils would result in increased carbon losses and increased sensitivity to change in temperature.
Soil samples taken from adjacent irrigated and non-irrigated paddocks on dairy farms in the Canterbury and Waikato regions were wet to five different moisture contents and incubated for 5 hours on a temperature gradient block (~2 to 50°C) to assess the pattern of respiration over various temperatures and moisture contents.
Preliminary results from Canterbury soils show that the Topt and Tinf were higher in the irrigated soils by an average of 8°C and 12°C respectively. This indicated that microbial respiration in irrigated soils was more sensitive to changes in temperature than non-irrigated soil. This analysis will be undertaken on a further ten sites from Canterbury and also seasonally with soil from a local Waikato site.