Dairy Australia

A Circular Economy for Silage Plastic:

Regional Collection and Recycling Trial Summary Report

DELIVERING for DAIRY

Acknowledgement
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Executive Summary

Between April 2022 and March 2023 Dairy Australia ran a silage plastic collection and recycling trial in the dairy region of western Victoria ("regional trial"). The regional trial was part of a larger Dairy Australia project, funded through the Commonwealth's National Product Stewardship Investment Fund program, to support the development of a national system for collection and recycling of silage plastics. The aim of the trial was to test key assumptions underpinning preliminary work carried out by MRA Consulting to design a product stewardship scheme for silage plastic, while also assessing the user experience of key stakeholders within the plastics management chain, ensuring that the industry was armed with the necessary information to launch a cost-effective, practical to use, and sustainable silage plastic collection and recycling program. Silage bale wrap and silage pit cover, made from linear low-density polyethylene (LLDPE) and low-density polyethylene (LDPE) respectively, were the materials targeted during the trial. Combined, there are approximately 8,800 tonnes of these products used in Australia each year.

Following an expression of interest process, which saw almost 160 farms in western Victoria seek to participate, 92 farms were recruited to be part of the regional trial. Farms were selected based on location, herd size, silage use, farm type and willingness to undertake basic cleaning and storage of the silage plastic. Participating farms were provided with purpose-built recycling bins and clear plastic bin liners for storing their used silage plastic in[1] . Farms were also allocated an individual farm number and educational resources to help farm staff understand how to prepare the plastic as well as arrange for collection or drop-off of the plastic for recycling. Working with local councils, five waste transfer stations in the region were made available for free drop-off of plastics, while local contractors provided on-farm collection of the plastic for a fee. The plastic collected was aggregated at one of the participating waste transfer sites (Corangamite Landfill) before being transported to Olympic Polymers – a plastics recycler in Clayton, Victoria, capable of processing the LLDPE/LLDPE materials collected.

The "bin and liner system", which is used by Plasback in their successful silage plastic recycling program in New Zealand, was selected based on several features. The clear liners contain the silage bale wrap, making it easier to handle and keep clear of contamination during storage and transport. The clear liners also provide a means for checking for contamination prior to acceptance of the plastic by the service provider, while a liner full of plastic acts a unit of volume to keep track of material flows and charge service fees to users. The use of a bin and liner system also provides flexibility in on-farm storage volumes that a traditional skip bin waste collection service does not, allowing for more cost-effective plastic collection for farmers.

Over the course of the regional trial approximately 70 tonnes of silage plastic was collected and recycled – equating to approximately 50,000 silage bales worth.

Key outcomes and learnings from the regional trial include:

The majority of farmers responded well to the bin and liner (or bulk bag system) supplied.

- 100% of the plastic collected was suitable for recycling with very low rates of contamination.
- On average, 72% of survey respondents found the bin and liner storage system suitable for their needs.
  - Most of those not in favour suggested that a skip bin was more practical.
  - On average, 59% of respondents said that the recycling bin was necessary.
- On average, 93% of survey respondents said the cleaning requirements were not too strict or difficult to meet.
- On average, 94% of survey respondents said the educational material supplied were easy to understand and follow.

1 A ventilated bulk bag system was tested with a subset of ten farms.

Farmers appreciated having a choice between either free drop-off of plastic at local collection points or arranging for paid on-farm collection of the plastic.

- 38 survey respondents (42% of the trial) claim to have used the free drop-off service during the trial with the average service rating being around 4.2 out of 5.
- 34 survey respondents (38% of the trial) claim to have used the paid on-farm collection service during the trial with the average service rating being around 3.5 out of 5. Key issues with the on-farm collection service were:
  - The time taken between booking a collection and receiving the collection service.
  - Confusion during the online collection service booking process.
  - Poor communication prior to collection by the collection provider.
- On average, 60% of survey respondents said they would drop their plastic at temporary collection point, while 30% said they would rather pay for on-farm collection. Many preferred having the option of either.

The cost of the preferred collection model is comparable to current best practice.

- A large liner of plastic was, on average, found to contain approximately 170 kg of material within 1.3 m^3. During the trial farmers were charged $25 per large liner full of plastic or $25 for three small liners of plastic picked up on farm. Actual costs incurred by the project for the on-farm collection service was closer to $50 per large liner (or equivalent). Feedback from farmer surveys showed that, on average, 63% of survey respondents would be willing to pay more for on-farm collection ($40/large liner full of plastic). Willingness to pay $50 per large liner was not tested during the trial.
- Using a collection charge of $50 per large liner worth of plastic, the cost of on-farm silage plastic collection works out to approximately $295 per tonne collected. Farmers in western Victoria are currently being charged roughly $230 to $355 per tonne to dispose of the plastic to landfill (driving it there themselves) or roughly $720 to $845 per tonne for monthly collection of 3 m^3 skip bins full of general waste (also landfilled). A collection charge of $50 per large liner is therefore comparable or better than current "best practice" of sending the plastic to landfill.
- During the trial the on-farm collection charge only covered movement of plastic from farm to a regional hub (Corangamite Landfill). Transport from the hub to the recycler cost approximately $120 per tonne. Grant funds covered this during the trial but to be commercially sustainable this amount would need to be covered either by charging the recycler for the plastic or via additional costs placed on farmers for collection services or by charging farmers for drop-off.
- It's likely that the on-farm collection costs could be reduced further as service providers capable of supporting the on-farm collection of the plastic were very difficult to find in the region and those that were engaged did not necessarily have the most efficient equipment available to them for the task.

Some characteristics of the collection service offering need further refinement.

- The main areas of complaints from farmers during the trial related to:
  - Delays in receiving additional bin liners.
    - Liners for the project were initially purchased from Plasback in NZ. However, these were expensive and required lengthy shipping times. An alternative supplier was found who could manufacture liners locally. However, issues with this supplier meant that the liners were several months late in being delivered and some farmers were left without additional liners when they ran out.
    - In the future a surplus of liners should be ordered ahead of time to avoid this problem.
  - The process of booking and receiving an on-farm collection (slow response and poor communication).
    - It was quite difficult to find local contractors who had suitable equipment and could reliably provide on-farm collection services. This was largely due to the novelty of the service requirement and the fact that the primary business of the contractors was focused on different job types (e.g. construction, skip bin waste collection).

  - In the future the plastic collection scheme operator may need to incentivise the collection service provider through either guaranteed minimum collection volumes or co-investment in the equipment necessary for on-farm collection (e.g. soft grabs, loader etc).
  - Difficulties dropping off large liners at the council waste transfer stations.
    - Large liners, when full of plastic, weigh approximately 170 kg. Most waste transfer stations have no lifting equipment available, so it is quite difficult for farmers to manually unload the large liners at the drop-off stations.
    - In the future the drop-off stations may need to be selected based on the availability of loading equipment. Alternatively, the drop-off stations may be required to only accept small liners which are easier to lift manually, or the plastic collection service provider may need to co-invest in the equipment necessary to assist with unloading.
- Timing of the trial.
  - Most farmers use silage through the summer months and are not ready to deal with plastic waste until March or April. The regional trial didn't start plastic collection until roughly May of 2022 (by which time many farmers had already dealt with their plastic) and ran until mid-March of 2023 (when farmers were still in the process of feeding out).
  - In the future it will be important to offer the collection services year-round to allow for seasonality of plastic and demands on farmers.
- To avoid the relatively high cost of renting hook bins for storing plastic at the waste transfer stations (minimum of $320 per bin per month), a decision was made to store plastic at some of the waste transfer stations on a hard stand and then load them into hook bins for transport when sufficient volume had built up. This approach, however, required coordination being the hook bin transporter and the contractor capable of loading the plastic – with a wait time at site during loading.
  - In the future it would be preferable that the drop-off sites either have loading/unloading equipment and/or hook bins are purchased to store plastic in prior to movement.
- Plastic balers unlikely to be necessary in short-term.
  - The purchase cost for the type of waste baler required to compact the silage plastic collected is in the order of $160,000 to $190,000. This is for a horizontal baler that can produce roughly 1 tonne bales of plastic. There are also additional running costs associated with producing these bales (e.g. power/diesel, baling wire, labour, maintenance). While compacting the plastic can reduce the associated transport costs, there is not an overall financial incentive to do so until the collection volumes are much greater. 30 m^3 hook bins were found to be able to hold up to 7.5 tonnes of plastic[2] and could be pulled two at time to the recycler.
- Truck access at recycler was found to be difficult due to limited space for turn around and unloading.
  - In the future the recycling partner may need to consider changes to traffic and material flows on their site to support easier access.

Overall, the regional trial provided the Dairy Australia team with a huge number of learnings which will be used to inform the ongoing development of a long-term solution for collecting and recycling silage plastic in Australia

Figure 1. Regional Trial Coordinator, Daniel Nipe, with silage plastic at Corangamite Landfill

2 Actual loaded weight was approximately 10 tonnes per 30 m^3 hook bin. However, it was assumed that 25% of this weight was moisture and contamination.

Introduction

Preservation of fresh forage and fodder crops as silage is an essential process for most dairy and beef farms in Australia. By producing silage, farmers can conserve forage and allow for uneven growth throughout the year or between years – maintaining quality feed for their herds and optimising productivity[1] . Most of the forage conserved as silage each year is ryegrass dominant pasture. However, significant quantities of other forage and cereal crops such as maize (corn), wheat, barley and sorghum are also conserved as silage in various regions of the country.

To make silage, fresh forage is fermented without free oxygen or air being available (anaerobic conditions). This requires that the forage is cut, compacted, and sealed in an airtight environment. The two most common ways of producing silage are to create tightly packed bales of forage that are then wrapped in multiple layers of a stretch-film plastic ("bale" silage) or to create a large pile of forage on flat ground or within a bunker and then cover this with an airtight flexible plastic cover weighed down from above[2] ("pit" or "bunker" silage). Sometimes round bales of fodder are also lined up in a row and wrapped in a continuous stretch-film plastic tube ("tube" silage). Baled silage can be stored for months after the end of the harvesting season and fed out to animals as needed. Pit silage can be stored for years (MRA Consulting, April 2021). See Figure 1 below for examples of the different ways in which silage is typically produced and the plastic types associated with them.

The stretchy, soft plastic used to cover round bale and tube silage is composed of linear low-density polyethylene (LLDPE). Additives are present within the plastic to protect from UV light degradation. For baled and tube silage, typically the silage rolls are first wrapped in a netting (made from high density polyethylene (HDPE)) or twine (made from polypropylene (PP)) to help the bale hold its shape prior to being wrapped in several layers of the LLDPE plastic. Silage pit covers are made of thicker low-density polyethylene (LDPE).

Around 8,800 tonnes of silage plastic (6,700 tonnes of silage wrap and 2,100 tonnes of pit covers) are used in Australia each year (MRA Consulting, April 2021). Whilst silage production is a valuable practice that provides quality feed to livestock year-round and supports high farm productivity, silage bale/tube wrap and silage pit covers are single use plastic products[3] and the use of silage results in significant amounts of plastic waste. Without a collection and recycling program for silage plastic, limited options exist for the recovery and recycling of the plastic wrap, netting and/or twine produced once it has been used.

Analysis conducted by MRA Consulting for Dairy Australia, showed that 67% of existing silage wrap and pit covers are either burnt or buried on farm. Less than 3.5% or around 300 tonnes are currently recycled. The rest is landfilled (MRA Consulting, April 2021).

1 For example, on most pasture-based farms in southern Victoria, most of the feed produced annually is grown in springtime. Excess feed grown during this period of the year is conserved and stored as silage, which is then fed out at other times of the year such as summer and winter when pasture growth is not sufficient for the herd to directly graze and still be fully fed.
2 Often using old tyres.
3 In some instances, the plastic in pit covers can be used for more than one season.

Figure 2. Silage plastic types targeted in trial.

The Australian Dairy Industry Council set a goal under the Australian Dairy Sustainability Framework, to recycle 100% of the silage plastic waste produced on dairy farms by 2030. In support of this target and consistent feedback from dairy farmers that finding an avenue for responsible disposal of silage plastic is an ongoing concern for the industry, Dairy Australia applied for, and was awarded, a $965,400 grant from the Australian Government under the National Product Stewardship Investment Fund (NPSIF) program. Dairy Australia's NPSIF project commenced in January 2021 with an agreed completion date of March 31st, 2023.

The grant has allowed Dairy Australia to fund further research into the development of a national product stewardship program for silage plastics; addressing a problematic industry waste stream and assisting the Australian Dairy Industry Council meet industry recycling targets. The project included three distinct phases:

- Phase 1: - feasibility assessment which involved developing a situational analysis, business case, logistics and operational modelling and examination of potential governance models.
- Phase 2: - Regional Collection and Recycling Trial. This phase encompassed the implementation of a localised proof of concept trial in Western Victoria which helped inform best practice systems for the national scheme as well as the broader scheme architecture.
- Phase 3: - development of an implementation pathway for a scheme that is independent, financially resilient, and commercially viable scheme and managed by an independent entity (from Dairy Australia).

This report provides a summary of the outcomes of Phase 2 of the project – Regional Collection and Recycling Trial.

Aim and Objectives of Regional Collection and Recycling Trial

The aim of the Regional Collection and Recycling Trial was to run a silage plastic collection and recycling service in one of Australia's key dairy regions to test key assumptions within Dairy Australia's proposed Product Stewardship Scheme design developed during Phase 1 of the project, while also assessing the user experience of key stakeholders within the plastics management chain. The trial findings are intended to inform the final Scheme design.

The objectives of the project were to identify, test and establish preferred method(s) of:

- Managing on-farm silage plastic separation and storage.
- Fulfilling the plastic collection processes (drop-off/pick up) from on-farm settings.
- Streamlining plastic handling and logistics processes (including aggregation, compaction, and transport) of silage plastic from aggregation points to recycling sites.
- Meeting the cleanliness requirements of the silage plastic collected such that it can be effective recycled.
- Communicating with farmers and developing educational resources such that they can effectively and easily participate in a silage plastic recycling scheme.
- Building the model for interacting with local community groups and other complimentary product stewardship schemes, and
- Collecting and recycling approximately 50 tonnes to 150 tonnes of silage plastic into a variety of end products, testing the suitability of the material collected, the quality of the products produced, and the potential market value of the plastic collected.

Implementation of the regional silage plastic recycling trial commenced in April 2022 and ran through until mid-March 2023, with the last plastic drop-offs and/or on-farm collections taking place on the 15th of March.

Western Victoria was chosen to host the trial due to its high rates of silage use, variety of farm types and sizes, spread of farm locations, supportive local councils and regional team, and relative proximity to potential recycling facilities. The farmer base in western Victoria can, at times, be somewhat sceptical of Dairy Australia's on farm initiatives and, for that reason, the region was seen as a good "acid test" for farmer participation and feedback on the plastic collection systems being trialled.

Recruiting farms to be part of the trial

To recruit participants to take part in the regional trial, farmers in the dairy region of western Victoria (which extends from Geelong to the South Australian border) were invited to complete an on-line expression of interest (EOI) survey. The survey was designed to gather information on the farm's silage production practices, current plastic waste management, and willingness to undertake trial requirements (e.g. preparing plastic correctly for recycling). The EOI was communicated out to farmers in western Victoria via several local channels (including radio slots, social media, local newspapers, industry publications etc) and participation was not restricted to dairy farmers alone. EOI respondents therefore also included beef and sheep meat producers that used silage.

Of the more than 150 EOI surveys completed, 80 farms were initially chosen to take part in the trial[1] . Applicants were asked 9 qualifying questions (Appendix A). Survey results were used to select a variety of silage user types, including farms of differing size, location, and proximity (<50KM) to one of five local council transfer stations who had agreed to support the project by acting as material drop off points during the trial.

Of the 80 farms selected to be part of the trial, 60 were provided with "large" bins for on-farm storage of the used silage plastic and 20 were provided with "small" bins. The bin size provided was based on farmer preference as indicated in the EOI survey and generally selected by the farmer based on the number of bale wraps used each year. Images of the two different bin types are provided below in Figure 3. A small 240L storage bin can indicatively hold 25 bale wraps and a large 1,300 litre bin can hold in the order of 120-150 bale wraps.

Figure 3. Small plastic storage bin (left) and large plastic storage bin (right) used during regional silage plastic collection & recycling trial.

1 A further twelve farms were later added as part of a cohort selected to trial the use of ventilated bulk bags.

Table 1 summarises the silage usage information supplied by the 80 farms selected for the trial, as identified through the EOI survey. Two of the farms selected only used silage pit covers, 64 farms selected only used silage bale wraps, and 14 used a combination of bale wraps and pit cover on-farm. The average number of silage bales produced annually by small bin users was 395, with a range from 45 – 1200 bales. Large bin users produced an average of 1526 silage bales, with a range from 0 – 5500 bales. An average of 2848 square metres of silage pit cover was utilised across the 16 farms in the trial.

The total estimated silage plastic use across all participating farms was 92,630 kilogram in bale wraps, 45,570 square meters of silage pit cover, generating a combined weight of approximately 101,314 kg of silage plastic waste each year.

Table 1. Estimated silage usage information for farms participating in the regional collection and recycling trial.

	Avg. no. of bales made per year	Range of bale silage used (bales per year)	Avg. pit cover use (m2 per year)	Avg. plastic waste
Trial farms using a small bin	395	45 – 1,200	-	448
Trial farms using a large bin	1,526	100-5,500	2,848	1,604
Overall average	1,203	-	2,848[2]	1,282

Table 2. Total estimated silage waste plastic generation for farms participating in the regional collection and recycling trial.

	No. of bales produced	Sq. metre of pit cover used	Kg of plastic waste generated
Totals from trial farms	92,630	45,570	101,314

Of the farms selected, 68% were paying for a waste contractor to remove and dispose of their silage plastic at the time of survey completion. Table 2 shows the 2022/23 gate fees (in dollars per tonne) for disposing of general waste at landfills in the trial region and hire rates for three cubic meter skip bins (3 m^3 skip bin) used for general farm waste removal offered in the trial area municipalities.

Table 3 Gate fees and Skip Hire charges in Western Victoria

Location/ Service provider	WestVic Waste & Recycling	Corangamite Shire	Moyne Shire	Barton's Transfer Station	Western Waste	Colac Otway Shire
Gate Fee ($ per tonne)	$345/t	$261.25/t $236.18/t (Industrial rate)	$198.00/3 m3	$355/t	$300/t	$227.7/t
Skip hire and tip fee ($ per skip load)	3 m3 Skip Hire $280			3 m3 Skip Hire $280	3 m3 Skip Hire $330	

Each farm was given an identification number (0 - 81) for ease of data recording. Farms were catagorised into collection zones to simplify on-farm collection scheduling. Each zone was named after the closest (< 50KM) participating council transfer station to the cluster (being Alvie, Killarney, Naroghid, Peterborough and Simpson, West Killarney). Farm 0 and 79, (both small bin users), were accepted into the trial despite being located more than 100kms from a transfer station, in light of their willingness to transport the material to a drop off location themselves. Chart 1 shows the location of each of the farms in the trial, grouped by collection zone and the participating waste transfer stations.

2 Only 16 of the 80 farms in the sample used silage pit cover on-farm.

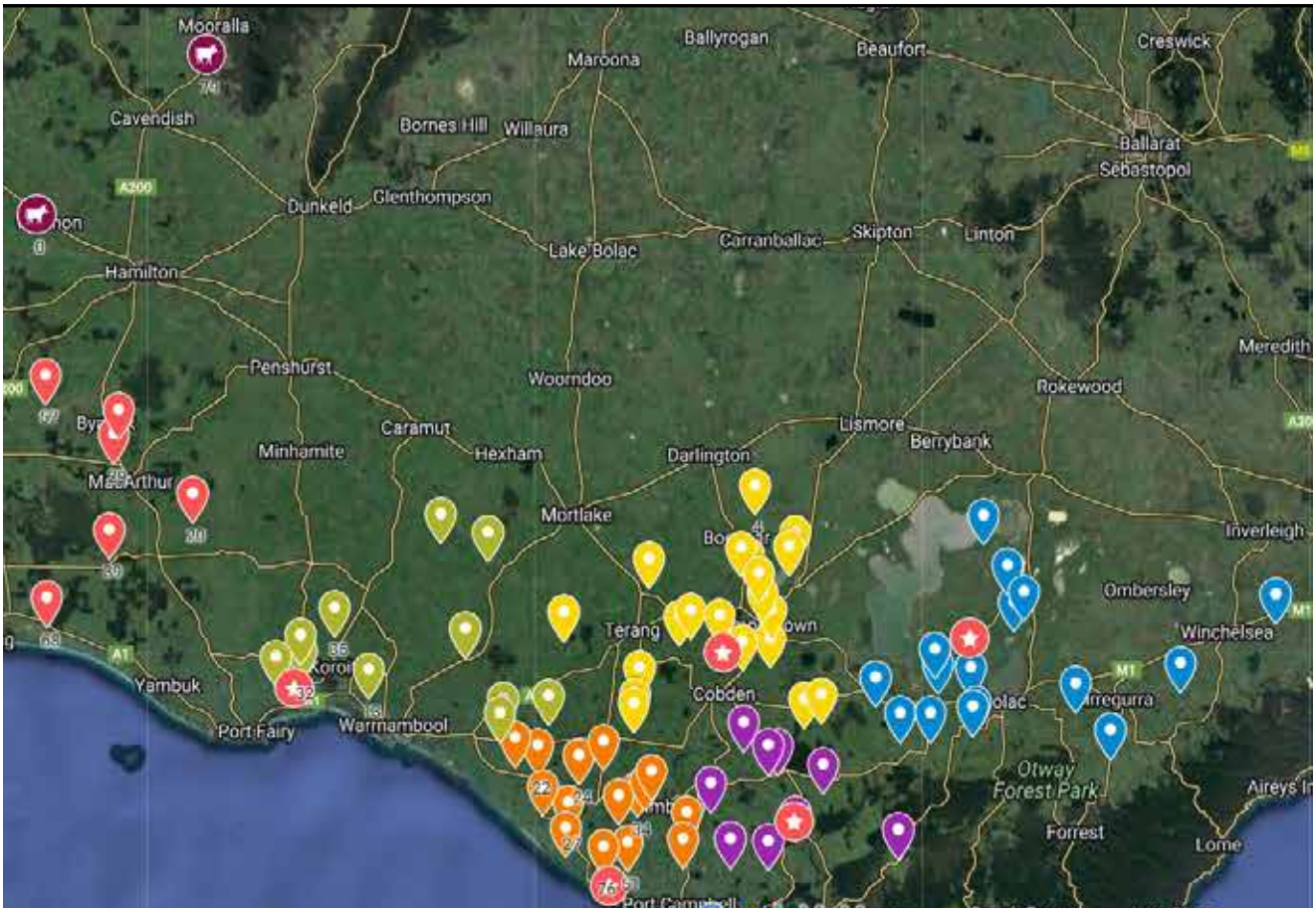


Figure 4. Location of farms participating in Regional Collection and Recycling Trial by Collection Zone

Trial Design

The trial design was based on MRA Consulting's insights and recommendations but was amended throughout the study in response to farmer feedback and preliminary findings.

MRA research (MRA, April 2021) identified material cleanliness, suitable on-farm storage, and flexible collection and aggregation options, amongst the barriers and incentives in developing a successful silage plastic stewardship scheme. As such, they were key considerations in the design of the trial (and are described below).

Cleanliness of Material

Silage wrap is often highly contaminated with fodder, dirt, and other farm-related material such as bale netting, twine, and hard solids. Contaminated silage plastic was identified as a common obstacle to the success of similar agricultural plastic recycling schemes around the world (MRA November 2021).

Only farmers willing to "clean" the material prior to loading it into the storage liner were accepted into the trial. Dairy Australia also developed educational materials around the correct use of the bin and liner system to further address this barrier (appendix B and C). Participants were asked to remove these sources of contamination from the collected plastic and advised that a failure to comply could result in liners being rejected by the re-processor, impacting the viability of the trial. Chart 2 shows the trial member EOI results for question 5, cleanliness of material.

Q5. Silage plastic needs to be reasonably clean in order to be recycled. Are you willing to separate your net wrap from bale wrap and shake them off to remove any large solids (eg: rocks, metal, etc...)?

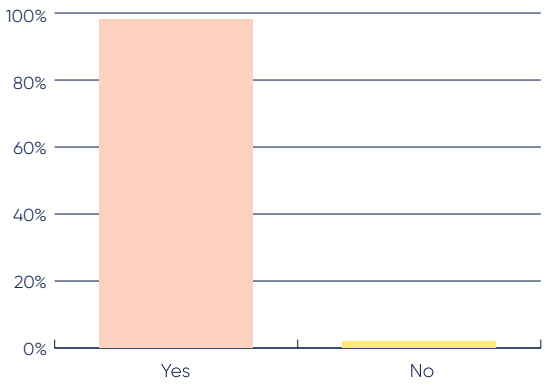


Figure 5. Western Victoria Silage Plastic Recycling Trial - Expression of Interest Survey results, Q.5

Suitable On-farm Storage

Purpose-built 200L capacity bins (made from recycled plastic) and heavy duty LLDPE liners, designed and utilised by Plasback New Zealand, were recommended for use in the trial (MRA Consulting January 25, 2022), due to their portability when compared to the larger, heavier liners. The bin and liner system was adopted as it supported our endeavours to reduce the levels of contamination associated with the collection of silage plastics
from farms.

Additional consultation with farmers, indicated a preference for the inclusion of both small (200L) and large (1300L) bins in the trial. The large bins and liners were sourced from Plasback New Zealand and the small liners from Plastic Forest, located in Australia. Delivery of the bins and liners took place in April and May 2022. Participants had indicated their preferred size of bin in the EOI survey.

An assembled small Plasback bin

Inserting a liner into a small Plasback bin

Loading a small bin with silage plastic

Figure 6. Small Plasback Bin and liner system

Assembled large Plasback bin with liner

Fitting the removable lid to a large Plasback bin

Loading a large bin with silage plastic

Tying off a large liner full of plastic

Figure 7. Large Plasback bin and liner system

Reusable Mesh Bulk Bag

A small-scale sub trial was set up in December 2022, with the distribution of custom-made mesh bulk bags and a metal bag stand to twelve (12) new farms, sourced from the initial EOI survey. This method was trialled as the overall costs were lower than those for the bin system described above – but could still be expected to minimise contamination. Farms were selected based on their use of silage bales, willingness to meet cleanliness and collection / drop off requirements, and relative proximity to other trial farms and/ or transfer stations. The ventilated polypropylene bags can be moved and emptied using the tines of a forklift, and returned to farms for reuse, before being retired – which therefore provides a further environmental benefit. Several trial farmers suggested the use of bulk bags over the LLPD liners in the mid-trial survey, citing that they were easier to pack and handle once full.

Mesh bulk bag and stand

Filling a bulk bag with silage bale wrap

Filled and tied bulk bags

Figure 8. Ventilated bulk bag system.

Drop-off and Collection Options

EOI survey results indicated a preference for both on-farm collection of the material (for a fee of $25 per large/ 3 small liners or bundle of pit cover plastic), and the option to drop the plastic at one of five (5) council-operated transfer stations for free. Figures 9 and 10 show the EOI survey results for the trial sample, concerning on-farm collection and drop-off options.

Q8. Would you be willing to pay a small fee for collection of your silage plastic waste from your farm during the trial (maximum cost of $25 per large bin or $25 for three small bins worth)? Note: This collection fee will be subsidised by Commonwealth grant funds.

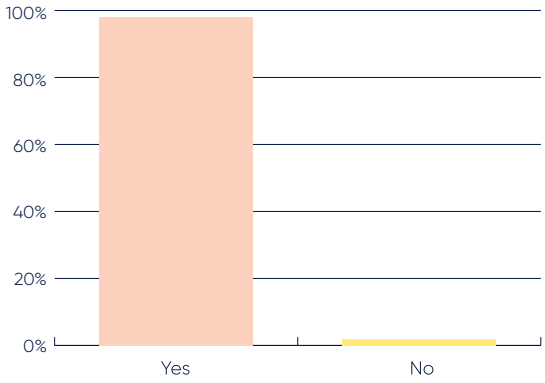


Figure 9. Expression of Interest Survey results, Q.8

Q9. Would you be willing to travel to waste transfer sites located at Killarney, Peterborough, Simpson, Naroghid, or Colac to drop off your silage plastic waste?

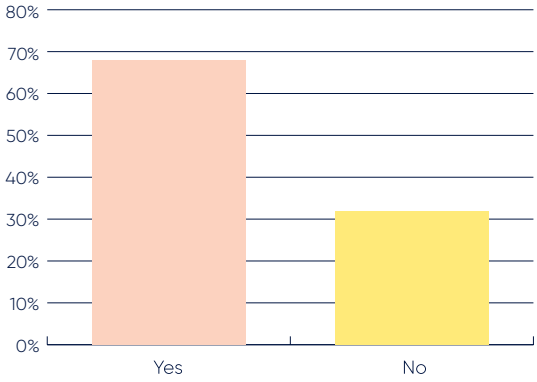


Figure 10. Expression of Interest Survey results, Q.9

Plastic Collection and Aggregation

Council Transfer Stations

Modelling by MRA Consulting (MRA, August 2021) identified preferred locations for plastic drop-off and aggregation points across the Western Victorian Dairy region, based on silage plastic sales, and milk production. With the help of the Barwon Southwest Waste and Resource Recovery Group (now Recycling Victoria) and WestVic Dairy staff, 5 council operated transfer stations from 3 different local councils, agreed to serve as free drop-off locations for the duration of the trial. They are listed in Table 4

Table 4: Participating Council Transfer Stations

Shire	**Transfer Station**
Colac Otway Shire	Alvie Transfer Station, Alvie VIC 3249
Corangamite Shire	Corangamite Regional Landfill Site (Naroghid), Camperdown, VIC 3260 Simpson Transfer Station, Simpson, VIC 3266
Moyne Shire	Killarney Waste Facility, Crossley VIC 3283 Peterborough Waste Facility, Peterborough, VIC 3270

Transfer station staff assisted the trial by assessing the cleanliness of dropped off material and recording the farm number, and the size and number of liners accepted through each location. At the beginning of the trial, transfer station staff were provided with a data record sheet load acceptance/ rejection criterion (appendix D), and a complete list of trial participants. The trial coordinator provided training in the use of these materials at the time of distribution. Table 5 shows the number of farms that contributed plastic through the free drop-off option.

In addition, the Corangamite Regional Landfill site, also known as Naroghid, served as a materials storage and central aggregation point for all the collected plastic prior to its transportation to the re-processor in Melbourne, due to its optimal location and facility size.

Table 5: Transfer station drop-off data

	June -Aug 2022	**Sep – Dec 2022**	**January 2023**	**February 2023**	**March 2023**	**Trial Total**
No. of farms dropping off plastic	13 /78[1] (17% of sample)	12/ 76 [2] (16%)	2/86[3] (2%)	5/86 (6%)	20/86 (23%)	**52 farms**
Total – Small liners full of plastic dropped off	92	72	10	18	77	**269**
Total - Large liners full of plastic dropped off	11	44	5	22	99	**181**
Total - Bulk bags full of plastic dropped off			0	6	28	**34**
Overall total	**103**	**116**	**15**	**46**	**204**	**484 bags full dropped off**

1 Two farms withdrew from the trial during this period.
2 Two more farms withdrew from the trial during this period before contributing plastic.
3 Two more farms withdrew during this period, while twelve more were added through bulk bag sub-trial.

A total of 21 farms (16 large, 3 small, 2 bulk bag) did not contribute any material to the trail. The various reasons for this are outlined in Table 13. Of the 20 contributing small bin users, 19 used the free drop off option at a transfer station, and 1 received on-farm collections.

Twenty eight percent of contributing large bin user farms and 70% of bulk bag user farms utilised the free drop off option exclusively during the trial, despite the average weight of a full large liner ranging from 160 – 180 kilograms and the average bulk bag weighing 70 kilograms. Most of these farms were located within 10 -15 kilometres of a transfer station. Trial members were advised that lifting equipment and transfer station staff would not be available to assist with the unloading of liners. However, conversations with transfer station staff indicated that some trial participants had requested and received help from staff, despite this. Other participants transported the liners to the transfer station in their own tractors or a vehicle with a tray, making for easier unloading at the site. Five farms used both the free drop-off and on-farm collection service during the trial. The majority of contributing large bin users (59%) used the on-farm collection service exclusively.

On-Farm Collection

The first on-farm collection took place on August 1, 2022. Trial members were asked to only request a collection once they had several full liners. A fee of $25 was charged per one large liner or three small liners, bundle of pit covers or bulk bag. Payments for the service were made via an Eventbrite webpage set up specifically for the trial. Once enough liners from the same collection zone had been requested (approx. 11 large full liners per load), a collection service was scheduled. Farmers were advised of the date and asked to leave the load in an accessible location on the farm. They were not required to be on-farm for the collection.

A civil construction contractor located in Camperdown Victoria, completed most of the on-farm collections. A tip truck and trailered skid steer fitted with soft grabs were used for the collections. This equipment was ideal for moving and loading the full liners without damaging them. As the silage plastic was typically stored near to the dairy at most farms, access by large vehicles was generally good, (as milk tankers access the dairy on a regular basis). The entire collection was typically completed in around 10 minutes per farm. The farm number was spraypainted onto each liner at the time of collection, to assist with future auditing and data recording.

Full liners ready for collection

Soft grabs moving liner during on-farm collection

Loading liners for transport during on-farm collection

Aggregated plastic awaiting tranportation at the transfer station

Figure 11: The on-farm collection process

In January, a skip hire company, also located in Camperdown was hired to perform collections. Farmers were asked to assist the contractor by loading the liners into the skip using their own equipment. Although this arrangement required coordination between the driver and farmer, the idea was well received by the trial farmers involved.

Throughout the trial, securing on-farm collection contractors was a challenge. In addition to the relatively specialised machinery required to load the liners, (tip truck, trailer, skid steer with soft grabs) which were not commonplace in regional areas, local labour shortages, and the coinciding silage cutting season resulted in limited contractor availability and interest. As a sporadic source of income for waste management and construction operators, it was difficult to compete with their regular clients and more lucrative contracts. This shortage in providers raised concerns about the scheme's future capacity to meet collection demands when more users were involved.

By involving farmers in the collection process, and removing the need for specialised, expensive equipment and vehicles, the pool of potential contractors increases, allowing for more responsive service and shorter waiting periods between payment and collection, which was a priority for many trial members.

Through the course of the trial a total of 53 on-farm collection events occurred, collecting, and transporting 266 items from the farm of origin to the central aggregation site at Naroghid transfer station. Table 6 summarises the month(s) and quantity or of material contributed through on-farm collections during the trial.

Table 6: On Farm Collection Data

	June -Aug 2022	Sep – Dec 2022	January 2023	February 2023	March 2023	Trial Total
No. of farms dropping off plastic	19/78[1] (24%)	6/ 76 [2] (8%)	2/86 [3] (2%)	6/86 (7%)	20/86 (23%)	53
Total – Small liners full of plastic picked up from farms	7	0	0	0	8	15
Total - Large liners full of plastic picked up from farms	71	29	16	45	74	235
Total - Pit cover bundles picked up from farms	3	0	0	2	3	8
Total - Bulk bags full of plastic picked up from farms	0	1	0	0	7	8
Overall total	**81**	**30**	**16**	**47**	**92**	**266 bags full dropped off**

Silage Use – Seasonality

Wet conditions in the 2022 Spring delayed the cutting of silage on many farms in the region. The trial saw its greatest plastic accumulation occur during late February and March 2023. Many farms indicated that in the current year (2023), much of their feeding out of silage would take place once the trial had ended. Delays in the arrival of the bins and liners from overseas suppliers, and subsequent delays in their delivery to farms, meant most trial participants had already ceased using silage for the 2022 season, by the time bins arrived. As such, many farms had already disposed of their plastic via landfill.

Conversations with trial farmers revealed variations in the use of silage. Several farms fed out silage year-round – contributing material consistently in smaller amounts throughout the trial. For example, farm 14, which produced 1200 bales annually, contributed a total of 46 small liners of plastic throughout the trial. Farm 79 and 20, with 300 and 500 bales annually, consistently contributed plastic during the trial, with totals of 19 and 22 small liners, respectively. Farm 62 with 4000 bales, used silage throughout the trial, contributing a total of 22 large liners and 1 bulk bag of silage plastic. Farm 66, with 1500 bales annually, reported they typically feed out 10 – 15 bales of silage per day, from December through March. Other farms identified peak silage use occurring from December through to March or part thereof. Farm 56 with 2000 bales annually, typically uses silage until May.

1 Two farms withdrew from the trial during this period.
2 Two more farms withdrew from the trial during this period before contributing plastic.
3 Two more farms withdrew during this period, while twelve more were added through bulk bag sub-trial.

Conversations with Dairy Australia regional staff across the country revealed significant variations in the peak feeding out periods at Dairy farms, ranging from March to July in Queensland and Northern New South Wales, May to July in Tasmania, September to November in South Australia, and October to December in New South Wales and Western Australia.

Trends and Observations

On- Farm Collection Costs

On-farm collection contractors charged an hourly rate from depot to depot, that included the loading and unloading of equipment. A typical collection run spanned properties within 10 – 20 kilometres of each other, with an average of 4 to 5 liners requiring collection at each farm. The capacity of the tip truck was the limiting factor in this arrangement, as in the peak feeding out period during late February and March, when plastic accumulation was at its highest, and the average number of liners requiring collection at each location was 6 to 11, it was sometimes necessary for the collection vehicle to return to the aggregation site at Naroghid to unload, before the route had been completed.

Other factors impacting the time taken to complete an on-farm collection included; accessing and locating the liners on-farm, liner condition (damaged or not), overfilled liners, or untied liners where the vehicle operator had to leave the vehicle to repack the liner before loading it into the tip truck, wet and muddy conditions in the spring, when some farm roads were impassable to the collection vehicle and the entire collection had to be postponed.

Ideally, the trial would have engaged on-farm collection partners within each of the 6 zones, to limit the driving time to the farm. However, given the limited volume of material and relatively specialised nature of the equipment required to collect it (large capacity tip truck, trailer, skid steer with soft grabs), locating suitable operators was challenging and could therefore not be accommodated as part of the trial. A fully fledged and ongoing scheme could conceivably overcome this hurdle. Despite selecting farms in concentrated pockets across the region, the need to return material to the central aggregation hub in Naroghid always added time to collection runs.

Farmer feedback (Mid-point survey Q9,) indicated a preference for a short waiting period between requesting a collection and receiving one. Comments included: "If this does move beyond a trial, I would expect that a run would be developed with more regular pickups" and "The unsightly mess of silage wrap laying about will lead to it going to landfill". Table 7 tracks the cost of on-farm collections during the trial.

Table 7: On-Farm Collection Costs

	Collection Zone	No. of Farms Visited	Item collected: Liners (LG/ SM4) Pit Cover (PC) Bulk Bag (BB)	Equivalent no. of large liners collected	Total weight (tonnes)	Hours Charged	Cost of collection run (@$140/hr)	Cost per large Liner/ bundle/ bulk bag*
1/08/22	Peterborough	6	26 LG	26	4.92	11	$1540	$59
10/08/22	Naroghid	5	21 LG, 3 PC	24	2.56	4	$560	$23
25/08/22	Alvie	3	5LG, 7 SM	7	0.82	8	$1120	$160[5]
26/08/22	Killarney	2	7 LG	7	1.1	4	$560	$80
26/8/22	Simpson	3	12 LG	12	2.1	3	$420	$35
11/9/22	Simpson	1	9 LG	9	1.6	6	$840	$93
24/11/22	Peterborough	2	7 LG, 1BB	8	1.5	4.5	$630	$78
25/11/22	Naroghid	3	14 LG	14	1.23	7.5	$1050	$75
17/1/23	Killarney	1	6 LG	6	0.86	3	$420	$70
18/1/23	Killarney West	1	10 LG	10	1.36	4.5	$630	$63
22/2/23	Peterborough	4	27 LG	27	2.88	5	$700	$25
23/2/23	Naroghid	2	18 LG, 2 PC	20	1.8	3	$420	$21
1/3/23	Killarney (#32)	1	18 LG	18	3.1[6]	4	$560	$31
2/3/23	Killarney (#32)	1	13 LG	13	2.1[4]	4	$560	$43
8/3/23	Peterborough Killarney	7	29 LG	29	2.8	7.5	$1050	$36
10/3/23	Killarney Killarney West Peterborough Naroghid	7	10 LG, 3 PC, 6 BB	19	2	8.5	$1,190	$62
14/3/23	Simpson	2	3 LG, 1 BB	4	1.6	3.5	$490	$122
21/3/23	Alvie	2	7 SM, 1 LG	3	N/A	3.5	$490	$163
Totals		**53**		**256 LG**	**34.3 t**	**94.5 hours**	**$13,230**	**$51.6/LG[7]**

Establishing Data Points

Throughout the trial, 12 audits were conducted on the collected bale wrap. Liners were weighed using the transfer station weighbridge at Naroghid (for the large liners), or portable scales for the small liners. The liner was opened, and the number of bale wraps counted. Throughout the counting process, individual bale wraps were weighed at random, to establish an average weight.

The average weight of a used silage bale wrap, as determined through the auditing process was 1.4 kilograms, with a range from 700 grams – 2.3 kilograms. Silage plastic is constructed of multiple layers of film plastic pressed together into a firm sheet. During the fermentation / storage process, the film absorbs and retains moisture between the layers. The variations observed in bale wrap weight can be explained by seasonal influences on moisture content. Audits undertaken in the winter and spring months, were noticeably heavier and more likely to be contaminated with mud, compared to the much drier bale wraps that were audited in March.

Load contamination was also measured. For the purpose of the audit, anything other than small amounts of dirt, mud or traces of silage was considered contamination. Small amounts of dirt, mud and silage is acceptable to the re-processor given the origin of the material and can mostly be addressed through the shredding and washing stages of plastics reprocessing.

4 In order to present the on-farm collection cost as a per large liner rate, 3 small liners, have been regarded as approximately equal to (≅) 1 large liner, as based on the on-farm collection charges.
5 This collection run included a large pit cover load that had been stored on an impassable dirt road. The collection took several hours, as the contractor attempted to load the plastic. Load was eventually abandoned.
6 Contractor reported the liners at this farm were muddy, bags had deteriorated and required careful handling, which added to time taken.
7 Average collection cost per large liner full of plastic collected (or equivalent)

Contamination that could be physically collected (e.g., hardened mud, pieces of silage) was weighed. By monitoring load cleanliness and establishing contamination level averages, we were able to provide the re-processor with a cleaner, higher value feed stock and judge the efficacy of our farmer education material.

Table 8 lists the data points established through the audits. A detailed record of the audit findings from the entire collection period is in Appendix E. To the credit of the trial farmers, the cleanliness of the contributed material was high. Of the estimated 850 kilograms of material audited throughout the trial, and the checks undertaken by the re-processor, problematic sources of contamination, such as twine, netting, or large solids were not found in the plastic, removing the need to inspect loads before processing.

Table 8: Established data points from the silage plastic recycling trial, 2022/23

	Small Liner (200L)	Large Liner (1300L)	Bulk Bag (930L)
Average Weight (kg)	20 -30	160 -180	64 -78
Average Number of liners	16	77	64
Average Contamination observed	< 1% of total weight	Range minimal – 10% of total weight	Ranged 0.5 -2% of total weight
Total on-farm collection (quantity)	15	235	8
Total dropped off (quantity)	269	181	34
Total number contributed	**284**	**416**	**42**

Transportation and Reprocessing

Throughout the trial, a total of approximately 70 tonnes of silage plastic were transported from Naroghid transfer station to Olympic Polymers, in Clayton, Victoria, for reprocessing. Olympic Polymers operate a mechanical plastic recycling facility where various types of plastic are shredded, washed, and pelletised for use in the manufacture of LLDPE or mixed polymer products.

The stages of processing at Olympic Polymers are as follows:

1 Silage plastic received at facility.
2 The liners and wraps are loaded into shredding machinery where they are torn into strips.
3 Shredded material passes through two wash bays where recycled water removes debris and contamination (largely mud, dirt, and silage) from the plastic.
4 The pH (a measurement of acidity ranging from 0 -14) of the water is altered so contaminants drop to the bottom of the vat.
5 Water is drained off and the plastic is dried using mechanical centrifuge.
6 Flaked plastic is melted and made into pellets using an Erema extruder.

On November 16, the first load of trial collected silage plastic, weighing 20 tonnes, was transported to Olympic Polymers from Naroghid transfer station in two 30m^3 hook bins. The load was baled onsite and stored for several months. The baling of the material received was undertaking to minimise the amount of space required for storage prior to processing.

On January 20, 2023, Olympic Polymers began processing the plastic. The facility has the capacity to process 500 kilograms of plastic per hour, 16 hours per day, 6 days a week. (Olympic Polymer site visit 2023). Initial reprocessing of the material on its own (or at 100% silage plastic) returned a shredded plastic that retained too much water post drying to be pelletised. Following this result, additional batches of silage plastic combined with agricultural tubing and post-consumer plastic already on-site were run at 30% and 50% ratios. The blend produced a product that retained less water and could be pelletised. The resin was sold and considered of a suitable quality for the manufacturing of garbage bags and builder's film.

At Olympic Polymers, plastic ideally needs to be processed at a minimum rate of 500 kilograms per hour to be profitable. This equates to an operational cost of $1.10 per kilogram. The market rate for garbage bag and builder's film quality resin at the time of writing was $1.25 per kilogram. As this quality of material makes up 90% of the business's revenue stream, reprocessing the supplemented silage plastic blend is considered worthwhile to the business (Olympic Polymers staff interview 2023) Table 9 looks at the cost per tonne to transport and reprocess the material collected during the trial.

Facility processing rates at Olympic Polymers return a combined 20% by weight loss of material during the shredding, washing and drying phases, and 3-4% loss through the extrusion (heating and pelletising) processes (Olympic Polymer site visit 2023). Based on these established metrics, of the 20 tonnes of collected silage plastic, an estimated 15 tonnes of usable pelletised plastic can be generated.

Table 9: Transportation and reprocessing charges: Establishing cost per tonne.

Date	Transport Cost	In-put Silage Tonnage	Waste (- 24% of in-put weight)	Resale value per kilo of resin	Fixed processing costs	Potential profitability
16/11/22	$2400 2 x 30M3 hook bins @$1200 each	20.8	Approx. 5 Tonnes	$1.25 per kilogram	$1.10 per kilogram	$0.15 x 15,000 kilograms $2250[1]
30/03/23	$2400 2 x 30M3 hook bins @$1200 each	21.5		$1.25 per kilogram	$1.10 per kilogram	

1 Does not include transportation costs, as this was covered by grant funding.

Farmer Engagement and Feedback

In addition to the educational material distributed at the beginning of the trial (Appendix B&C) an instructional video featuring a trial member was filmed and shared directly with trial members, and the wider public via the Dairy Australia website and YouTube[1] . The video provided trial members with a guide to using the bin and liner system, requesting, and paying for an on-farm collection, and outlined the long-term goals of the trial and Product Stewardship Scheme.

A trial coordinator was hired to administer the trial for the duration of the collection period (April 2022 - March 2023). The coordinator served as a regional contact for trial members, gathered collection data and participant feedback.

In September, trial members were invited to take part in an online information and feedback session. The aim of the session was to provide farmers with an update on the progress of the trial and gather user feedback. The session was attended by members of Dairy Australia's Silage Plastic Recycling Trial and Stewardship project teams, WestVic Dairy staff, and a plastic industry professional. Unfortunately, despite pre-registrations, farmer attendance on the day was limited and feedback was minimal.

In October, 5 months into the trial, the Silage Plastic Recycling Trial - mid-trial farmer feedback survey was sent to trial members to gain further preliminary feedback. Participants were asked to evaluate the bin and liner, drop-off, and collection systems in place. Questions about possible changes to the system (e.g., an increase in on-farm collection fees, bin-free collection, and paying for liners and bins in the future), were also asked. The survey questions are listed in Appendix F.

Of the 78 trial members, 47 (60%) completed the survey: 32 large bin holder and 15 small bin holders. Sixty-four percent of respondents had used the system from start to finish – they had filled liners and received an on-farm collection or dropped their material at a transfer station at the time of survey completion. Thirty-six percent had been filling the liners but had not used the collection / drop-off system at the time of completion. Five trial members who had used the bin and collection system from start to finish, did not complete the survey.

1 www.youtube.com/watch?v=bBdnpYdtnTo

Mid-trial Survey - Key findings

Key findings from the mid-trial survey results are provided in the table below.

Table 10. Mid-trial Survey – key results

Question	Yes	No	Other			
Q. Is the bin and liner system suitable to your needs?	65%	11%	23%			
Q. Were the educational materials developed easy to understand and follow?	91%		9%			
Q. Are the wrap cleaning requirements too strict and difficult to meet?	0%	91%	9%			
Q. Would you pay more for an on-farm collection ($40 / large liner)?	68%	19%	13%			
Q. Would you be willing to pay the cost of the large bin ($680)?	20%	33%	47%			
Q. Would you pay for the liners $11 large liner, $3.50 for small liner?	60%	15%	25%			
Q. Do you agree that the bin and liner system provides the best outcome on balance?	68%	13%	19%			
Question	**1 = Poor**	**2**	**3**	**4**	**5 = Great**	**Average**
Q. How was your experience at the Council transfer station when you dropped off plastic?	5%	5%	16%	42%	32%	3.89/5
Q. How was your experience requesting, paying for, and receiving an on-farm collection?	15%		26%	22%	37%	3.67/5

End of trial survey

The Silage Plastic Recycling Trial – End of Trial farmer feedback survey was sent to trial members on February 27. See appendix G for questions. At the time of this report's submission, 44 or 49% of the 90 involved throughout the trial, had completed the survey.

Bulk bag sub-trial - survey response summaries

Eight of the twelve bulk bag sub-trial members completed the Silage Plastic Recycling Trial – End of Trial farmer feedback survey.

Table 11. End of Trial Survey – Key results (bulk bag users only)

Question	No. of Responses	Yes	No	Other			
Q. Is the bulk bag system suitable to your needs?	7	57%	11%	43%			
Q. Are the wrap cleaning requirements too strict and difficult to meet?	8	0%	100%	0%			
Q. Would you pay more for an on-farm collection ($40 / large liner)?	8	62.5%	0%	37.5%			
Q. Would you be willing to pay $250 for a bulk bag stand?	8	25%	12.5%	62.5%			
Q. Would you pay $6 for bulk bags?	7	100%	0%	0%			
Q. Would you travel 30 km to drop plastic off for free at temporary collection points?	8	62.5%	25% [1]	12.5%			
Q. Do you agree that the bin and liner/bulk bag system provides the best outcome on balance?	7	57%	14%	29%			
Question	**No. of Responses**	**1 = Poor**	**2**	**3**	**4**	**5 = Great**	**Average**
Q. How was your experience at the Council transfer station when you dropped off plastic?	4	0%	0%	0%	25%	75%	4.75/5
Q. How was your experience requesting, paying for, and receiving an on-farm collection?	2	0%	0%	50%	0%	50%	4.0/5

1 Response option here was, "No, I would rather pay for on-farm pickup"

All respondents

As of March 28, 45 trial members had completed the end of trial survey. Between the mid-trial survey, one-on-one phone interviews, and the end of trial survey, most trial members had provided feedback on their experience with the trial. The feedback from non-contributing trial farms is summarised in Table 13.

The End of trial survey was completed by 11 small bin users, 19 large bin and 8 bulk bag users.

Table 12. End of Trial Survey – Key results (All respondents)

Question	No. of Responses	Yes	No	Other			
Q. Is the bin and liner or bulk bag system suitable to your needs?	36	78%	3%	19%			
Q. Are the wrap cleaning requirements too strict and difficult to meet?	37	0%	97%	3%			
Q. Would you pay more for an on-farm collection ($40 / large liner or equivalent)?	37	59%	3%	38%			
Q. Would you be willing to pay $680 for large bin or $250 for a bulk bag stand?	36	58%	14%	28%			
Q. Would you pay $11 for large liners, $3.50 for small liners or $6 for bulk bags?	37	84%	3%	13%			
Q. Would you travel 30 km to drop plastic off for free at temporary collection points?	37	54%	30% [2]	16%			
Q. Do you agree that the bin and liner/bulk bag system provides the best outcome on balance?	7	77%	9%	14%			
Question	**No. of Responses**	**1 = Poor**	**2**	**3**	**4**	**5 = Great**	**Average**
Q. How was your experience at the Council transfer station when you dropped off plastic?	23	0%	0%	22%	13%	65%	4.43/5
Q. How was your experience requesting, paying for, and receiving an on-farm collection?	19	11%	16%	42%	11%	21%	3.2/5
Question	**No. of Responses**	**1 = Not at all**	**2**	**3**	**4**	**5 = Very important**	**Average**
Q. How important is it to you to have an on-going way to recycle your silage plastic?	44	0%	0%	14%	11%	75%	4.61/5
Q. How important is it for you to know what product(s) have been made from your recycled silage plastic?	45	22%	13%	31%	9%	24%	3.0/5
Q. How important is it that industry service bodies like Dairy Australia and Meat and Livestock Australia continue to provide leadership in this space?	45	0%	2%	9%	16%	73%	4.6/5
Question	**No. of Responses**	**As soon as possible - one to two weeks**	**A month at the most**	**I don't mind, whenever enough requests have been made in my area**			
Q. What is a reasonable amount of time to wait for an on-farm collection to take place after requesting and paying for one.	42	31%	24%	45%			

2 Response option here was, "No, I would rather pay for on-farm pickup"

Withdrawn and Non-contributing Farms

By trial end, 21 of the 92 farms selected to participate in the trial, had not contributed plastic. Of these, 7 completed surveys, 6 provided feedback via phone, and 5 did not respond to requests for feedback.

Table 13. Non-contributing farmer feedback summary

Farm Number	Survey(s) completed	Feedback
Small Bins		
6	N	Withdrew due to delayed trial start and missed season.
7	N	No feedback provided.
16	N (Phone)	Too time consuming. Did not use the system. See phone interview comments below.
Large Bins		
22	Y	System met needs. Missed the deadline for dropping the plastic off.
29	Y	Mostly uses pit cover. Survey: System meets my needs. Why is it not possible to recycle twine? we could easily have two bins full since start of trial and very clean.
35	Y	Withdrew prior to contribution. Survey: Does not meet needs "The bin liners are not practical for large quantities of wrap. A simpler metal bin that is collected on a more regular basis would work better. In other words, no liner involved".
37	N (Phone)	Positive about the system. Health issues prevented participation. See phone interview comments below.
45	N (Phone)	Positive about system - See phone interview comments below.
47	Y	Survey: Bin and liner system did not meet needs. Thought a skip would be better. "bin and liners are useless".
55	N	Withdrew due to delayed trial start and missed season.
57	N	No feedback provided.
59	Y (Phone)	Positive about the system. System meets my needs. Did not get around to loading liners.
60	N (Phone)	Season meant they didn't use silage in time to contribute to the trial. Positive about the system.
63	N	Withdrew prior to contribution. Largely a pit cover user. Found the system too labour intensive for volume used.
65	N	No feedback provided.
68	Y	The system did not meet needs. See comments below for survey response.
73	Y	Survey: System does not meet my needs. See comments below.
75	N	No feedback provided.
78	N	No feedback provided.
Bulk Bags		
B1	N (Phone)	Hadn't started using silage yet, no plastic on-farm yet.
B4	N (phone)	"Didn't bother using the system".

Comments included:

Farm # 16 (Small bin) The trial member did not contribute any plastic to the trial or complete a survey. He didn't use the system because he is busy and "...didn't want to take the time to load the liners and drop them at the tip. It would be easier to just have a skip to put the plastic in".

Farm # 37 (Large bin) The trial member did not contribute any plastic to the trial or complete a survey. The trial farmer experienced health issues at the start of the trial and "fell behind on separating the wrap from the twine" They eventually disposed of the silage plastic via landfill. The participant thought the bin and liner system would be workable on their farm, and would be "willing to take it up, if it became a permanent thing".

Farm # 45 (Large bin) The trial member did not contribute any plastic to the trial or complete a survey. Participant explained that the season meant the herd hadn't needed much silage, and so the plastic they had was minimal and not worth bagging. He felt the "system was workable on his farm, and ...would use it if introduced going forward." Participant said, the "old farmers who don't care about the environment have mostly gone... most farmers these days want to do the right thing, be responsible". Feels the use of a skip to collect the plastic would be more practical, and the risk of load contamination was low given more responsible farming practices.

Farm # 68 (Large bin) This trial member completed a survey "This system is useless. All we farmers have front end loaders with forks which could handle the liners better if they had lifting hoops on them like bulk bags which I have used in the past. Also it is pretty much impossible to close off the tops of the large liners. They need a "draw string" like bulk bags on top edge. They also do not hold enough silage wraps for most "average" farms.

Farm # 73 (Large bin) This trial member completed a survey. "The large bins are too small for our needs. We requested more bin liners and are still waiting for them. as such we haven't had a pick up".

Farm B1 (Bulk bag) Participant thought the system could work on their farm but was not planning to start using silage until after the close of the trial, so did not have material to contribute.

Council Transfer Station Attendant Feedback

In February 2023, a short questionnaire was given to staff from the five council transfer stations accepting material for the trial. out All 6 of the staff directly involved in collecting the silage plastic completed the survey. The attendants considered the criteria for accepting or rejecting material and the data record sheet to be easy to follow and use. Communication with the trial coordinator was considered satisfactory. No additional comments were made by the sample. The use of attendants was critical for reliable data recording, given the spread of the trial area, and provided and added level of insurance against the inclusion of contaminated liners or the disposal of other waste in the designated skip or laydown area. Trial questions and responses are summarised in Table 14.

Table 14: Transfer station attendant feedback

	Yes	No
Q1. Have you seen the acceptance fact sheet	6	
Q2. Was it easy to understand	6	
Q3. Ideas for its improvement		6
Q4. Have you used the record sheet to note plastic	6	
Q6. Was it easy to use?	6	
Q7. Suggested improvements		6
Q8. Trial Coordinator communication satisfactory	6	

Summary of Project Deliverables

Table 15: Summary of Project Deliverables

Objective	Outcome
4. Provide farmers with equipment.	Total of 78 bins, 73 bulk bags and 900 liners delivered throughout the trial.
5. Provide farmers with necessary training	• Educational literature, video and webpage developed and distributed. • Follow-up emails and phone calls throughout the trial. Drop-in session. Group email updates throughout the trial. • Site visits, on-to-one feedback from farmers. • Discussion groups with WestVic Dairy staff members.
8. Provide council collection staff / on-farm collection staff with training	• Developed and distributed forms and instructional material to transfer station staff at the start of the trial. • Shadow on-farm collection contractors to explain contamination protocols and data recording requirements. • Follow-up emails and phone calls with contractors. • Feed-back interview /survey at the end of the trial.
9. Develop on-farm collection booking system	• Eventbrite payment page set-up. • Process explained to trial farmers, link provided. • Farms put into collection zones based on proximity to transfer station. • Farmers request a collection via email, state number of liners ready. • Requests recorded by zone. Liners paid for. Contractor engaged once enough bags in the same zone have accumulated. Contractor confirms date of collection. • Communicate date of collection to the farmer by text or phone call. Email less effective for some farmers.
11. Collect plastic collection data	• Transfer station staff provided with data recording sheet for dropped-off material. Records date, farm of origin and the number and size of liners accepted or rejected. • Photo of completed form emailed to coordinator monthly. • Data is collated monthly throughout trial. • On-farm collection driver sent a run sheet of farms requiring a collection. List farms requiring a collection, number of bags paid for, location of the farm and liners on site. • Driver completes run-sheet and records weight of load at Naroghid against farms. • Completed run sheet photographed and emailed to coordinator. • Collection data is compared to collection requests and payment records. • Date, size and number of liners collected recorded against farm number. Load weight recorded against collection date/ route. • Total number of farms, liners collected, and hours charged recorded for each collection. • Data recorded for trial report. • Seasonality of plastic use varies with seasonal conditions. • A wet spring delayed the cutting of silage for many farmers, delaying the start of the feeding out period. Trial farmers identified December through March as peak silage use. • Some farms used silage consistently year-round. • Peak plastic accumulation occurred during February and March in the trial. • Many farms indicated that much of their feeding out would take place after the trial ends.

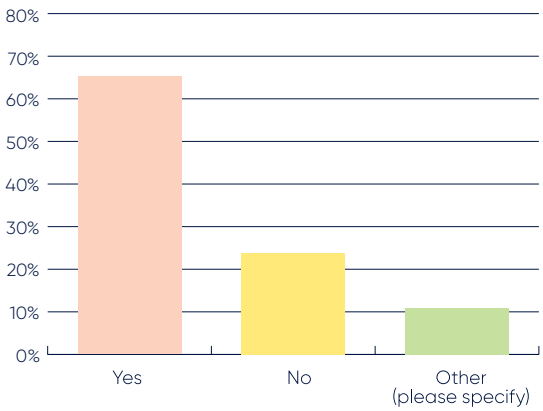
Objective	**Outcome**
11.1 Identify general waste landfill charges in the trial area municipalities	• Skip hire and local council gate fees for general waste or landfill disposal researched and recorded to provide a cost benefit to farmers for recycling material instead of landfilling. • Average per tonne disposal charges at council landfills was ($298/tonne) and 3m3 skip hire and disposal service had a starting rate that ranged from $280 - $330. Charges increased in-line with distance from the hire-company's depot.
12. Collect transport cost data	• Charges for transport of plastic from council transfer stations to Naroghid aggregation site recorded using invoicing and payment records. • Material weight and associated hourly or per bin cost to transport from aggregation site to reprocessor recorded through invoice and payment records.
13. Collect reprocessing cost data	• Input tonnage data and available reprocessing data used to establish the cost and potential resale value of reprocessing the collected silage plastic. • Used business established rate per hour benchmark 500KG per hour or $1.10/ kilogram operating costs required to be profitable. • Resale value for builders film and garbage bag -quality resin is 1.25/ KG. Was
14. Evaluate value of various digital platforms for managing plastic data	• Scheme website requirements and aims identified through consultation with DA digital team. • Market was scanned for existing platforms that could be used (payment gateway, salesforce for registration. • Data security. • Data accessibility. • Value to scheme.
15. Collect and recycle 50 -100 tonnes of silage plastic	• As of March 30 – Approximately 70 tonnes of trial generated silage plastic had been collected and transported to the reprocessor. – 20 tonnes had been run through the reprocessing line. – 20 tonnes of pelletised plastic was generated. – 44 tonnes was still to be recycled at the close of the trial – March 31, 2023.
16. Gather farmer feedback on system design	• Trial members were invited to a drop-in, information session in September 2022, to provide the team with user feedback. Attendance was limited. • A mid-trial survey was sent to trial members in October 2022, to gather farmer feedback on the user experience. 60% of trial members completed the survey. • Results were used to refine scheme design elements and are included in the report. • An end of trial survey was sent to trial members in late February 2023, 49% of trial members completed the survey.
17. Gather feedback from council staff and collection partners on system design	• In February 2023 a questionnaire was given to council transfer station staff directly involved in the trial. • 100% of directly involved staff completed the questionnaire. • 100% of attendants thought the program's acceptance criteria and record sheets were easy to understand and use. • 100% thought communication with the trial coordinator was satisfactory.
18. Identify preferred system for on-farm silage plastic separation & storage	• Overall opinion of the bin and liner system 68% think it works well, 13% said another system would be better, 19% Other. • 65 % said the bin and liner system met their needs. • 10% said the bin and liner system did not meet their needs. • 91% of survey respondents said the wrap cleaning requirements were not too hard to meet. • 20% said they would still recycle the plastic if they had to pay for the bin ($680). • 33% of survey respondents said they would not cover the bin cost. • 57% said they would pay for the liners ($11 large/ $3.50 small) • 21% said they would not be willing to pay for the liners, 21% other.

Objective	**Outcome**
19. Identify preferred plastic collection process (free drop-off/ paid pick up) for silage plastic	• 95% of small bin, 28 large bin and 70% bulk bag farms used the free drop off service exclusively. • 5% of small and 59% of large bin and 30% bulk bag farms used the on-farm collection service exclusively. • 12% of farms used both drop off and collection options. • Users rated paying for and receiving an on-farm collection as Great 30% Good 23% Poor 14% • Asked if they would be willing to pay more for a collection (- $40/ large liner) Yes 68% No 19% Other 13%. • Majority of small bin holders said they would still participate in the scheme if free drop-off options were reduced, and on-farm collection fees increased to $40/ 3 small liners. • Users rated the experience as Good 42% Great 31% Poor 5% • Transfer station staff were comfortable with the amount of time required to administer the drop-off service. • The cost of maintaining 18M3 hook bins at each transfer stations to store plastic outweighed benefits, due to comparatively low volumes dropped off. • 2 of the 3 Shires agreed to storing the liners loose on site to reduce project costs. 1 Council retained the bins for ease of storage. • Drop off option was preferred by small bin users with all but one farmer using this option. Ease of handling compared to large liners likely influenced this decision.
20. Identify preferred plastic handling & logistics arrangements – including requirements for aggregation, compaction, and transport of silage plastic to recycling sites	• Analysis from logistic consultant puts benefit from bailing plastic before bulk hauling as minimal, due to the compaction achieved through the packing process on-farm, when compared to the staff and equipment costs associated with baling. • Reprocessor able to bale the plastic on-site for storage purposes, if necessary.
21. Identify the quality requirements for effective silage plastic recycling	• Initial reprocessing of 100% silage plastic returned a shredded product with high levels of water, making it unsuitable for extrusion without installing alternative drying machinery. • Combining the silage plastic with other LDP material (agricultural tubing, post-consumer plastic) at 30% and 50% ratios, delivered improved results and performance. • Pelletised material met quality and performance standards for builders' film and garbage bag manufacturing. • These revenue streams make up 90% of Olympic Polymer's resale market, so considered a viable material to reprocess for the business. • On-going ratio trials are planned for subsequent loads.
22. Identify the preferred educational and communication resources required to ensure effective farmer participation in a recycling scheme.	• 92% of survey responses said the trial educational material was easy to understand and follow. 1% had not seen, 6% other. • 70% said communication and response time with the trial coordinator was satisfactory, 4% said it was not satisfactory. • 17% had not been in contact, 9% other. • Audits of collected plastic showed minimal to trace amounts of contamination. • Reprocessor happy with the cleanliness of the feedstock. Material did not need pre-sorting prior to being fed into the line. • High farmer-literacy levels on the importance of removing twine and netting from load before packing, and the impact poor preparation could have on scheme success. • Suggests the educational approach used in the trial was affective and well received by the farmers. Use of on-line, video and printed material that can be accessed on-farm works well. • Trial farmers identified contact or information provision via text message or phone call, as the most efficient. Many farmers said they did not always check their email daily.

Appendices

Appendix A: Mid-trial Survey – Detailed Responses

Q2. Is the bin and liner system you are using suitable to your needs?



"Other (please specify)" comments:

1 Even the large bags do not fit a very large amount of plastic in them.

2 We need more liners.

3 No, it's Labor intensive. A big container would be easier.

4 Not overly suitable, when heavy feeding is occurring on farm the bin fills too quickly.

5 The size is ok but I've overloaded the first one and `it's hard to tie!

6 Would rather a skip or the bulka bag we have trialled is better than the plastic .

7 Difficult to get a large amount of silage plastic into the liner, we have the ability to press down the plastic in our normal waste bin, therefore getting more plastic into the waste bin.

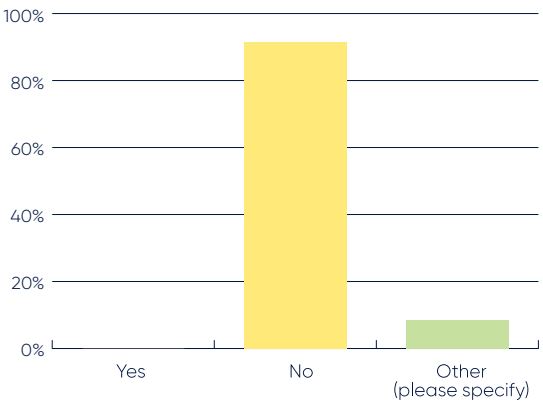
8 Could use either system as I have previously used plastic dust vacuum bags (240ltrs) to store plastic wrap.

9 Needs to be removed in a large skip that's on most dairy farms Australia wide.

10 It works well, however a skip would be even better due to the larger size and ability for more regular collection.

11 Don't use it just as easy to put straight into the bag, especially if it is from a tube wrap.

Q3. Are the wrap cleaning requirements too strict and difficult to meet?



"Other (please specify)" comments:

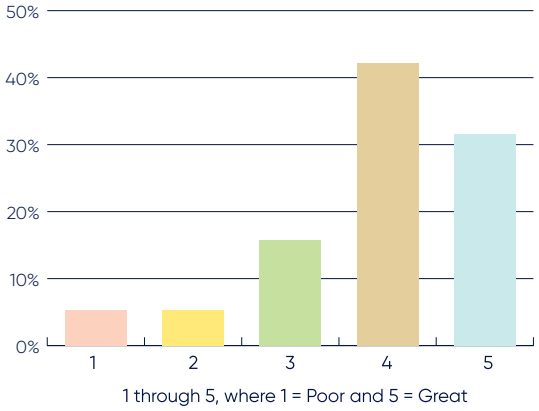
1 Haven't been rejected yet so ok I would say.

2 Don't know.

3 Okay in our feeding system may be an issue in others.

4 Only when it's really wet and muddy (mid-winter).

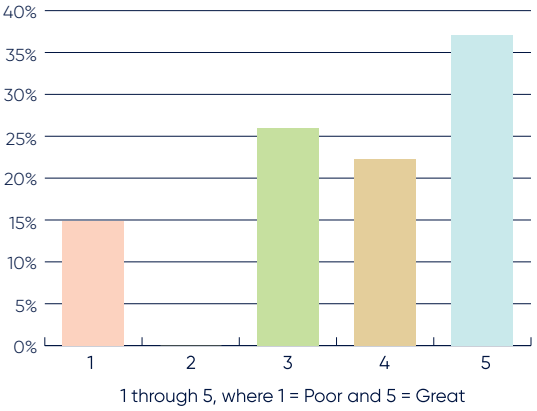
Q5. How was your experience at the Council transfer station when you dropped off plastic?



Q6. How could it be improved??

1 Provide bigger bin.
2 Everything was good.
3 Council skip high to put bags in.
4 Sides of bin Not quite so high.
5 Can drop off your self for free.
6 Timboon used to send the plastic off for recycling and the rules were the same as this project. Worked really well and it met my desire to remove the wrap from my farm as soon as possible.
7 Needs a large bin you can push off Ute straight into below the same as all other rubbish collection options up there.
8 No one to unload me.
9 More bags to start with.
10 need more liners.
11 Had to unload plastic myself.

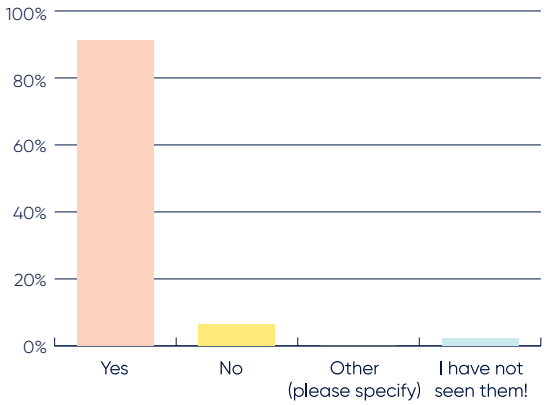
Q8. How was your experience requesting, paying for, and receiving an on-farm collection?



Q9. How could it be improved?

1 All good.
2 Would be great to receive an invoice.
3 Supply more liners. We asked for more but never received any.
4 All O/k.
5 Seemed a tad unorganised.
6 Requesting and payment was okay but the collection was not. We did not know when they were coming and they did not contact us on arrival, as a result did not collect all the bags, only one instead of three. Those they left behind then were damaged by stock and had to be taped up with silage tape!
7 Great, good to put bags on pallet .
8 Not applicable.
9 Make it free.
10 I haven't had a request for payment yet so no collection has occurred.
11 More regular pick ups. Or skip so you don't have to pick up as often .
12 Have the ability to get more plastic into the liners.
13 Haven't had pickup.
14 I would prefer to shift it sooner, but the collection method this time was fine. If I was taking it to a Council transfer station to 'store' it there as a central collection point then the smaller bags would be a better option.
15 Wasn't sure exactly how to allocate for pit cover plastic.
16 No cost for on farm pick up.
17 Sending a text message with collection date and details might be better.
18 There were many delays, otherwise easy to facilitate.
19 Don't use.

Q10. Do you agree that the instructions and educational materials developed for the trial were easy to understand and follow?



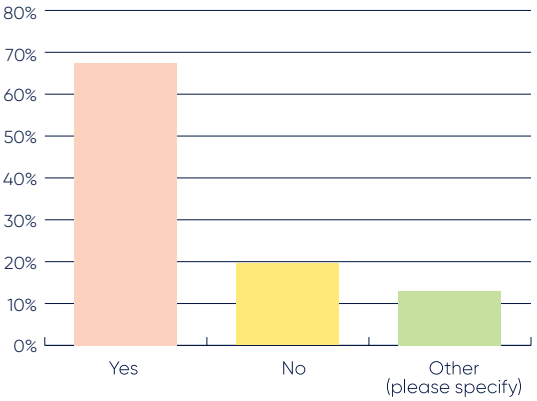
"Other (please specify)" responses:

1 I haven't looked at the online video yet.

2 Didn't state how clean silage sheet has to be.

3 I've seen them but husband and employees are yet to access them.

Q12. To simplify the plastic collection process and minimise costs to farmers we are considering a system which mostly offers on-farm collection (for a fee) and has only a handful of drop-off points. We would aim for on-farm collection fees that are less than or comparable to current landfill charges and much less than current skip bin collection costs. We estimate that the eventual charge would be approx. $40 per large liner full of plastic and $40 for three small liners full. Would you still participate in the silage plastic recycling program if these changes were made?



"Other (please specify)" responses:

1 Wouldn't be happy about it.

2 Only if there's no other option.

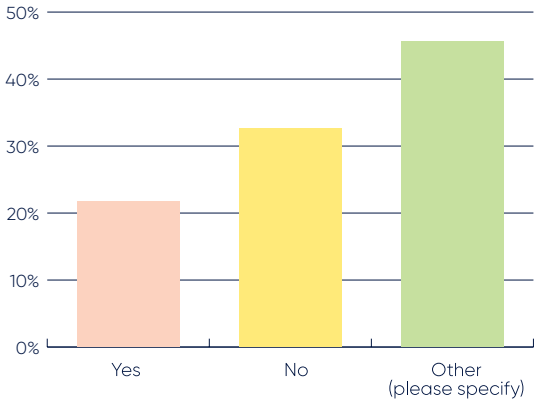
3 Maybe, I'm undecided.

4 What's cost for pit sheets.

5 Possibly that's to much cost though.

6 One visit for multiples of 40 is steep. 40 per stop more realistic.

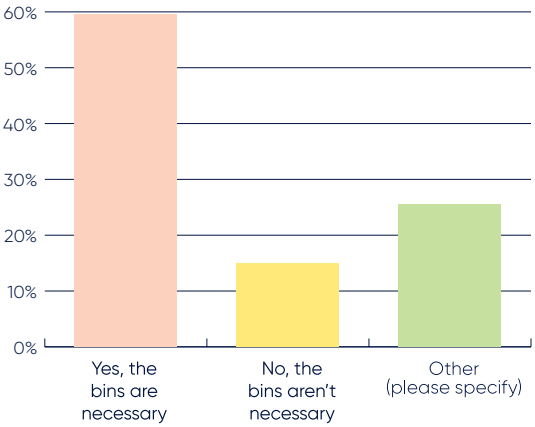
Q13. The cost of the large bins being used in the trial is currently around $680 each. You will be able to keep these at the end of the trial. Would you still participate in a silage plastic recycling program if you had to pay for the bin yourself?



"Other (please specify)" responses:

1 Not certain that cost would not put us off and pretty certain it would put lots of other farmers off.
2 Not applicable.
3 possibly a deterent.
4 get rid of bins needs to in bulk.
5 Probably. It's expensive but we don't really have any other option to get rid of it responsibly.
6 Not for amount we use in wrap.
7 No, as I indicated above, I have already previously sourced suitable plastic bags in which i can store plastic wrap. That keeps the refuse in a neat state and also it is easy to transport in the smaller bags. The small bins that were offered with the 240ltr bags looked okay but I don't think they were needed. Bigger bags needed the large bins and they were a good set up.
8 Yes, but on a deposit system if returned.
9 Possibly.
10 you will get more take up on supply and return even with bond.
11 If the economics stacked up, absolutely.
12 I don't use a large bin and don't need a bin just the bags.
13 would need to come at a reduced disposal fee.

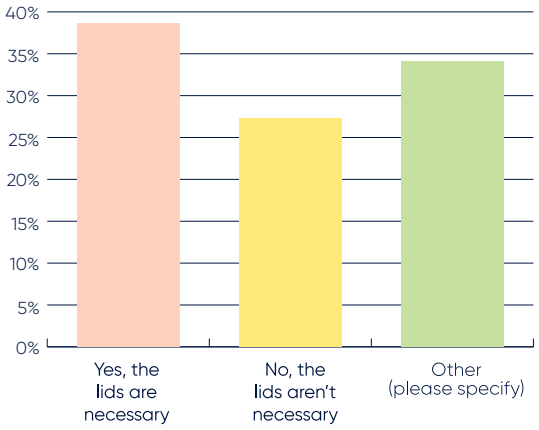
Q14. Assuming farmers are still required to store bale wrap in clear plastic bin liners provided, do you think the recycling bins are necessary? Could you still manage filling the liners with bale wrap and keep the plastic collected clean and mostly free of water without the bins?



"Other (please specify)" responses:

1 The bins definitely assist the ensuring the bags are filled and kept clean.
2 A bin is necessary to be able to get volume into the liner.
3 Short people find it hard to access inside the bin to squash wrap down.
4 Bins make it easier and fit more in.
5 It is possible to fill the bags without the bins but it would be a lot harder and probably the effort would put a lot of people off.
6 We can use clear bags in good conditions, easier with bin.
7 I didn't realise you could recycle the bale wrap.
8 Not sure.
9 Bin an liners are useless.
10 The bin liners are not practical for large quantities of wrap. A simpler metal bin that is collected on a more regular basis would work better. In other words no liner involved.
11 I don't think the small bags need the small bins, but I definitely recommend that the big liners need a structure (ie a bin) to assist the filling process.
12 Large skip farms are only getting bigger fair enough for a trial but if we are serious it's skip bins.

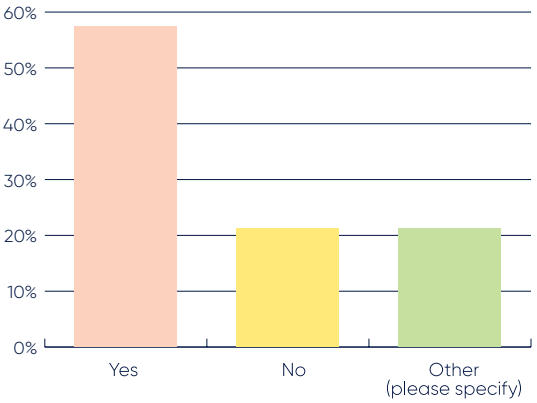
Q15. The lids for the large recycling bins are an expensive component of the bin (e.g. about a quarter of the cost). Do you think the lids for the recycling bins are necessary? Could you still manage filling the liners and keeping the plastic collected clean and free of water without the lids for the bins?



"Other (please specify)" responses:

1 This might be an option if farmers had an onset over area to store there bin.
2 Not applicable.
3 Could put in drainage holes in bin.
4 Didn't use large bin.
5 Not if it rains.
6 Have not used large bin.
7 It would be very difficult to keep water out of the bags without the lids, although it would be possible.
8 If the pile is collected and added to the bin in one go the lids aren't necessary but if added to daily the lids are needed.
9 NA.
10 Not applicable.
11 Yes if the bin remains a lid of some sort would be needed.
12 Could keep it mostly free of water by putting some small holes in the bottom of the bag as I already have to do this as the wrap holds water.
13 The bin lids keep the rain out of the liners and keep the neck of the liner open so it is easier to fill the bag.
14 Lids are necessary. A decent rainfall would deposit a fair volume of water into the large plastic bags - which would require a drainage point.

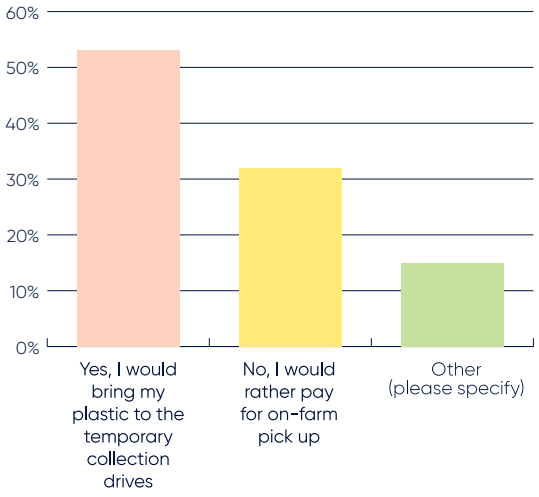
Q16. The bin liners being used in the trial cost around $11 each for the large bins and $3.50 for the small bins. You have been provided these for free for the trial. Would you still participate in a silage plastic recycling program if you had to pay for the liners yourself?



"Other (please specify)" responses:

1 Yes if paying for the liner would the price payed be removed at the drop off end.
2 I strongly support all recycling and would use the plastic liners if it was the only option. Prior to this trial I packed the wrap into bulka bags which is much easier, especially because they can be easily lifted moved around and compressed with the tractor.
3 Maybe.
4 No, it's not easy to fill these liners efficiently and the supply of the liners is not sufficient. It would be easier to send a truck with a large container to pick up the plastic once or twice a year.
5 Again I'm undecided. A liner at $11 + collection of $40 per bag, it might be easier and more cost effective to simply dispose of wrap via skip bin to landfill, as the liners don't hold very much plastic.
6 It's starting to add up... I could say yes now but I think a lot of people will think it's easier to just put it in landfill.
7 Have done so previously for 'small' vacuum dust bags (around 80 x 120cm) that I sourced on ebay. They worked really well and had similar plastic to what this trial provided.
8 Possibly.
9 Providing the economics of the whole initiative stacked up.
10 Need more bags.

Q17. If we were to offer more options for free drop-off of plastics, one way to achieve this would be to run temporary plastic collection drives at a few strategic locations. These collection drives would last for one or two days, once or twice a year in each location – depending on the amount of plastic used in the area. If farmers missed that window, however, they would need to arrange for on-farm collection or bring the plastic to the next closest collection drive. If temporary collection drives were offered within 30 km of your farm to allow for free drop-off of plastic, would you use that service? Or would you prefer to pay for the convenience of on farm collection?



"Other (please specify)" responses:

1 I would likely do a combination of both as that doesn't seem often enough for peak usage time (summer autumn).

2 I am close to the transfer station.

3 Would use both methods depending on time and staff.

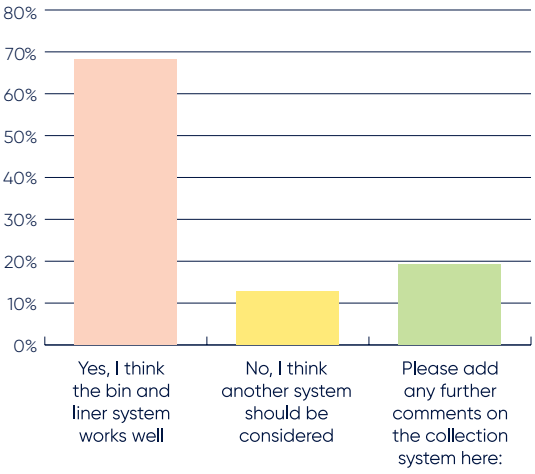
4 Both.

5 I will find an alternative disposal method.

6 On farm drop off is 'easiest' but mailing them out or with a courier could end up being the overall cheapest option.

7 I'd rather stay with the plastic being picked at the local landfill.

Q18. For the silage plastic recycling scheme to work long term, it is important that we keep the plastic as clean as possible from farm all the way through to the recycler. Otherwise, the recyclers will not accept it. The bin and liner system allows us to see into the liners and check for contamination. It also keeps the plastic contained and off the ground so that we minimise how much mud and grit is added to the plastic along the way. The large and small liners also provide a rough unit of measurement for the volume of plastic collected from of each farm and allow us to charge per unit. The fact that multiple liners of plastic can be filled and stored on-farm prior to pick up allows our on-farm collection service to be more cost effective and service more farms. Skip bins do not offer this flexibility. Once a skip bin is full, it needs to be collected. Skip bins are also more difficult to audit for contamination and are expensive to purchase. Collection or drop-off of loose plastics without any sort of bin or container results in large amounts of contamination and severely limits recyclability. For these reasons, our current preference is to continue to use the bin and liner system for collection of bale wraps. Do you agree with this preference?



"Other (please specify)" responses:

1 System is good but it is extremely difficult to keep wrap totally clean in winter.

2 It's a volume game. The unsightly mess of silage wrap laying about will lead to it going to landfill.

3 Makes sense why clear bags are used but a skip would be easier.

4 If moving to large scale recycling program a dedicated skip bin is a must. Current bins hold far less than advertised, resulting in weekly liners changes, and there'll also be an issue around where and how do I store full bags on farm.

5 As I have written previously for large volumes(>2,000 bales) per year a skip bin is preferable. The system needs to be user friendly for staff.

6 A bulka bag is much easier to use. Would also be cheaper for everyone.

7 Currently I think it's not going to cater to large farms if they aren't environmentally motivated.

8 We found the liners quite fragile and easy to burst. A bulka bag or similar would be more practical, but would make collection difficult. The bin and lid are necessary, but inconvenient. We needed to keep the bin accessible for putting liners in, but then ideally the bin could be shifted out of the weather/out of the way once full. It wasn't possible to move the bin as they are too fragile.

9 A skip style system to reduce labour.

Q19. Are there any other comments you would like to make about the trial?

1 The trial has been great, however it is more difficult to keep wrap clean and dry during the winter when the trial occurred and I would suggest that you would get more wrap of a cleaner/dryer nature during the peak silage use season January- May.

2 No additional comments.

3 one would ask do the plastic recyclers get their plastic without cost?

4 I would be happy to utilise the bin liner on its own i would still have the ability to store keep clean dry and save the considerable amount of money not using the black bin.

5 I managed to get 60 wraps into the liner before I had to either get in the bin and stamp it down or use the tractor fork to press it down. Neither of these options are safe work practices. I eventually got 120 wraps into the liner but then tying off the top of the liner became difficult. I think the bulk liner is not a good option because they become difficult to pack and handle manually once they get over 60 bale wraps in them. I could not come up with a safe work system to allow an employee to pack more than 60 wraps. This would result in soft packed bags which are difficult to handle and transport. The cost of the whole system per bale is too expensive.

6 The large bins are too small for our needs. We requested more bin liners and are still waiting for them. as such we haven't had a pick up.

7 No.

8 No.

9 Good thing to be recycling. Could look at recycling the plastic centre of silage rape.

10 Getting the liners has been difficult. We seem always to be waiting for more liners! The whole trial is predicated on an upside-down idea. We're being charged to do the right thing rather than being rewarded for doing the right thing. What should happen is an environmental charge should be put on at the point of manufacture in Australia, or importation, (identification of the charge on the packaging) of all the plastic and then farmers who participate in recycling should get some sort of rebate.

11 Thanks for the opportunity as it is important to address the silagge wrap issue.

12 Very glad to see that this trial is being undertaken, hopefully all silage plastic will be recycled in the future.

13 Fantastic effort - I look forward to next year.

14 The communication is good but the plastic needs to be stored other places right now because we haven't got enough liners.

15 Will this service continue?

16 I haven't fully participated to date, so my responses may be somewhat irrelevant. My bin arrived late and silage feeding was almost done. I also only received one liner, once that was full I returned to disposing of my plastic to landfill as it's easier and I only had a small amount of plastic left to dispose of for the season. Also I'm paying for a monthly skip pickup of waste, and only half filling it.

17 I have a big pile to put into bags. I started and got too full on the first one and lost motivation so my feedback is not really based on lives experience!

18 This system is useless. All we farmers have front end loaders with forks which could handle the liners better if they had lifting hoops on them like bulka bags which I have used in the past. Also it is pretty much impossible to close off the tops of the large liners. They need a "draw string" like bulka bags on top edge. They also do not hold enough silage wraps for most "average" farms.

19 Go the bulka bags if you are not going to use skips that for the farmers would be the best option, but hey, we are just the ones that need to deal with it every day ;-)

20 If there was an easier way to compress the silage wrap into the liners it would make the collection much easier on farm.

21 Why is it not possible to recycle twine? We could easily have two bins full since start of trial and very clean.

22 Overall philosophy of recycling is great. The usage of the end product(s) should be a great selling point for everyone involved and a lot of that depends on the end users of the recycled product(s).

23 We were disappointed to see that someone had thrown metal waste into the bin at the naroghid tip very early in the trial.

24 We appreciated the chance to take part in the trial. However, if we had to pay for the bin, liners and collection we would return to our previous system of storing liners in bulka bags and taking them to the tip at the end of the season. Thank you. we had to.

25 A super-important initiative that we really hope succeeds.

26 No.

27 Liner supply issues have been the drawback.

28 N/A.

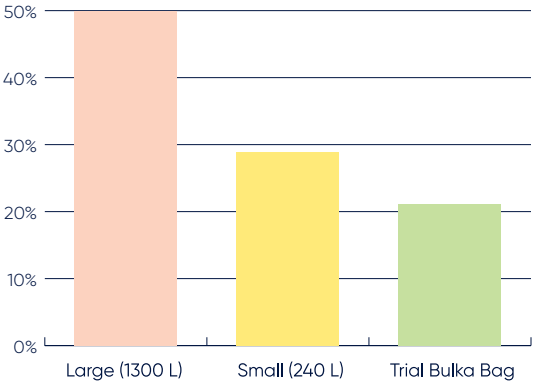
29 Is it possible that we could use bulka bags to put the wrap in as this is something we would be recycling.

Appendix B: Farmer feedback - End of trial survey

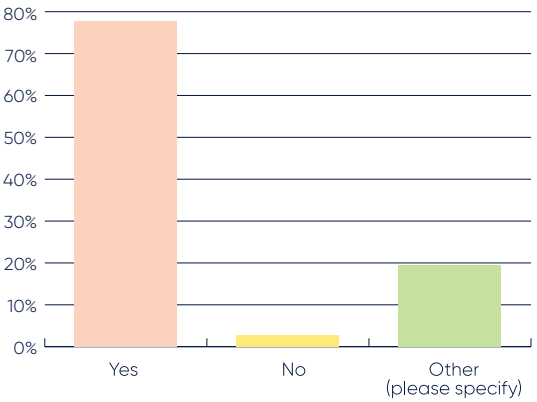
The Silage Plastic Recycling Trial – End of Trial farmer feedback survey was sent to trial members on February 27. See appendix G for questions. At the time of this report's submission, 45 farmers (or 50% of the 90 involved throughout the trial), had completed the end of trial survey. Some of these, however, had contributed to earlier mid-trial survey as well and others that completed the mid-trial survey chose not to complete the end of trial survey.

Between the mid-trial survey, one-on-one phone interviews, and the end of trial survey, most trial members had provided feedback on their experience with the trial.

Q1. What size recycling bin are you using during the trial?



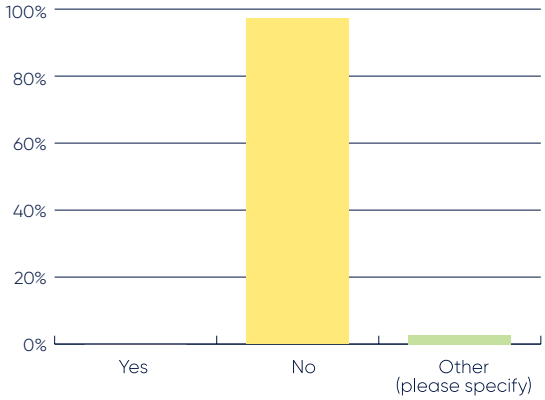
Q2. Is the bin and liner / bulka bag system you are using suitable to your needs?



"Other (please specify)" responses:

1 It's awkward to tie off and can be difficult to handle when full.
2 maybe could be a better design, was difficult to get workers to adopt change to bags.
3 would prefer a skip bin or similar - bags were hard to fill (Bulk bag user).
4 But need to be a large bin on farm cmon guys we are better than that.
5 Did work but was far from ideal (Bulk bag user).
6 No, I would have preferred to have gone with the smaller more manageable system.
7 Kind of...a skip bin would be better (Bulk bag user).

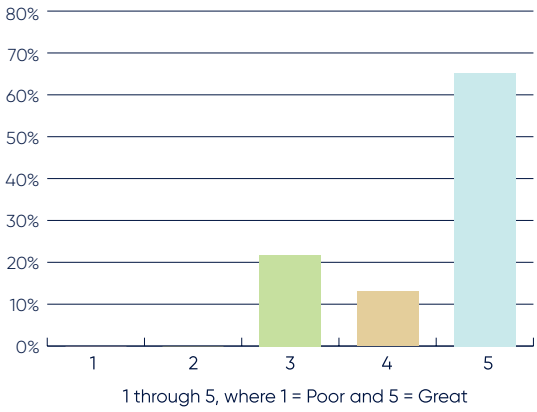
Q3. Are the wrap cleaning requirements too strict and difficult to meet?



"Other (please specify)" responses:

1 Mostly fine, but will limit capacity to recycle plastic during wet winter months.

Q5. How was your experience at the Council transfer station when you dropped off plastic?



Q6. How could it be improved?

1 Shallower side to bin so not don't have to throw so high.

2 Bags were heavy and hard to get off trailer.

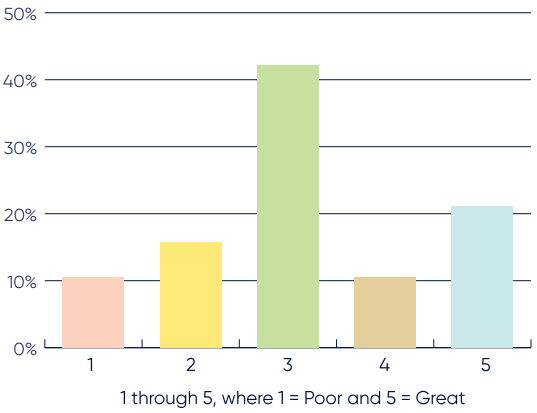
3 Bag supplies need to be quicker.

4 No suggestion. Worked perfectly for us.

5 Nothing really.

6 No issues.

Q8. How was your experience requesting, paying for, and receiving an on-farm collection?



Q9 How could it be improved?

1 A bit time consuming searching through old emails to work out how to pay for pickup.

2 Was all a bit clumsy, order 10 bags and 6 are delivered. Hard to keep workers engaged if the right equipment or bags aren't on farm to use.

3 NA.

4 I always dropped off.

5 no N/A option offered. We haven't fed silage yet in 2023.

6 Was all good for the trail but may need a more structured system than e-mail for an industry wide program.

7 Going through the online payment was a bit confusing for the first time.

8 Eventbrite not that easy.

9 Need to give address for each individual item not just one off details and then how many liners.

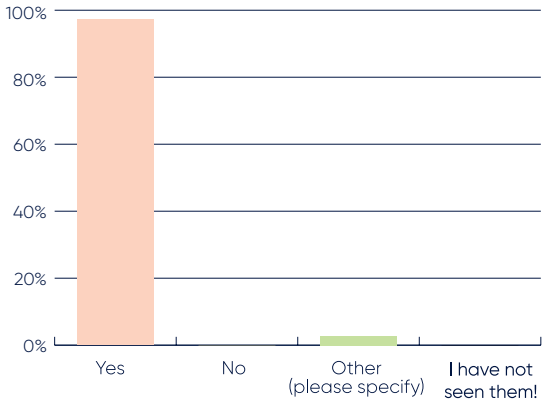
10 Nil.

11 embed the cost of pickup in the price of liners.

12 Not applicable.

13 Never had one.

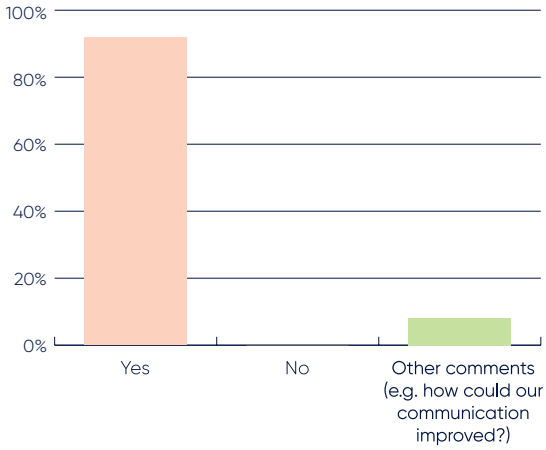
Q10. Do you agree that the instructions and educational materials developed for the trial were easy to understand and follow?



Other (please specify)" responses:

1 Haven't read them - was already separating unwanted materials as a matter of practise.

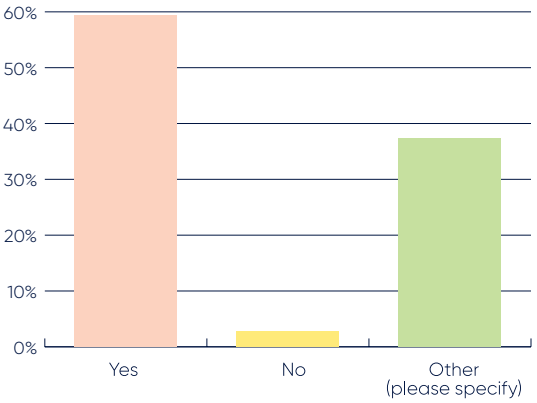
Q11. Communication and response time with the trial coordinator has been satisfactory



"Other (please specify)" responses:

1 Communication and supply need better co-ordination.
2 Didn't receive bags until quite late in trial (bulk bag user).
3 We haven't fed silage yet this season - so to conclude the pickups in March was a bit pointless for us.

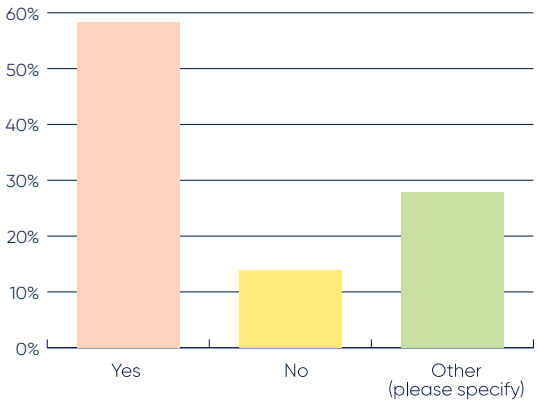
Q12. To simplify the plastic collection process and minimise costs to farmers we are considering a system which mostly offers on-farm collection (for a fee) and has only a handful of drop-off points. We would aim for on-farm collection fees that are less than or comparable to current landfill charges and much less than current skip bin collection costs. We estimate that the eventual charge would be approx. $40 per large liner / bulka bag full of plastic and $40 for three small liners full. Would you still participate in the silage plastic recycling program if these changes were made?



"Other (please specify)" responses:

1 The drop off is easy for us. we live near the Peterborough site.
2 It could be simplified using a dedicated skip and dedicated truck and dropped off at the recyclers direct.
3 The cost at the moment to drop off large liner was $2.
4 I think something more permanent than bulka bag would work better.
5 Happy to take to tip site.
6 Only if there is a drop off at Peterborough still.
7 $40 for three small liners seems a little high.
8 We would most likely opt to drop at a depot at this cost.
9 Costs seem excessive. We already pay to have rubbish picked up.
10 Maybe the free drop at landfill works really well.
11 the cost maybe a bit high so I would look for other options.
12 the Drop off at Tip site worked OK
13 We have our own bulka bags.
14 should have bulk volume collection discounts eg 10 plus liners 50% less.

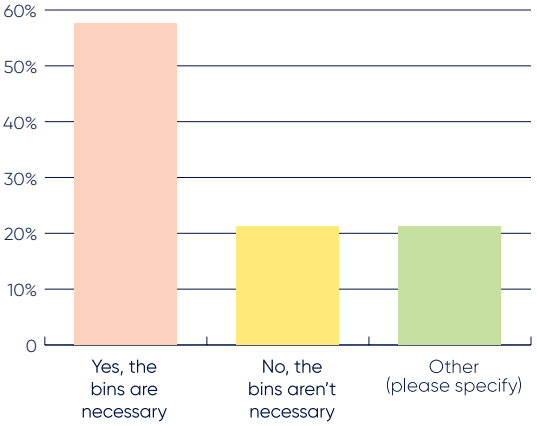
Q13. The cost of the large bins being used in the trial is currently around $680 each and the bulk bag stands are around $250 each. You will be able to keep these at the end of the trial. Would you still participate in a silage plastic recycling program if you had to pay for the bin yourself?



"Other (please specify)" responses:

1 I don`t need bins.
2 Can we use a large skip as we do for general waste that is collected by truck -if we dont recycle we do end up putting the plastic in general waste so cost will be no different.
3 The fertiliser or pellet bags could also work potentially. Possibly not pay I'd have to think about it I'm unsure if farmers would take it on plenty still happy to burn it.
4 The 680 is abit steep but would pay 250 for bulk bag stand also we often get single use bulka bags with other products so would be able to reuse these.
5 I had the small bin and will still use it.
6 We couldn't put the stand together. It just fell over. I think we done something wrong.
7 Stand was a waste of time and I didn't use it. (Bulk bag user).
8 Yes, on the knowledge it was a system that would continue longer term.
9 I only used 240 litre place ratchit strap around to keep bag tight and Tramp worked well.
10 I have my own stand. You can have this one back if you like. (Bulk bag user).

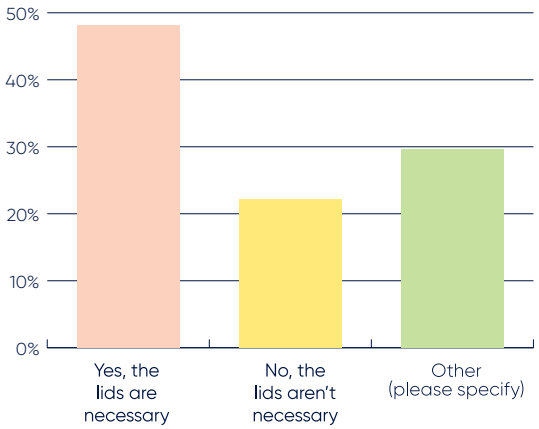
Q14. Assuming farmers are still required to store bale wrap in clear plastic bin liners or bulk bags provided, do you think the recycling bins or bag stands are necessary? Could you still manage filling the liners/ bulk bags with bale wrap and keep the plastic collected clean and mostly free of water without the bins/stands?



"Other (please specify)" responses:

1 Maybe redesigned to easier to use.
2 Skip preferably.
3 I think bins similar to rubbish collection bins would be more suitable.
4 To compact the wrap into bags the bins are necessary.
5 The stands make it considerably easier to fill the bags.
6 my small bin was good as i could press in the wrap and fit more into the bags.
7 The bins are effective but fiddly. A staff member in a rush or lacking enthusiasm is not going to take the time they'll just throw the rubbish on top or around a full bag. A skip is the go.

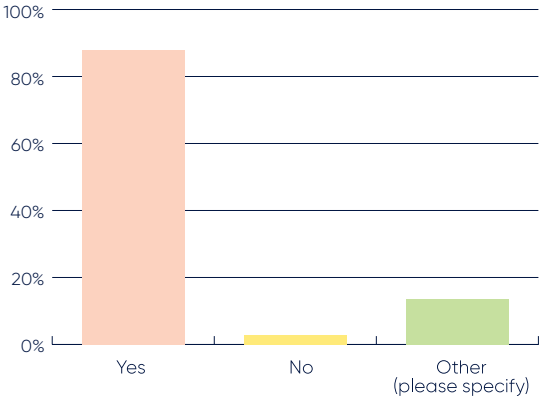
Q15. The lids for the large recycling bins are an expensive component of the bin (e.g. about a quarter of the cost). Do you think the lids for the recycling bins are necessary? Could you still manage filling the liners and keeping the plastic collected clean and free of water without the lids for the bins?



"Other (please specify)" responses:

1 Rains too much in our area to not have some sort of lid.
2 We used a small bin stored undercover.
3 Bins are not necessary at my farm.
4 Use bulk bags.
5 Can put bins in the shed, but lid system keeps bag in place while compacting wrap.
6 It would mean storing the bin in the shed, we could make it work but would vary farm to farm depending on the time of year they are feeding silage and rainfall conditions.
7 In high rainfall or windy conditions the lids are necessary, a net might work in windy areas.
8 Didnt have one and kept our small one in our shed.

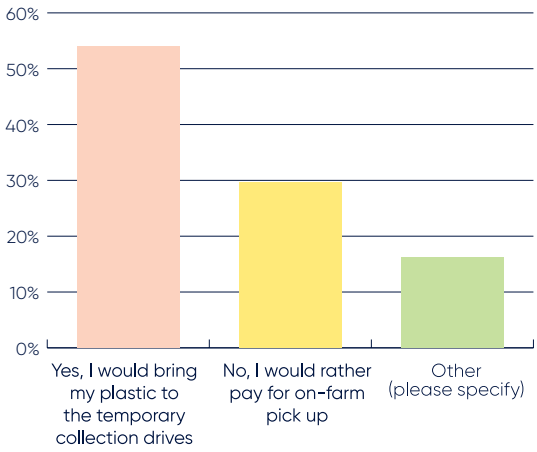
Q16. The bin liners being used in the trial cost around $11 each for the large bins, $6 for the bulka bags, and $3.50 for the small bins. You have been provided these for free for the trial. Would you still participate in a silage plastic recycling program if you had to pay for the liners yourself?



"Other (please specify)" responses:

1 If they are getting a free product then turning it into something and selling then why are we being charged to provide something if it's turning a profit. Is should be free and as it builds and become s more profitable we should be selling it there's plenty of grain waste which still gets turned into something and sold.
2 Yes, but it would be more enticing if they were free.
3 No, I have bought smaller clear bags off ebay previously.
4 I would need to work out the cost of liner and pick up as at $51 it would be easier and cheaper to throw the material in the rubbish skip.
5 please note, we used to purchase these ourselves previously.

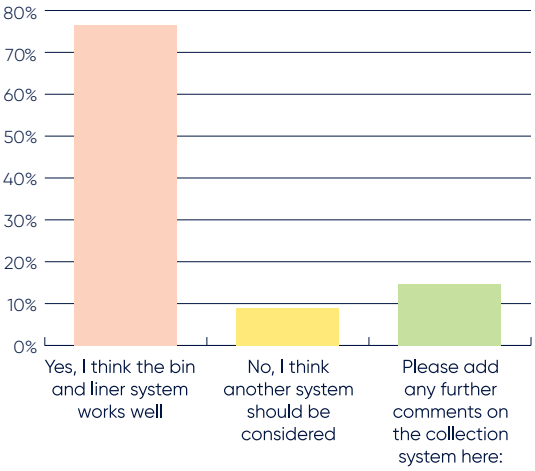
Q17. If we were to offer more options for free drop-off of plastics, one way to achieve this would be to run temporary plastic collection drives at a few strategic locations. These collection drives would last for one or two days, once or twice a year in each location – depending on the amount of plastic used in the area. If farmers missed that window, however, they would need to arrange for on-farm collection or bring the plastic to the next closest collection drive. If temporary collection drives were offered within 30 km of your farm to allow for free drop-off of plastic, would you use that service? Or would you prefer to pay for the convenience of on farm collection?



"Other (please specify)" responses:

1 Depends on how many bags there are for collection.
2 A combination of both would suit us.
3 I'm happy dropping it off at transfer station.
4 I'd prefer no cost.
5 Rather drop off at our nearby transfer station (Peterborough).
6 The timing of the service is important to me, otherwise I will use the local transfer station.

Q18. For the silage plastic recycling scheme to work long term, it is important that we keep the plastic as clean as possible from farm all the way through to the recycler. Otherwise, the recyclers will not accept it. The bin and liner or bulka bag system allows us to see into the liners and check for contamination. It also keeps the plastic contained and off the ground so that we minimise how much mud and grit is added to the plastic along the way. The large and small liners also provide a rough unit of measurement for the volume of plastic collected from of each farm and allow us to charge per unit. The fact that multiple liners of plastic can be filled and stored on-farm prior to pick up allows our on-farm collection service to be more cost effective and service more farms. Skip bins do not offer this flexibility. Once a skip bin is full, it needs to be collected. Skip bins are also more difficult to audit for contamination and are expensive to purchase. Collection or drop-off of loose plastics without any sort of bin or container results in large amounts of contamination and severely limits recyclability. For these reasons, our current preference is to continue to use the bin and liner system for collection of bale wraps. Do you agree with this preference?



Further comments:

1 It would be beneficial to be able to compress the silage wrap into something similar to a wool bale to utilize as much bag space as possible and make handling easier.
2 I think the bin and liner system could work.
3 Bulka bags better than bins.
4 Personally the only system I feel is sustainable is a designated skip bin for plastic, collected in the same manner as usual skips.
5 If using skip bins I think you will get more than just plastic.

Q19. Are there any other comments you would like to make about the trial?

Further comments:

1 It was good to be involved in this trail.

2 Important that the silage wrap issue is addressed and we need to change our on farm practices to make sure recycling works.

3 We would like to see options for recycling net wrap to in the future.

4 Please make sure this program continues.

5 I think going forward the ability to recycle silage wrap will be very important.

6 Worked well.

7 Ultimately the product is relatively free to the recycler yes they pay for the cartage surely if we supply a clean product we should get the bags free of cost

8 Due to the good season while the trial ran, we didn't use as much silage as usual.

9 Nil.

10 We would love to see this program continue in a more permanent way. The trial ran at a time of year that did not allow us to recycle most of our wrap however we were still able to recycle a fair amount.

11 Farmers know about recycling. Perhaps advise what the plastic is being used for once recycled.

12 Any feed back on contamination as each farm had their own delivery number specified on the bags.

13 This needs to become a permanent thing soon. It's an inditement on our industry that we are still doing trials for plastic recycling in 2023.

14 This is a great initiative and I would be pleased to see a portion of levy money directed to such pursuits. I think if everybody knows they're contributing to a scheme then they will abide by its rules and be more likely to adopt as they see it as an existing expense.... they are paying for it whether they adopt it or not.

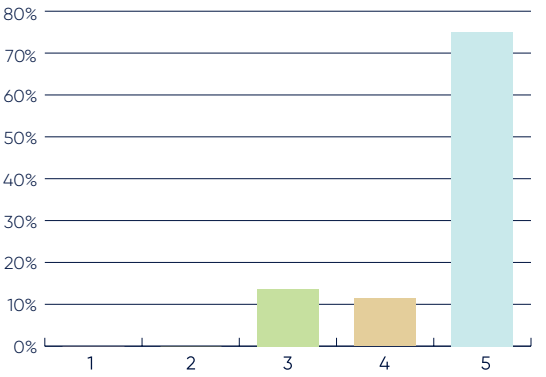
15 Bulka bags with 4straps for front end loaders.

16 The amount of silage wrap we use is too large for the size of bins offered. Going forward much bigger bins would need to be used.

17 The need to manually compress the wrap in the large liners is slow and not an ideal system of work. A system whereby it could be pressed mechanically would be better.

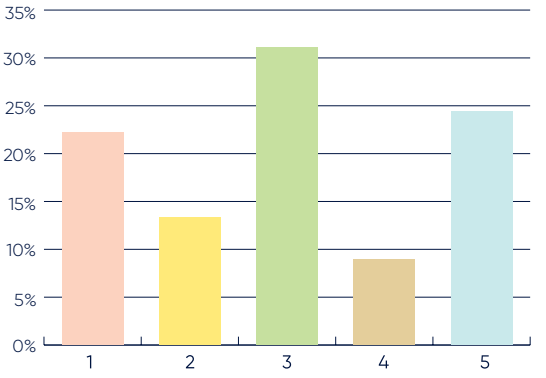
18 Payment system is very clunky and could be streamlined.

Q20. How important is it to you to have an on-going way to recycle your silage plastic?



1 through 5, where 1 = Not Important and 5 = Very Important

Q21. How important is it for you to know what product(s) have been made from your recycled silage plastic?



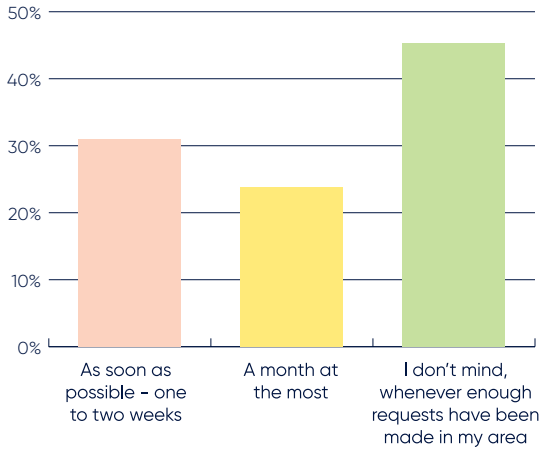
1 through 5, where 1 = Not Important and 5 = Very Important

Q21a. Why is it important to you to know what products have been made from your silage plastic?

Further comments:

1 Silage wrap on farm is a bad look for dairy.
2 Helps to keep staff motivation.
3 It's just nice to know that we are leaving v less footprints.
4 Nice to know it is being recycled rather than going to landfill.
5 Going to good use.
6 Whilst it's nice to anecdotally know the silage wrap has gone into a recycling program, in the current environment with multiple recycling soft plastic programs not actually being recycled it would be nice to know what products we have contributed to. It would also be very beneficial for the industry's social licence in regards to what sustainability practices the dairy industry is implementing and utilising.
7 See where it goes.
8 To ensure that it is being utilised.
9 It is nice to know where the recycled products end up as.
10 I'm just happy if the plastic can be put to some sort of productive use.
11 Proves its worthwhile.
12 the product is being useful.
13 So we can talk about and share accurate information about what the plastic is repurposed into.
14 I think the knowledge of what things can be recycled into can have a huge impact on changing the old fashioned mindset of farmers.
15 Better than waisting it.
16 To promote the scheme in a meaningful way to non-dairy audiences.
17 So you can see the point of recycling. Otherwise who knows where the wrap would end up.
18 So you can buy recycled products.

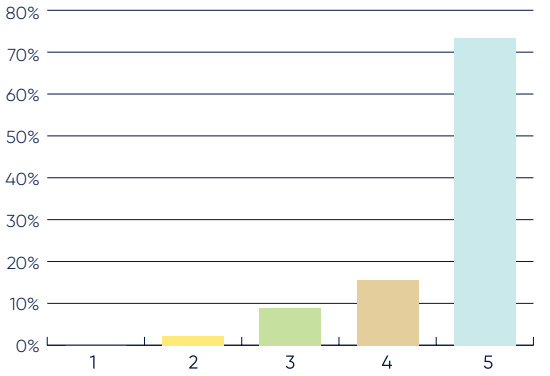
Q22. What is a reasonable amount of time to wait for an on-farm collection to take place after requesting and paying for one.



Further comments:

1 When you are doing most of your silage feed out it is hard to keep up good practices if there is too much wrap on farm.
2 I think with a skip bin you could make a monthly pickup during busy summer feeding out times and less frequently during other times.
3 Not applicable.
4 I personally don't like storing silage wrap on farm. It is unsightly and in summer represents a unwanted fuel load.
5 Happy to store on farm until enough plastic in my area to make a truck load.
6 Sometimes we'd fill 3 liners a week, other times a month to fill 1.
7 The economics need to stack up foremost. Obviously, they are unattractive to have sitting around but the sustainability of the project is more important.
8 Closer to one week.

Q23. Dairy Australia has undertaken significant work over the past two years (using Commonwealth funding) to understand and build the business case for a national silage plastics recycling scheme. Going forward, how important is it that industry service bodies like Dairy Australia and Meat and Livestock Australia continue to provide leadership in this space?



1 through 5, where 1 = Not Important and 5 = Very Important

Further comments:

1 They should be involved.

2 Remember dairy farmers already paying for DA via fees.

3 It's important to get this going but hopefully it can be picked up by businesses so our RDCs can work on other issues.

4 At end of Day the silage wrap is our problem We have bought it.

5 It is very difficult for the voice of the farmer alone to be heard.

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