

Mulches and their Impact on Weeds

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Opaque plastic mulches are commonly used to prevent weed germination in the production of strawberries, fresh market peppers, tomatoes and other horticultural crops, especially on organic farms. Previous work by Steve Fennimore et al. showed that polyethylene (PE) mulches that were black, red, yellow, green or white on the top side and black on the under side provided 78-98% broadleaf weed control while weed control under clear or blue mulches was poor (44-50%). However, the sharp shoots of yellow nutsedge (*Cyperus esculentus*) penetrate through any commonly used PE mulch and the weed can establish within 1-2 weeks. Yellow nutsedge is difficult to control even with non-methyl bromide fumigants and there are currently no effective strategies to manage this weed in non-fumigated strawberries or in any organic production systems. Hand weeding can cost \$5,000/acre per year or even more and has little effect on nutsedge tubers. Additionally, hand weeding of nutsedge requires labor allocation from other operations, such as harvest, and therefore is often not completed. When uncontrolled, nutsedge starts to produce tubers at 4-5 leaf stage; the tubers are spread in the field with tillage and are viable for up to 3 years.

In a series of experiments we have been evaluating mulches or mulch combinations for reliable, long-lasting nutsedge control. In 2006-07 an RCB experiment with five replications was conducted at Oxnard, California to compare emergence of yellow nutsedge and strawberry performance in beds covered with black PE mulch alone and beds where Novovita paper (recycled newspaper, gypsum) was laid under mulch. In 2007-2008 this experiment was repeated but Novovita paper was installed between the two layers of PE mulch, and, as additional treatments, weed barrier mat and water resistant Tyvek (DuPont) home wrap paper were tested under black PE mulch. All plots were 4 by 25 ft. In 2008-2009 all above mentioned mulch combinations were tested again, and one additional treatment included a single layer of Dura Skrim (0.167 mm thick) plastic.

In fall and winter 2006-2007 the combination of paper under plastic completely eliminated yellow nutsedge germination that otherwise germinated through plastic at a density of 0.5 plants/ft² per week. However, in spring when the paper disintegrated due to contact with wet soil and when soil temperature increased above 60°F, the nutsedge resumed germination at a rate of 0.3 to 1.6 plants/ft² per week in all treatments. This indicated that paper with greater water resistance or that could be protected from contact with wet soil was needed for season-long control.

In 2007-2008 the plastic-paper-plastic treatment (paper between two PE mulch layers), weed barrier mat, and Tyvek all provided complete control of nutsedge shoots for nine months, which

otherwise germinated through PE mulch alone at a density of 0.1 plants /ft² per week. In the first 3 months of the 2008-2009 season all treatments, including Dura-Skrim, controlled nutsedge germination 100% and the evaluation will be completed in summer 2009.

In 2006-2007 and 2007-2008 seasons none of the mulches or mulch combinations affected strawberry plant growth and fruit yield or soil temperature in the root zone. However, in 2008-2009 planting holes in weed barrier mat and in Dura Skrim plastic were small and made transplanting difficult, resulting in poor plant establishment. Since these two materials do not stretch and the planting hole can not be enlarged by hand during planting, we suggest cutting larger planting holes if these mulches are used. This is especially important for plants such as strawberry that require space within planting holes for crown division and expansion but this may be less of an issue for crops with a single stem such as pepper or tomato.

Our results so far show that all of the mulch combinations tested in 2007-2008 provided near 100% nutsedge control. Additionally, the mulch combinations significantly reduced the number of wind-dispersed weeds in planting holes, likely by minimizing weed seed-to-soil contact. The weeds in planting holes directly compete with crop and can only be selectively controlled through hand-weeding. Economic analyses of physical barriers showed that plastic-paper-plastic combination was least expensive, followed by weed barrier mat, Tyvek and Dura Skrim. Costs for all mulch treatments were less than or similar to hand weeding estimated at \$6,500/acre /9 month season.

Since no deterioration was observed after nine months for Tyvek, weed barrier mat and Dura Skrim we will collect them the end of current season, store and install them at a nutsedge-infested site at the beginning of the following season. Even though additional labor may be involved, the reuse of these mulches will cut the expenses in half while reducing the need for disposal. Biodegradable mulches are also being considered as treatments for the next experiment.

Table. Evaluation of mulches and mulch combinations for weed control near Oxnard, CA.

Treatment	Years tested	Yellow nutsedge control, % ^a	Wind-dispersed weed control in planting holes, % ^b	Treatment cost, \$/acre
Regular black PE mulch (control)	2006-2007	0	0	500
Paper under PE mulch	2006-2007	100 for 3 months, 0 afterwards	---	870
Paper between two PE mulch layers	2007-2008 2008-2009 ^c	100 100	67	1,370
Weed barrier matt under PE mulch	2007-2008 2008-2009	100 100	62	4,856
Tyvek home wrap under PE mulch	2007-2008 2008-2009	100 100	89	5,209
Dura Skrim plastic	2008-2009	100 100	---	6,500

^a Yellow nutsedge control excludes nutsedge germinated in planting holes.

^b Wind dispersed weeds were: annual sowthistle, horseweed and common groundsel.

^c 2008-2009 evaluations are in progress and results for the first 3 month only are reported.