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THE EFFECT OF LAND DISPOSAL OF DAIRY FACTORY WASTES ON SOIL PROPERTIES

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Keith William McAuliffe

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ABSTRACT

Many New Zealand dairy factories dispose of their wastewater by spray irrigating onto pasture. Little is known, however, about the effects of this disposal on soil properties. Research was undertaken at three pasture disposal sites in order to determine whether certain soil property changes may have occurred as a result of the wastewater treatment. Of particular interest were those properties related to water movement.

Laboratory studies using 'undisturbed' soil cores indicated that dairy factory wastewater can impede soil water movement. A single application of simulated whey effluent resulted in approximately a 50% decrease in saturated hydraulic conductivity (K) within two days. This reduction was observed to be caused by a combination of both physical and biological blockage processes. With repetitive doses of effluent a K decrease of over 99% was induced in some cores. Several cores, particularly those containing earthworms, showed signs of recovery, and in some cores the final hydraulic conductivity value was greater than the initial value.

Analyses of soil samples from the disposal and control sites at Te Rehunga and Tokomaru suggest that fifteen years of wastewater irrigation have resulted in marked changes in soil physical, chemical and biological properties. Total carbon and nitrogen levels were found to be significantly higher at the disposal site; for the Te Rehunga site, the differences in the organic matter level down to 600mm represented an increase of 250 000 kg ha^{-1}.

Water balances for the Te Rehunga and Longburn sites indicate that, in the absence of wastewater, pasture is likely to be water stressed on average for approximately forty days per year. The water balance also shows that deep percolation will be greatly increased by the wastewater application. The period of maximum deep percolation loss is likely to be September to October at both the Te Rehunga and Longburn disposal sites.

The major site management problems encountered at the disposal sites examined occurred as a result of poor soil drainage, pasture burning and pasture pulling. An infiltration problem was observed at the Longburn site and the recently established disposal site at Tokomaru, with two major causes of the low infiltration rate appearing to be blockage from the effluent and pugging; these observations illustrate the need for controlling the effluent application rate, the suspended solids level in the wastewater, and the stock grazing pattern, in order to minimise site drainage problems. A drainage problem over the winter-spring period at Te Rehunga was due to a high groundwater table. Pasture burning was observed at all three disposal sites. The pasture pulling problem at Te Rehunga is the only cited example of such a problem occurring at a dairy factory disposal site.

Observations made at the established Te Rehunga and Tokomaru disposal sites show that long term spray irrigation of dairy factory wastewater can occur without inducing undesirable soil property changes. It appears as though considerable benefit can be gained from the wastewater irrigation, particularly in reducing the incidence of water stress in the pasture and decreasing the requirement for fertilizer.

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