Black Degradable Plastic Mulch Evaluation

RFR-A1120

Joseph Hannan, horticultural field specialist
ISU Extension and Outreach

Introduction

Black polyethylene plastic mulch provides many benefits to fruit and vegetable producers. It increases earliness by increasing spring soil temperatures, conserves soil moisture, and reduces pesticide usage by decreasing weed and disease pressure. Furthermore, during seasons of high precipitation, it protects fertilizer from leaching below the root zone. Unfortunately, polyethylene mulches do not degrade and must be removed from the field and discarded each season. This is a labor-intensive process whether it is done mechanically or by hand. Several degradable plastic mulches have been developed that are designed to be incorporated into the soil profile, eliminating the need for removal, with no negative impact on soil quality or health. However, these degradable plastics often do not meet degradation expectations (either degrade too quickly or degrade incompletely and require manual removal). The objective of this project was to evaluate several degradable mulches for storage life, ease of use, and influence on tomato production.

Materials and Methods

The site was located on a Clarion Loam soil in Story County. The black degradable mulches included in this evaluation were a 0.6 mil biodegradable mulch from Dubois Agrinovation, Quebec, Canada; a 0.9 mil photodegradable mulch from Poly Expert Inc., Quebec, Canada; and a 0.5 mil oxo-degradable mulch from Eco-One, Ontario, Canada. A standard 1.0 mil polyethylene embossed black mulch was used as a control. To observe the effects of storage, a second 0.6 mil biodegradable mulch purchased in 2010, partially used, and stored in a non-climate controlled environment for one year, was also included. Trial design was a complete strip block with three replications. All mulches were 4 ft wide and laid on May 9, 2011. Plots were a single row of mulch with Celebrity tomatoes planted with an 18-in. spacing (ten plants per plot) on May 16. Only the center eight plants were harvested. Standard cultural practices were followed for irrigation, fertilization, and pest control as outlined in the 2010 Midwest Commercial Vegetable Production Guide. Plants were trellised according to the Florida Stake and Weave system. Fruit were harvested from July 26 to August 16 to determine the effect of mulch on early yield.

Results and Discussion

Dubuis Agrinovation recommends storing unused rolls of biodegradable mulch in their original packaging, away from water, sunlight, and heat sources. However, there was concern as to how well partially used rolls would store from one year to the next. The 2010 roll of biodegradable mulch showed no signs of wear, decay, or imperfections caused by storage. It was not more brittle and no more difficult to lay than the newly purchased roll of biodegradable mulch. Furthermore, there were no differences in early yield or soil temperatures between the old roll and the new roll of mulch. If properly stored, growers should be able to keep unused rolls of mulch from one season to the next.

Soil temperatures under the oxo-degradable (68.5°F) and photodegradable (68.4°F) mulches were warmer, although less than one degree, than the polyethylene (67.9°F) and biodegradable (67.8°F) mulches. This was not consistent with results observed in a 2010 study on a coarse, sandy soil where no

differences in temperature were observed. There were no differences in early yield between the treatments; there were no differences in number of fruit per plant or harvested weight per plant.

The biodegradable and oxo-degradable mulches were noticeably thinner than the photodegradable and polyethylene mulches. This made them more difficult to handle and install in the field than the photodegradable and polyethylene mulches. When handling these rolls, any minor bump or ding caused damage to the plastic several layers deep. These minor imperfections in the plastic tended to be where the first holes in the mulch formed. In addition, soils must be well worked and very loose before laying the plastic as any protrusion or point of pressure on the plastic caused them to prematurely break down. Because these mulches are so lightweight, any wind while laying them made it very difficult to get a tight, clean application. Unlike the photodegradable and polyethylene mulches, the biodegradable and oxo-degradable mulches were fragile, making them difficult to plant into without tearing.

Each mulch adequately controlled weeds throughout the season. However, the biodegradable and oxo-degradable mulches formed small tears allowing weeds to grow through the mulch as the season progressed. The degradable mulches were rototilled into the soil on September 2, 2011. The biodegradable mulch was very brittle and easily broke apart into small pieces. The photodegradeable and oxo-degradeable were more elastic than the biodegradable and left larger pieces in the field. The polyethylene embossed mulch was removed by hand and was very elastic at removal.

In this trial, all mulches performed adequately. However, for maximum effectiveness of the oxo-degradable and biodegradable mulches, it is important to follow the manufacturer's directions and lay the mulch as close to planting as possible. These mulches are more expensive per linear foot but when the cost of removal and disposal is included, the total cost for polyethylene, photodegradable, and oxo-degradable mulches are similar (Table 1). The biodegradable mulch is about twice the cost of the others.

Acknowledgements

Thanks to the Horticulture Station staff and the Research and Demonstration Farms for providing funding and generously maintaining this project.

Table 1. Cost per linear foot of each mulch and total cost per acre.

Mulch	Cost per linear ft	Total cost per acre[z]
Polyethylene	$0.024	$236
Photodegradable	$0.024	$186
Oxo-degradable	$0.036	$273
Biodegradable	$0.080	$593

[z]Cost per acre assumes 7,260 linear ft per acre, a labor cost of $10/hr and a disposal cost of $2/ton. Assume six hours labor for polyethylene mulch removal and one hour labor for all others.