

Final Project Report to the NYS IPM Program, Agricultural IPM 2000 – 2001

Title: Biodegradable Films for Establishment Year Weed Suppression in Matted Row Strawberries

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Abstract: Adequate weed control in matted row strawberry plantings in the establishment year is crucial for the long-term viability of the planting. Suppression of weed growth until the new strawberry plants are established and spreading would add a new tool in the management of weeds in new strawberry plantings in New York and nationally where strawberries are grown in matted rows. Three biodegradable films were compared to standard weed control for establishing matted row strawberries. Two films were biodegradable polymer, either clear (IP40clear) or black (IP40black), covering brown 40# Kraft paper (International Paper, Geneva, NY). The third material was planters paper (Ken-Bar, Reading, MA), which is commercially available black paper mulch used for vegetable production. The films were evaluated for their ability to suppress weeds and for their rate of degradation. The ability of runners to root as the film degrades was also observed. The IP40black suppressed weeds significantly compared to the standard control but did not degrade quickly enough for runners to set. It needed to be slit at the end of July to allow runners to root. The planters paper also suppressed weeds significantly. However it degraded quickly along the edges where it was covered by soil. This allowed the wind to tear it and blow large pieces off the plots. The IP40clear degraded in a timely manner, which allowed runner set, but encouraged weed growth so was not acceptable as a weed suppression material. The IP40black and planters paper were effective for weed control in the establishment year but both had major drawbacks that must be addressed before they become widely utilized. Runner formation was not significantly affected by any treatment. Yield and long term degradation of the materials will be assayed in 2002.

Background and justification: Weed control is the most pressing problem encountered by strawberry growers in matted row strawberry production. Newly planted strawberries are most susceptible to weed competition during the first 2 months after planting (Pritts and Kelley, 2001). Yield losses of up to 65% were documented after early season weed competition. Weed control during this critical period in matted row plantings is especially critical for the long term viability of new plantings and is difficult because only one herbicide with a limited 6 week residual activity is available for establishment year weed control (Pritts and Kelley, 2001). This has been shown to be insufficient to prevent weed competition and yield reduction.

In a matted row system, straw is applied on the established field in the late fall of each year for cold protection and weed control in the following year. Therefore, new plantings are without this mulch weed control until they are fully established. Current plasticulture with non-degradable plastic provides excellent weed control but cannot be used for establishing a

matted row planting because the plastic stops runners from rooting and filling in the row. By using a material that degrades within 60-90 days of application, weed suppression during the critical part of the season can be accomplished while still allowing runners to fill in the row as the material degrades. The subsequent straw application will further help in the degradation process and prevent blowing of fragments thus making complete degradation more likely.

Objectives:

1. Determine if any of 3 biodegradable films are effective for providing weed control in the establishment year of matted row strawberry plantings and compare the weed control to standard establishment practices.
2. Determine degradation rate of the films and the rate of runner rooting through the film.
3. Examine the long term degradation of the films through observing film fragments in the field for 2 years and beyond

Procedures:

1. The weed control potential of 3 row covers designed to degrade in the environment will be compared to standard weed control practices in establishing a matted row strawberry planting. Weed assessments will be made at intervals after planting to compare 5 treatments. Two films were biodegradable polymer, either clear (IP40clear) or black (IP40black), with backing of brown 40# Kraft paper (International Paper, Geneva, NY). The IP40clear was used both polymer-side-up and polymer-side-down. The third material was planters paper (Ken-Bar, Reading, MA), which is commercially available black paper mulch used for vegetable production. The percentage of degradation of each material was evaluated at intervals after planting based on visual observations. Also, the number of runners in each treatment was recorded for comparison.
2. The planting will be managed as a matted row for 2-3 years. Yield will be evaluated in these years. The percent breakdown of each of the films will also be noted in the years after establishment.

A completely randomized design was used for this experiment. For each of the 5 treatments, 2 varieties, Jewel and Honeoye, will be planted in 3 replicated 50-foot blocks for a total of 300 row feet for each treatment. That makes a total of 30 blocks (2 varieties x 5 treatments x 3 replicates) and a total of 1500 row feet. All plots were treated with Devrinol (napropamide) pre-emergence herbicide before planting at the recommended rate. The five treatments are as follows:

- Treatment #1: Standard practice-acts as control.
- Treatment #2: IP40black.
- Treatment #3: Ken-Bar planters paper.
- Treatment #4: IP40clear- polymer-side-down.
- Treatment #5: IP40clear- polymer-side-up.

Results and discussion:

Significant differences among the treatments for weed control were seen throughout the season. All plots had supplemental hand weeding to keep weed competition to a minimum. For the first 6 weeks after planting, the standard control, treatment #1, plot had the most weeds (Table 1, Figure 1). By 8 weeks, treatment #5 , IP40clear-polymer-side-up, had higher weed pressure than the standard control and by 10 weeks both treatment #4, IP40clear-polymer-side-

down, and #5 had significantly more weeds than the standard control (Table 1, Figure 1). Treatments #2, IP40black, and #3, planters paper, had significantly fewer weeds than the standard control for the entire 10 week period (Table 1, Figure 1).

The degradation of the row coverings varied greatly throughout the season. Treatment #3, planters paper, quickly broke down along the edges covered with soil, which allowed the wind to blow under and tear much of the covering. By 6 weeks after planting, most of the planters paper had blown off the plots even with supplemental covering with soil (Table 2, Figure 2). By December, few traces of Treatment # 3 were visible in the plots.

Treatments #4 and #5, IP40clear, were similar to each other in degradation but placing the polymer side up did increase the speed of degradation (Table 2, Figure 2). Much of the paper backing of this material was blown away by the wind. By December, most of this material was degraded regardless of whether or not the biodegradable polymer was contacting the soil.

Treatment #2, IP40black, degraded very little. This film had to be slit at the end of July to allow runners to root. Degradation of the paper backing proceeded quickly from that time, but the biodegradable polymer was still nearly intact in December (Table 2, Figure 2).

All of the plots will be covered with straw for winter protection and degradation monitored in 2002. Yield will also be measured in the plots in 2002 to determine if there are any variety or treatment effects of these weed control measures.

Treatments #2 and #3 were more effective at weed control than standard control practices for establishing a matted row strawberry planting. However, both materials had definite disadvantages. The planters paper, treatment #3, quickly degraded where it was in contact with the soil, which allowed for wind action to tear and blow large pieces from the plots. It did have a residual effect on weed control even after it was gone from the plots. The temperature and/or light exclusion under the material possibly worked synergistically with the pre-emergent herbicide to make weed seeds more susceptible. To use this material, it would be necessary to cover it with soil or organic material before it blows away or place a windbreak to catch blowing pieces.

Treatment #2, IP40black, was very effective at weed control but did not degrade soon enough for rooting of runners. It had to be slit so that sufficient runners could fill in the matted row. That may be a viable requirement as it would reduce hand weeding costs significantly. However, after 5 months in the field the biodegradable polymer has not significantly degraded. It will be monitored in the 2002 to see if the material will degrade sufficiently to be used for this purpose. Alternatively, this material may be attractive for annual production of strawberries or vegetable crops or as a mulch for raspberry or blueberry plantings if it will break down with cultivation or by covering with organic matter.

The IP40clear, treatments #4 and #5, was not an effective weed control material over the season. As the material began to breakdown, it appears that the material encouraged weed growth by providing a moist, warm environment for germination with sufficient light for growth. This material did degrade well but would not be recommended for weed control.

Runner production was not significantly different among any of the treatments in either strawberry cultivar. Yield will be measured in 2002 which may indicate if there were any differences in runner setting or flower bud development.

Table 1: Cumulative mean number of weeds per 50ft. plots in new matted row plantings with different weed control measures at 4 dates during the establishment season. Hand weeding was done during the season and weed numbers totaled.

| Treatment | Number of Weeds | | | |
|--------------------------------|-----------------|------------------|------------------|------------------|
| | June 15 | July 13 | July 27 | August 17 |
| #1 Standard Control | 3 ^a | 120 ^a | 187 ^a | 229 ^b |
| #2 IP40black | 0 ^b | 3 ^b | 14 ^b | 39 ^c |
| #3 Planters paper | 0 ^b | 8 ^b | 33 ^b | 57 ^c |
| #4 IP40clear-polymer-side-down | 0 ^b | 11 ^b | 40 ^b | 528 ^a |
| #5 IP40clear-polymer-side-up | 0 ^b | 28 ^b | 221 ^a | 535 ^a |

^{a,b,c} indicate significantly different classes at each date using Duncans Multiple Range test, $P \leq 0.05$. (Gomez and Gomez, 1984).

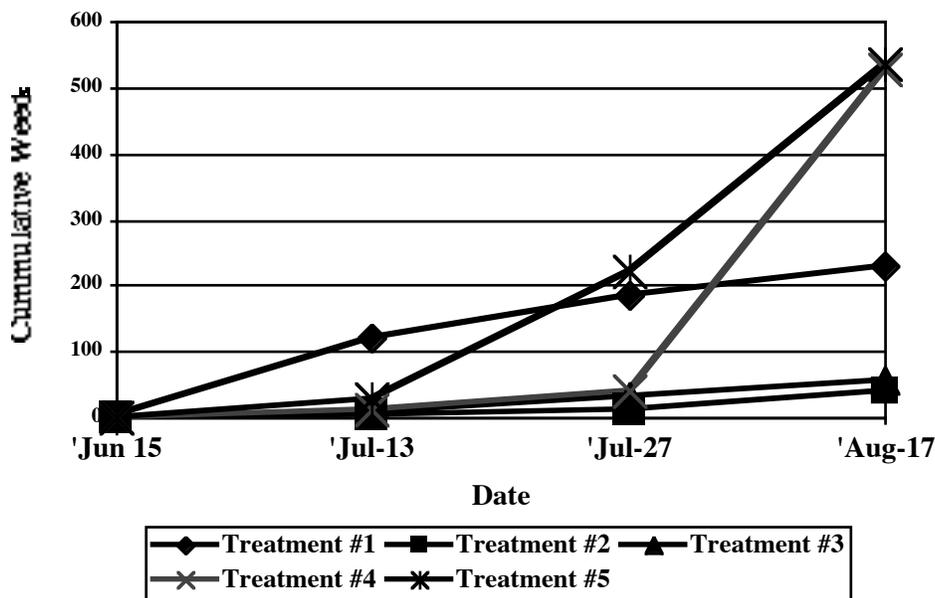


Figure 1: Cumulative mean weed counts over time of 5 weed control treatments in matted row strawberry establishment: Treatment #1-standard control; Treatment #2-IP40black; Treatment #3- planters paper; Treatment #4-IP40clear-polymer-side-down; and Treatment #5- IP40clear-polymer-side-up.

Table 2: Mean degradation ratings for 4 row covers in matted row strawberry plots on 5 dates throughout the establishment year.

| Treatment | % Degradation | | | | |
|--------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | Jun-15 | Jul-13 | Jul-27 | Aug-17 | Dec-10 |
| #2 IP40black | 0.2 ^a | 2.5 ^a | 4.2 ^a | 11.7 ^a | 60 ^a |
| #3 Planters paper | 4.3 ^b | 83.3 ^c | 95 ^d | 95.8 ^d | 99.2 ^c |
| #4 IP40clear-polymer-side-down | 0.33 ^a | 10.8 ^b | 16.7 ^b | 50 ^b | 73.3 ^b |
| #5 IP40clear-polymer-side-up | 0 ^a | 23.3 ^b | 79.2 ^c | 84.2 ^c | 92.5 ^c |

^{a,b,c,d} indicate significantly different classes at each date using Duncans Multiple Range test, $P \leq 0.05$. (Gomez and Gomez, 1984).

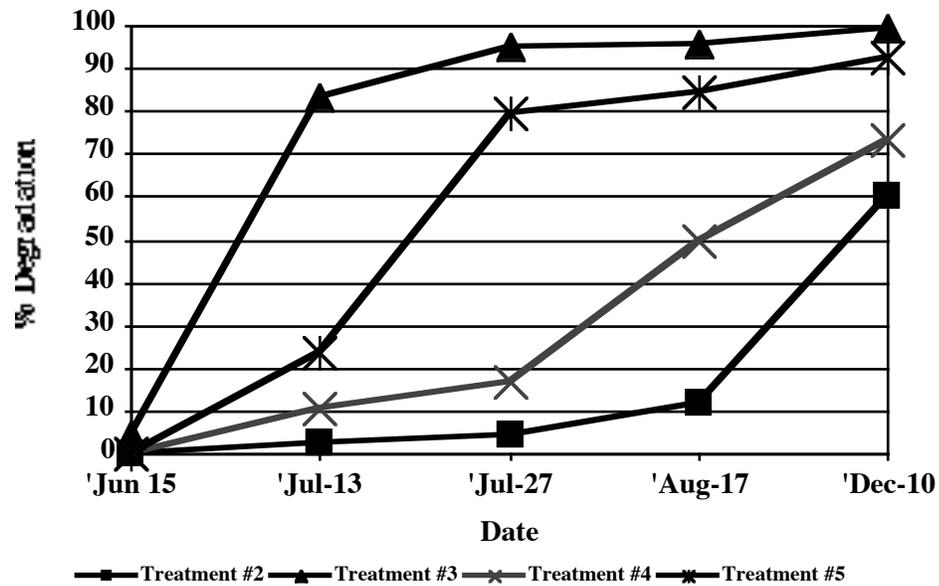


Figure 2: Mean degradation ratings for 4 weed control treatments in matted row strawberry plots in the establishment year taken at 5 dates during the season: Treatment #2-IP40black; Treatment #3- planter paper; Treatment #4-IP40clear-polymer-side-down; and Treatment #5-IP40clear-polymer-side-up.

References:

- Gomez, K.A. and Gomez, A.A. 1984. *Statistical Procedures for Agricultural Research*. John Wiley & Sons. New York. p. 187-216.
- Pritts, M.P and Kelly, M. 2001. *Early season weed competition reduces yield of newly planted matted row strawberries*. *Hortscience*. 36(4):729-731.