



Performance and Adoptability Biodegradable Mulch

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Report No. FA-2019-02

August 2019

Authors:

Jenny Moore

Annette Wszelaki

Summary

Polyethylene (PE) and biodegradable plastic mulch (BDM) provide many crop production benefits, one of which is weed control. However, nutsedge can be a very destructive weed that will break through both PE mulch and plastic BDM. Effective herbicide options for this weed are limited and mechanical control can be expensive and impractical. Paper mulch prevents nutsedge emergence, providing growers with a mulch that can be used in place of PE mulch or other BDMs when nutsedge control is needed.

This material is based upon work that is supported by the National Institute of Food and Agriculture, under award number 2014-51181-22382. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.



United States
Department of
Agriculture

National Institute
of Food and
Agriculture

Paper Mulch for Nutsedge Control in Vegetable Production

Polyethylene (PE) mulch has been widely used in vegetable production for decades due to its many benefits, such as weed control, moisture retention, decreased disease pressure, early harvest, and increased yield and quality, among others. Similarly, biodegradable plastic mulch (BDM) use is on the rise as it provides many of the benefits of PE mulch with the advantage of being tilled in or composted at the end of the season, avoiding the disposal problems of PE. Though weed control is among the benefits of PE mulch and BDM, nutsedge [purple nutsedge (*Cyperus rotundus* L.) and yellow nutsedge (*Cyperus esculentus* L.)] can penetrate both PE mulch and plastic BDM. This creates holes in the mulch allowing other weeds to emerge, making removal of the plastic more difficult, and can cause significant yield losses. Fumigation and herbicide applications are limited and mechanical or hand weeding can be expensive leading some growers with nutsedge infested fields to abandon vegetable production until the weed can be controlled.

Paper (cellulose) mulch has been shown to prevent the emergence of nutsedge. In a two year field experiment in eastern Tennessee growing peppers on PE, five different plastic BDMs and a paper BDM, only the paper suppressed nutsedge (Table 1, Fig. 1), resulting in higher pepper yields. Additionally, paper mulch is the only BDM currently allowed in certified organic production.



Figure 1. Early in the growing season, nutsedge penetrates black (top) and white-on-black (center) BDM but not paper BDM beds (bottom).

Things to consider when selecting mulch

Like any other mulch, there are advantages and disadvantages to paper mulch, depending on a grower's needs. The paper mulch used in the Tennessee experiment is a light brown, creped paper and is commercially available. Due to the weight of the mulch, shipping costs can be expensive, and rolls are shorter (500 ft/roll) compared to PE or BDM (2,000-4,000 ft/roll). Therefore, more rolls are needed to cover the same amount of land.

Table 1. Average number of nutsedge plants (per m²) in each treatment [Bare ground (hand-weeded/no mulch), plastic BDMs (Bio360, Experimental PLA/PHA, Naturecycle, Organix AG Black and Organix AG White-on-black (WOB)), traditional PE, and a paper BDM (WeedGuardPlus)] for each weed rating date over the pepper growing seasons in 2017 & 2018, Knoxville, TN.²

Treatment	Number of nutsedge plants per m ²			
	5 June 2017	6 Sept 2017	1 June 2018	21 Aug 2018
Bare ground	-	30 bc ^x	-	5 d
Bio360	2	34 bc	6 cd	165 a
Exp PLA/PHA	5	67 ab	24 a	169 ab
Naturecycle	11	72 a	17 ab	163 abc
Organix AG (Black)	11	84 a	9 bcd	173 a
Organix AG (WOB)	6	48 ab	13 bc	99 bc
WeedGuardPlus	0	6 c	0 d	10 d
PE	3	63 ab	6 cd	53 c
P-value	0.19	0.0006	0.0007	<0.0001

²Peppers were transplanted into the field on 25 May 2017 and 29 May 2018.
^xTreatment means with the same letter within a given column are not significantly different (Fisher's least significant difference at $\alpha = 0.05$).

Once mulch laying equipment is properly adjusted, the time to lay creped paper mulch is the same as PE mulch or BDM. The creping allows for stretching and minimizes tearing. Depending on the weather conditions in a given season, paper mulch usually stays intact long enough to provide weed control during the critical period (Fig. 2). The critical period is the first four to six weeks after planting in which the crop establishes a canopy large enough to shade out and out-compete weeds. In the Tennessee experiment, the light-brown paper mulch provided a beneficial soil cooling effect in the middle of the season; however, for an early season crop, paper mulch would not provide the same soil warming as black colored mulches that hasten crop maturity for earlier harvest. In both years of the experiment, there was no visible paper mulch left by the end of the season, so there were no disposal costs or mulch fragments remaining in the soil. With the paper completely broken down by the end of the season, crops that touch the ground may require washing before sale. Yet if nutsedge is a problem and fumigation is not an option, paper mulch can be a viable alternative for growers wanting to use a mulch in their production system.



Figure 2. Nutsedge is going to seed in one of the BDM plots (top) while the paper mulch is still free of nutsedge (bottom).

References and Resources

Haapala, T., Palonen, P., Korpela, A., Ahokas, J., 2014. Feasibility of paper mulches in crop production — a review. *Agricultural and Food Science* 23, 60–79. <https://doi.org/10.23986/afsci.8542>

Nutsedge Factsheet from Clemson University Extension: Includes life cycle and identification, control methods for lawns, landscapes and vegetable gardens. <https://hgic.clemson.edu/factsheet/nutsedge/>

Nutsedge Management Guide from University of California IPM: <http://ipm.ucanr.edu/PMG/PESTNOTES/pn7432.html>