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REGENERATIVE AGRICULTURE INCREASING YIELDS AND REDUCING GHG EMISSIONS

Potato pioneers in New Zealand.

Understanding local contexts is essential for selecting and implementing practices to regenerate farming systems. Take the potato, which is among the most important crops grown globally (FAOSTAT, 2013). They are cultivated on approximately 19 million hectares worldwide, with an annual production of 378 million tons (Devaux et al., 2020). Their high yield potential, short growing cycles, climate adaptability, and relatively high water-use efficiency, along with their compatibility with cereal crops, make them a preferred choice for many farmers (Devaux et al., 2021). Consequently, potatoes are the largest vegetable crop by both area and production volume in New Zealand, with over half a million tonnes grown annually, generating more than 1 billion USD in farmer revenue (Te Puni Kōkiri, 2024).

However, because the harvestable part of the potato grows underground and the crop is clonally propagated (i.e., tubers are planted instead of true seeds), potato crops are susceptible to seed- and soil-borne pests and diseases, such as fungi and nematodes. Continuous cultivation of potatoes on the same land can exacerbate the accumulation of these pests and diseases, reducing yields and necessitating increased pesticide use.

Adapting a global outcome-based framework to local contexts.

This case study highlights the flexibility and ability to adapt SAI Platform's Regenerating Together global framework for regenerative agriculture, into the New Zealand landscape to achieve regenerative agriculture outcomes.

Embracing a four-step approach for regenerative agriculture (as illustrated in Figure 1), enables farmers to immerse themselves in the intricacies of their surrounding environment.

Figure 1. SAI Platform's Regenerating Together global framework for regenerative agriculture process flow

1. CONTEXT ANALYSIS

In 2012, a group of arable farmers in the Mid and South Canterbury region of New Zealand noticed that their potato yields had plateaued at around 55 tons per hectare. This plateau occurred despite increased investments in fertilisers and crop protection inputs, reducing their profits. To address this issue, the farmers conducted a **context analysis** of their production system to identify the factors limiting their productivity (Figure 2). Beside seed quality limitations, the analysis identified the following farm management practices for the plateauing potato yields:

Crop Diversity. Low crop diversity shortens rotation cycles, leading to the accumulation of soil-borne diseases. The abundance of potato crops increases the prevalence of diseases specialised in potatoes.

Soil Fertility. Current tillage, nutrient management, and rotation practices disrupt soil integrity and deplete soil nutrients. This limits water and nutrient availability, slowing crop growth.

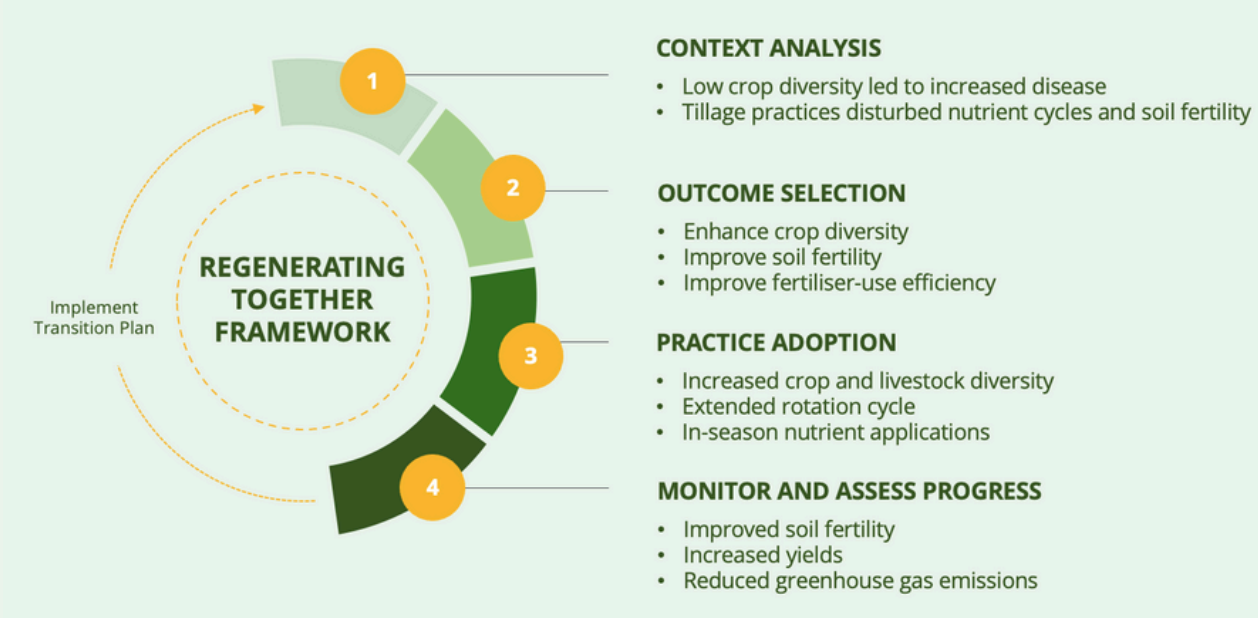

Figure 2. The Regenerative agriculture process of Canterbury potato farmers in New Zealand, using the SAI Platform's Regenerating Together global framework for regenerative agriculture process flow and indicating major decisions at each step of the process.

2. OUTCOME SELECTION AND 3. PRACTICE ADOPTION

To address these yield-limiting criteria and secure future yields, farmers decided to prioritise the following **outcomes** to monitor and report progress against and **practices** to implement:

Enhance crop diversity
to establish a more diverse cropping system that reduces the share of depletive crops (such as potatoes, onions, and carrots) and reduces potato disease prevalence through rotation cycles extended from 6 to 9 years. Up to 14 crop species are now included per rotation cycle.

Improve soil fertility
by minimising nitrogen use at planting with well-informed in-season nutrient applications through frequent petiole testing to monitor the nutrient requirements of the plant and provide inputs accordingly.

Increase livestock diversity
in mixed farms to reduce soil compaction caused by heavy livestock stocking through the introduction of lighter livestock, such as sheep.

4. MONITOR PROGRESS

As a result of the context-based selection and adoption of these practices, the following **outcomes and environmental performance indicators** have been achieved:

Increased Yields.
Average potato yields have increased by 25% compared to the 2000-2023 averages (Figure 3).

Improved soil fertility.
With confidence in root health, due to a better rotation, there is confidence in the plant to grow better and nitrogen application at planting has decreased substantially over the last decade.

Reduced Greenhouse Gas (GHG) Emissions.
Over the last five years, New Zealand growers reduced GHG emissions per ton of potatoes produced by approximately 9% compared to the baseline.

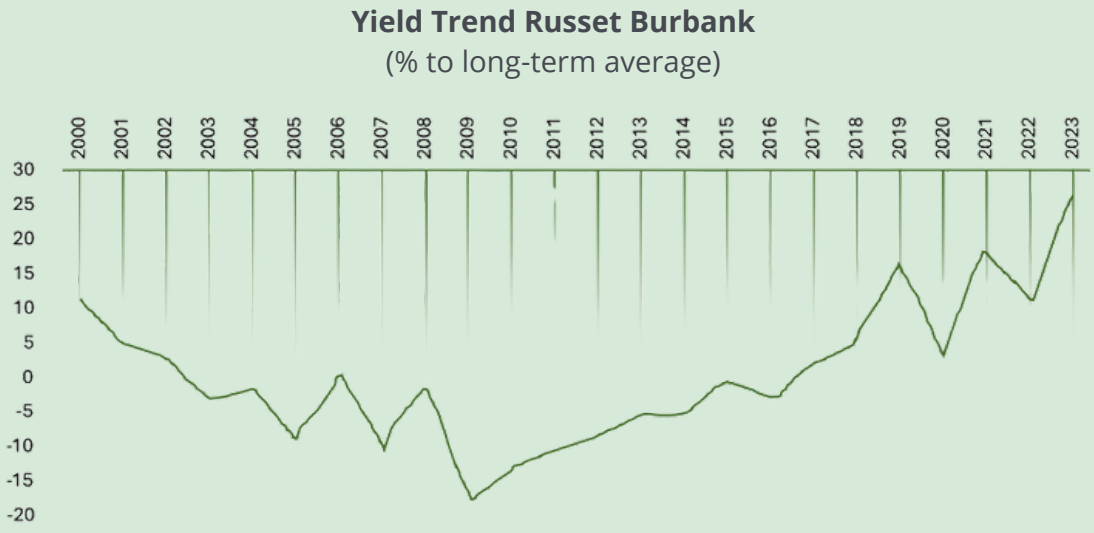

Figure 3. Yield Trend Russet Burbank (% to long-term average) of Canterbury Potato Farmers in New Zealand, depicting average annual potato yields from 2000-2023. The farm management changes described in this case study were initiated in 2012 after the publication of a yield gap study, resulting in a signifiant yield increase.

NEXT STEPS

Regenerative agriculture aims to continuously enhance the environmental performance of farming systems. The farmers in this case study share this goal and have identified future focus areas for improvement:

- **Improved Pesticide Use Efficiency**: Implementing Integrated Pest Management (IPM) approaches to control Zebra Chip, a vector-based potato disease.
- **Minimise Soil Disturbance:** Testing and implementing alternative means for destoning soils.
- **Extended Rotation Diversity**: Increasing crop rotation diversity and enhancing on-farm biodiversity to attract pollinators and support IPM through the presence of beneficial insects.

Acknowledgement

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We are eager to build out more case studies to demonstrate regenerative agriculture across a variety of production systems and geographies. If you are implementing regenerative agriculture using our framework and would like to showcase your learnings, please reach out!

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A Global Framework for Regenerative Agriculture

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