# FACTORS AFFECTING THE SUPPRESSION OF NUTSEDGE BY TRANSLUCENT PLASTIC FILM MULCH

**David T. Patterson***, USDA/ARS, Ft. Pierce, FL 34945-3138

Purple nutsedge *(Cyperus rotundus* L) is a major weed of polyethylene film-mulched vegetable crops, because its sharp-pointed shoot tips readily penetrate conventional opaque mulch films. This characteristic enables nutsedge to emerge through the mulch and compete with the vegetable crop. Young vegetable plants typically are poor competitors with weeds, and heavy infestations of nutsedge cause substantial yield losses. Nutsedge currently is managed with soil fumigant mixtures containing methyl bromide. Therefore, alternatives for nutsedge control must be developed.

Majek and Neary (199 1) reported that translucent, photoselective, infrared-transmitting (IRT) mulch films suppressed emergence of a related species, yellow nutsedge *(Cyperus esculentus* L). In greenhouse, field, and growth chamber experiments, Patterson (1996, 1997) determined that IRT mulch as well as other translucent mulches also suppressed emergence and reduced tuber and rhizome production of purple nutsedge, in comparison with opaque white-on-black (W/B) mulch. In the greenhouse and field environments, soil temperatures under translucent mulch were 4 to 13 C greater than under opaque mulch, but, in the growth chamber, soil temperatures were only 0.4 to 0.6 C greater under the translucent mulches. Therefore, the suppressive effects of translucent mulch could not be attributed to solarization. When maintained in the dark, emerging nutsedge shoots readily penetrated translucent mulches as well as the conventional opaque mulch, indicating that the suppressive effects of translucent mulches probably are related to photomorphogenic processes in the developing nutsedge shoot.

To determine the range of conditions under which translucent mulches effectively suppress purple nutsedge emergence, further experiments were conducted in controlled-environment plant growth chambers. The growth chambers were illuminated by a mixture of fluorescent and incandescent lamps providing 400 $\mu E\ m^{-2} s^{-1}$ . Unless otherwise indicated, the photoperiod was 14 h, and day/night temperatures were 32/26 C. All experiments were conducted in 16-cm diam. pots containing heat pasteurized field soil (Oldsmar sand).

The effect of depth from which shoots emerged was determined by planting nutsedge tubers at depths of 2 or 6 cm below the soil surface. Ten tubers were planted per pot at the specified depth. The pots were filled to the rim with soil and covered with squares of translucent IRT mulch or opaque W/B mulch held in place by rubber bands. Uncovered bare soil pots were included to determine effects of planting depth on emergence from the soil surface. There were four pots per treatment. The deeper planting delayed initial emergence from the bare soil, but by 39 days after planting (DAP) equal numbers of shoots had emerged from both depths. In comparison with bare soil, emergence through the opaque W/B mulch was equal or greater, regardless of planting depth. More shoots emerged from the shallow planting than from the deeper planting, however. By 39 DAP, 50 shoots per pot (2500 $m^{-2}$ ) had emerged through the opaque mulch from the 2 cm planting depth, compared with 33 shoots per pot from the 6 cm planting depth. The IRT mulch completely suppressed emergence from the 2 cm planting depth, but an average of 3.5 shoots per pot emerged through the IRT mulch from the 6 cm planting depth.

Earlier field observations indicated that nutsedge penetration of plastic mulches on raised beds occurs more often on the shoulders of the bed where the mulch is most closely appressed to the soil. The influence of "free space" under mulch therefore was investigated by filling pots either to the rim or to within 2 cm of the rim with soil before covering the soil with either opaque W/B mulch or translucent IRT mulch as above. Twelve tubers were planted 3 cm below the soil surface in each pot. There were six pots per treatment. Allowing 2 cm of free space between the mulch and the soil surface significantly reduced penetration of both opaque and translucent mulches by nutsedge shoots. At 38 DAP, 41 shoots per pot (2050 $m^{-2}$ ) had emerged through the opaque mulch without free space, compared to 30 per pot with free space. The translucent IRT mulch with free space completely suppressed nutsedge emergence. Three shoots per pot penetrated IRT mulch applied without free space.

Because earlier work demonstrated that growth in continual darkness enabled nutsedge shoots to penetrate translucent mulches as readily as opaque mulch, an experiment was conducted to determine the effect of daylength on the suppression of nutsedge by both types of mulch. A longer daily dark period would be expected to increase penetration of translucent mulch. Photoperiods of 8 and 16 h of full fluorescent and incandescent lighting were established in two growth chambers. The dark periods in the chambers were 16 and 8 h, respectively. In order to eliminate thermoperiod effects, both chambers were maintained at 29 C during both light and dark periods. Within each photoperiod, treatments consisted of bare soil, translucent IRT mulch, and opaque W/B mulch. Ten nutsedge tubers were planted 3 cm deep in each of four pots per treatment as described above. At 35 DAP, nutsedge emergence from bare soil or through opaque W/B mulch was significantly greater in the longer (16 h) photoperiod: bare soil-long PP, 35 shoots per pot (1750 $m^{-2}$); bare soil-short PP, 21 per pot; W/B mulch-long PP, 29 per pot; W/B mulch-short PP, 22 per pot. In comparison with opaque mulch or bare soil, translucent IRT mulch significantly reduced nutsedge emergence in both photoperiods, but emergence through the IRT mulch was significantly greater in the short photoperiod: IRT mulch-long PP, 3 shoots per pot; IRT mulch-short PP, 8 shoots per pot. Further studies are underway to examine the diurnal dynamics of nutsedge shoot emergence in order to determine relative shoot emergence during daily light and dark periods.

Translucent polyethylene film mulches are potentially useful components of nutsedge management systems to be developed as alternatives to methyl bromide. Their effectiveness will be influenced by factors such as those discussed above. Their use also will be limited seasonally, because they elevate soil temperature. This latter characteristic may be desirable or undesirable, depending on the crop and the climatic conditions during its growing season.

Literature Cited

Majek, B.A. and P.E. Neary. 1991. Selective wavelength transmitting mulch for yellow nutsedge control. Brighton Crop Prot. Conf.-Weeds-1991: 263-268.

Patterson, D.T. 1996. Suppression of nutsedge with plastic mulch. 1996 Ann. Int. Res. Conf. on Methyl Bromide Alternatives and Emissions Reductions. Pp 11-1 - 11-2.

Patterson, D.T. 1997. Suppression of purple nutsedge (*Cyperus rotundus* L.) with plastic film mulch. Abstr. Weed Sci. Soc. Am. 3 7: 5 8.