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FACT SHEET | JANUARY 2024

PROGRESS ON PLASTICS

Plastic recycling and alternatives to plastic mulch in vegetable and melon production

KEY MESSAGES

- Vegetable and melon farms generate a range of plastic waste, some of which can currently be recycled like chemical containers, bulka bags and irrigation tube.
- Plastic mulch benefits productivity through moisture retention and weed suppression, however its disposal poses a problem for growers.
- While the purchase price is cheap, plastic mulch requires significant costs in labour and time for removal and disposal. If stockpiled on-farm, plastic mulch can contaminate farmland, take up valuable production areas and harbour pests and diseases.
- Valuable topsoil is usually lost when plastic mulch is removed from beds each season. The major asset of soil could be ending up in landfill or in waste stockpiles.
- Two current alternatives to plastic mulch are organic mulch such as straw or cover cropping between rows, or certified soil biodegradable mulch.
- Certified soil biodegradable mulch has a higher purchase price than plastic mulch, however as it does not need removing, this is mostly offset by savings later in the growing season.
- Other benefits to using alternatives to plastic mulch may include:
  - Building soil organic matter
  - Protecting topsoil from erosion and don't cause any soil to be removed
  - Encouraging beneficial insects and deterring some pests (organic mulch)
- Changing costs of fossil fuels, labour, transport and inputs may increase the cost of plastic mulch or decrease the cost of alternatives over time.

Hort Innovation

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RMCG

ahr applied horticultural research

Why is on-farm plastic waste an issue?

Plastics have many useful properties and have become embedded in the way we produce food. Plastic can be durable, lightweight, mouldable, customisable and cheap. The use of plastic in agriculture has helped to increase productivity, improve transport, boost crop protection and widen consumer choice. Plastic use in agriculture has helped to address the need to feed a growing population.

However, the very properties that make plastic useful, and the scale of its use, make it a major environmental problem. Plastic use has a wide range of negative impacts, from the greenhouse gas emissions generated in its manufacture and transport, to its detrimental effects in soils and waterways. Even though plastics are a mainstay on farms, many growers are looking for alternatives.

At the farm level, many plastics are single-use. These may help to increase productivity, however their use comes with consequences. Many plastic items are stockpiled, buried or burned on-farm, and their impacts to the immediate farm environment and worker health are depicted in the diagram below.

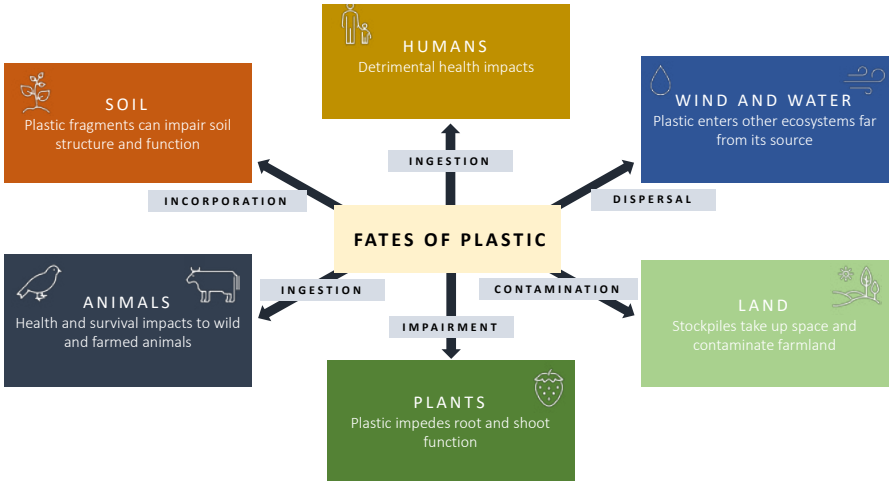

Figure 1: Potential fates of plastic in the immediate farm environment.

It is worth considering the cost efficiency of using single-use plastics and whether alternatives may be cheaper – especially when it comes to the cost of disposal. Farms may want to align with national strategies on waste reduction, which may help to access specific markets and prepare for legislative change[1]. Farms can also reduce their plastic use to align with industry sustainability frameworks[2]. Growers may also recognise the importance of soil health and be looking for more ways to encourage a healthy soil environment.

There are multiple reasons to search for alternatives to plastic for some on-farm applications. This factsheet focuses on plastic mulch and its alternatives and gives an update on current pathways for recycling some common agricultural plastics.

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[1] National Plastics Plan, 2021, accessed via <https://www.agriculture.gov.au/sites/default/files/documents/national-plastics-plan-2021.pdf>

[2] Australian-grown Horticulture Sustainability Framework, 2021, accessed via <https://www.horticulture.com.au/hort-innovation/our-work/horticulture-sustainability-framework/>

Common sources of plastic in vegetable production

The most common sources of plastic used in horticulture are[3]:

What recycling schemes are currently available?

The National Agricultural Plastics Stewardship Scheme is currently working on a solution for recycling common agricultural plastics, such as films, irrigation tube, and netting. Barriers that need to be overcome include the long transport distances between farms and recycling centres, limited collection points, the cost of recycling and problems of contamination with dirt and plant material. The Scheme aims to overcome these barriers and help growers recycle their used plastic, reducing waste and saving growers money in the process.

While the Scheme gets established in coming years, there are some existing and effective options for recycling certain types of agricultural plastics. These are summarised in the table below.

Table 1: Existing schemes for agricultural plastic recycling

Scheme	What type of plastics?	Where can I access it?	More information
drumMUSTER	Empty AgVet containers larger than 1 L/kg. Must have the eligibility logo.	There are collection points in all states and territories.	drummuster.org.au
Big Bag Recovery	Large agricultural bags, known as 'bulka bags' (fertiliser).	There are collection points in most states and territories.	bigbagrecovery.com.au
Recoil (Netafim)	Irrigation tube and drip line	On-farm collection and transport can be organised through Netafim	netafim.com.au/irrigation-products/Recoil/Recycling/
bagMUSTER	Large agricultural bags, known as 'bulka bags' (seed and pesticide).	Currently in development, the program aims to be available nation-wide by 2024.	bagmuster.org.au

[3] Agrifutures Pre-farm Gate Waste Program data report, 2022, accessed via <https://agrifutures.com.au/wp-content/uploads/2023/05/23-006.pdf>

Figure 2: drumMUSTER logo for eligible containers.

Plastic mulch – what's the problem?

Plastic mulch is commonly used in crops such as capsicums, zucchinis, melons, tomatoes and strawberries. It helps to suppress weeds, reduce herbicide use, prevent soil erosion and retain soil moisture. Plastic mulch is usually removed after each growing season and is usually only used once before disposal. Plastic mulch left in the field, stockpiled or buried easily fragments into microplastics which can contaminate the soil.

Figure 3: The average lifespan of plastic mulch, amount of plastic mulch used in Australia per year and crop soils in Australia covered in plastic mulch per year[4 5]

There are significant costs associated with plastic mulch when its whole lifespan is considered. While it may be cheap to purchase, growers must then pay for labour, equipment and fuel to remove it after each season. It incurs additional costs during transport and disposal to landfill, as it is currently difficult to recycle. If buried or stockpiled on-farm, it can take up valuable cropping land, and contaminate soil and waterways.

[4] Food and Agriculture Organisation of the United Nations, 2021, accessed via <https://www.fao.org/3/cb7856en/cb7856en.pdf>

[5] Agrifutures, 2022, accessed via <https://agrifutures.com.au/wp-content/uploads/2023/04/23-009.pdf>

PLASTIC MULCH – NEED TO KNOW

- **Valuable topsoil and organic material is often lost** when plastic mulch is collected from fields. Many growers invest a lot of time, energy and money into enhancing their topsoil, so it's important to consider whether using plastic mulch makes sense from an economic and soil health point of view.
- **The high cost of transporting and disposing of plastic mulch may outweigh** the initial low purchase cost of the mulch.
- **Valuable, productive land is often taken up by stockpiled or buried plastic mulch**, which could otherwise be used for cropping.
- **Burning plastics on-farm produces toxic pollutants that are harmful to human health**. These can include soot, ash, dioxins and mercury.

What are the alternatives to plastic mulch?

There are two main alternatives to plastic mulch – organic mulches and certified soil biodegradable mulches.

Organic mulches

Organic mulching refers to using straw, wood, and 'living' mulch (cover cropping between rows).

- **Straw** has many similar benefits to plastic mulch, however, straw does not warm the soil like plastic mulch, and it should be high quality and weed-free.
- **Woodchips** can add a large amount of organic matter to soil over time, but their source should be clear to ensure they are free of weed seeds and other contaminants.
- **Living mulch** can support beneficial insects and fix nitrogen if legumes are used as the cover crop. However, it must be managed properly so that it doesn't spread into growing beds (e.g. timing of termination). Strip tilling can be used to terminate living mulch and can add significantly to soil organic matter and support soil health.

CASE STUDY – ORGANIC MULCH

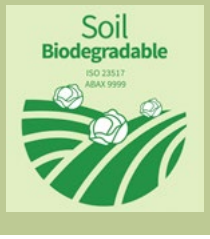
- Intensive vegetable grower Kim Ngov has been conducting trials in using cover crops to replace plastic mulch at his Western Sydney farm since 2021.
- He has had success using self-terminating varieties like sorghum and millet, as well as ryegrass, which he terminates with herbicide.
- Kim found that the living mulch has helped to increase the resilience of his farm to weather extremes, as it has reduced soil erosion during heavy rains and eliminated the challenging task of laying plastic mulch in wet conditions.

Certified soil biodegradable mulch

Alternatives to plastic mulch that don't need removal and beneficially break down into the soil have been around since the early 2000s. A significant difference with **certified soil biodegradable mulches** is that it's left in place to break down – meaning no costs are incurred at all for their removal, unlike plastic mulch. Instead of taking up valuable growing space and contaminating farmland, these products enhance soil by adding carbon and do not lead to topsoil loss because they decompose in the field. Film thickness can also be adjusted to break down over varying time periods (generally 4-12 months). The crops best suited to this alternative are zucchinis, capsicums, melons and other vegetable crops such as eggplant, fennel, celery, salad greens and pumpkins, as well as strawberries.

CERTIFIED SOIL BIODEGRADABLE MULCH – NEED TO KNOW

- Products must be certified to ISO 23517. This certification means they fully biodegrade and are beneficial for soil.
- Many products claim to be biodegradable but are actually plastics which fragment easily into microplastics and not carbon, such as photodegradable (by light) and oxodegradable (by air). This is an example of greenwashing.
- Talk to your agronomist or product supplier and ensure that any alternative biodegradable mulch you purchase is certified to this standard. Look for the certification label:



What are the costs and benefits of plastic mulch alternatives?

It's important to consider the whole-of-life costs of using different types of mulch, because costs and savings can be found in different parts of a product lifecycle.

When comparing conventional plastic mulch to certified soil biodegradable mulch, AgriFutures found that the non-plastic alternative was $200 more per hectare than the conventional plastic mulch. A summary of this cost is shown in the table below. Note that the costs are based on broad assumptions about the price of different mulches and other input costs such as labour and transport. These costs may be different in your area.

Table 2: Cost comparison between plastic mulch and soil biodegradable mulch

Cost (/ha)	Plastic mulch	Soil biodegradable mulch
Purchase price	$1,031	$2,061
Installation cost	$335	$342
Removal cost	$840	$0
Total	**$2,206**	**$2,403**
Difference	-	$197

CHANGES TO COSTS – NEED TO KNOW

- A number of dynamic factors influence this cost and may lead to changes over time.
- If the cost of certified soil biodegradable mulch reduced over time by just $160 per hectare on average, it would become cheaper than conventional plastic mulch.
- It would also become cheaper if disposal, transport, labour or machinery costs increase, for example through rising landfill levies or fuel prices.

The important thing to consider when weighing up the costs is the entire lifecycle of the product. In this example, using certified soil biodegradable mulch saved $840 in removal costs, however this saving was offset by the initial upfront purchase price. Talk to your agronomist or product supplier and calculate your own cost benefit using your records, to see if there could be an overall saving from using an alternative to plastic mulch.

There are other benefits to using alternatives to plastic mulch which may influence your decision. These include:

- Eliminating the need to dispose of, stockpile and bury plastic waste.
- Improving soil health through the addition of carbon and nutrients to the soil and enhancement of soil microbiology.
- Improved farm biosecurity, as stockpiles of plastic mulch can harbour plant pests and diseases.
- Mitigating future risk, for example changes in legislation and input costs.
- Reduced transport emissions.
- Significant labour and time savings through avoiding the need to remove mulch.

What else do I need to know about plastic mulch alternatives?

There are some important factors for growers who are interested in using certified soil biodegradable mulch to consider. These include:

- **Certified soil biodegradable mulch has a high upfront cost**. The high upfront cost can be prohibitive, even though the whole-of-life cost can be similar to plastic mulch.
- **Greenwashing**. Look for the certification symbol and code above to ensure the product you may be purchasing is actually biodegradable.
- **Differences in product performance or suitability.** Certified soil biodegradable mulch is not suitable for fumigation as it is permeable. Local and seasonal climatic variation can also affect the lifespan of certified soil biodegradable mulch.
- **Organic mulch may be well suited to your growing operation**. Products like straw, wood chips and cover crops are often cheap and have a range of other benefits that can be considered.
- **Changes to costs over time**. Even if alternatives are not economically viable for your operation at the moment, there are many factors that may change, for example rising oil costs or landfill levies.

Key questions to ask your agronomist or product supplier

- How can I avoid or reduce plastic use in my production system?
- Where is my closest collection point to recycle used chemical containers, bulka bags and/or irrigation tube?
- What alternatives can I consider to conventional plastic mulch?
- What is the local cost of alternative products?
- Is certified soil biodegradable mulch suitable for my crop and growing conditions?
- How durable is certified soil biodegradable mulch and will it last long enough for my needs?
- What if I need to fumigate?
- What other potential benefits might come from alternatives to plastic mulch?

Further resources

Table 3: Further learning resources for plastic mulch alternatives

Topic	Resource
In-depth options analysis and costings for certified biodegradable plastic mulch	AgriFutures *Options for Improved Waste Management* report
Global assessment of agricultural plastics sustainability	FAO *Assessment of Agricultural Plastics and their Sustainability: A Call for Action*
The National Agricultural Plastics Stewardship Scheme	RMCG's *National Agricultural Plastics Stewardship Scheme –May 2023 Update*
Agriculture, Fisheries and Forestry National Waste and Resource Recovery Roadmap	Agrifutures, *Agriculture, Fisheries and Forestry National Waste and Resource Recovery Roadmap October 2022*
'Living' mulch cover cropping as an alternative to plastic mulch in a Western Sydney vegetable farm	Soil Wealth ICP demo site updates
Replacing plastic mulch	Cover crops for weed supression and soil health, September 2023 (Kim Ngov, Wedderburn NSW)
Wheat straw as an alternative to plastic mulch in melon crops, Mildura	Soil Wealth ICP demo site updates
Cover crops for Australian vegetable growers	Poster on the Soil Wealth ICP website
Cover Crop Termination Guide	Poster on the Soil Wealth ICP website
Cover Crop Herbicide Guide	Poster on the Soil Wealth ICP website