



## Burning Plastic

Understanding the behavioural patterns of Sheep and Beef farmers related to farm waste streams

Sam Reynolds

Kellogg Cohort 45 – 2021/22

I wish to thank the Kellogg Programme Investing Partners for their continued support.

#### Strategic Partners



#### Programme Partners



#### Service Partners



#### Disclaimer

In submitting this report, the Kellogg Scholar has agreed to the publication of this the material in its submitted form.

This report is a product of the learning journey taken by participants during the Kellogg Rural Leadership Programme, with the purpose of incorporating and developing tools and skills around research, critical analysis, network generation, synthesis, and applying recommendations to a topic of their choice. The report also provides the background for a presentation made to colleagues and industry on the topic in the final phase of the Programme.

Scholars are encouraged to present their report findings in a style and structure that ensures accessibility and uptake by their target audience. It is not intended as a formal academic report as only some scholars have had the required background and learning to meet this standard.

This publication has been produced by the scholar in good faith on the basis of information available at the date of publication, without any independent verification. On occasions, data, information, and sources may be hidden or protected to ensure confidentially that individuals and organizations cannot be identified.

Readers are responsible for assessing the relevance and accuracy of the content of this publication & the Programme or the scholar cannot be liable for any costs incurred or arising by reason of any person using or relying solely on the information in this publication.

This report is copyright, but the dissemination of this research is encouraged, providing the Programme and author are clearly acknowledged.

Scholar contact details may be obtained through the New Zealand Rural Leadership Trust for media, speaking, and research purposes.

## Executive Summary

Environmental awareness is at the forefront of most sheep and beef farmers' minds. A perceived flood of regulation towards farmers has led to farmer protests and a dangerous perception that farmers pushing back against environmental regulation signifies farmers do not care about the environment. Burning or burying farm rubbish was formerly a habitual part of being a farmer, a lack of access to waste recycling or landfills meant there often was no alternative. There are now alternatives but, from my own experience working on sheep and beef farms in Hawke's Bay, I still see a significant amount of waste going into on-farm landfills or up in smoke.

This project discovered why some farmers still burn their plastic and investigated current waste recycling options for sheep and beef farmers. I sought to gain a deeper understanding of the mentality of farmers who burn or bury rubbish to help understand how their opinions could be swayed. The perception of farmers as kaitiaki could easily be undone by smoking piles of plastic or holes on farms full of plastic containers.

The research completed for this project was in the form of interviews with five local sheep and beef farmers, two focus groups with local sheep and beef farmers, and conversations with key stakeholders involved in plastic recycling schemes. Thematic analysis of the data gathered from the interviews and focus groups helped to give insights into the current behaviours and thoughts related to farm waste streams.

The key learnings from the farmer interviews and focus groups were that:

- Cost and convenience are current barriers to engagement
- A perceived thought that they are not harming the environment with current practices of burning and burying
- Rumours and misinformation about current recycling programs

Key learnings from current farm recycling plastics programs

- Farmers learn from Farmers
- Farmers need to see tangible products made from recycled plastic to believe it is worth recycling
- The cycle of misinformation and distrust of the current schemes must be broken
- A simple system where one company manages all of the farm waste streams, rather than the fragmented current system, would be easier for farmers to engage with

After thematic analysis of my own research and completing a literature review heavily related to farmer behaviour I concluded that to improve the uptake of farm recycling schemes there must be a straightforward model where one company deals with all waste streams. If this company could produce a number of functional, tangible products (being made from recycled plastic) it would make it much easier for farmers to engage with the programs as they can see where the plastic is going. And finally, engagement with farmer led catchment groups by this company to ensure that the correct segments of farmers are targeted for the uptake of these programs to be ensured.

## Contents

Executive Summary	2
Acknowledgements	6
Limitations	6
Introduction	7
Aims and Objectives	7
Background	8
The Problem	9
Current Agricultural Plastics Overview	11
Product Stewardship Schemes for Priority Products	11
Current Farm Plastic Recycling Providers	11
Plasback	11
Agrecovery	12
Literature Review	15
Farmer Behavioural Changes	15
Diffusion of Innovation Theory	15
Farmer Segments	16
Behavioural Change	20
Social Issues	20
Change	20
Culture	21
Agricultural Waste in New Zealand	21
I. Trish Rankin – What a Waste My Story	22
II. New Zealand Rural Waste Minimisation Project Milestone 6b phase three project completion report	22
Discussion	23
Results	25
Farmer/Grower Themes	25
Misinformation/Distrust of Current Recycling Providers	25
Convenience/Cost Concerns	25
Tangible Recycled Products	25
False Starts	26
Lack of Awareness of Environment/Legacy Farmers	26
Case Study – Fonterra the Co Operative Difference	27
Case Study 2	29
Future Post	29

Discussion	30
Culture	30
Information Flows to Farmers	31
Change	32
Farmer Led Catchment Groups	33
Conclusions	33
Recommendations	34
One Stop Shop (Company) is a must	34
Tangible Products	34
Engage with Farmer Led Catchments	34
Beware of False Starts	34
References	35
Appendix	37
	37

## Acknowledgements

Firstly I'd like to thank Scott, Patrick, Lisa and the Rural Leaders team for giving me the opportunity to be on the course. Secondly, Hawke Bay Regional Business Partners for funding half of the course. My parents and girlfriend Kate for being patient with me while I was on the course, Dad thanks for harvesting the Rocket seed while I finished the assignment.

Finally thanks to all of the Key Stakeholders who helped with Data and interviews in particular Fraser Scott from True North Consulting, Richard Carroll (and his team) from Agrecovery.

## Limitations

Covid prevented me from travelling to visit a number of key stakeholders who I would have liked to interview in person for this assignment (Agrecovery and Future Post in particular).

The main limitation was finding actual Data on the volumes of Farm Plastic that come into New Zealand each year and how much goes out as recycled plastic. Companies do not want to release this information for competitive reasons. I have used Data from a PWC report to estimate the volume, even with a conservative estimate and large margin of errors it is still a very low amount that is being recycled.

I would have liked to increase the number of farmers interviewed and surveyed but I felt the ones who were unlikely to respond to a survey would be the ones who were not engaging with a recycling program at least not willing to admit they were not engaging.

## Introduction

Farmers are Kaitiaki of the land, burning or burying of rubbish goes against this. This project sets out to investigate why some farmers still burn and bury their rubbish. He Waka Enoa pushes farmers to be aware of greenhouse gas emissions and their impact on the environment. Farm plastics should be included in this. It would be a significant blow to the image of New Zealand farming if the public was made aware of the putrid black smoke that often comes from the burn holes on farms.

This project focused on sheep and beef farmers in Hawke's Bay. I am an agricultural contractor in this area and a farmer myself. Part of the reason I focused solely on this demographic was because I suspected that these are farmers who are not part of regulation or accreditation schemes that make engaging with a recycling program mandatory. I am aware of this because I am one. Currently I am not forced to recycle my farm plastics and, although the burning or burying of farm plastic is prohibited by the Hawke's Bay regional council, enforcement is extremely limited in a rural environment (Hawke's Bay Regional Council Enforcement Office, confirmed that no fine had ever been issued to a farmer for burning farm plastics).

Dairy Farmers' accreditation schemes and an incentivisation program by Fonterra mean that engagement with waste recycling streams is extremely high in that industry, but the same level of awareness does not extend to sheep and beef.

## Aims and Objectives

The aims of this project were to:

- Understand the current recycling systems for farm plastics
- Gain an understanding of why farmers are or are not using these recycling schemes
- Increase my knowledge of behavioural theories related to Farmers

The Objectives are to:

- Give an overview of the current schemes, systems and attitudes towards these systems
- Find a way for this to become a positive promotional opportunity for New Zealand farmers
- Use current research to help guide information channels towards necessary targets

## Background

Farm Plastics can be broadly split into three categories:

1. Firstly, agrichemical containers that are made from **high density polyurethane (HDPE)**. HDPE is a suitable packaging for Agri chemicals because of its durability and resistance to the products that they contain. They range in sizes from one litre up to 1000l pods for bulk buying of chemicals. The majority of containers are bought in the five to twenty litre range. There is not a safe alternative to HDPE containers, they are often transporting dangerous chemicals and any risk of spillage would be detrimental to the environment or people in the vicinity.
2. The second main type is **silage (also known as baleage) wrap**. This is a stretchy film made from low density polyurethane (LDPE). Silage is effectively pickled grass or crop. Grass or crop is baled or stacked into large piles, LDPE is then used either to wrap each individual bale or cover the silage stack creating an anerobic environment that preserves nutrients as much as possible (ScienceLearn NZ, 2006). The silage is then fed to the animals when conditions are dry or cold and natural feed growth does not occur. The LDPE wrap must be air tight and in the case of baleage wrap it must have an elastic element so that it wraps tightly around the bale and does not let oxygen into the bale. This wrap is hard to recycle as it often catches organic matter and must be cleaned before being processed.
3. Finally there are **polypropylene (PP) bags**. These range in size from 5kg bags to One tonne bags. They are a strong sacks used to transport seed, fertiliser and stock feed. Historically these bags could be used more than once but Health and Safety regulations have forced manufacturers into often declaring the bags as single use to prevent wear in the bags and potential for bags to break putting humans at risk of injury.

The common theme with these plastics is that they are hard to replace with a compostable alternative. The plastics have very specific jobs and they are highly effective at these jobs, protecting the environment and the operators from the dangers of the goods they are transporting. The government is aware that it is hard to find alternatives and has included farm plastics in the priority product stewardship scheme, (see section below for a full explanation of this scheme). In my experience dealing with farmers and being one, it was common practice to burn or bury all of your rubbish. A lack of access to recycling or awareness of recycling programs meant a habitual "Saturday morning burn" was, and in some cases still is, common practice on farms around New Zealand.

## The Problem

Finding data on farm plastic inflows and what is recycled each year proved to be very challenging. Suppliers of chemicals and farm plastic do not release information, (except to the government), in order that competitors do not know volumes they are importing. Fortunately, Agrecovery commissioned PWC to complete a *Farm Plastics Priority Product Stewardship Scheme: Materials Flow Analysis* in 2019/2020. The below graphs and tables are taken from this report.

Figure 1 Volumes of Baleage and Silage film Wrap from PWC Report 2020

Figure 11: Weight of plastic packaging of all farm plastics for the year ending 30 June

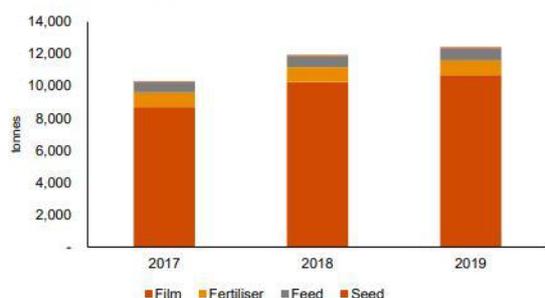
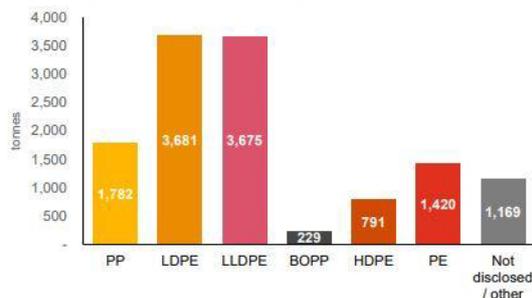


Figure 12: Weight of plastic packaging of all farm plastics by plastic type for the year ending 30 June 2019



To be clear the above graphs and numbers do not include chemical containers which are recycled by Agrecovery. PWC only tried to ascertain as follows:

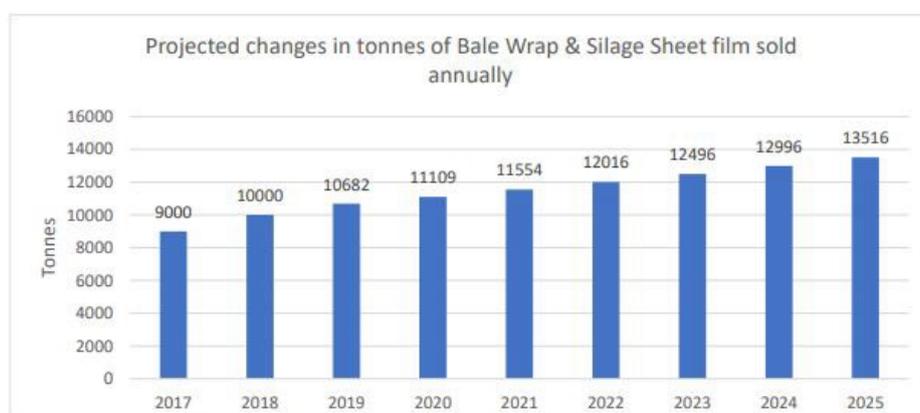
PwC developed a survey to collect data on the volume of the following farm plastics:

- seed, feed and fertiliser bags
- crop packaging films (eg silage wrap/covers and horticultural films/netting)

This is because Agrecovery's recycling program for Agri Chemical containers is a separate recycling program to that of the baleage and silage wrap recycling – this will be explained in the following section.

Agrecovery extrapolated that data from the PWC report to see the following trend for coming years:

Figure 2 Agrecovery extrapolated date for Baleage and Silage Wrap (Green Farms Report 2021)



Plasback explained via email that in 2019/2020 they recycled 2600 tonnes of baleage and silage wrap and since 2006 they have recycled 19000 tonnes.

Using PWC's data in 2019 11,109 tonnes of silage and baleage wrap were sold in New Zealand, this equates to **less than 25% of this type of plastic being recycled.**

Using the extrapolated Agrecovery/PWC data, just 2017 and 2018 volumes of silage and baleage wrap would cover the amount that has been recycled in the fourteen years of Plasbacks operation.

The statistic of less than 25% being recycled is in line with my own personal observations from farmers in my district and is in line with my survey and focus groups' observations. Fifteen years ago, there were no options for recycling either plastic containers or silage wrap. Everything was buried or burnt on the farm. It is not feasible to expect farmers to change this ingrained behaviour overnight as recycling options became available and at an expense.

The less than 25% of silage and baleage Wrap may not directly correlate to less than 25% of Agri Chemical container being recycled. For the purpose of the report and due to the lack of transparent data about recycling volumes it is safe to assume that less than 50% of farm plastics are currently being recycled.

## Current Agricultural Plastics Overview

### Product Stewardship Schemes for Priority Products

As part of the wider plan to reduce the amount of rubbish ending up in landfills or polluting the environment, the Government has declared six priority products for regulated product stewardship under the Waste Minimisation Act 2008. Farm plastics are one of these six priority products. Regulated product stewardship means regulations are used to increase incentives for circular resource use and the responsibilities of producers for managing end-of-life products. It can put more responsibility for a product's life-cycle and waste management on manufacturers, importers, retailers and users, rather than on communities, councils, neighbourhoods and nature (MFE website, 2021).

The expected effects of product stewardship schemes are for circular resource use, internalised end of life costs, public accountability and collaboration. The expected schemes must be not for profit organisations and generally only one scheme per product unless specific criteria are met. There is currently a co-design process underway for the Product Stewardship guidelines being run by the government and Agrecovery.

### Current Farm Plastic Recycling Providers

#### Plasback

Plasback was founded in 2006 by Agpac, an importer of baleage wrap to New Zealand. To date they have recycled 19,000 tonnes of Farm Plastics. The majority of plasbacks recycling is baleage wrap (LDPE Plastic). They offer a user pays service where the farmer purchases plastic bags or hard plastic bins that are used to collect the used wrap on farm. The farmer organises for Plasback to come and collect the wrap for another fee. The collection service is fragmented and often uses different contractors in different regions to collect the bags. The registration process on the Plasback website is clumsy, complicated and at times confusing.

Figure 3 Plasback logo (Plasback website)



Plasbacks current model does not fit in with Product Stewardship Scheme guidelines. It is a for profit company and a user pays model. They have negotiated with the government to remain in practice until at least 2024 with the government helping them to purchase bale presses to help with transport of wrap. Plasback's involvement in recycling plastic waste proved to be contentious throughout my research, it seemed many in the industry felt Plasback was heading in its own direction. This is a complex and sometimes political minefield as Plasback has had government funding in the past but as outlined above their current model does not fit with Product Stewardship guidelines.

## Agrecovery

Agrecovery provides agrichemical container recycling and chemical recovery for New Zealand farmers and growers.

The brand owners that distribute agrichemical, animal health and dairy hygiene products into the New Zealand market take responsibility for the disposal of these products and their packaging at the end of their useful life. They do this by paying the

Agrecovery Foundation fees and levies to cover programme costs. This enables free access to programme users (Agrecovery website, 2021). The current Agrecovery model fits all of the specifications for the governments General Guidelines for Product Stewardship.

Agrecovery are seeking to expand the services they offer to farmers and growers to include other products for recycling, they are part of the co design process and are working on the establishment of other similar schemes to take more farm plastics as part of the Priority Product Stewardship Scheme. In my own experience I have found them professional to deal with and great communicators. I did not fully complete my registration process when I was signing my company up to Agrecovery (I was missing some information). I intended to gather the information and complete the registration process the following week, the following day I received a call from Agrecovery asking what the issue was and if there was anything they could do to help.

Figure 4 Agrecovery logo (Agrecovery Website)



Figure 5 Agrecovery Brand Partners (Agrecovery website)



**AGRECOVERY**  
Rural Recycling Programme

**Participating Brand Owners**

**0 - 60 litres**

Take your empty triple-rinse containers from these brands to the nearest Agrecovery collection site or event for free.



**61 - 1000 litres**

Free on-property collection for empty triple-rinse drums & IBCs from these brands. Maximum of 4 drums or 4 IBC. Book at [www.agrecovery.co.uk](http://www.agrecovery.co.uk) or call 0800 347 348.



DO YOU HAVE UNWANTED CHEMICALS TO DISPOSE OF?

7-14-23-AL-v35

## Methodology

The data that Agrecovery, PWC and True North Consulting provided gave me a broad overview of volumes and a small understanding of farmers' attitudes towards waste. To get my own insights I completed:

- Two focus groups with each having six sheep and beef farmers from Hawke's Bay
- Interviewed five other Sheep and Farmers individually
- Interviewed Fraser Scott (True North Consulting), Richard Carroll (Agrecovery), Chris Hartstone (Plasback), Jenny Marshall (Ministry of the Environment) and Caleb White from Hawke's Bay Regional Council.

I used thematic analysis to interpret the responses to the interviews and focus groups.

Concurrently I did a literature review focusing on farmers behaviour and the most effective means of changing behaviour

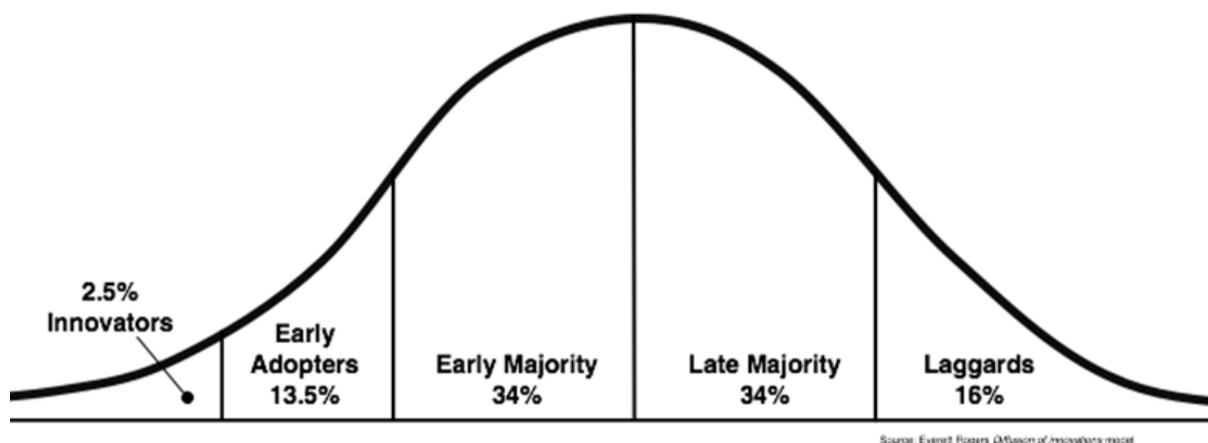
## Literature Review

The Literature Review is split into two sections the first relating to behavioural changes and attitudes of farmers and the second literature related to the current waste systems in New Zealand.

### Farmer Behavioural Changes

#### Diffusion of Innovation Theory

Figure 6 Innovation of Theories (Rogers, 1962)



The Diffusion of Innovation theory was Developed by EM Rogers in 1962. It is one of the oldest Social Science models and is still applicable today. Katz et al (1963) defined the diffusion of innovations as “the acceptance, over time, of some specific item, idea, or practice, by individuals, groups, or other adopting units, linked to specific channels of communication, to a social structure, and to a given system of values or culture”.

Adoption of innovations and management changes has been described as a bell-shaped curve, initially by Rogers (1962), revised by Rogers and Shoemaker (1971) and again by Rollins in 1993. Journeaux et al, 2016 sum up the segments below:

The first **2.5% of the population are the innovators**. Innovators are described as adventurous, eager to try new ideas, have diverse relationships, and often communicate with, and belong to, a group of innovators. These are what I like to think of as the quirky or different people.

**Early adopters make up 13.5%** of the population and generally have a larger degree of leadership and often are looked to by other adopters for advice and information and are therefore key people in achieving positive behaviour change – these are the ‘cool people who are often leaders’.

The **early majority are 34%** of the population and adopt before the average time. They tend to deliberate for some time before adopting an idea and follow the early adopters willingly, but will seldom lead.

The **late majority also make up 34%** and tend to be sceptical and cautious in their approach. They do not adopt until most others in their social systems have done so, and social norms need to favour the innovation or practice before they are convinced.

The final group are the **16% of laggards**. These are traditionalists who have a propensity to be guided by the decisions of the past, are very suspicious and allow a long time to elapse before adopting an innovation or practice.

## Farmer Segments

There has been recent work done in New Zealand and Australia that tries to better understand farmer behaviour. The Derived Attitudinal Farmer Segments (DAFS) method was developed in conjunction with Dairy Australia who wanted to understand their farmers. It was developed in 2000 as a means of identifying groups of farmers with similar world-views and preferences. They developed this method so they could better target specific content at segments within the farmer groups they identified. The DAFS method has particular strengths in accounting for both individual and situational characteristics of farms and farmers (Waters et al., 2009).

**“Farmers are motivated by a diverse range of drivers and constrained (and enabled) by a range of social, cultural, economic and physical factors. Farmers will therefore react in different ways to external drivers of change and will respond differently to encouragement, incentives and legislation aimed at influencing their farming practice.”** (Thomson, 2008 in Waters et al., 2009).

Thomson captured the response of farmers to 35 attitudinal statements, using a non-hierarchical clustering method (K-Means clustering) cases (farmers) are grouped according to their patterns of response (Water et al, 2009). A telephone survey of 450 Australian Dairy Farmers was completed, data collated and the table below displays the results.

Table 1 DAFS Results Breakdown (Thomson, 2000)

**Table 1: Overview of attitudinal characteristics of each DAFS group. Cells indicate if the group is higher, lower or close to the sample average on each attitudinal index**

DAFS group:	Group 1 5.5%	Group 2 3.6%	Group 3 17.0%	Group 4 24.9%	Group 5 21.5%	Group 6 27.4%
<b>Business Orientation</b>	Low	Low	Average	Average	High	High
<b>Aversion to Risk</b>	High	High	Low	High	Low	Average
<b>Sustainable Improvement</b>	Low	Low	Average	Average	High	Average
<b>Knowledge &amp; Self-Reliance</b>	Low	Low	Low	Average	High	High
<b>Intergenerational orientation</b>	High	Low	High	Low	Low	High
<b>The 'Dairy Way of Life'</b>	Average	Low	Average	Average	Average	High
<b>Financial Pressure</b>	High	Low	Low	High	Low	High
<b>Farming Tradition</b>	Low	Average	High	Average	Low	High

'Low' = Lower than sample average. High = 'Higher than sample average'.

Waters et al provide a short summary of each group below:

**Family first (Group 1) – 5.5%** This group of dairy farmers are likely to be driven by the desire to maintain their farms so that their families can continue to enjoy the dairy way of life. They are 'established' farmers who are 'stable' in terms of their growth speed. Their risk-averse nature, combined with their lower than average business orientation and their lower than average score on the sustainable improvement index combine to make these a challenging group in which to encourage change

**Winding down (Group 2) – 3.6%** Whilst they tend to value the tradition of dairy farming, this group of dairy farmers are not necessarily motivated towards sustaining or improving their businesses for the future. They are very risk-averse and, whilst they do not tend to perceive that they are under financial pressure, this group will be difficult to motivate to make changes in their enterprises. They tend to be older than the average dairy farmer and have a lower than average level of formal education.

**Love farming (Group 3) – 17%** These farmers are very positive about the future of dairying and are motivated to ensure the next generation can continue to enjoy the tradition of farming as much as they do. This is reflected in their willingness to make improvements to their farm businesses to ensure its sustainability. They do not feel under financial pressure to the extent that most other dairy farmers do, and are quite open to taking some risks.

**Established and stable (Group 4) – 24.9%** These are self-reliant, risk-averse dairy farmers who value the dairy farming tradition but are not particularly concerned about the future of their farms in terms of intergenerational transfer. They feel that they are under financial pressure, which combined with their high aversion to risk, make them likely to be difficult audiences to 'sell' R&D outcomes to.

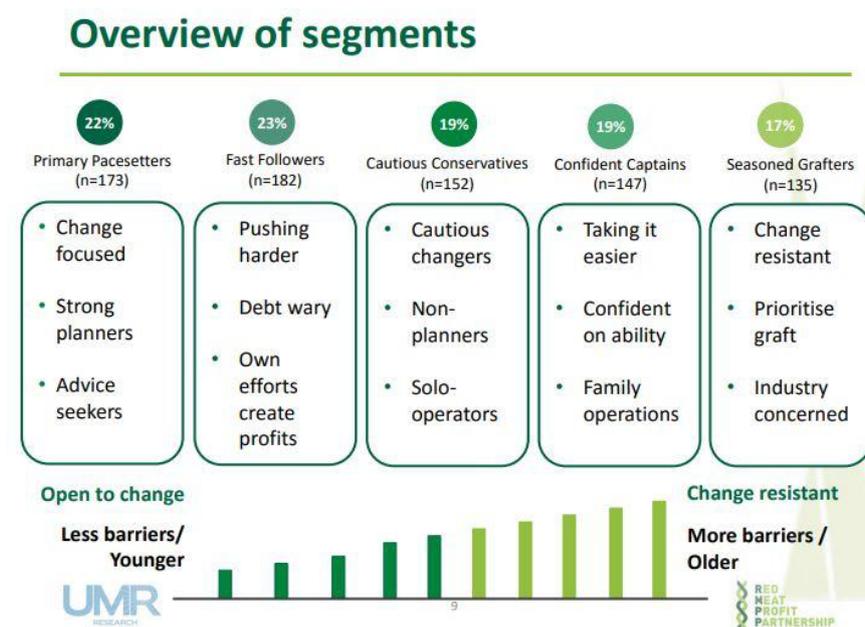
**Open to change (Group 5) – 21.5%** This group of farmers enjoy running a dairy business and are motivated to develop a sustainable and successful business. They are prepared to take some calculated risks. They are not particularly concerned about the tradition of farming and are less likely to be motivated by ensuring the next generation continue on with the farming business. However, they do enjoy the dairy way of life.

On a similar mission to Dairy Australia the Red Meat Profit Partnership (RMPP) in New Zealand commissioned research by UMR to ensure that RMPPs projects reflected the current issues faced by farmers and farm advisors. RMPP commissioned an extensive research programme in 2014 involving more than 1,000 farmers and industry professionals from across the country. The research focused on three areas:

1. **Understanding characteristics of high performing farmers**
2. **Understanding the motivations and barriers to change (on farm)**
3. **Understanding best approaches to drive extension (knowledge and technology uptake)**

The results are the table below:

Figure 7 UMR RMPP Research finding on New Zealand Farmer segments (UMR, 2014)



These segments are quoted from UMR, (2014a).

**‘Primary Pacesetters’ (22%)** are performance driven, strategic planners, are most interested in adopting new practices and making changes. They are strongly open to accessing professional and technical advice, have strong husband/wife teams. This segment is skewed towards younger farmers but there are also many older farmers who are pacesetters. These farmers learn from other farmers, spouse and/or other family, and small group sessions led by farmers and technical experts.

**The ‘Fast Followers’ (23%)** will take calculated risks but only on proven practices. They are one of the younger segments, have the energy to keep driving their operation and have a focus on performance. A significant difference between this segment and the Pacesetters is that they are less comfortable with borrowing money to lift returns. They learn from other farmers, spouse and/or other family and veterinarians.

**‘Cautious Conservatives’ (19%)** are more introverted, less inclined to be involved in industry activities and tend to be more risk adverse. They are less likely to be avid planners and more likely to keep doing what they did last year. They know how to farm to stay in business and would have kept their farms operating through tough times when others would have failed. They learn through other farmers, veterinarians, and independent advice from a technical expert.

**The ‘Confident Captains’ (19%)** are most interested in taking it easier, have a strong focus on lifestyle and have confidence to farm mostly on instinct (or gut feel). They will be solid family farmers that will be reasonably comfortable and will have little need or desire to push harder, unless an on-farm driver such as a son, daughter or motivated manager is prepared to take up the reins. They learn through other farmers, spouse and/or other family and veterinarians.

**The ‘Seasoned Grafters’ (17%)** who are the oldest segment with close to half being over 60 years. They will have worked hard throughout their long farming career and now be quite resistant to change. To be fair, they will not have any need to change; they would have been successful in their own right, evidenced by their ability to survive long-term in a tough industry. They also learn through other farmers, spouse and/or other family and veterinarians.

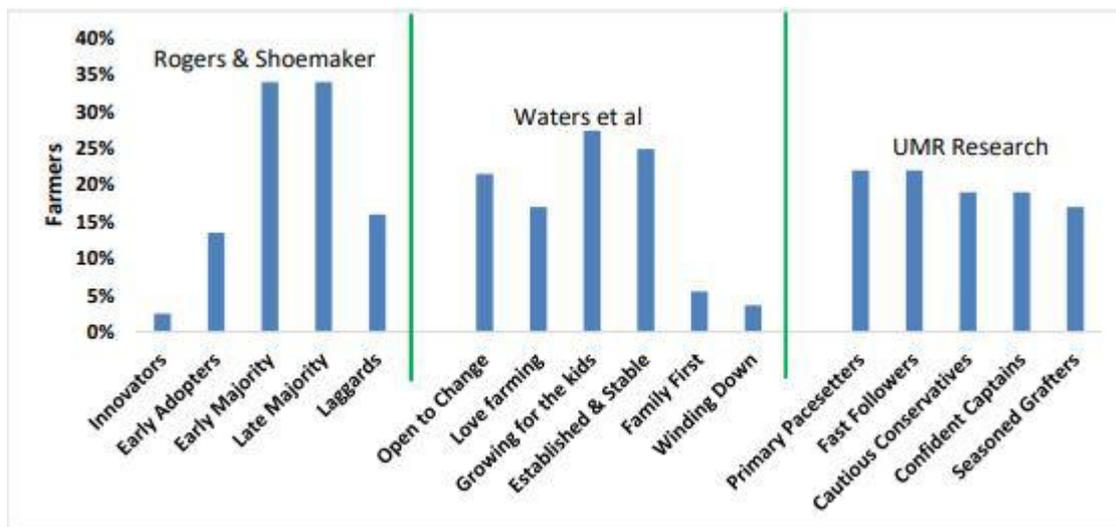
It is worth observing that despite five very different segments being identified by this research, note the last sentence of each group – **“They learn through other farmers, spouse and/or other family”**. Farmers learn from other farmers. A quote from their study is worth mentioning:

**Farmers are always looking over the fence at the next door neighbours and people down the road. And if it turns out to be a good idea they will do it. They have to be left to make up their own minds because they are stubborn and independent. You can’t tell them something, they have to absorb it. (King Country, farmer, male, UMR, 2014)**

The UMR and DAF research suggest that farming agencies should identify the Primary Pacesetters or Open to Change groups with new ideas, these segments are the most likely to be willing to at least try new ideas. The other segments are likely to follow the innovators in years to come, but only if the innovations work and suit them. Pannell (2008) noted four conditions necessary for an individual farmer to adopt an innovative farming system: awareness of the innovation, feasibility of trialling the innovation, perception that it is worth trialling, and perception that the innovation promotes the farmer’s objectives. The Primary Pacesetters or Innovators are likely to become aware, then trial new innovations. Other farmers will then often watch for a number of years and, if the innovation is beneficial, then they may adopt.

The graph below displays the spread between different segments from the three different models, there are definitely similarities between the DAFs segments and the UMR segments but less so with the original Bell Shaped Curve model (Journeux et al, 2016). UMR research and DAFs identified the Innovators (Primary Pace Setters or Open to Change Groups) as a much larger portion of the farming population compared to that of Rogers 2.5% Innovators.

Figure 8 Comparison of Innovation adoption theories graph, (Journeux et al, 2016)



## Behavioural Change

Tafi Manjala wrote a fascinating Nuffield Scholar Report 'Good to Great Extension - Influencing on farm change at pace and scale. Bandura (2013) in Manjala (2014), notes that despite the number of times a person observes behaviour, they will only engage in the behaviour if they believe they can be successful (self-efficacy). Albert Bandura's most famous experiment was the 1961 Bobo doll study. In the experiment, he made a film in which a woman was shown beating up a Bobo doll and shouting aggressive words. The film was then shown to a group of children. The children were allowed to play in a room that held a Bobo doll. The children immediately began to beat the doll, imitating the actions and words of the woman in the film. The study dispelled the belief that all behaviour is directed by reinforcement or rewards as the children received no encouragement or incentives to beat up the doll. They were simply imitating the behaviour they had observed (Manjala, 2014). Manjala makes the point that people learn not only from their own experiences, but also from experiences of others, especially if the others are similar to the observer.

Incentives or disincentives are only part of the solution to encouraging behavioural change. Farmers observing other farmers is a large part of getting farmers to change behaviour.

## Social Issues

With respect to social issues affecting farmers, Vanclay (2004) developed 27 principles. Many that are valid to this study, but the two I feel most applicable are below;

- Principle 3. Adoption is a socio-cultural process – extension is not just a process of communication between science as the only originator of ideas and farmers as passive adopters. Adoption is a social process – it is not an unthinking response to information provided by extension, but a deliberate decision by a farmer in response to a wide range of issues. Adoption also takes place in a social context with farmers discussing their ideas
- Principle 15. Farmers construct their own knowledge. It is a mistake to believe that only "science" (as a social institution) can create knowledge that is transferred to farmers via extension. Farmers often create their own knowledge through experimentation and trial, and through their own theorising. Farmers use the knowledge created by scientists when it is consistent with their own understanding and even then adapt it to fit their own world view.

Both of these principles link directly with the quote from the King Country Farmer in UMR 2014 – adoption takes place in a social context and via a farmer's own hands on learning.

## Change

Resistance to change in farming is a perennial issue. The volume of research (some mentioned above) shows the lengths that farming agencies are willing to go to help understand how better to change farmers' behaviours. Gleicher's Formula for Change:

*Figure 9 Gleichers Formula for Change (Dannemiller, 1992)*

$$D \times V \times F > R$$

D = Dissatisfaction with how things are now

V = Vision of what is possible

F = First Concrete Steps

R = Resistance

The model above will come into focus in the findings and discussion section as I relate my own findings into the model.

## Culture

Figure 10 Schein's Model of Culture (Schein, 1992)

**Figure 1: Schein's model of culture**



Schein's model can help to evaluate paradoxical organisational behaviour; organisations can profess highly sustainable, environmental standards on the second level of the iceberg while underneath it they have completely different actions that undermine this. This will be elaborated on more in the discussion section.

Changing an organisation's culture is a challenging task. There are beliefs and norms that have been ingrained over years of work. Organisational culture has been defined as "the specific collection of values and norms that are shared by people and groups in an organization and that control the way they interact with each other and with stakeholders outside the organization" (Charles & Gareth, 2001). Edgar Schein (1992) has a more in depth definition of culture: "A pattern of shared basic assumptions learned by a group as it solved its problems of external adaptation and internal integration which has worked well enough to be considered valid, and therefore is taught to new members as the right way to perceive, think and feel in relation to these problems". Both of these definitions link back to the UMR research which found it common practice for farmers to learn from other farmers/spouses – farmers teach other farmers how to think and feel in relation to these problems. We will come to discuss this more in the discussion section, particularly in relation to farmers' thoughts on the government and regulation.

## Agricultural Waste in New Zealand

The next section of the literature review looks into two reports that directly relate to farm waste in New Zealand.

## I. Trish Rankin – What a Waste My Story

What a Waste My Story is a report written by Trish Rankin a previous Kellogger. Trish's main points: Regenerate natural systems, design out waste and pollution, and finally keep products and materials in use. The report is heavily focused on the Dairy Industry and creating Circular Economies. It was insightful and gave a thorough overview of waste streams on dairy farms through Trish's own Waste Audit. All of the current options for waste recycling were laid out and potential positive spin offs were investigated by Trish.

It was very useful as a reference point for my own report, but with the focus being on the Dairy industry as opposed to sheep and beef, I could not glean deep perceptions.

## II. New Zealand Rural Waste Minimisation Project Milestone 6b phase three project completion report

This report by True North Consulting 2018 gave a thorough overview of the agricultural plastics scene in New Zealand. It is the culmination of six years work by True North Consulting, who left no plastic unturned in their quest to find the best solutions for all parties involved in farm waste minimisation.

I had the opportunity to interview the author of the report Fraser Scott, his knowledge and advice was indispensable. Fraser was neutral and objective in his assessment of the plastic recycling industry – something I found refreshing compared to interviewing other key stakeholders who were focused on pointing out negative aspects of competing schemes.

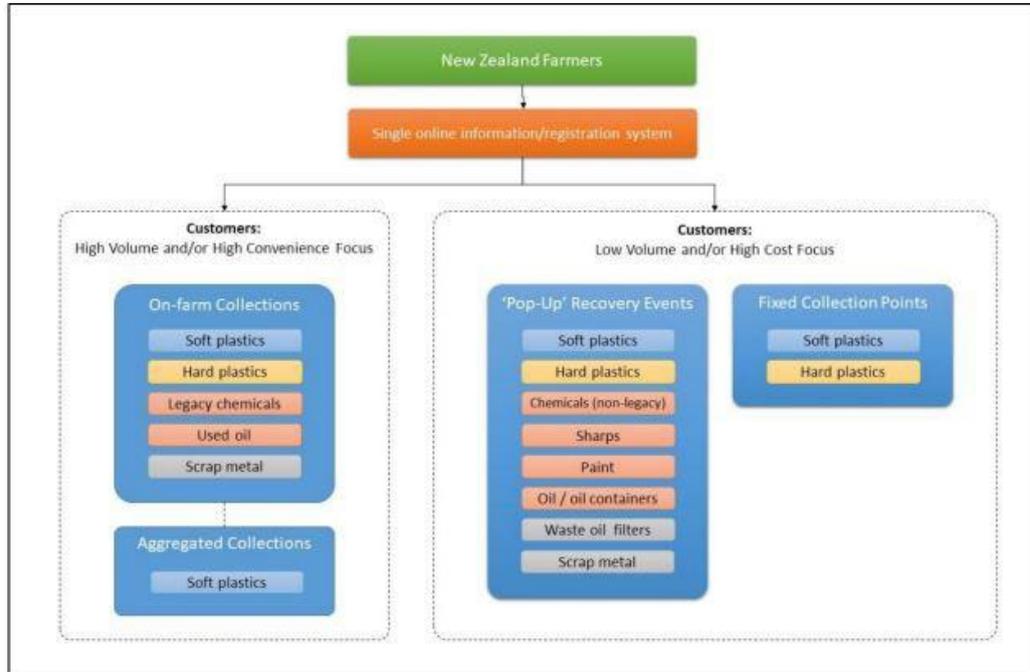
*The New Zealand Rural Waste Minimisation Project (the Project) is being undertaken to better understand the nature of waste on farms and to identify sustainable alternatives to burning, burial and bulk storage of waste.*

*The Project has the following objectives:*

- 1. To determine the impacts on and risks to New Zealand's natural resources (land, water and air), economy, and social and cultural wellbeing from current rural waste burning, burying and stockpiling practices.*
- 2. To identify new waste minimisation options for rural waste management and assess the technical and economic feasibility of these.*
- 3. To develop implementation plans with service providers for feasible waste minimisation options.*

The project investigated all current options for plastic waste, as well as government plans for the future. The end markets for plastic and current collection schemes were main focus points. The conclusion of the work was that a One Stop Shop was the most cost effective, user friendly method of collecting and then disposing of farm waste streams. True North ran two pilot programs in Matamata and Geraldine where for one day only, farmers were able to bring used chemical containers, waste oil and fertiliser/seed bags to a venue where they could be collected at once. The pilots proved successful and True North has recommended that one company take responsibility for all waste streams with a single online information/registration system.

Figure 11 True North Consulting Single System - One Stop Shop (True North Consulting Report, 2019)



The Key Learnings from True North's six years work are below:

- Farmers are already motivated to protect the land.
- Service uptake depends on flexibility in cost and convenience.
- Waste should be dealt with all at once.
- Solutions need to be designed around farmers.
- Waste end-market sustainability is the key threat to service viability.
- Legislation is unlikely to be the primary solution to current farmer waste management issues.
- Service participation is best ensured by partnering with industry organisations.
- Effective service provision and farmer engagement is being modelled by community organisations.

Soon after this report was completed government regulation classifying agricultural plastic as a Priority Product was released. This classification changed the course of agricultural plastic again but True North Report was highly influential in advising certain aspects of the Priority Product Stewardship scheme regarding farm plastics.

## Discussion

The DAF and UMR reports highlighted the need for agencies to be quite specific in the targeting of new ideas at specific farmer groups who would be more open to new ideas. If these groups can be targeted neighbouring farmers and other farmer segments are more likely to in farming terms, be looking over the fence and adopting the practise if they see benefit from it. This is what leads to cultural changes. Trish Rankins report on a circular economy is ideologically a very sound idea but hard to execute when potentially only 25% of plastic waste is currently being recycled and according to UMR only 23% would be open to change their habits. First steps need to be getting farmers engaged with current schemes and designing schemes that work for farmers needs as highlighted in

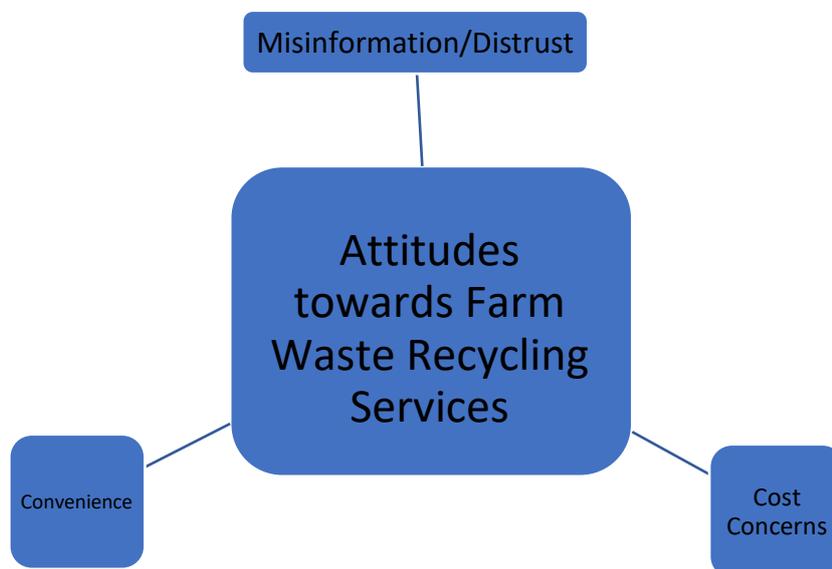
the True North Consulting report. An idea that will be expanded on more later in the report and is inline with the circular economy idea is for tangible products to be made from recycled plastic that can then be used by farmers. Examples could be culverts or fence posts. Farmers can touch and use a product that they have recycled, they get the satisfaction of self-efficacy and see the benefit of recycling.

Farmers learn from farmers, this was a common theme in the literature review and one that needs to be acknowledged by an agencies that are trying to introduce new practises to farmers. Focusing on the primary pacesetters then letting the practises wash down through the segments of farmers would be a smart model. As opposed to attempting to get all farmers to take up a practise at the same time.

## Results

### Farmer/Grower Themes

These are common themes that came from the farmer focus groups and interviews.



### Misinformation/Distrust of Current Recycling Providers

A prevalent theme during focus group one was distrust of current systems and factually incorrect information the group believed. In reference to recycling of silage wrap more than one farmer said the following, “I heard that they send it all to China and they burn it there anyway” or “it uses more energy to recycle this plastic than it does to make new ones”(Unnamed Interviewee, Focus Group One). With mumbblings of approval from the group. There was also one comment from someone who had attempted to return a single use fertiliser bag back to the company they had purchased it from. They were laughed at by the store keeper and told to take it home and burn it. None of this group were required to recycle as per accreditation schemes.

Focus Group Two provided a contrast to Focus Group one in that all except one member actively recycled all containers and wrap, they were very environmentally aware and motivated by sustainability and environmental reasons.

### Convenience/Cost Concerns

In focus group one there was a general lack of awareness of recycling schemes or what seemed like plausible lack of awareness. It is much easier and quicker for farmers to push the plastic into a hole on the farm or onto a bonfire than for them to have to make a special trip to town to recycle it. In two instances that is what their father had done so that is what they had done.

### Tangible Recycled Products

Interviewees and focus groups agreed that being able to see/touch/use the end product of the recycling would encourage people to engage with recycling programs. If people could see it then

they know it is not being burnt in China. Future Posts, (recycled plastic fence posts) were a common reference point but again not one person (except myself) has actually purchased plastic posts as there is still general scepticism about these posts.

#### False Starts

A number of interviewees had attempted to recycle their baleage wrap but had been turned away or had wrap rejected because the wrap was dirty. In one instance a farmer had packaged the baleage wrap in the bags provided for by Plasback (paid for by the farmer), plasback had rejected the wrap due to organic matter contamination. The farmer had then burnt the whole bag containing hundreds of kilograms of plastic on his bonfire. Organic matter contamination is a constant issue for Plasback as they want clean plastic that will not have contaminants which will make imperfections in the recycled plastic. There were also complaints about the wait time for collection of the wrap. This had completely turned those farmers against using Plasback, they would then burn the plastic.

#### Lack of Awareness of Environment/Legacy Farmers

The group who were not engaging with the recycling programs often commented that it was what their father had done and they weren't aware that of the negative environmental impacts that burning plastic had on the environment.

## Case Study – Fonterra the Co Operative Difference

Figure 12 Co Operative Difference, Fonterra Website

In 2018 Fonterra introduced the Co operative difference, from 1<sup>st</sup> of June 2021 they began paying premiums on milk prices for farmers who achieve goals that align with Fonterra's beliefs which are across five facets of milk production – People & Community, Environment, Animals, Co-op & Prosperity and Milk.



The Co-Operative difference is split into three steps on the Journey:

Figure 13 Fonterra’s Cooperative Difference Journey, Fonterra website



Meeting all of the requirements for Te Putake and Te Puku will gain you a 10c/kg milk solid Premium on qualifying milk. Part of meeting the environmental standards requires that each farm engage with Product Stewardship Schemes Agrecovery and Plasback. Agrecovery provided me with data related to new registrations to Agrecovery’s program. The graphs and table below highlight the significant increase in sign ups from Dairy Farms that can be directly related to the advent of the Co-Operative difference scheme.

Figure 14 Agrecovery New Registration by Property type (Agrecovery Direct)

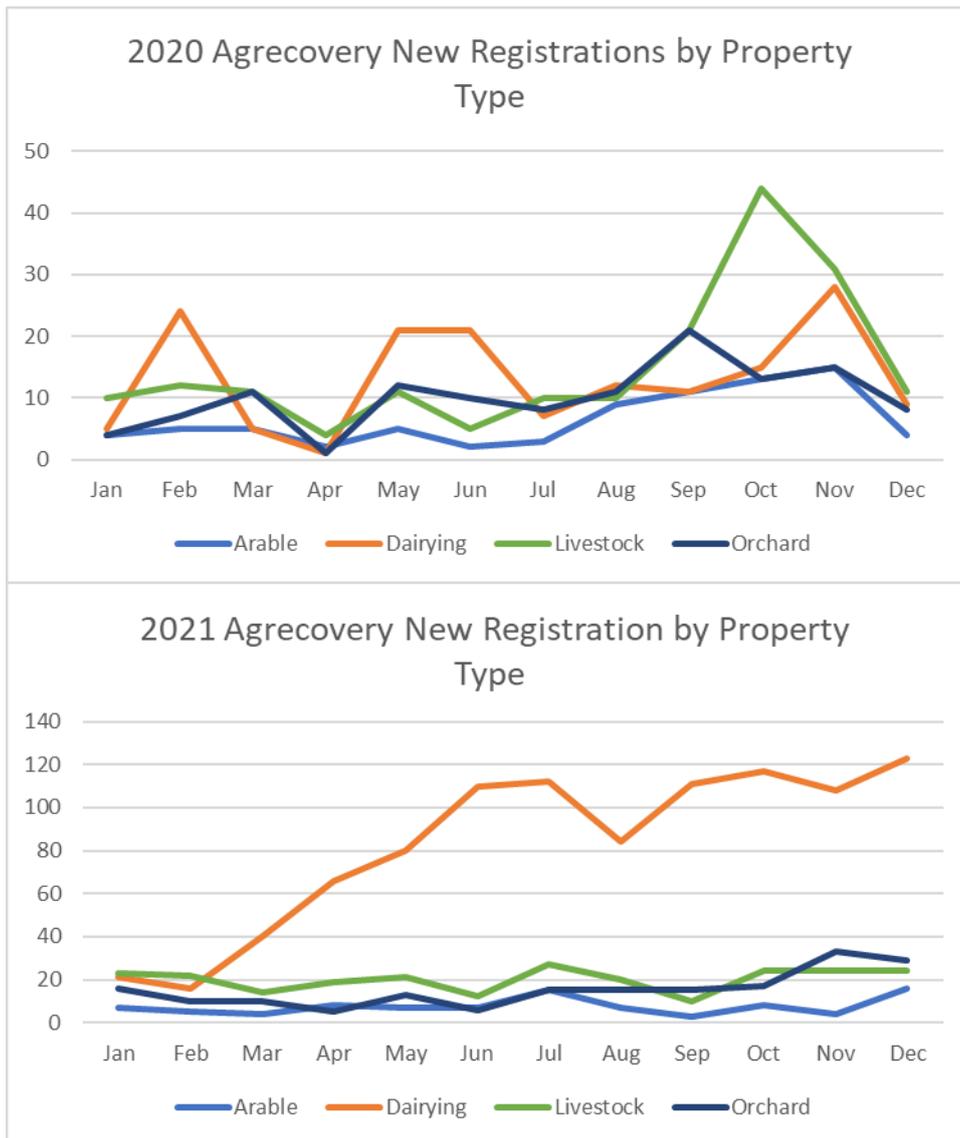


Table 2 Agrecovery New Signups by Property Type (Agrecovery)

Agrecovery New Registrations	2020	2021	%	Difference
<b>Property Type</b>				
Arable	78	91	17%	13
Dairying	159	988	521%	829
Livestock	180	240	33%	60
Orchard	121	184	52%	63

I do not want to draw too many contrasts between Fonterra's model and sheep/beef; it is not comparable as 85% of dairy farms supply one organisation (Fonterra). Sheep and beef farmers supply many different processors and suppliers. However this does show that when there is financial incentive people are more likely to engage with the recycling providers.

## Case Study 2

### Future Post

Although not part of Farm Plastics recycling, Future Post is worth discussion as an innovative company who are using recycled plastics to make fence posts. 'A better performing, longer lasting post that's also better for the environment' (Future Post Website, 2021).

Figure 15 Future Post Recycling Process (future post website)



I personally bought 140 plastic fence posts last year to use on my property and was impressed with the posts. These posts come with a lifetime guarantee and if you do want to return a post they will take it and recycle it at no cost. The posts are not tanned so do not leach alleged poisonous chemicals into the soil and for this reason are certified for use on organic properties.

Future Post has very recently been back in the news as they are recycling used face masks and making these into fence posts (NZ Herald Article, 2021). Future post is currently a user pays model, where people pay a price per ton for Future Post to recycle the plastic items.

## Discussion

There are cultural shifts that need to occur for farmers to engage with recycling programs in which ever form they take. The cultural shifts cannot occur until a number of steps have been taken by the farm plastic recycling programs, a robust, transparent model run by one company who deals with all waste streams must be operating before promotional campaigns begin. If this company could produce a number of functional products to be used on farms (fence posts, culverts) this would greatly help farmers to engage in the cultural shift it will take to move them out of their current habits.

## Culture

The current culture of Sheep and Beef farmers must first be understood before it can be attempted to be changed. Below I have highlighted a short overview of the current culture and information flows to farmers that mould the culture among farmers.

See Fig.1 below for my adapted version of Schein's Model of culture when related to sheep and beef farmers. The groundswell protests were a public display of farmers pushing back against environmental regulations – a very easy assumption is that farmers then don't care about the environment. One or two racist, sexist signs that were displayed at the protests undermined most of the positive messages that could have come out of the protest. Every single farmer I interviewed or who was part of a focus group alleged that they cared for the environment and that they were proud to have a farm that had been passed onto them and they could pass onto their children. This is despite many of these farmers burning or burying plastic.

Figure 16 Schein's Adapted Model of Culture

**Figure 1: Schein's model of culture**



Underlying assumptions among farmers as revealed in the literature review often come from other farmers or perceived industry experts, (such as a veterinarian in the UMR research). An example of a source of information not mentioned in the research is stock agents. Sheep and beef farmers deal with stock agents on a weekly basis when trading livestock. They receive weekly market updates from the agents that normally include a joke or general blurb about what is going on in the world/New Zealand.

## Information Flows to Farmers

The UMR research and DAF research highlighted how farmers learn from farmers or others in the industry. Although not mentioned specifically in this research stock agents are perceived industry experts who speak with farmers often on a weekly basis. I myself receive a monthly email from my agent with his thoughts and the details of market activity. My agent is polite and professional however they do not all follow the same behaviour. Below are two examples that can be found online from Central Livestock, a livestock trading company based in the Central North Island.

Figure 17 Quotes from Central Livestock weekly emails (Central Livestock Mailchimp Weekly Email)

### Good Evening

You can't help but feel that Jacinda's reign of tyranny is starting to self destruct. (Central Livestock Limited Website)

### Good Evening

Well the world has certainly lost the plot  
The impact of Putin's last stand will be huge  
Ukraine is Europe's biggest source of grain and that's just a start  
Where is Trump when you need him oh yeah the socialists got rid of him  
Anyhow that's the political speech done.

The Dairy Cockies are on a high and good for them.  
Covid is still wreaking havoc in the meat industry - Thanks  
Cindy and the muppet show.

The Anti-Government narrative is clear in these messages from stock agents who farmers deal with and 'chew the fat' with on a weekly basis. This narrative continues in over the fence discussions and came through in the interviews and focus groups. Farmers' echo chambers of thoughts that the government is against them, the government are tyrants are rife in rural New Zealand. UMR (2021) research into public opinion about the Primary industries states that: "**Sheep and beef farming (at 58%**

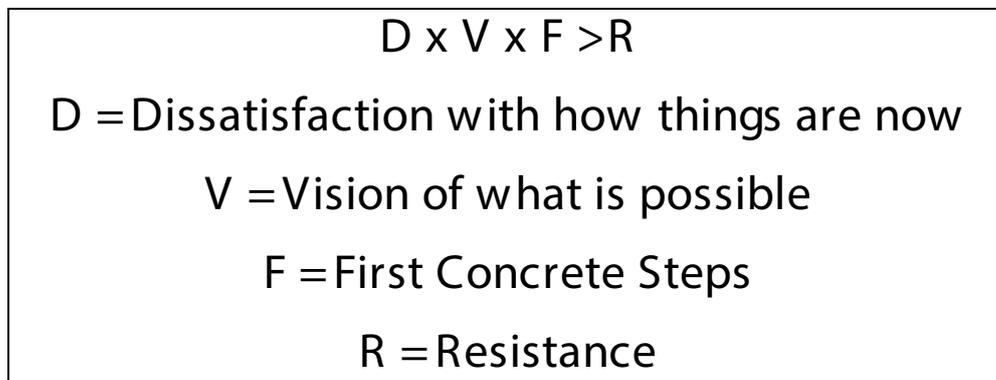
**positive and 13% negative) continues to be viewed much more positively than not by New Zealanders.” (Primary Purpose, 2021).**

Sheep and beef farmers have a misconstrued view that everyone is against them and trying to regulate these farmers into submission will I believe only cause backlash. This is important to keep in mind when trying to communicate or introduce new ideas, introducing regulation after regulation will only cause backlash.

## Change

Once the intricacies of the culture of Sheep and Beef farmers is understood then changes to this culture and the behavioural patterns that flow from the culture can be understood. Gleichers formula for change is helpful model for understanding why or why not farmers are not engaging with recycling programs.

*Figure 18 Gleichers Formula for Change (Dannemiller, 1992)*



If we use the example of farm plastics recycling and put it into Gleicher's Formula for change, currently most sheep and beef farmers I interviewed are not dissatisfied with their current methods of disposal, burning, burying or bulk storage are working adequately. There is no clear vision of what is possible if they do change to recycling, (no fines being applied by local councils, no incentives from companies they supply or purchase from), and although some people have taken first concrete steps, it is not enough.

Pannell (2008) wrote about innovative farming systems, but it can be related to farmers adopting a new practice. There were four conditions necessary for the farmer to change awareness of the innovation, feasibility of trialling the innovation, perception that it is worth trialling, and perception that the innovation promotes the farmer's objectives. At the moment why is it worth a Sheep and beef farmer going to the effort to try Plasback or Agrecovery? If a farmer is not educated on the pollution caused by burning or does not care about the pollution, then an incentive or disincentive (fine) for burning/burying must be introduced.

The following theory of my own could help introduce change in this field. First we would need to introduce dissatisfaction with the current methods through education about the negative effects that burning and burying plastic has on the environment and farms; at a later date farmers could be fined for burning or burying their farm plastics – (Dissatisfaction)

A vision of what is possible could be premium pricing for New Zealand's products because of the care we take for all facets of the environment – taking notes from Fonterra's model. Including the production of recycled goods that can be used on farms in New Zealand, such as fence posts or culverts. These are both visions of what is possible if you recycle farm plastics

The first concrete steps could be the identification and targeting of Primary Pacesetters and targeting this segment to ensure that they are engaging with the recycling programs.

### Farmer Led Catchment Groups

Farmer Led Catchment Groups are relatively new initiatives which have started to appear across New Zealand rural districts. The backlash against government forcing regulation onto farmers and the propensity for farmers to take up ideas if they come from farmers has come to the logical conclusion that farmers buy into farmer led discussion. Unfortunately there is currently no research into the impact of farmer-led catchment groups, but they will become indispensable in encouraging farmers to get on board with programs such as Farm Plastic Recycling. As the literature review asserts – farmers listen to farmers, they do not like being told to recycle their plastic by government or enforcement agencies.

### Conclusions

Change is possible but it will take a number of collaborative steps and the current fragmented plastic recycling industry is not helping the situation. The one stop shop model that True North Consulting suggested must be implemented, this would be the first step. If this company could produce a number of tangible, functional products from recycled plastic that farmers can use on farm it would help the next steps. Following on from this, research such as UMR Farmer Segments groups will become invaluable in learning how best to communicate with the most stubborn of farmers. Farmers learn from farmers – this message is simple and came up a number of times during this research. Some farmers are more open to change (eg Primary Pacesetters) – target these farmers and recycling practises will flow on to other farmers.

## Recommendations

### One Stop Shop (Company) is a must

It must be one company that deal with all waste streams for farmers, the current fragmented nature makes it difficult for farmers to engage on an already challenging topic. In years passed farmers had no obligation, incentives or disincentives to deal with farm waste in an environmentally friendly manner. To ensure that the program appeals to the most stubborn of farmers, (The Seasoned Grafters in the UMR 2014 research), it must be as simple as possible. One company responsible for the collection of all streams of farm waste. Communication and promotional material all coming from one company that is transparent with where the waste ends up and the benefits that farmers are having if they engage.

### Tangible Products

Waste recycling companies must look into the opportunity to produce functional products such as fence posts or culverts that farmers can use on their farms. Products such as fence posts or culverts made from recycled plastic are great opportunities for farmers to see, touch, feel, even buy a product that has used their own recycled plastic. These products are beneficial on two fronts, not only do they encourage farmers to engage but they also provide fantastic promotional and marketing content for New Zealand farming. It is also a first step towards a circular economy.

### Engage with Farmer Led Catchments

Farmer led catchments groups are beginning to emerge across New Zealand. I would argue that these are the primary pace setters with buy-in soon coming from other segments. They are very aware of regulation that is coming and, if you can penetrate these groups with your messages, then it will filter onto neighbouring farms.

### Beware of False Starts

It is very easy to upset and put farmers off recycling programs. As mentioned, a number of farmers I talked to had been put off by bad experiences and had gone back to the cheaper, easier method of burning or burying their farm waste. Until a stable consistent system for farm waste is established then I would not present anything to farmers.

## References

- Dannemiller, K. D., & Jacobs, R. W. (1992). Changing the way organizations change: A revolution of common sense. *The Journal of Applied Behavioral Science*, 28(4), 480–498
- Agrecovery. (2021). (rep.). *Farm Plastics Project GREEN-Farms Product Stewardship Scheme Application for Accreditation under the Waste Minimisation Act 2008*.
- Beckhard, R., & Harris, R. T. (1998). *Organizational transitions: Managing complex change*. Addison-Wesley.
- Journeaux, P., E. van Reenen, S. Pike, D. Miller and G. Austin (2018) Literature Review and Analysis of Farmer Decision Making with Regard to Climate Change and Biological Gas Emissions, AgFirst, <https://www.mpi.govt.nz/dmsdocument/32137/direct>
- Katz, E., Levin, M.L., & Hamilton, H. (1963). Traditions of research in the diffusion of innovations. *American Sociological Review*: 28, 237-252.
- Livestock, C. (2022, February 16). *Hi << test first name >> the worm has turned*. us6.campaign. Retrieved March 6, 2022, from <https://us6.campaign-archive.com/?u=3d664e11c208816a547fbbe1d&id=978a272917>
- Livestock, C. (2022, March 2). *Hi << test first name >> what a crazy world! but still people have to eat*. us6.campaign. Retrieved March 6, 2022, from <https://us6.campaign-archive.com/?u=3d664e11c208816a547fbbe1d&id=c2f4db4f48>
- Manjala, T. (2014). Good to great extension. Influencing on farm change at pace and scale. Report completed for Nuffield Programme. Nuffield New Zealand.
- Organizational Culture and Leadership, Edgar H. Schein. 1992. Jossey-Bass Publishers, San Francisco, CA. 418 pages. ISBN: 1-55542-487-2. \$25.95. *Bulletin of Science, Technology & Society*. 1994;14(2):121-122. doi:10.1177/027046769401400247
- Pannell, D.J. (2008). Public benefits, private benefits, and policy mechanism choice for landuse change for environmental benefits. *Land Economics*, 84(2), 225-240.
- Primary Purpose. (2021). (rep.). *Public opinions of Primary Industries*.
- PWC. (2020). (rep.). *Farm Plastics Priority Product Stewardship Scheme: Materials Flow Analysis*. Agrecovery.
- Rankin, T. (2019). (rep.). *What a waste: My story*. Rural Leaders.
- Recycling Project Tackles Soft Plastics*. Agrecovery. (2022, March 1). Retrieved March 6, 2022, from <https://agrecovery.co.nz/recycling-project-tackles-soft-plastics/>
- Regulated product stewardship*. Ministry for the Environment. (2021, November 4). Retrieved March 6, 2022, from <https://environment.govt.nz/what-government-is-doing/areas-of-work/waste/product-stewardship/regulated-product-stewardship/>
- Rogers, E.M. & Shoemaker, F.F. (1971) *Communication of innovations; a cross-cultural approach*. Free Press, New York.
- Rogers, E.M. (1962, 1983). *Diffusion of Innovations*. Free Press, New York

Rollins, T. (1993). Using the Innovation Adoption Diffusion Model to target Educational Programming. *Journal of Agricultural Education*: 34(4), 46-54.

UMR Research. (2014a). Red Meat Profit Partnership: Sheep and beef farmer segmentation. Red Meat Profit Partnership [www.umi.co.nz](http://www.umi.co.nz)

Vanclay, F. (2004) Social principles for agricultural extension to assist in the promotion for natural resource management. *Australian Journal of Experimental Agriculture*: 44, 213-222.

Waters, W., Thomson, D., & Nettle, R. (2009). Derived attitudinal farmer segments: A method for understanding and working with the diversity of Australian dairy farmers. *Extension Farming Systems Journal*: 5(2) 47-57.

*What is silage?* Science Learning Hub. (n.d.). Retrieved March 6, 2022, from [https://www.sciencelearn.org.nz/resources/2006-what-is-silage#:~:text=Silage%20is%20pasture%20grass%20that,sugars%20and%20proteins\)%20as%20possible.](https://www.sciencelearn.org.nz/resources/2006-what-is-silage#:~:text=Silage%20is%20pasture%20grass%20that,sugars%20and%20proteins)%20as%20possible.)

# Appendix

Figure 19 Survey that Interviewees and Focus Groups completed

3/6/22, 8:35 PM Plastic Use on Farms

## Plastic Use on Farms

1. What is your role in the farming organization?

*Tick all that apply.*

Farm Owner/Operator/Manager  
 Director  
 Shephard  
Other:  \_\_\_\_\_

2. How old are you?

*Tick all that apply.*

20-35  
 35-45  
 45-55  
 55+  
Other:  \_\_\_\_\_

3. How big is the farming operation you are involved in (Hectares)?

*Tick all that apply.*

0-50  
 50-300  
 300+

4. What types of plastics do you use on farm?

*Tick all that apply.*

Chemical Containers (Ag Chems/Animal Health)  
 Baleage Wrap/Silage Covers  
 Hay Bales (Twine)  
 Seed/Animal Feed/Fertiliser Sacks  
Other:  \_\_\_\_\_

5. Approximately how many plastic items do you use per year? (Write next to the option)

*Tick all that apply.*

Chemical/Animal Health Containers (Any Size)  
 Baleage Wrap (Bales)  
 Hay Bales (Twine)  
 Seed/Animal Feed/Fertiliser Sacks 25kg  
 Seed/Animal Feed/Fertiliser Sacks 500/1000kg  
Other:  \_\_\_\_\_

[https://docs.google.com/forms/d/19YcDIHlx5EUqJmwpxy5lsQPjAqEp3\\_RnFJy1HpvkMJ0/edit](https://docs.google.com/forms/d/19YcDIHlx5EUqJmwpxy5lsQPjAqEp3_RnFJy1HpvkMJ0/edit) 1/2

6. What do you do with your Plastic Waste?

*Tick all that apply.*

- On Farm Burial
- On Farm Burning
- Recycling Program (Plasback/Agrecovery)
- Bulk Storage and then Landfill

7. If you do not use one of the recycling schemes, why not? (Select more than one if necessary)

*Tick all that apply.*

- Cost
- Convenience
- I am happy with my current disposal method

Other:  \_\_\_\_\_

8. If you do use one of the recycling programs, why?

*Tick all that apply.*

- Accreditation
- Environment
- My partner/children make me
- Our plastic waste is too small to make a difference

Other:  \_\_\_\_\_

9. What would motivate you to use Plasback or Agrecovery?

*Tick all that apply.*

- Financial Incentives (A premium for my products)
- Community Kick Backs (Funding for local School)
- What we are doing is not polluting the environment

Other:  \_\_\_\_\_

This content is neither created nor endorsed by Google.

Google Forms