Evaluation of sustainable fertilisers in strawberry and other crops

David Riches, Scott Mattner, and Ian Porter, La Trobe University, Bundoora, Melbourne

Berry growers will soon have better tools and products to manage organic (e.g., composts and manures) and fertiliser inputs in their cropping systems. Collaborators in a Smart Farming Partnerships project are developing an App that will allow growers to calculate the release of nutrients from organic amendments into soil to reduce fertiliser rates and costs.

At the same time, Incitec Pivot Fertilisers (IPF) are developing and commercialising new organo-mineral fertilisers containing carbon, manures and nutrients in a granular product that will be locally manufactured in Australia for horticulture and other agricultural industries. These products are being developed through the Australian Bio Fert business of which IPF are a major shareholder.

A field trial in a strawberry crop by La Trobe University showed that the use of these products resulted in equivalent runner yields as conventional inorganic fertilisers, but with greater carbon inputs being applied into soil. This is a promising first step and further trials with different formulations of these products are set to continue.

Costs of fertilisers have increased dramatically for growers over the past months. Recent world events such as the COVID-19 pandemic have highlighted the importance of domestic supply chain security, including for fertilisers. A further complication for growers is that up to 50% of nitrogen can be lost to the environment from soils treated with fertilisers and organic amendments (e.g., manures) through volatilisation (emission of gases) and other processes. This not only represents a waste of valuable nutrients for crops and money for growers, but also a source of pollution for the environment.

The Federal Department of Agriculture, Water and the Environment's Smart Farming Partnerships Program is supporting research by La Trobe University and other collaborators on ways to better manage fertiliser and organic inputs in cropping systems, such as strawberry production.

The program is developing an App that will allow growers to better calculate the release of nutrients from manures and other organic amendments into soil to reduce fertiliser rates and costs, without sacrificing yields (see PAGE 81 Autumn 2022 edition of the Australian Berry Journal for details).

Separately to the research program, Incitec Pivot Fertilisers (IPF) and Australian Bio Fert Pty Ltd (ABF) have recently announced a partnership and a multimillion-dollar investment into the construction of a largescale plant to manufacture more sustainable fertilisers for Australian agriculture. The plant will have the capacity to produce granular biological fertilisers that combine torrefied organic waste (e.g., manures) with functional carbon and mineral nutrients.

The new products aim to improve soil health, nutrition, and crop production. Researchers from La Trobe University are evaluating the performance of the new products compared with standard inorganic fertilisers and organic amendments in a range of crops, including strawberry.

A strawberry runner trial was established on a site with a ferrosol soil at Toolangi, Victoria (Figure 1). Organic amendments of composted (16 t/ha, 1.8% N) and pelletised (9 tonnes/ha, 3.0%N, BounceBack®) chicken manure were applied in April 2021 before soil fumigation with methyl bromide / chloropicrin.

The site was planted with mother plants of the strawberry cultivar 'Red Rhapsody' in September 2021. Different fertiliser treatments were chiselled into the soil on both sides of the transplant row at planting. Top-dress applications of the fertilisers were then made at three times through the season, by spreading the products over the top of individual plots.

All fertiliser products were applied at a total equivalent rate of 200 kg N/ha over the entire season (8 months). The fertiliser treatments included two of IPF/ABF's prototype fertilisers (B5, 8.9% N and B7, 10.0% N) and a conventional inorganic product (Platinum Plus®, 10.0% N). Researchers monitored soil and plant nutrition, crop growth and development, and soil health parameters at regular intervals through the trial.

The final yield of strawberry runners was determined in April 2022. Treatments in the trial were replicated in four blocks (called a randomised complete block design) and results statistically analysed using standard techniques (ANOVA).

Preliminary results from the trial showed that growth of strawberry mother plants was comparable in soils treated with the new biological products and the standard inorganic fertiliser (Figure 2). Runner yields were significantly higher in plots treated with biological and inorganic fertilisers, compared with the control and those treated with chicken manures on their own (Figure 3).

Figure 1. Strawberry field trial at Toolangi, Victoria featuring La Trobe University's automatic chamber system for measuring emission losses of nitrogen and carbon gases from soils treated with different fertilisers and organic amendments. Photo credit: La Trobe University

Figure 2. Growth of strawberry runners (cv. Red Rhapsody) in soil treated with different fertilisers in a field trial at Toolangi, Victoria in 2021/22. The products B5 and B7 are potential biological fertilisers that will be commercially produced by Incitec Pivot Fertilisers / Australian Bio Fert, and made from organic waste, carbon and inorganic nutrients. The conventional inorganic fertiliser was Platinum Plus®. All fertiliser products produced equivalent runner yields, but the biological fertilisers inputted greater amounts of carbon into the soil. Carbon is a fuel for soil microbes and improved soil health. Photo credit: La Trobe University

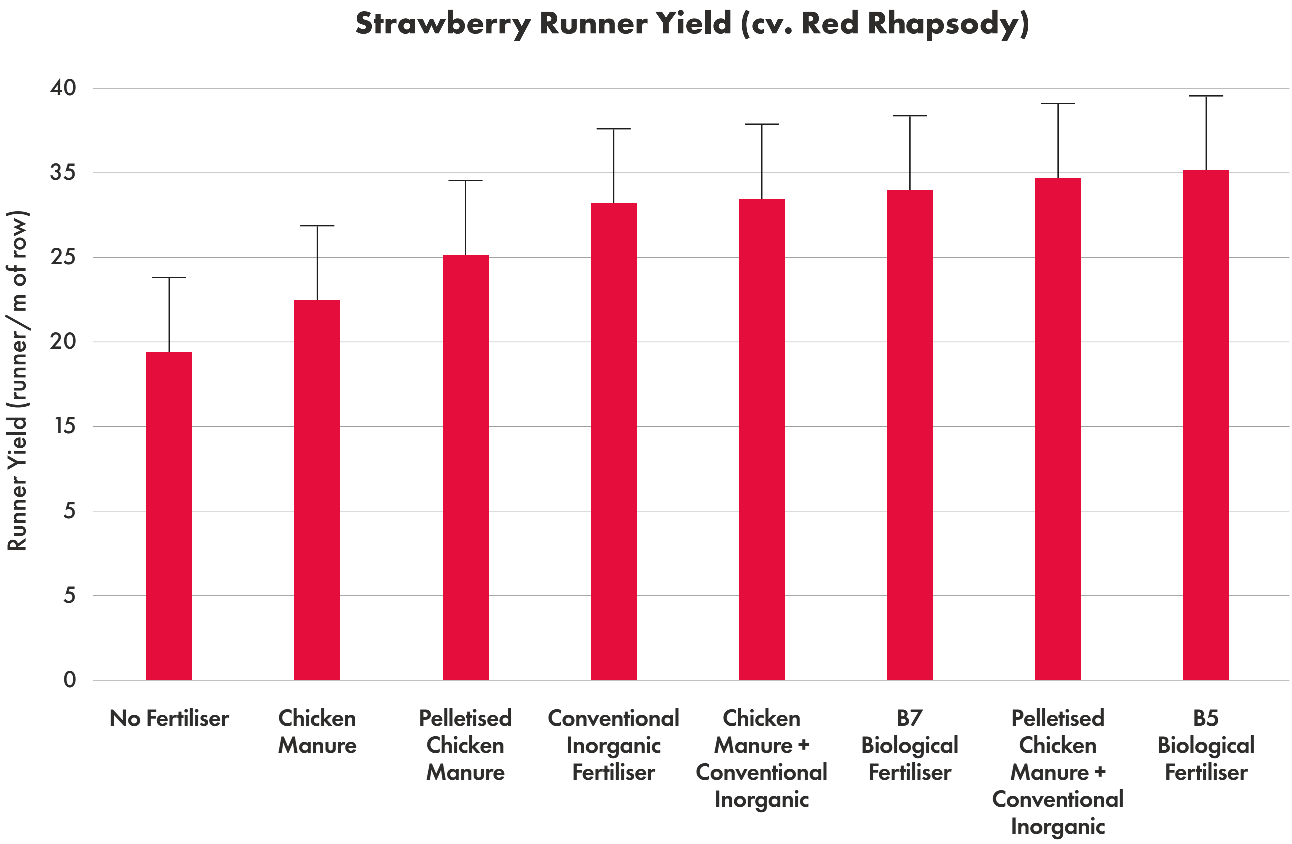

Figure 3. Histogram of average yields of strawberry runners (cv. Red Rhapsody) grown in soil treated with different fertiliser products in a field trial at Toolangi, Victoria in 2021/22. The bars above the histograms are statistical error bars for comparing treatments (least significant difference, where p = 0.05).

Figure 4. Local growers and agronomists inspecting strawberry runners at the trial site at Toolangi, Victoria and discussing the benefits of new biological fertilisers. Photo credit: La Trobe University

Most importantly, runner yields were statistically equivalent in plots treated with the new biological fertilisers and the conventional inorganic fertiliser (Figure 2 & 3). Final analysis of all of the results from the trial are currently being conducted and will be reported in upcoming editions of the Australian Berry Journal.

Some of the practical benefits of the new biological fertiliser observed in the trial were that they contained nutrients and manure in a single product. This meant they could be applied effectively in less passes than chicken manure/inorganic fertiliser combinations.

Moreover, the compound nature of the granule meant that it could be spun out without separating compared with blended fertiliser products. Furthermore, human pathogens are killed by the high temperature in the torrefaction process, thereby reducing food safety risks compared with the use of raw manures.

La Trobe University recently held a farm walk at the trial site for local growers and agronomists (Figure 4). The day included information on IPF/ABF's new products and a demonstration of La Trobe University's automated system for measuring emissions of nitrogen and carbon gases to the atmosphere. This equipment will form an important component of future research evaluating the efficiency of new fertiliser and organic products to minimise losses of nitrogen and carbon from treated soils to the atmosphere. For example, some of IPF/ABF's new products will include inhibitor compounds that suppress the ability of soil microbes to convert nitrogen into gases (i.e., though nitrification processes). It is expected that the inclusion of these inhibitor compounds into the granular products will help to reduce losses of nitrogen through nitrification and volatilisation by 50% or more, and this will flow onto efficiency and cost savings for growers. In addition, many of carbon and nitrogen gases lost from treated soils are environmental pollutants. Therefore, developing ways to use nitrogen and carbon amendments more efficiently is an important component of the shared environmental stewardship of fertiliser companies and horticultural industries.

Growers can follow the progress of research in the national program on twitter (@UnlockSoilOAs), or by contacting David Riches at La Trobe University (d.riches@latrobe.edu.au).

Australian Government | National Landcare Program | LA TROBE UNIVERSITY