Plastic Produce Sticker Impacts on Compost

Green Industries SA

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MRA Consulting Group

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Disclaimer

In the spirit of reconciliation MRA Consulting Group acknowledges the Traditional Custodians of Country throughout Australia and their connection to land, sea and community. We pay our respects to Aboriginal and Torres Strait Islander peoples and to Elders past, present and emerging.

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Glossary

Terminology	Definition
GISA	Green Industries SA
AS 4454	Australian Standard 4454-2012 *Composts, soil conditioners and mulches*
AS 4736	Australian Standard 4736-2006 *Biodegradable plastics - Biodegradable plastics suitable for composting and other microbial treatment*
AS 5810	Australian Standard 5810-2010 *Biodegradable plastics - Biodegradable plastics suitable for home composting*
EN 13432	European Standard *Packaging. Requirements for packaging recoverable through composting and biodegradation - Test scheme and evaluation criteria for the final acceptance of packaging*
FOGO	Food Organics and Garden Organics
MRA	MRA Consulting Group
PLU	Price look up
PP	polypropylene
SA	South Australia
tpa	tonnes per annum

Executive Summary

Plastic produce stickers are a widespread and persistent contaminant in Food Organics and Garden Organics (FOGO) composting systems across South Australia. These small stickers are difficult to separate from organic waste and remain visible in finished compost, which reduces the compost market value and consumer acceptance. Annually, an estimated 5.62 billion plastic produce stickers enter the produce supply chain nationally.

For commercial composting operators, managing sticker contamination incurs substantial costs. South Australian composters have collectively invested over $14.5 million in decontamination equipment, with total investments in film plastic removal exceeding $19.5 million. Despite these investments, decontamination technology is not reliably effective at removing produce stickers. Contamination by plastic produce stickers slows machinery running speeds by 10-15% and requires additional labour for sorting. One composter estimated their disposal costs for contamination alone at $750,000 per annum, and the labour component related to quality control and decontamination costs approximately $800,000 per annum for a 200,000 tonnes per annum (tpa) facility, with stickers contributing an estimated $160,000 annually.

The presence of stickers also devalues recycled organic products by 20%, representing a potential loss of revenue of approximately $2 million per annum for a 200,000 tpa facility, and an estimated $8-10 million per annum across the entire SA organics processing sector. This contamination also negatively impacts the reputation of processors and the industry.

In urban amenity and agricultural markets, stakeholders report that premium compost with little to no visible contaminants sells for 20% more than standard compost. For a company selling into the prime agricultural market this is estimated as a value add of $10 per tonne.

The survey of compost end-users identified produce sticker as an issue of minor or little importance in feedback, indicating general satisfaction with the balance of cost and quality of compost products currently being received.

For community and home composters, sticker contamination creates considerable time and labour burdens. Home composters spend an average of 25 minutes per week managing stickers. Despite efforts, 53% of school and community composters and 15% of home composters *always* find plastic produce stickers in their finished compost. This indicates educating households or students and communities is not sufficient to eliminate produce stickers from home and commercial composting systems, requiring upstream policy intervention.

Stickers are rated as an "extreme nuisance" by home composters, with an average nuisance rating of 4.1 out of 5. Concerns include microplastic formation in soil, unsightly compost, and annoyance/nuisance value. There is significant support within the composting community for a complete ban on produce stickers or their replacement with compostable alternatives.

The report assessed current and emerging alternatives to plastic produce stickers:

Compostable Produce Stickers: Most labelling industry stakeholders supply these, made from cellulose, wood pulp, or starch/grass-based materials. Performance is generally comparable to plastic, though some adhesion issues exist on waxed or curved surfaces. Products can be certified to Australian Standards like AS 4736 (industrial composting) and AS 5810 (home composting). The industry has production capacity to meet increased demand but lead times of 4-6 months and sourcing certified adhesives are bottlenecks. Compostable labels are currently 15-35% more expensive than conventional plastic stickers due to lower production volumes and higher material/certification costs, though costs are expected to decrease with increased production. Barriers to adoption include price sensitivity, lack of regulatory pressure, and embedded supply chain arrangements.

Laser Labelling: This emerging technology applies identifiers directly onto fruit skins, eliminating the need for stickers, inks, or non-compostable backing sheets, offering a zero-waste solution. However, it is four times slower than stickering (15 seconds vs. 0.3 seconds per item) and requires further research to improve speed. Consumer acceptance has been high in small-scale trials in avocados. Wider consumer acceptance across other types of produce is yet to be determined.

No Stickers: Advances in AI and optical recognition have made traditional Price Look Up (PLU) codes and barcodes virtually obsolete at checkout. Some suppliers only use stickers for branding, and they are unnecessary when fruit is sold in packaging.

In conclusion, plastic produce stickers are a persistent and costly contaminant that result in millions of dollars in lost revenue annually for commercial composters and create significant burdens for community and home composters. While the labelling industry is prepared to supply compostable alternatives, their higher cost and the lack of regulatory certainty are key barriers to widespread adoption. A successful transition away from plastic produce stickers requires supportive policy, market certainty, and continued supply chain investment.

1 Introduction

Green Industries South Australia (GISA) is committed to taking action on single-use plastics. Alongside a retained focus on diverting food waste and organics for productive use, enhancing the quality of compost products across the state is a priority. Reflecting on this commitment, and in recognition of over 80% of South Australian households now having access to a Food Organics and Garden Organics (FOGO) kerbside bin to divert food waste, a statewide ban on plastic produce stickers is proposed.

Plastic produce stickers present as a contaminant in FOGO systems through being discarded alongside food waste. This is frequently the case for produce where skin is not consumed such as avocados, citrus, and kiwi fruit.

Despite their small size, plastic produce stickers present considerable challenges for composting operations, primarily due to difficulties in separating them effectively from organic waste. The challenge is that produce stickers pass through even the most advanced composting decontamination processes as they adhere to produce rinds and skins because they behave the same as organic matter. Plastic produce stickers persist through the composting process, remaining visible and intact in finished compost, thereby reducing its market value and consumer acceptance.

As a result, plastic produce stickers create substantial contamination issues in end products, leading to increased operational costs, reduced marketability and quality of compost products, and broader economic impacts on both commercial and community composting systems.

For commercial composting operators, addressing sticker contamination necessitates significant investments in infrastructure and additional operational procedures, both of which incur substantial costs.

At the community level, encompassing schools, community gardens, and household composting systems, sticker contamination introduces considerable time and labour burdens, further complicating efforts to increase community participation in composting.

MRA Consulting Group (MRA) was engaged by GISA to quantify the economic impacts of plastic produce sticker contamination on composting systems and assess the feasibility of transitioning to certified compostable or alternative labelling solutions.

This report details the outcomes of stakeholder consultations, economic analyses, and evaluations of viable alternatives. By delivering a robust evidence-based assessment, this report provides insights to inform effective policy implementation, support industry and community transition, and minimise the economic burdens associated with sticker contamination across South Australia's composting operations.

The findings and recommendations presented aim to facilitate South Australia's successful transition away from plastic produce stickers, ensuring alignment with broader environmental objectives while promoting sustainability and economic resilience within the state’s composting sector.

Scale of the problem

Considering apples and avocados alone;

The average annual consumption of apples in Australia is 7.7kg per capita. An average apple weighs 80g. For SA that’s 180 million apples.

The annual per capita consumption of avocados is 4.7 kg – amounting to 44 million pieces in SA.

Assuming each piece has 1 sticker that results in a potential **224 million** produce stickers from apples and avocados alone.

Nationally, the estimate across all produce is **5.62bn plastic labels** each year according to a 2024 report by Blue Environment.

2 Methodology

The methodology for this study combined stakeholder engagement with data-driven economic analysis and an evaluation of alternative materials and technologies.

This method ensured that findings were based in actual occurrences across commercial, community, and industry settings.

Consultation activities were carried out with four key stakeholder groups: commercial composters, community and household composters, representatives from the packaging and labelling industry and compost end users.

These consultations provided the foundational qualitative and quantitative data required to inform the economic modelling and comparative assessment of alternatives.

2.1 Stakeholder engagement

Stakeholder input was essential to understanding the operational, behavioural, and economic implications of plastic produce sticker contamination.

Engagement was tailored to the context and role of each stakeholder group.

2.1.1 Commercial composters

Questionnaires and structured interviews were conducted with key representatives from major commercial composting operators, including

- Jeffries
- Integrated Waste Services (IWS)
- Peats Soil
- Van Schaik's BioGro

The consultations focused on:

- Operational costs incurred due to plastic sticker contamination
- Investments in infrastructure for contamination removal
- Effects of contamination on compost quality, product marketability, and sales revenue
- Existing practices and strategies for mitigating sticker contamination.

2.1.2 Community and household composters

An online survey was developed using Survey Monkey and distributed to community composting stakeholders, including schools, community gardens, and households actively involved in composting.

The survey was designed to gather information on:

- Frequency and visibility of plastic produce stickers in food waste inputs
- Behavioural patterns related to sticker removal and disposal
- Labour and time burdens associated with removing produce stickers before composting
- Educational practices around compost contamination
- Incidence and perceived impact of produce stickers in finished compost
- End-use of compost and how contamination influences its application
- Overall perceptions of the nuisance caused by produce stickers.

2.1.3 Packaging and labelling industry representatives

To assess the feasibility of transitioning away from plastic produce stickers, MRA consulted with stakeholders from the packaging and labelling sector.

Industry representatives were invited to respond to a structured set of questions covering:

- Types of alternative labelling products supplied (e.g., compostable stickers, laser etching, biodegradable tags)
- Material composition and compostability certification status
- Performance characteristics of alternatives across various produce types
- Customer feedback, including successes and challenges in adoption
- Market demand trends, customer profiles, and barriers to uptake
- Production capacity, scalability, and investment in new technologies
- Comparative cost structures and competitiveness relative to conventional plastic produce stickers

- Broader industry readiness and perceived barriers to sector-wide transition.

2.1.4 Compost end-user representatives

Compost end-users were surveyed using a questionnaire to gauge their attitudes to produce stickers and willingness to pay for less contaminated products, including presence of plastic produce stickers, to inform the impact on compost market value. The questionnaire was sent to 130 identified end users across broad-acre agriculture, viticulture, horticulture and rural suppliers with 2 responses provided.

Each of the composters were also asked to nominate a customer to participate in the survey. Two responses were received through this approach.

End users were invited to respond to a structured set of questions/provide feedback on areas covering:

- The size of the operation and how much compost they use
- The % of costs that compost represents
- The frequency of plastic contamination and the frequency of specifically produce sticker contamination seen
- A rating of the issue of plastic contamination
- What is the preparedness to pay more for no plastic contamination.

2.2 Economic impact analysis

The financial impact of plastic produce sticker contamination was assessed through a partial budget analysis, drawing on data collected during stakeholder engagement across both commercial and community composting systems. Partial budgeting is commonly employed to determine the isolated net benefits of changing a practice in an enterprise by accounting for the positive effects of increased revenue, reduced costs, the negative effects of reduced revenue and added costs. In this case, the costs of production for decontamination were isolated from the remainder of costs and compared with an estimated reduced film plastic contamination loading and increased revenue from sale of improved quality product.

Within commercial composting operations, the assessment estimated both capital and operational expenses incurred in managing sticker contamination. This included investment in screening, sorting, and disposal technologies, as well as ongoing labour and equipment costs required to identify and remove plastic produce stickers from incoming organic waste streams.

The analysis included the market value of high-quality, uncontaminated compost products with the market value of compost affected by sticker presence to estimate depreciation in price or saleability.

At the community level, including households, schools, and community gardens, plastic produce stickers present practical challenges that result in additional time demands and, in some cases, labour costs. Survey results were used to estimate the time spent removing produce stickers and to determine whether this effort translated into a direct financial cost when performed by paid staff or volunteers. The analysis also considered behavioural barriers caused by sticker contamination, such as reduced willingness to participate in composting activities. While some of these impacts are not directly financial, they represent significant constraints on the effectiveness of small-scale composting systems and were included in the overall impact assessment.

Comparative analysis was undertaken to understand how compostable stickers compare to plastic stickers in terms of cost, compostability, and readiness for market adoption.

3 Impact assessment of plastic produce stickers on commercial and small-scale composting operations

Plastic contamination found in food waste streams can include fragments of rigid and film plastics of varying size that originate from material such as food packaging, containers, bags and produce stickers. Produce stickers are estimated to make up 10% of film plastic contamination in food organics feedstocks. They are easily identifiable, therefore noticeable and memorable.

Plastic contamination in food waste causes operational problems for compost and anaerobic digestion facilities and can reduce the value of their final products[1]. Recent research in Australia found PET and PP and PE microplastics in the range of 1500 – 16,000 units per kg of dry weight recycled organics.[2] Produce stickers would be contributing to this loading. Processors can at times receive highly contaminated food waste loads. Whilst produce stickers may not be the primary contaminant, their ubiquitous nature means they will be present and can pass through the composting system to appear as a contaminant in output products.

AS4454, sets limits on contamination, including film plastic which has a limit of 0.05%. While there is a limit within the standards, the market expectations of the acceptable level of contamination are far below those thresholds.

AS4454- sets limits on contamination, including a film plastic limit of 0.05% by weight. While there is a limit within the standards, the market expectations on level of contamination in compost products are far below these. With each produce sticker weighing an average of 0.02g, if produce stickers were the sole film plastic contaminant, this could amount to 25,000 stickers per tonne being acceptable under this limit. However, this level of contamination does not meet compost market expectations.[3] It is therefore understandable that physical contaminants of most concern to composters are plastic, glass and produce stickers. The Australian Organics Recycling Association (AORA), lists plastic fruit and vegetable food labels as a significant contamination challenge for organic recycling processors as well as plastic bread seals and Styrofoam food packaging.[4]

3.1 Commercial compost operations

The organic processing industry in South Australia is responsible for the recovery of 735,000 tonnes of organic waste per annum.[5] Of this approximately 45% is comprised of food and garden organics (330,000 tpa) from the kerbside collection. On a per capita basis, South Australia is the lead in organics recovery, capturing over 720kg per person each year.[6]

The majority of the organic waste is processed by the four major processors; Peats Group, Jeffries Group, Van Schaiks Biogro and Integrated Waste Services. These processors manufacture compost for agricultural, horticultural urban amenity and on-site use.

The market value of the recovered materials in South Australia exceeds $350 million, produced from an investment exceeding $26 million in processing infrastructure. In addition to the direct contribution to the economy of South Australia, the compost industry is estimated to contribute a further $130m in value-added demand for goods and services. [6]

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[1] Scopetani, C. et al. 2022.Hazardous contaminants in plastics contained in compost in agricultural soil. *Chemosphere* 293 133645.
[2] Lu, H., et al. 2025. Microplastic in Australian processed organics: Abundance, characteristics and potential transport to soil ecosystem. *Journal of Environmental Management* 375 (2025) 124359.
[3] Grob, M. et al. 2024 Plastic Fruit Stickers in Industrial Composting - Surface and Structural Alterations Revealed by Electron Microscopy and Computed Tomography. *Environmental Science & Technology April 2024, 58, (16), 7124-7132* fruit sticker weight = 0.02g
[4] https://aora.org.au/wp-content/uploads/2024/11/AORA-Better-Compost-with-Smart-Bans-Position-Paper-Nov24.pdf
[5] National waste report database.
[6] AEAS 2022.*The Economic contribution of the Australian Organics Recycling Industry*. Report prepared by Australian Economic Advocacy Solution on behalf of Australian Organics Recycling Association. August 2022.

Stakeholder engagement identified that the South Australian commercial composters have collectively invested over $19.5 million in decontamination equipment. This amounts to $3 per tonne lifetime cost.[7]

3.1.1 Cost analysis for sticker contamination removal

Produce stickers are a ubiquitous contaminant in organics feedstocks. Stakeholders report that stickers appear on visual assessments on a load and individual tonne basis. Contamination management is embedded in daily operational costs through manual labour and machinery operations and represents a "significant and escalating cost" to business operations.

In addition, multi-million dollar capital investments support the removal of film plastics generally. This investment includes purchase of infrastructure (estimated costs per unit) such as:

> *"Even with our investment of over $10 million in decontamination lines, fruit stickers get through. They are impossible to remove."*
>
> Processing stakeholder

- Conveyors and picking stations: ~$500,000
- Air separators / wind sifters: ~$500,000 - $900,000
- Optical recognition and sorting: ~$2 million
- Screening (trommels, star screens – fine mesh): ~ $750,000
- X-Ray and laser technologies: ~$1 - $2 million
- Density separators: ~$600,000 - $800,000

However, stakeholders report that even with the collective investment of over $19.5 million, decontamination technology is still not capable of reliably or routinely removing produce stickers. This represents a capital investment over-time of the equipment of $3 per tonne of compost supplied annually in South Australia without eliminating sticker contamination in end-product.[8]

Contamination in feedstock has additional costs associated with it including:

- Additional labour for picking lines, load inspection and manual sorting
- Machinery has to run slower, estimated at 10-15% below manufacturer recommendations
- Contaminated batches may require screening multiple times or even rejection from final stages, which delays composting processes and incurs further costs
- Staff training to identify contamination
- Valuable organics are lost along with plastic contamination as produce stickers mimic the size of fine compost fragments.
- Disposal costs associated with contamination, one composter estimated this as $750,000 per annum
- Internal rejection of final product as finished and suitable for market. This material is returned to the processing line for further processing and decontamination.

Stakeholders state that all of the labour component of processing is focussed on quality products and that 50% of this is dedicated to manual removal, operating decontamination equipment and load quality control.

Analysis shows that for an operation producing 200,000 tpa of end product with 20 operational staff this is estimated to cost $800,000 per annum. One stakeholder estimated that produce stickers could be as much as 10% of contamination and put the estimated cost of fruit sticker contamination alone as $160,000 per annum.

[7] Assuming a 7-yr equipment lifespan.
[8] Assuming a 10-year lifespan for equipment

3.2 Impact on compost market value

Produce stickers devalue recycled organic products in end markets, particularly agricultural markets are highly sensitive to contamination in compost products. Plastic contaminants can be visually obvious, be ingested by livestock and break down into microplastics resulting in long-term contamination of soil.

> *"If we are to take the circular economy seriously, we cannot knowingly put materials into compost that are contaminants."*
>
> Processing stakeholder

Whole stickers can remain complete with colour and codes even in finished products. They are identifiable and therefore noticeable and memorable. Stickers are not an unknown piece of plastic contamination; they are a separate and attributable contaminant.

In urban amenity and agricultural markets, stakeholders report that premium compost with little to no visible contaminants sells for 20% more than standard compost. For a company selling into the prime agricultural market this is estimated as a value add of $10 per tonne.

For the 200,000 tpa facility above this represents a loss of revenue of approximately $2 million.

The impact of fruit stickers extends across the entire supply chain. The management of stickers (i.e. removal) must occur up stream of compost processors as they require disproportionate amount of energy, labour, and infrastructure to manage downstream.

Commercial composters report produce stickers have a negative impact not only on end products, but also the reputation of the processors and the industry more broadly. Community and home composters reported that stickers are prevalent in commercial bagged products bought in large retail outlets. This bagged compost may or may not originate in South Australia but when stickers are obvious in the material its casts doubt on the other quality parameters or marketing claims depicted on bag labels.

> *"Even a few visible plastics can result in sales complaints, batch rejection, or loss of certification compliance (e.g., AS 4454)*
>
> *No one wants contaminated mulch and compost in their garden beds."*
>
> Processing stakeholder

When visible plastic pieces (contamination) are found in composts that have been applied to parks or farms, processors report they work with customers to "manually remove as much of it as possible to ensure that they are satisfied with the results".

The compost end-users that rated plastic contamination or contamination from produce stickers as having little to low importance in their use of compost purchasing were those that reported rarely seeing plastic contamination in the compost received and rated it as a minor issue or not an issue at all. This is likely to be a result of the considerable effort that compost processors put into contamination removal.

Those that reported plastic contamination as significant, identified plastic contamination in their initial load and did not purchase compost again. Plastic produce stickers were not specifically noted in the contamination.

Compost cost is reported as having very little economic impact on the operation, with cost of compost being less and 5% of outlay of the businesses surveyed. Yet, those end-users of compost report a strong price-sensitivity for compost products, as they do not express a willingness to pay much more (<5%) for compost without plastic contamination.

Conversely, the end-user that reported plastic contamination as significant was willing to pay 10% more for compost with less plastic contamination.

The results suggest that the end-users are happy with the quality of product they are currently receiving (for the price they are paying) and highlights potential sensitivities to or expectations of low contamination in compost.

Research by KPMG also noted this price – quality sensitivity. Contamination is a concern, yet many users tend to prioritise price over quality.[9] Limiting or reducing costs carries a greater importance than the presence of plastic contamination in the products.

[9] https://www.greenindustries.sa.gov.au/resources/fogo-material-flows-and-markets-report

3.3 Impacts on community and home composters

The survey of community and home composters received 77 responses from people who compost either at home, school or in a community garden. 62 respondents (81%) were home composters; the remaining 15 (19%) composted in schools, community gardens and other community settings.

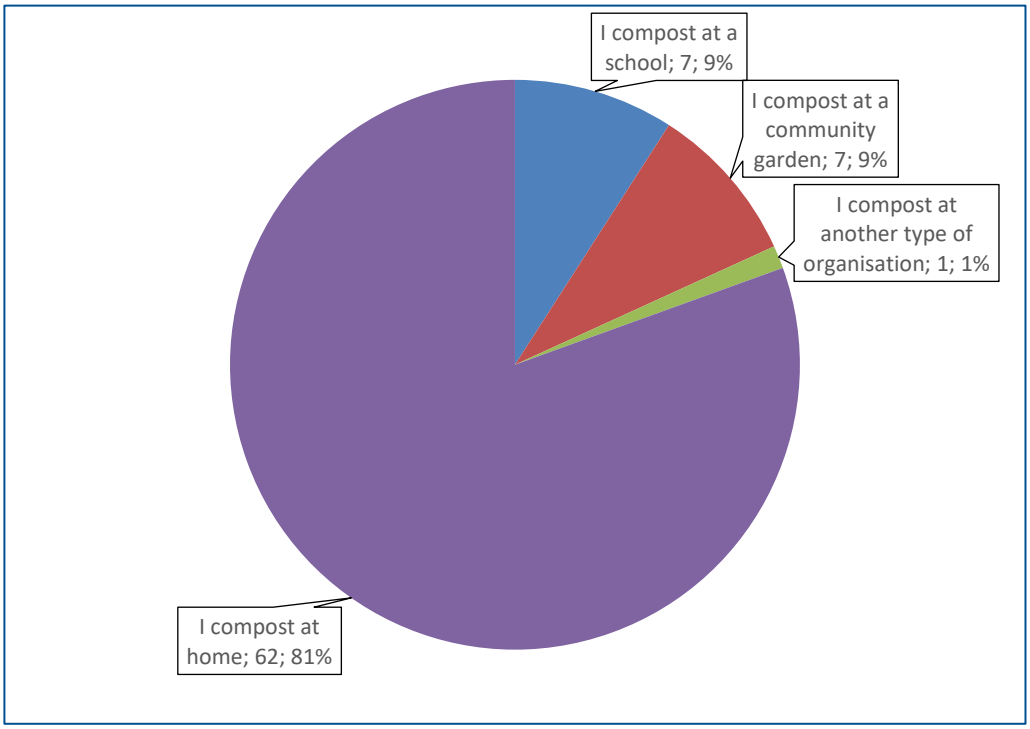

Figure 1: Survey respondent breakdown

On average, home composters place 10L of food waste into their home composting system each week and yield an average of 7L of compost each week. On average, school and community composters place 90L of food waste into their organisation's composting system each week and yield an average of 15L of compost each week.

In schools and community compost settings, students and garden members are provided education to remove stickers from food scraps before depositing food scraps into the organics bin.

However, when putting food waste into compost, 13 out of 15 (86%) of school and community composters report that they find plastic produce stickers often or always stuck to the food waste or scraps.

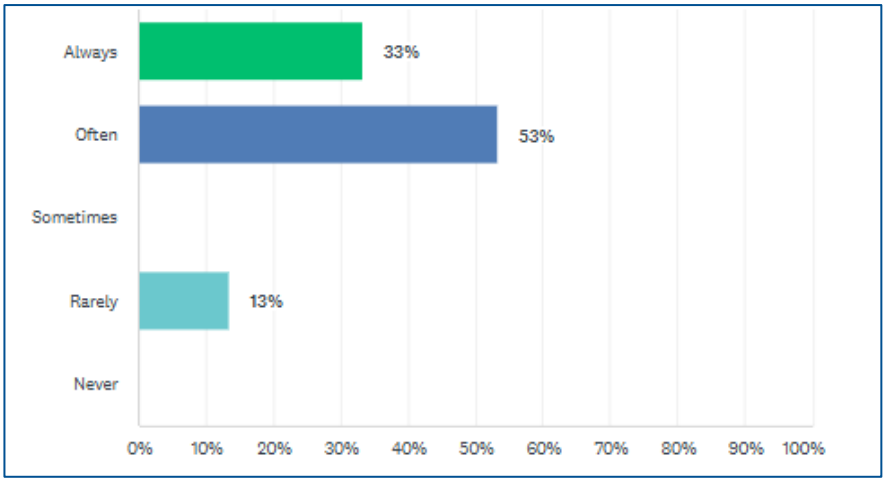

Figure 2: Frequency of finding stickers on food scraps – School and community composters

In school and community settings, only 33% of users usually remove produce stickers. 74% of home composters usually remove produce stickers from food scraps. If engaged stakeholders such as these are not always removing stickers, the community more broadly (such as FOGO bin users) is potentially even less likely to remove produce stickers from food scraps.

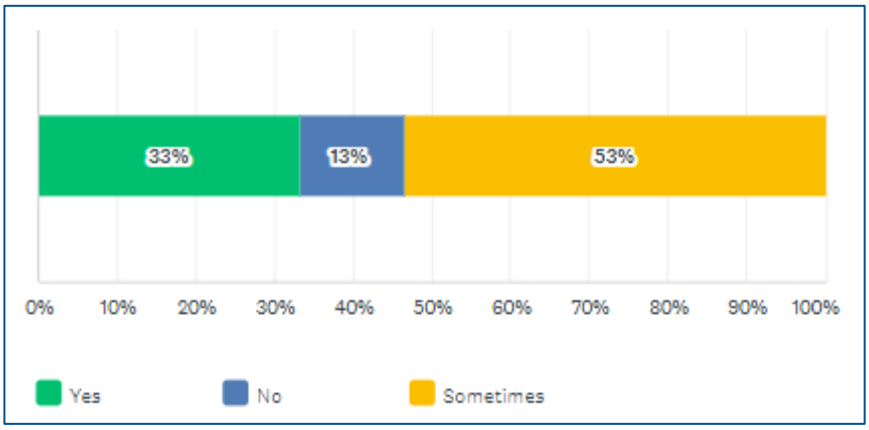

Figure 3: School and Community compost users – "Do you or others usually remove plastic produce stickers before putting food scraps in the bin?"

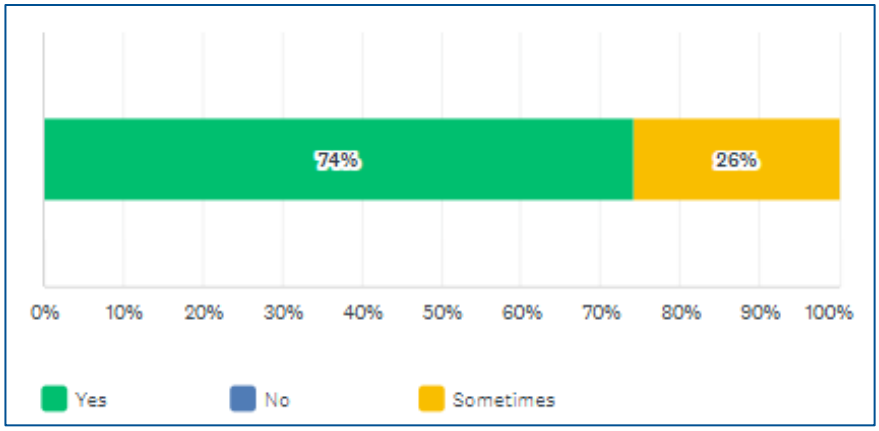

Figure 4: Home composters – "Do you or others usually remove plastic produce stickers before putting food scraps in the bin?"

Produce stickers that do end up in the food scraps bins then have to be removed by either the compost manager or volunteers.

There was a strong sentiment amongst composter responses to not wanting produce stickers at all:

- *"They are unnecessary!"*
- *"I dislike them and they need to be abolished or changed to biodegradable. I worry that animals may mistakenly take them as food items."*
- *"Ban them! Unnecessary waste."*
- *"I hate them and don't see what the point of them is - train the staff to recognise fruit and veg."*
- *"The plastic produce stickers should be completely removed from vegetables. They are not useful and cause more plastic waste. Please get rid of them all together [sic]."*

It is difficult to quantify the cost of stickers in home and community composting operations as compost is not used for revenue, nor is time utilised as a cost to the enterprise. However, non-monetary costs provide an insight into the impact that produce stickers can have.

Those that remove stickers at home report that it takes time – a few seconds up to one hour to manage stickers per week, with an average of 25 minutes per week. In school and community composting settings, respondents spend 5-30 minutes per week removing stickers.

Despite efforts to remove stickers prior to composting, 53% of school and community composters *always* find plastic produce stickers in their finished compost. In fact, responses indicated there is invariably some degree of plastic stickers found in compost. Of the home composters surveyed, 15% *always* find plastic stickers in their finished compost.

> *"They are a constant nuisance, difficult to collect and dispose of once they have entered the composting process, difficult to detect when harvesting compost from the bin and they show up later when working the soil, even though we have always tried to keep plastic stickers out of our garden. Stickers serve no useful purpose - we know what varieties of fruit and veggies look like..."*
>
> Home composter

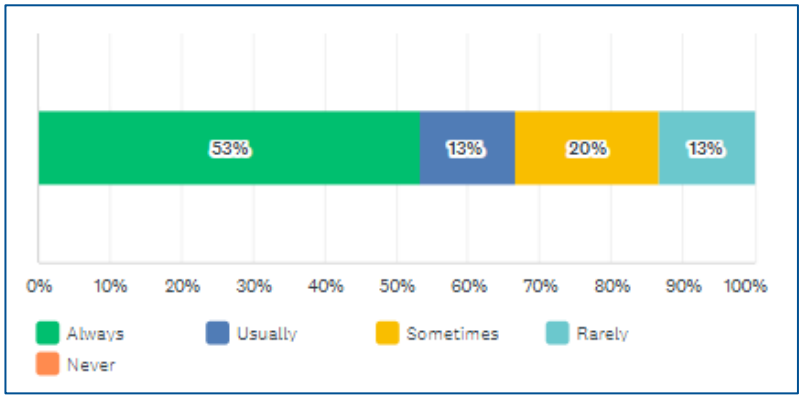

Figure 5: School & community composters – "How often do you find plastic produce stickers in your finished compost?"

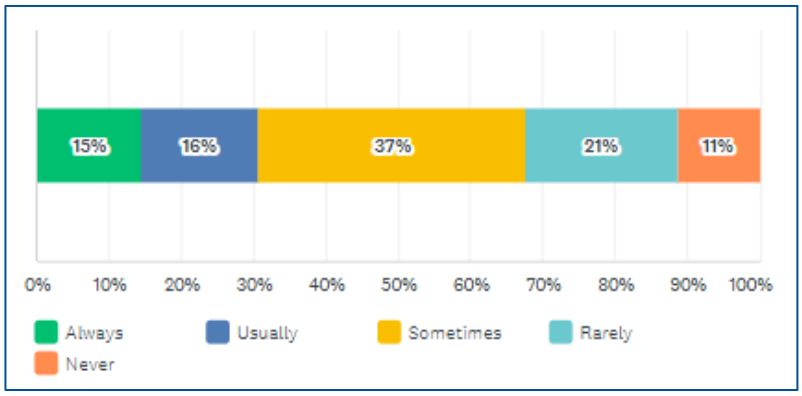

Figure 6: Home composters – "How often do you find plastic produce stickers in your finished compost?"

The presence of stickers impacts the time taken to compost and the quality of the compost:

- *"Sometimes the contamination is so severe that I have no choice but to throw the finished compost into the red bin. I've counted as many as 20 plastic stickers in a single shovel of composted soil."*
- *"I put the compost aside for screening to remove the stickers. It takes a lot longer to get the stickers out of compost than if I had been able to find and remove them before composting the item."*
- *"I need to dig into the compost and then I take them out and put them in the landfill bin."*
- *"I try to remove contaminated portion of compost."*
- *"We still use it in the garden but try to remove all the stickers. Sometimes they are missed though as we still find them throughout the garden over time."*
- *"I have a worm farm so I have to manually remove the stickers from the compost that were missed in the first round before placing in the garden."*

- *"I try to pick the plastic out from the compost. I often also find plastic in bought compost from Bunnings."*
- *"It is time consuming to remove small pieces of plastic."*

Other impacts the community and home composters report include:

- *"They make green bin recycling difficult."*
- *"Most students will take stickers off if parents haven't already, so we see them in schools on benches and walls, on bus shelters, park benches, fences etc near parks and sports grounds, on frames of playground equipment. It's unsightly."*
- *"They go into the soil and become microplastics which can potentially go into vegetable crops."*

Figure 7: Produce sticker management requires intensive household education on FOGO systems (note produce sticker on food waste)

Additional education for households is required if produce stickers are to be reduced in FOGO. However,education will not solve the issue of plastic produce stickers getting into the FOGO stream. Councils need to provide waste and recycling messaging across all materials and it would be unrealistic to focus limited resources and media space on a campaign specifically on removing stickers.

In addition, it is unrealistic to expect households to remove produce stickers from rinds. Respondents report:

- *"Although I am careful in removing it, I have noticed others just dump it in the red bin. They are really not needed if they can't be composted."*
- *"The stickers are nuisance and hard to control how or if they are removed before going into the compost bin especially with multiple people living in one house."*

Across all types of composters – home, school, and community – the average nuisance rating for was 4.1 out of 5 (where 1 indicates "not at all a nuisance" and 5 indicates "an extreme nuisance"). School and community composters gave a slightly higher average nuisance rating of 4.2, while home composters gave a rating of 4.0.

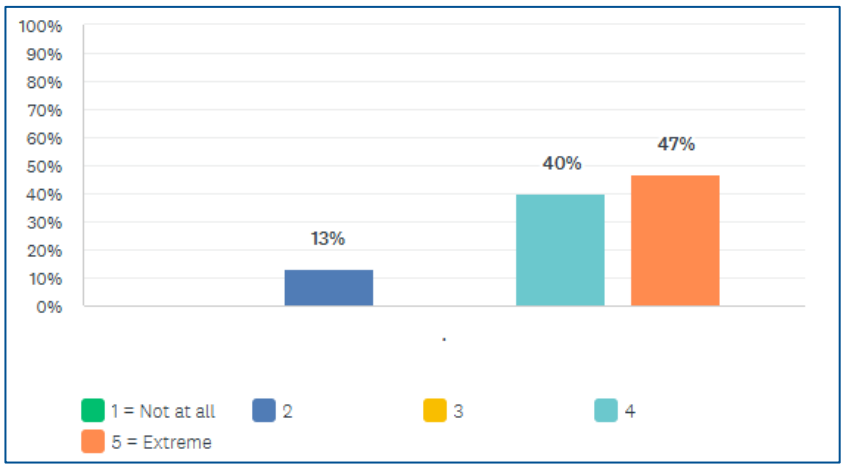

Figure 8: Nuisance ratings - School and community composters (weighted average 4.2)

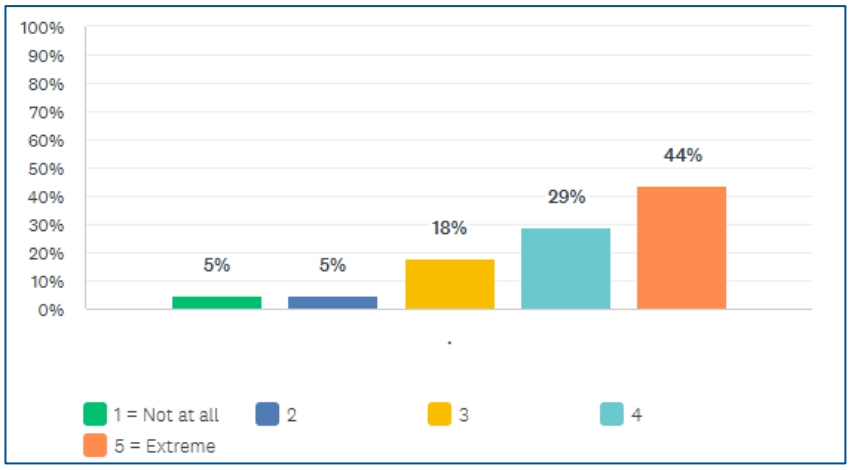

Figure 9: Nuisance ratings - Home composters (weighted average 4.0)

There is significant support for a complete ban on produce stickers within the composting community:

- *"Please get rid of and come up with alternative, safe, biodegradable option."*
- *"Ban them! removing as much plastic from our environment should be a priority regardless of whether it impacts composting or not."*
- *"They need to be banned they are the worst. There are fruits that don't have them so it must be possible for producers to not use them."*
- *"Please get rid of them to make home composting easier and to prevent microplastic pollution."*

> *"These stickers are completely unnecessary and are just another source of pollution. The sooner they are banned, the better for all composters and our planet."*
>
> Home composter

In addition, there is strong support for compostable versions:

- *"I'd like to see them replaced by compostable labels, if they're necessary."*
- *"They need to go! Either remove entirely or replace with biodegradable versions."*
- *"I'd LOVE for these to be banned for use, or for compostable/paper stickers only to be allowed. I understand the need for fresh food businesses to market their brands on their products, but we need to move away from single-use plastic ASAP."*

4 Assessment of current and emerging alternative sticker solutions

4.1 Compostable produce stickers

Four out of five consulted labelling industry stakeholders supply finished compostable stickers and one respondent supplies compostable label material (i.e. unfinished stickers) to third-party printers.

When asked about the types of materials used, respondents reported a range of compostable substrates:

- Cellulose-based films (e.g. NatureFlex), widely used for their durability and compostability.
- Wood pulp–based papers, particularly suited to dry or low-moisture produce.
- Corn starch–derived and grass-based materials, currently under trial by some respondents.

Each respondent pairs face stock materials with adhesives, some of which are already certified compostable to Australian or international standards. Several reported ongoing efforts to improve performance across produce types while maintaining compostability.

4.1.1 Performance compared to plastic stickers

Respondents generally indicated that compostable labels perform comparably to conventional plastic stickers.

Key points include:

- Labels adhered well to common fruits such as apples, citrus, and stone fruit. Some noted reduced adhesion on waxed or high moisture produce with current adhesive
- One respondent reported a temporary discolouration issue on banana skins, which was resolved by modifying the adhesive
- Factors like surface texture, moisture, coatings, and temperature can affect performance; pre-application testing was recommended
- Compostable stickers do not adhere as well to curved surfaces as plastic stickers and application pads may need to be adjusted
- Proper storage is crucial as humidity and heat can affect material stability and adhesion
- Print quality, including barcodes and branding, was consistently reported as high and comparable to plastic

4.1.2 Compostability certification and verification

Certification plays a critical role in verifying that alternative labels will safely break down in composting environments. AS 4736 is the Australian standard for compostable plastics in industrial composting facilities. It requires 90% biodegradation within 180 days and passing a worm toxicity test to ensure environmental safety. AS 5810 applies to home composting conditions, with similar biodegradation and safety criteria but tested over a longer period to reflect the lower temperatures and variability of backyard compost systems. The EN 13432 is the European Union standard for compostable plastics in industrial composting facilities.

- One respondent described a specific label construction certified for both home (AS 5810) and industrial (EN 13432) composting.
- Other respondents referenced having products certified to various standards but did not confirm dual certification for individual labels.
- One respondent is in the process of obtaining certification [10]for their paper-based product.

Most respondents reported that their labels perform well in industrial composting systems. Home composting performance was less certain:

[10] Not stated but assumed to be AS4736.

- One respondent stated that their labels degrade effectively in industrial settings and are undergoing testing in home systems.
- Another confirmed that their face stock is AS 5810 certified, but their newly certified adhesive still requires real-world validation.
- One respondent does not yet offer a home-compostable label but is seeking certification.

Multiple respondents highlighted the challenge of achieving compostability certification for adhesives. One supplier recently obtained AS 5810 certification for a new adhesive and is pairing it with compatible face stocks, although further field validation is ongoing.

4.1.3 Scalability, lead times, and production readiness

The labelling industry is ready to respond to demands for compostable sticker base-products. Respondents reported having the production capacity to meet increased demand, provided that lead times and material sourcing are managed effectively:

- One supplier estimated a 4–6-month lead time to scale up specialised compostable film production
- Several respondents indicated they could scale quickly if demand is clearly signalled in advance.
- Another noted that sourcing adhesives meeting compostability standards remains a bottleneck

4.1.4 Market demand, customer feedback, and regulatory landscape

Sustainability-focused customers are showing clear interest in compostable alternatives. However, adoption is primarily driven by regulatory pressure.

Without clear mandates, price sensitivity and uncertainty around composting standards continue to deter uptake. Respondents highlighted regulatory inconsistency across jurisdictions as a significant barrier.

Several labelling respondents called for nationally harmonised regulations to streamline implementation and provide clarity to producers and suppliers.

4.1.5 Cost analysis

Compostable labels are currently more expensive than plastic due to:

- Smaller production volumes
- Higher material and certification costs

The cost of compostable material are reported to be 15-35% higher than PP sticker materials. Cost of compostable stickers depending on colour and shape range from $3.80 - $5.60 per thousand. Respondents indicated that the cost of compostable labels is expected to reduce as production volumes increase. One supplier noted that, at scale, the price of compostable labels has the potential to closely align with that of conventional plastic stickers.

The major market player provides a service offering where the machinery, servicing, and support are provided. The offering also includes supply of labels. The units supplied may not be compatible with a competitor’s stickers. This means that producers are locked into a supply chain with limited capacity to switch suppliers or materials.

Respondents emphasised that compostable and alternative sticker solutions are technically viable, with industrial composting readiness already demonstrated. However, high costs, proprietary equipment constraints, and inconsistent regulations remain barriers to wider adoption.

4.2 Laser labelling

Laser marking of the surface of fruit is an emerging technology that may replace the use of produce stickers in some instances. The laser marking industry respondent noted that a large advantage laser marking offers over compostable labels, is that laser marking eliminates the materials used for produce stickers and silicone coated backing sheets entirely, as well as label inks or additives.

Laser marking has been trialled on tomatoes and hard-skinned fruit such as avocados and apples. The industry respondent highlighted that, while the equipment involves upfront investment, return on investment can be achieved in under 12 months by eliminating ongoing label procurement costs.

Research conducted on laser labelling identified that laser labelling takes four times longer than stickering – laser labelling applies a code every 15 seconds compared with a stickering rate of 0.3 seconds. The same research identified that laser labelling did not significantly increase post-harvest spoilage or risk of microbial contamination. The conclusions suggest that laser labelling technology could potentially be used in a commercial application to improve food traceability as a potentially safe alternative to the price look up (PLU) stickers in Red Delicious apples, green bell peppers, and cucumbers. However, research efforts are required to improve the etching speed and optimise laser parameters for each commodity to meet the industry's needs.[11] The industry respondent noted that significant investments are being made for research and development.

According to the laser marking industry respondent, consumer acceptance of laser-marked avocados has been high during trials conducted across 20 supermarket stores in Victoria. In the literature, research into consumer perception and acceptance of laser labelling compared 'no label', 'standard sticker' and 'laser labelling' on Red Delicious apples.[12] The research found that 83% of the respondents agreed that laser labelling is a sustainable option, but only 61% agreed that they would consume it, and only 49% agreed that they would recommend such products to others. In addition, when respondents were given information about the labelling techniques, their preference for 'no label' increased and the preference for both 'sticker' and 'laser labelling' decreased. This suggests that consumers may not yet be ready for laser marking of fruit with edible skins and that an education program would be required to increase acceptability.

Figure 10: Produce stickers are superfluous when the retailer ignores them and adds their own label (yellow price sticker)

4.3 No stickers

The original purpose of produce stickers was as a price look up (PLU) code then to apply a barcode to quantify and control correct sales data at the point of checkout.[13] Recent advances in AI and optical recognition infrastructure has rendered this function virtually obsolete. Check outs at the major supermarkets are now equipped with optical recognition that identifies and makes the selection without the need to PLUs barcodes for many items.

Some fresh produce suppliers simply use the stickers as a branding mechanism.

Figure 11: Where fruits are sold in packaging, fruit stickers are not necessary as the packaging carries the PLU features. In some cases, stickered fruit still ends up being packaged in containers.

[11] Khadka, D. et al. 2024. CO2 Laser-labelling on Fresh Produce: Evaluating Postharvest Quality, Microbial Safety, and Economic Analysis. *Journal of Food Protection* 87 (2024) 100329.
[12] Khadka, D. et al. 2024a Evaluating consumers' acceptability of laser-labeled [sic] apple fruit. *Future Foods* 10 2024 100401.
[13] International Federation for Produce Standards . PLU-codes. https://www.ifpsglobal.com/PLU-Codes

5 Conclusion

Produce stickers are ubiquitous in compost feedstock and due to their small size, remain as contaminants in end products - matured, processed compost and mulch.

The major compost processors in South Australia have invested over $19 million in decontamination infrastructure with additional investments in labour, yet plastic produce stickers remain a persistent contaminant in composted products.

Contamination results in an estimated 20% reduction in product value, costing the average processor $2 million per annum in lost revenue. Across the South Australian organics processing sector, this amounts to approximately $8-10 million per annum.

Compost end-users vary in their response to produce stickers, with agriculture end-user tolerating the level of contamination at the price point they are paying, whilst home and community composters have little tolerance for stickers and expend time and effort to remove prior to composting.

There is the potential each year for 224 million produce stickers from apples and avocados alone to be entering into FOGO feedstock and ending up in compost being applied to land.

The labelling industry is poised to supply compostable versions of produce stickers. Barriers currently include:

- Cost disincentive of 15-35%
- Lack of regulatory pressure to ensure all growers switch to create sufficient market demand to be price competitive.
- Embedded supply chain arrangements limiting competition between label and labelling equipment providers.

> *"Why should the environment pay the cost of branding and marketing for fruit growers?"*
>
> Community composter

Alternatives such as laser labelling are not commercially ready but offer potential solution. The consultation indicates that the labelling industry is prepared to transition away from plastic produce stickers, contingent on supportive policy, market certainty, and continued supply chain investment.

Plastic produce stickers are a persistent and costly contaminant that result in millions of dollars in lost revenue annually for commercial composters and create significant burdens for community and home composters. Based on responses across composting stakeholders indicating that despite best efforts, produce stickers are still present in composted products, educating households or students and communities alone is not sufficient to eliminate plastic produce stickers from composting systems.

Compostable alternatives are available however their higher cost and the lack of regulatory certainty nationally are key barriers to widespread adoption by growers.

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