

Simulation-based decision support for nitrogen management in vegetable production: The Sustainable Vegetable Systems (SVS) Tool

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Abstract: The New Zealand vegetable industry faces increasing pressure to improve nitrogen management due to environmental concerns such as nutrient leaching, greenhouse gas emissions and declining water quality. Vegetable production systems are characterised by intensive management of multiple species and short crop cycles, often resulting in several harvests within a single year. These systems also produce substantial quantities of crop residue, which may contain significant amounts of nitrogen. This nitrogen can be mineralised or immobilised by soil microorganisms. The frequent turnover of crops and return of residues creates a dynamic and complex nitrogen environment that is difficult to manage using static fertiliser guidelines.

Decision support systems have been developed to address this challenge, but most focus on a single crop or are too detailed. The Sustainable Vegetable Systems (SVS) project developed the SVS Tool based on a simplified crop and nitrogen balance model. This model captures the key components of nitrogen dynamics and can be easily parameterised for different crops.

Key features of the tool include:

- Initialisation with a soil nitrogen test, with the ability to reset using additional tests during the season,
- Integration of the hot water extractable organic nitrogen test to predict nitrogen mineralisation.
- A residue component to predict for nitrogen mineralisation or immobilisation from crop residues,
- Parameterisation of over 60 crops and can easily be adapted for additional crops.
- A user-friendly, web-based interface purpose-built through consultation and prototype testing with growers to ensure usability and relevance.
- Open-source code and free access.
- Ongoing support for growers provided by a network of advisers who have both contributed to the tool's development and are well-versed in its use.

Built on extensive field trial data from commercial and research sites across New Zealand (Searle et al. 2023), the SVS Tool provides growers with real-time insights into nitrogen supply relative to crop demand. It marks a significant step forward in sustainable nitrogen management for the vegetable sector, aligning with national goals for environmentally responsible agriculture.

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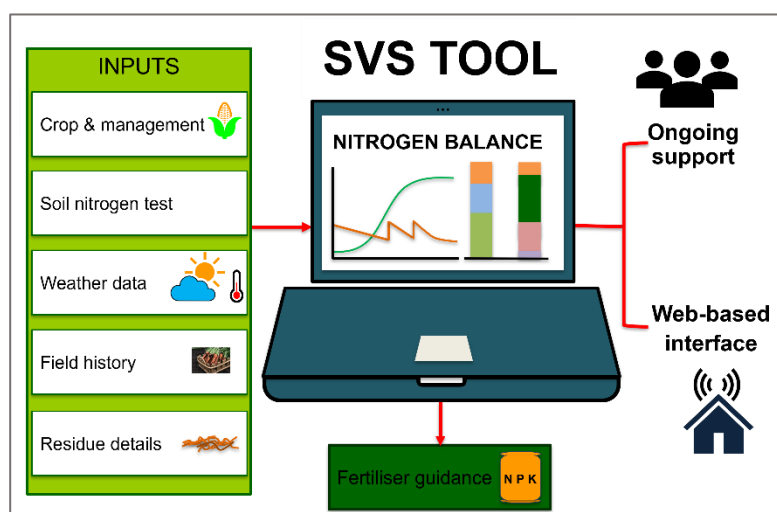


Figure 1: Overview of the Sustainable Vegetable Systems (SVS) Tool.

trials and collecting data. We also thank the growers for generously allowing the use of their farms for trials and for their active participation in the project.

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