Performance and Adoptability
Biodegradable Mulch
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Plastic Mulch in Fruit and Vegetable Production: Challenges for Disposal

Summary

Plastic mulch provides many benefits to growers, but is its use sustainable? This fact sheet gives a brief overview of how polyethylene (PE) mulch is being disposed of currently and what sustainable options are available.

Plastic mulch (polyethylene or PE) has been used in agriculture for over 60 years. Its use has expanded because of its well-known benefits including earlier harvests, efficient water use, and weed control, among others. However, the disadvantages of plastic mulch are also becoming more apparent each year. The main disadvantage with PE mulch is that it must be removed and disposed of at the end of each season. An article by Rollo from 1997 is titled, "Agricultural Plastics: Boon or Bane?" This same question is still being asked almost 20 years later.

After it is used, PE mulch is often stockpiled on farms.

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USDA United States Department of Agriculture National Institute of Food and Agriculture

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Potential Disposal Options

Recycling

Potentially, one of the best options for disposal would be to recycle used mulch film; however, this has proven to be very difficult to implement because mulches are dirty after field use, recycling facilities are limited, and it can be challenging to transport used plastic to recycling facilities. In some areas progress has been made in recycling, including the Recycling Agricultural Plastics Program (RAPP) at Cornell University, and the Florida Agricultural Plastic Recyclers (FLAG), which have developed ways to clean used mulch film efficiently. A 2008 report from California states that about 36% of producers surveyed recycle some of their agricultural plastic, and that on-farm plastic pick-up would greatly increase their recycling rate (Hurley 2008). The Southern Waste Information Exchange provides an online listing service for businesses to find markets for materials they might otherwise discard (http://www.wastexchange.org/). However, recycling options are very limited in many states and regions around the country. Extension workers in Michigan report that after 15 years working with the recycling industry, not much progress has been made in recycling used mulch (Shek 2014). According to a 2013 report from Moore Recycling Group, there has been a rise in plastic film recycling (items like grocery bags), but recovery of used agricultural film has declined by 11% for dirty agricultural plastic film and by 98% for clean ag film. This decline is partially due to China's 2013 "Green Fence" program which implemented strict regulations for the quality of recyclables they will accept.

Incineration

There is potential to recover energy from plastic film through incineration, but as with recycling, there are obstacles (Hemphill 1993, Briassoulis et al. 2012). Facilities that produce fuel from used plastics often operate 24 hours a day, seven days a week, thus they need a predictable fuel supply. Agricultural film tends to be widely dispersed, seasonal, and low in volume, which makes it harder to use for fuel production (Hemphill 1993, Springman 2014). Other concerns with incineration include pesticide residues and emissions (Garte and Kowal 1993, Felton 2016).

On-farm Burning

Many growers continue to dispose of PE mulch by open burning on the farm. This is now illegal in many states, including Arizona, California, Colorado, Connecticut, Hawaii, Idaho, Kentucky, Massachusetts, New York, Ohio, Tennessee, Vermont and Wisconsin (Hawkins 2010). Burning PE can release carcinogenic substances, such as dioxin, and other toxic particles into the air (Valavanidis et al. 2008).

Landfills

In many areas where recycling or incineration is not readily available, growers are faced with hauling the plastic to a landfill and paying the increasing tipping fees. From 1985 to 2010, national average landfill tipping fees per ton have increased by an average of $1.24 per year, and

the number of landfills has decreased from about 20,000 in the 1970s to just over 1,900 in 2010 (NSWMA 2012). In Tennessee, it can be difficult to locate a landfill that accepts agricultural plastic and one landfill in East Tennessee that does accept it charges $53/ton as of this writing. A Tennessee grower reported that he bales his plastic and rents a dumpster. He can fit 40 acres/dumpster if baled (only 15 acres/dumpster if not baled), and it costs about $400-450 per load plus a $50 deposit for the dumpster and a $3/day dumpster rental fee. In addition to tipping fees, other expenses include the cost of fuel to transport the mulch to the landfill and the employees' wages to pull the plastic from the field and then deliver to the landfill. Due to the limited options, some growers bury the plastic on farm or dump it into rivers and other waterways. This practice can cause water and soil contamination. PE mulch fragments in the soil degrade very slowly and some research suggests complete degradation might take around 300 years, depending on the soil conditions and climate (Ohtake et al. 1998) so neither are long-term mulch disposal solutions.

Biodegradable Mulches

Much progress has been made in the formulations of plastic film mulches that are biodegradable (BDMs) since the first BDMs became available in the 1970s and 1980s. These are truly biodegradable in that they break down in the soil or in compost to only carbon dioxide and water. Biodegradable mulches would allow a grower to reap the benefits of black plastic, but then till the mulch into the soil at the end of the season, saving labor, fuel, and eliminating disposal issues. Many consumers are interested in how their food is produced and how that affects the environment. Despite advancements with recycling and incineration, much of the plastic mulch used is still disposed of in unsustainable ways. Of all the progress made so far, the most important may prove to be the developments in BDMs. As these products become more widely available and understood, growers will be able to have the benefits of black plastic mulch, with the benefit of tilling them in the ground at the end of the season, providing a sustainable way to benefit from mulch technology.

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