# Plastic Film Mulch on Agricultural Fields

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## Introduction

Plastic mulch use in agriculture has many positive benefits that enhance crop growth but disposing of the plastic mulch after it is used on one crop cycle creates a waste problem in landfills and can pollute nearby watersheds. Plastic fragments left in the field can cause a decrease in soil health and can also migrate to nearby waterbodies in agricultural run-off.

This segment of the research will be based upon opinions that stakeholders have on the use of plastic mulch based on their experiences and their values regarding the environment. The stakeholders include a company that collects and recycles agricultural plastic waste, an expert agricultural water quality coordinator representing the Monterey Bay Marine Sanctuary, organic farmers, and the plastics industry. Although, the general consensus is that plastic mulch is necessary for the agricultural industry, all of these stakeholders have different opinions of how plastic should be used.

## Local and International Stakeholders

### Monterey Bay National Marine Sanctuary

In Monterey County, agricultural water quality coordinator for Monterey Bay National Marine Sanctuary, Pam Krone advocates for recycling plastic mulch after use on agricultural fields because massive amounts of plastic waste end up in landfills and some winds up in adjacent water bodies. Krone collected data and shows that 7,941,839 pounds of plastic mulch are used in Monterey County agriculture per year. In a three-year study, Krone collected data from ten streams in agricultural areas of Monterey County, and discovered that, although agricultural plastic comprises just three to five percent of all general plastic use, a surprisingly large amount of agricultural plastics were found on stream banks near agricultural fields. Eighty-one percent of that plastic waste was fragments of agricultural plastic mulch which measured 1.73 pounds per square meter. “ I was surprised when I read a study by the Washington State University Study that

looked at plastic removal of polyethylene mulch from the field and their study found that about ten percent of the plastic remained in the field after it was removed because it fragmented and broke apart and remained in the soil in the field and didn't get completely removed. So finding equipment so that we can remove more of that plastic and being super vigilant and looking for plastic…is really important. Second in importance is recycling, making sure that we recycle as much plastic as we can."

Krone's team also monitored microplastics in local streams and found that the quantity of microplastics in the streams was equal to what Monterey Bay Aquarium Research Institute found in Monterey Bay ocean environment. The Monterey Bay National Marine Sanctuary is going to conduct more studies on measuring the amount of plastic in nearby watersheds and streams. There is a pilot study underway sponsored by the Monterey Bay Marine Sanctuary, UC Cooperative Extension, and Washington State University involving five growers who are using biodegradable mulch, Krone hopes to have a larger study next year.

## Revolution Plastics

Revolution Plastics is a plastics manufacturing and recycling company. They make agricultural films, bags, and tubing. Revolution collects agricultural film and other plastic products from the farmer, cleans the dirty plastic and then turns it into post-consumer resin (PCR). Then they turn the PCR into other agricultural plastic products. Revolution processes over 150 million pounds of agricultural plastic per year and manufactures products that are 97% post consumer resin. "Those plastics that they're using, they get really dirty and most recyclers throw their hands up and say, 'We can't help you, that's too dirty, it smells too bad, we can't handle it,'" said Price Murphy, director of operations for Revolution. "Over 30 years, it took a long time to perfect the process, we were able to create our own process, which was able to wash and clean these materials so we're able to use them again," said Murphy. "It's just about the conservation and preservation of natural resources.". (Stevenson) "We use our expertise in recycling technology and post-consumer resin to provide green solutions to consumers and communities." (Calliendo, 29) Part of Revolution's company is the 125,000 square foot Encore recycling located in Salinas, California. Revolution works with over 400 agricultural operations in California, providing free pick up of used agricultural plastic, working closely with the farmers to make sure that the plastic they collect in specialized trucks is a s clean as possible. "A lot of work on the recycling side relies on the willingness of the farmers to play an important part as well." (Caliendo, 30) Revolution has partnered with irrigation industry giant, Toro, to recycle drip tubing. Encore is the largest agricultural plastics collection facility in California. Encore makes the post-consumer resin and supplies the plastic bag manufacturing division of Revolution with PCR. Revolution is an example of an utilitarian approach because they are consuming a waste product to produce a more sustainable product with value to the agricultural consumer and to the environment.

## Organic Farmer

Even though organic farmers realize that plastic mulch has benefits to their fields, the farmers are concerned with the amount of waste and plastic going to the landfill. Also, farmers have a potential opportunity cost to pick up and dispose of the plastic mulch at the end of each growing season when they could be sowing a cover crop instead. Organic farmers would like an alternative to

the conventional plastic mulch such as a mulch that can biodegrade in the soil. Drew Norman, an organic farmer who owns One Straw Farms, notes, “it is certainly a better choice than putting dumpsters of plastic in a landfill. In 2014, the USDA's National Organic Program (NOP), which implements and oversees organic regulations, specified that any biodegradable mulch could only be used if it were one hundred percent "bio-based" — that is, made entirely from plant material. Plastic mulch benefits both conventional and organic farmers by conserving water. The water savings achieved by using a system that conserves water by delivering it directly to plant roots through a network are significant enough to justify using the plastic mulch. "The water savings, in gallons per acre, is like 60 percent compared to using sprinklers," said Drew Norman of One Straw Farm. Norman would like to use biodegradable mulch, but it is not allowed under USDA NOP standards.

### Biodegradable Plastics Manufacturer

table one below is plastic and chemical producer BASF who understands that farmers desire a plastic mulch that biodegrades in the soil. While collaborating with Italian farmers who had a major problem with the excess plastic left in the soil from other biodegradable mulches, plus being aware of the mass amount of waste after the conventional plastic mulch is removed from agricultural fields at the end of the growing cycle, European based BASF came up with a solution for the farmers: Ecovio M biodegradable mulch that can be plowed into the soil after the harvest where the mulch biodegrades, saving time and money. In the promotional video, the BASF representative states, “Partnership is essential to act with foresight.” This stakeholder demonstrates practical stewardship of the environment because BASF has designed biodegradable mulch that provides a modern solution to the plastic problem. Zumstein, et al found, using BASF PBAT agricultural film mulch, that it completely biodegrades into CO2 and microbial biomass. This research could pave the path toward biodegradable mulch use by certified organic growers and approval by the USDA National Organic Program.

## Conclusion

The stakeholders realize that plastic mulch is beneficial to farmers, but that there is a solid waste problem after the plastic is removed from the field. These stakeholders’ views highlight how plastic mulch collection and manufacturing can be improved.

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## Table 1 Stakeholder Groups

| Stakeholder Group | Representative Examples | Stakeholder Values* | What are the concerns of the stakeholder? | What does the stakeholder contribute? |
|---|---|---|---|---|
| Chemical and plastic manufacturers | BASF<br><br>Green Dot Plastics | Practical stewards of the environment . Utilitarian | Concerned with the producing biodegradable and conventional plastic mulch (PE Films) | By producing a superior biodegradable mulch, BASF will eliminate extra plastic particles left in the fields after growing season. |
| Environmental advocate | (Pam Krone) Monterey Bay national marine sanctuary | Ecological_ scientific evidence | General health of the aquatic ecosystem | Collects plastic pollution data and educates agricultural industry, growers research groups and stakeholders. |
| Plastic industry | Plastics Europe (Trade association) | Utilitarian, | Plastics Europe wants to find alternative to plastic | Plastic Europe would advocate a top sustainable alternative when available. |
| Organic farm | One Straw Farm, Drew and Joan Norman | Practical stewards to the environment | Concerned about the massive amounts of plastic film waste in landfills. | They don't use Biodegradable Plastic Mulch it is not approved by National Organic Standards Board or by the USDA |
| Plastic industry | Revolution / delta | moralistic, ethical concern for nature Utilitarian | landfill capacity and plastic waste, increased reuse from agricultural plastic waste. | Collects agricultural plastic waste (drip tape and plastic mulch) and turns it into another product |