

Abstract

Application of water and effluent to boost agricultural production is increasing in New Zealand, particularly in the Waimate District; a drought prone region traditionally associated with extensive sheep farming, but now converting to dairying. To determine how this intensification affects soil properties, we sampled soil from 615 locations across 41 farms in the District between April and September 2012. Effluent applied soils had between 8% and 15% higher amounts of soil carbon, nitrogen and phosphorus, while application of water alone increased these nutrients by between 17% and 35%. Soils where both effluent and irrigation water were applied had the highest amounts than the untreated “control” locations. Irrigation and effluent dispersal affected soil structure by reducing bulk density in the range of 14% to 26% but increased soil water content by 29% to 100%. The effect of water application was more pronounced in cattle grazed soils. For example, phosphorus increased by 63% in dairy compared to a decrease of 5% in sheep farms when irrigated. When compared with untreated locations, total earthworm density was higher by 42% in effluent locations and 72% in irrigated locations. Maximum density and biomass occurred where both effluent and irrigation were applied. Earthworm densities and biomasses were higher on sheep farms than on dairy farms. Soils with a lower abundance of *Lumbricus rubellus* earthworms, had higher total carbon and nitrogen whereas those with greater earthworm biomass had a higher water holding capacity. The study however failed to find evidence of linear and directly proportional relationships between earthworm measurements and other soil properties.