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Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 1 Agricultural and Horticultural Science RAS 2023

91931 Demonstrate understanding of sustainability considerations that influence primary production management practices

EXEMPLAR

Excellence

TOTAL 08

The dairy farming production system encompasses the breeding, raising and milking of dairy livestock (particularly cows). Unfortunately, when water management practices are not performed, dairy farming pollutes nearby waterways with excessive nutrients from livestock's effluent deposition and overapplication of fertilizers.

Riparian planting is a water management practice performed in dairy farm systems to protect the nearby waterways. When carrying out the management practice farmers should plant water tolerant scrubs on lower banks near waterways, small trees and flaxes on the upper banks and leave grass strips between vegetation and fences. The riparian margins stabilise the banks with their tightly held root systems, preventing erosion and loss of sediment into the water. Sediment from dairy farms typically contains nutrients that are considered as water contaminants, contributing to Eutrophication. As nutrients, especially Phosphorus and Nitrogen, enter the water through run-off, leaching or direct deposition, they promote the excessive growth of algal blooms. Algal blooms consume the water's dissolved oxygen at considerably fast rates on cloudy days and at night. Without this oxygen the water is deoxygenated and becomes anoxic. Anoxic water is toxic for all aquatic organisms and life that are found in that water source. Riparian vegetation also filters and utilizes high amounts of nutrients from dairy farm run-off and leaching before they can pollute and eventually deoxygenate the water. Additionally, riparian margins provide shade, cooling the water temperatures. Rivers require 70% shade and a temperature of 10 degrees Celsius for optimal conditions to be achieved. Riparian margins present the Māori value of Tiakitanga, referring to the guardianship and protection of our land and natural resources for future generations. Although riparian planting has no immediate economic gain, as farmers prevent the contamination of water sources, they are being socially sustainable, maintaining the condition of our waterways for future generations of rural communities to use and successfully sustain economic benefit from.

Effluent is a nutrient-rich natural resource that is produced by livestock and released as urine and poo. Effluent, collected from milking sheds, holding yards and stand-off pads, is diluted with water to become a supplementary liquid irrigation system on dairy farms. Effluent contains Nitrogen, Phosphorus, Potassium, Magnesium, Sulphur, and other trace elements dairy farmers usually purchase to fertilise their pastures with. When performed and controlled well this management practice is socially, environmentally, and economically sustainable. Each dairy cow typically produces \$25 worth of nutrients annually as Farm Dairy Effluent (FDE). Therefore, a 400-cow herd produces approximately \$10,000 worth of nutrients annually as FDE. This offers an opportunity to capitalise on a cost-effective natural resource. When applied to paddocks effluent promotes pasture and crop productivity which in turn provides dairy livestock with a sufficient food source. To control this practice, farmers must ensure the effluent drift will not reach the water, consider their soil deficit, leave a 20-meter strip of unirrigated land, and not irrigate within 50 metres of a water source. Soil deficit refers to the volume of water that the soil can hold before it reaches 'field capacity.' If farmers where to irrigate with effluent after it reaches capacity, it is likely that ponding, run-off, or leaching will occur, potentially severely damaging the waterways. Effluent, like commercial fertilisers, contains nutrients that can cause water contamination at high concentrations. Making sure that their effluent irrigation is preformed both effectively and responsibly prevents the risk of Eutrophication, a harmful cycle of water deoxygenation and degradation that I have explained in my previous paragraph. By managing effluent effectively, farmers can recycle and capitalise on a natural resource while preventing the contamination of waterways. If dairy farmers did not control effluent, it would pollute and degrade the nearby water sources severely. When performed well, effluent management shows Manaakitanga, respect and consideration of the land and waterways on the farm and around it. This consideration of environmental and social sustainability prevents any harm that can be associated

with irresponsible effluent management. When members of society drink from or swim in water downstream, their health and wellbeing has been considered and the risk of illness reduced.

Overall, planting riparian margins will have the greatest impact upon water and environmental sustainability as it actively reduces the contamination of water ways and although it has no large immediate economic benefit, it sustains the health of our land's natural resource for use by future generations of New Zealand rural communities and animals. Effluent management is environmentally and socially sustainable, preventing water contamination and maintaining safe waters, but it is often instead performed by dairy farmers due to the economic sustainability consideration of pasture productivity and overall milk production for sale. If accidents happen while effluent irrigating, riparian vegetation stops the associated nutrients entering and degrading the water. Therefore, when planned and planted correctly, riparian vegetation reduces the nutrient contamination and eutrophication of waterways significantly, successfully improving water sustainability.

Excellence

Subject: Agricultural and Horticultural Science

Standard: 91931

Total score: 08

Q	Grade score	Marker commentary
One	E8	<p>The candidate has evaluated riparian planting by explaining how it can improve water sustainability. The candidate has discussed both environmental and social sustainability considerations of riparian planting. The candidate has evaluated effluent by explaining the negative effects effluent can have on the water if applied incorrectly. They have discussed how to apply effluent to reduce the chance of water pollution and have discussed both economic and environmental sustainability considerations when applying effluent. The candidate has demonstrated a good understanding of tiakitanga in their response.</p>