Circular Economy Organics R&D Fund

Impact Summaries

Cirque Du Soil groundwork brings rapidly dehydrated food waste into the circular economy

Sustainability Victoria

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Sustainability Victoria acknowledges Aboriginal and Torres Strait Islander people as the Traditional Custodians of the land and acknowledges and pays respect to their Elders, past and present.

Background

Sustainability Victoria (SV) delivered funding to enhance the market for recycled organics under the Circular Economy Markets Acceleration Program. Impact Summaries are an outline of the successes by recipients of this funding. SV expects that the information in these summaries will generate discussion, stimulate ideas, inspire action and ultimately contribute to a more profitable and sustainable organics sector.

Based in Fitzroy, an inner suburb of Melbourne, Cirque Du Soil is a certified social enterprise. They know that access to healthy food is a challenge for communities, with almost 1 in 4 Victorians facing food insecurity. They also believe Australia's reliance on synthetic fertiliser products for commercial and home growing of food is unsustainable. Solving these issues is the core DNA of Cirque du Soil aka 'Circular Soil' and they are on a mission to transition urban precincts into regenerative and circular economies. They are committed to food waste recycling with the view that returning the nutrients in food waste to soil in an urban context is a genuine circular economy

Food waste dehydrators heat and grind food waste into a dry, pasteurised, powder-like substance known as rapidly dehydrated food waste (RDFW). They are used in multi-unit developments, shopping centres, hospitals, fresh produce markets and other commercial buildings so food waste can be safely stored on-site and efficiently transported to an organics processing facility. RDFW generally has a higher nutrient concentration than household garden waste.

Typically, RDFW is sent to an organics processor, where it is composted with kerbside food and garden waste. Although this produces a useful product, it is argued that the RDFW is not kept at its highest value, because the valuable nutrients in it are diluted into feedstocks that have lower nutrient concentrations. Keeping waste at its highest possible value is an established principle of a circular economy.

Seeing an opportunity, Cirque Du Soil partnered with RMIT University and Maze Products to undertake research to determine the feasibility of RDFW as a fertiliser for urban vegetable production. Cirque Du Soil also undertook market research with general public, urban nurseries and urban farms, to gage market demand and identify the market niche for RDFW that aligns with their precinct based circular economy mission.

Figure 1: Rapidly dehydrated food waste collected from five sites by RMIT university.

Research questions

1. Can blended RDFW be used as a fertiliser for vegetable production?
2. Will re-sellers stock a fertiliser made from food waste?
3. Will consumers purchase a fertiliser made from food waste?

Methodology

RDFW was collected from five sites operating WasteMaster dehydrator systems, each week for five weeks. The samples were sieved to remove bones, hard seeds and vegetable skins. Sub-samples of each sample were sent to a laboratory to determine the concentration of 16 plant nutrients that characterise the fertiliser value of the product.

Two experiments were conducted at the RMIT Bundoora campus. Vegetable crops were grown in pots of soil that were blended with RFDW or fertilised with mineral fertiliser. The details of each experiment are shown in Table 1. Plant measurements, such as plant dry weight (biomass) and crop yields were collected from each experiment. A statistical analysis (called an ANOVA) was used to determine if RDFW treatments had significant effects on plant growth.

Table 1: Description of experiments at RMIT University Bundoora campus.

Experiment	Treatments
Experiment 1 - Spinach. Seedlings planted in July 2022	1. No fertiliser 2. Mineral fertiliser (Osmocote® at recommended rate) 3. 1:5 RDFW to soil blend 4. 1:20 RDFW to soil blend 5. 1:200 RDFW to soil blend
Experiment 2 – Tomatoes Seedlings planted in October 2022	1. No fertiliser 2. Mineral fertiliser (Osmocote® at 50% recommended rate) 3. 1:10 RDFW to soil blend 4. 1:20 RDFW to soil blend 5. 1:40 RDFW to soil blend 6. 1:80 RDFW to soil blend

The market research consisted of a general public survey at the Melbourne Flower and Garden Show (72 respondents), a survey of 13 urban farms and market gardens (6 respondents) and a survey of 25 suburban plant nurseries within a 10km radius of the Melbourne CBD (13 respondents). The survey questions were designed to determine the market of acceptance of RDFW as an alternative to mineral fertilisers. The responses were analysed to compile a report on potential product demand, market expectations and market niche.

Results

The RDFW analysis found that nutrient concentrations are highly variable across sites and over time (Figure 2). In some samples the ratios of nutrients were satisfactory as a fertiliser, while others had ratios that would be toxic to some plant species, because the food waste used to create the product varies according to the composition of food consumed at each establishment. By blending samples from multiple locations, however, it is possible to make RDFW that has more consistent nutrient

concentrations. Cirque Du Soil named this blended product 'GrowGood fertiliser'

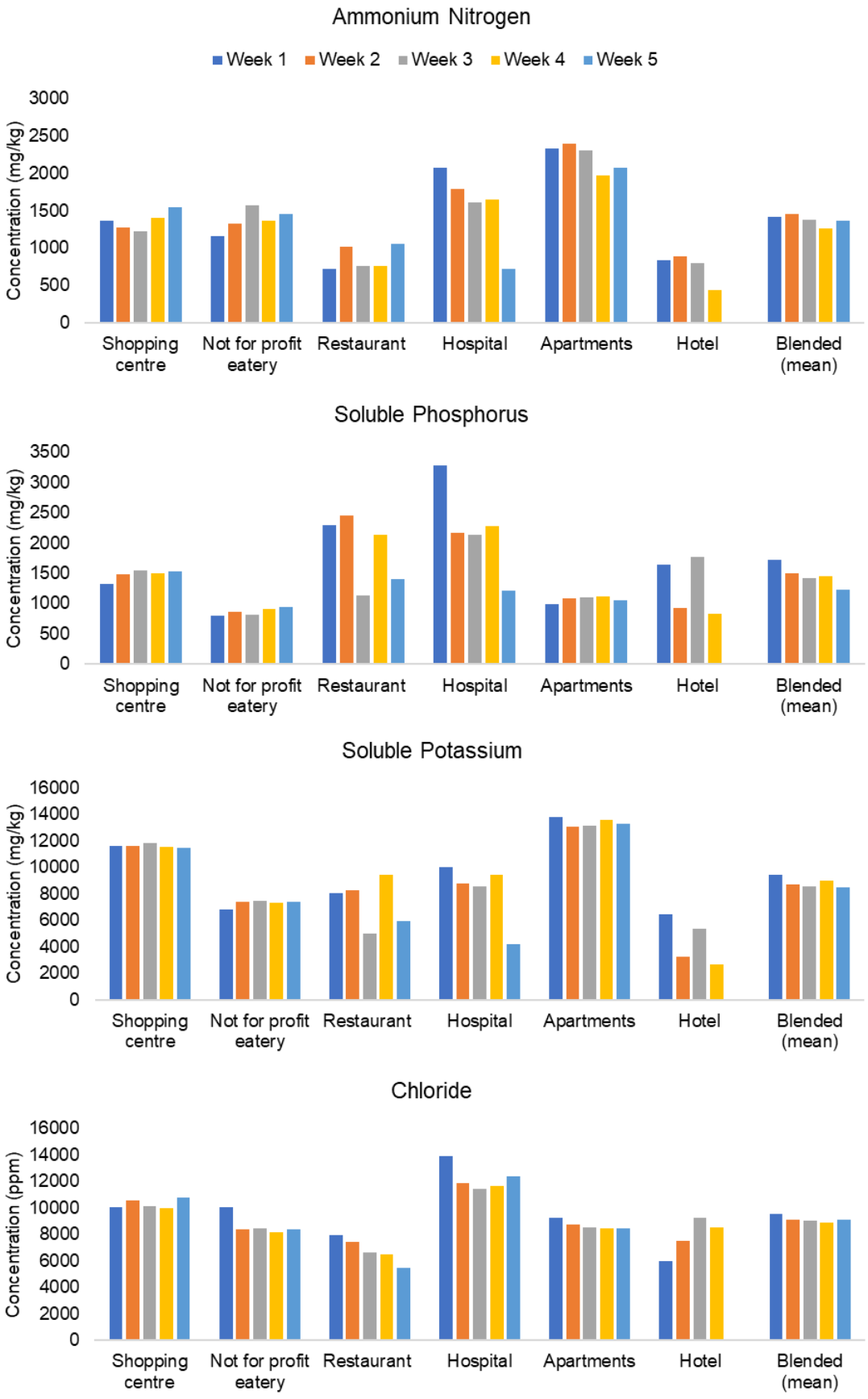

Figure 2: Nutrient concentrations in RDFW from five different dehydrators over a five-week period in May and June 2022.

Crop yields from the RMIT experiments are shown in Figure 3, treatments with the same letter are not significantly different to each other. In the spinach experiment, fertiliser and soil blend treatment achieved a significantly higher biomass than all the other treatments and the 1:20 GrowGood to soil blend was the next highest. In the tomato experiment, the 1:10 GrowGood to soil blend produced the highest dry biomass and highest fruit mass. This indicates that RDFW can produce yields at least as high as mineral fertilisers, and aligns with existing Australian and international research[1][2][3].

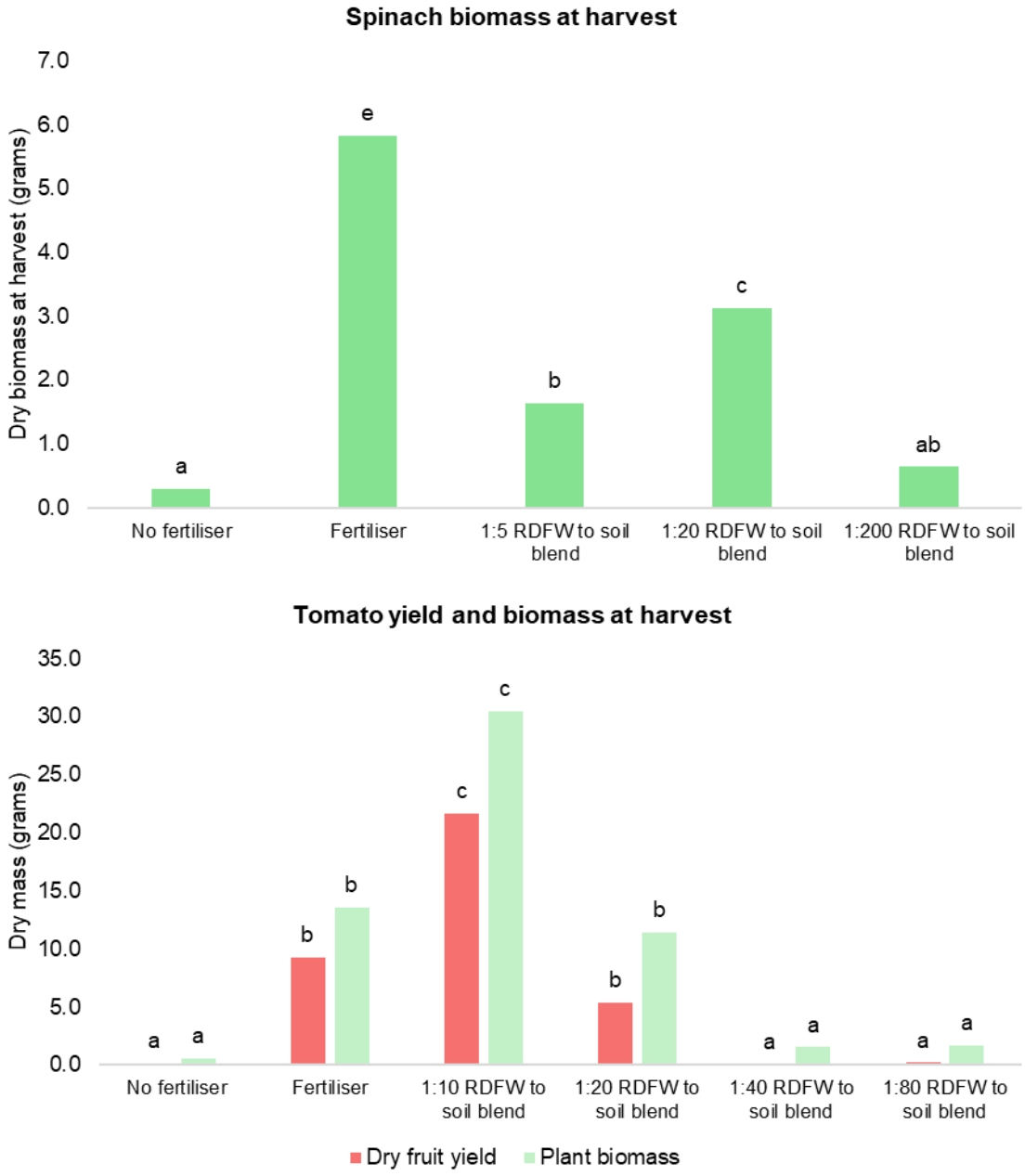

Figure 3: Biomass and crop yields from Experiment 1 (Spinach) and Experiment 2 (Tomatoes).

The 2023 Melbourne Flower and Garden survey undertaken by the Cirque du Soil engagement team suggests that fertiliser made from food waste would be accepted by consumers. Ninety percent of respondents indicated they would consider buying a fertiliser product made from food waste, 96% would buy a product that positively improves the environment over a product that does not, and 94%

[1] Value of dehydrated food waste fertiliser products in increasing soil health and crop productivity - ScienceDirect
[2] Assessment of Dehydration as a Commercial-Scale Food Waste Valorisation Strategy
[3] Comparison of Effects of Chemical and Food Waste-Derived Fertilizers on the Growth and Nutrient Content of Lettuce

would be prepared to pay a premium for a product that has strong environmental benefits. However, consumers also want surety, 68% of respondents would be more likely to purchase the product if it had a form of certification.

The survey of urban farms also returned positive results, with all four farms open to testing the product at multiple locations.

Key data from the survey of suburban nurseries within a 10km radius of Melbourne is shown in Figure 4.

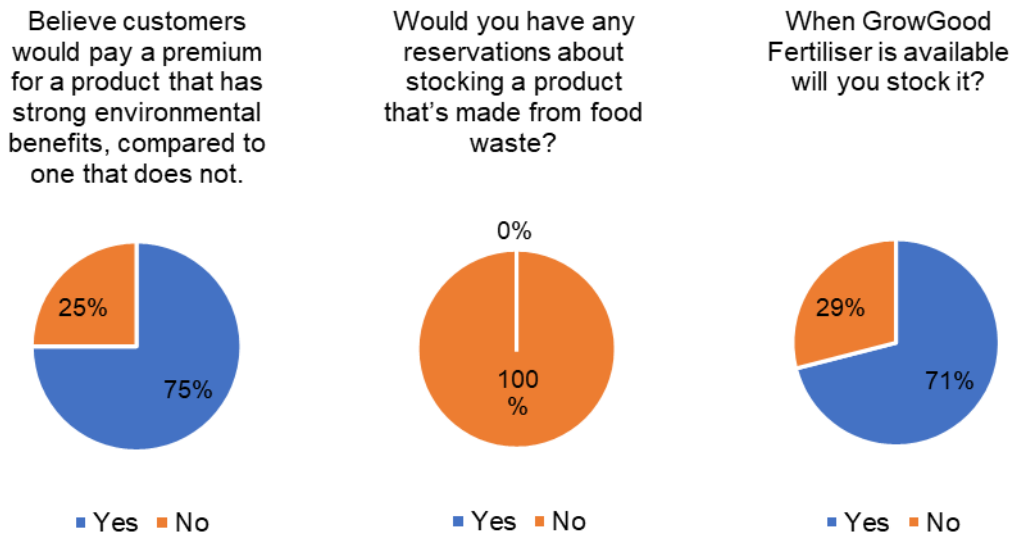

Figure 4: Key responses from the survey of 13 suburban nurseries.

The data shows that if offered the product, the majority of nurseries surveyed would stock the product. The market research phase concluded that there is a need and market for a locally produced fertiliser product made from food waste inputs collected in a hyper-local radius.

Opportunities

Rapidly dehydrated food waste can be a fertiliser

However, the output from as many food waste dehydrators across as possible, across different sectors of the food waste industry needs to be blended to create a consistent product.

Customers will buy it at a premium

However, customers will have more confidence if there were less barriers to the ACO certification process.

Nurseries will stock the product

If Cirque Du Soil can take the next steps towards commercialising GrowGood fertiliser, they would contribute to their mission to transition urban precincts into regenerative and circular economies.

Figure 5: GrowGood fertiliser – an impactful Cirque Du Soil circular opportunity.

Further information

For further information contact:

[Contact Us - Cirque Du Soil]