



## Managing Used Plastic Mulch Film: Degradable Versus Non-Degradable

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**W**hen many community members and waste management officials discuss plastic products, they typically are referring to consumer commodities such as milk jugs, soda bottles, and detergent containers. But the use of plastics has gone beyond everyday consumer products, finding an increasing number of markets in the agricultural industry. Rising worldwide in popularity is the use of low density polyethylene (LDPE) film for mulching crops. In 1991, 234 million pounds of LDPE film was consumed by the agricultural industry in the United States. A significant amount, approximately 40 to 140 million pounds, was used for mulching applications, and this amount is expected to rise. (See Fact Sheet C-8 for a description of agricultural plastics.)

### Managing Non-Degradable Mulch Film

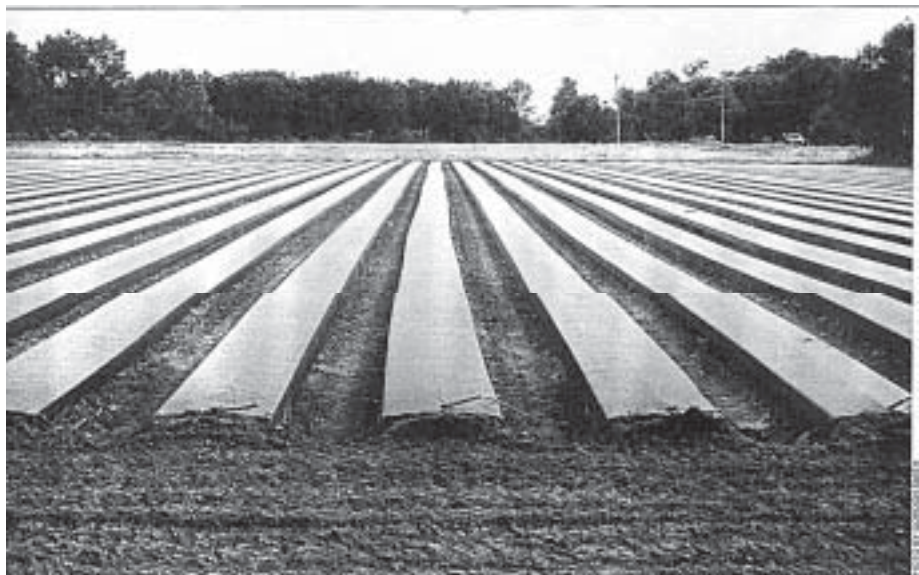
Plastic mulch film provides growers with many benefits, including extending the growing season, conserving moisture, warming the soil, controlling viral-carrying insects and weeds, and reducing herbicide usage. Because plastic mulches vary in properties such as thicknesses, pigmentation, texture and longevity, growers can choose a combination of properties that best suits their particular growing requirements.

Yet, despite these many benefits, the primary drawback is the disposal of the film after the growing season; proper disposal

can be difficult, time consuming, and expensive. For example, non-degradable plastic mulch film must be removed manually, resulting in labor and disposal costs of approximately \$17 per acre. These costs can add up quickly, depending on the number of acres, proximity to a landfill, the tipping fee, and the availability of farm labor and equipment.

After removal, possible methods to manage used mulch film are landfilling, on-farm disposal, recycling, and incineration.

**Landfilling** Most growers landfill their used film. However, the amount of available landfill space is limited due to the filling of landfills, stricter regulatory laws, and the public's negative perception of landfills. In addition to these problems, the bulkiness of plastics makes transportation difficult, and the tipping fees can be high.



*Plastic mulch used in the field.*

**On-Farm Disposal** Another common method to manage used film is on-farm disposal, by burning or burying. One problem with on-farm disposal is the possible release of toxic substances into the environment. Also, on-farm disposal is illegal in some areas of the United States and often requires a permit.

**Recycling** Although the possibility to recycle used mulch film is increasing, significant obstacles to recycling are the high collection and processing costs, the heavy level of contamination, the seasonal variations in the amount of film generated, and the lack of end markets. It can also be difficult to find access to companies that will take back the used material for recycling and to locate pilot projects that recycle plastic mulch film.

**Incineration** Off-farm incineration may be an option, except public perception of pesticides and other chemical agents makes facilities reluctant to accept agricultural wastes, regardless of their amount of exposure to chemical agents. Also, waste-to-energy facilities in Pennsylvania are required to have a separate permit to accept agricultural plastics, which are typically labeled as “residual” waste by the Department of Environmental Resources.

These problems with managing used mulch film can sometimes make the costs of disposal outweigh the benefits of use. To balance the benefits and costs, many growers, educators, and industry members have expressed an increasing amount of interest in degradable mulch film.

## **Degradable Mulch Film**

Similar to non-degradable film, degradable mulch film is placed over the seedbed early in the year, before soil temperatures are optimum for plant growth. However, degradable film does not need to be removed at the end of the season, because the film is designed to eventually decompose into natural by-products, such as carbon dioxide and water. (For a more detailed description of the various

degradation processes, see Fact Sheet C-15.) The film’s ability to degrade allows growers to achieve the benefits of mulch film, without experiencing the problems and costs of managing the used material.

So far, the challenge facing producers of degradable mulch film is predicting the exact time and extent of degradation. Several factors can affect the duration and extent of breakdown, such as the time between laying and planting the crop, crop canopy development, and the tightness of the stretched film over the soil. The breakdown process can also be unstable and inconsistent due to environmental factors such as temperature, humidity, rainfall, ultraviolet light exposure (particularly sunlight), and other climatic conditions. Also, the method of degradation can affect the amount of breakdown; some films break down into sheets, but others crack or disintegrate into smaller pieces. Other factors influencing the breakdown process include weed growth, mowing of crop, foot traffic, animal and tire tracks, depressions in the bed, trickle irrigation tubes under the film, soil

*Table 1. Factors affecting the breakdown of degradable mulch films.*

Factor	Suggested Control Method
Formulation of Material (Long and Short Term)	Consult the company or distributor to select the proper mulch formulation for local climatic conditions and for the type of crop.
Planting Date	Apply long-term mulches one to two weeks before planting to allow enough environmental exposure. Apply short-term mulches just before planting.
Holes, Depressions, Footprints, and Animal or Tire Tracks	Minimize stress concentrations, which may damage the film. Avoid unnecessary foot traffic, especially during planting and early part of growing season.
Weed Growth	Control weeds between mulch strips to allow for proper degradation.
Covered Edges of Film	Lift soil-covered edges as soon after harvest as possible to expose the edges that haven't degraded
Residual Plastic Material	Plant a cover crop and a border strip of small grains to trap larger fragments of residual plastics and to prevent fragments from blowing into neighboring areas.
Crop Canopy Shading	Mow and remove crop canopy immediately after last harvest to continue the breakdown process.

covering the film edges, and stress caused by making holes for transplanting the crop.

In addition to breakdown variations, other concerns are the residual plastic from long-term mulches and the presence of heavy toxic metals in additives such as photodegradable promoters and coloring agents. Residual plastic—fragments which are left after the breakdown process occurs—can be a nuisance to neighbors and may pose problems the next year by releasing heavy or toxic metals, such as nickel, cobalt, and iron, into the soil. Fortunately, studies to date have shown that the residual material and the metals, which are in low concentration, have negligible effects on plant growth from prolonged use, but further testing is taking place.

Some of these concerns can be reduced by adapting the extent and rate of decomposition to local climatic and growing conditions. Table 1 offers some suggestions for ways to control the breakdown process of degradable mulch films.

## Conclusion

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As the use of plastic mulch film continues to increase in the agricultural industry, the need for a cost-effective, environmentally sound method to manage this used material is also increasing. Because non-degradable mulch film presents several waste management problems, environmental concerns have created a greater interest in degradable film. However, degradable mulches can only play a major role in this waste management dilemma if they provide significant benefits as well as degrade. At the present time, further research is being conducted to answer some of the questions concerning degradable mulches, to enhance the benefits achieved from degradable mulches, and to continue their increasing popularity in agriculture.

### Reusing Mulch Film

Some members of the agricultural community are questioning the need to remove and dispose of non-degradable mulch film after *every* growing season. They claim that if the lifespan of the film was increased for longer than its usual one year, the film could possibly be left on the ground for several years. Deterioration could be prevented by adding ultraviolet inhibitors and by increasing the thickness of the film. This would allow the film to resist degradation caused by environmental factors and foot traffic. Also, they acknowledge that plowing the land will be inhibited by the presence of the film, but claim that plowing is done mainly for the convenience of the operator to make the soil more manageable and usually does not benefit the succeeding crop.

One method to allow reuse is to increase the lifespan of the film, level the field, and form precise beds. Trickle tube is placed along each side of the bed, where the tube can irrigate and fertilize the crop. The plastic mulch film is laid over the bed and holes are made in the film for the plants. The plant residue that collects between the beds forms a mulch which gradually decays. Next year's crops are planted in the same holes. Although the film eventually must be removed, this method of reuse can reduce environmental, capital, and labor costs associated with single-use applications.

*\*"Vegetable Grower Update." Dr. James Ellis. 1993. Colorado State University Extension.*

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