

1. Title:

Integrating Weed Management Options in Strawberries

2. Project Leader:

R.R. Bellinder, Department of Horticulture

3. Cooperators:

M.P. Pritts, Department of Horticulture
Deborah Breth, Cornell Cooperative Extension

4. Abstract:

Weed management in perennial strawberries is essential for long-term productivity. Particularly, management during the planting year is especially important to maximize stand establishment and minimize pressure in years to come. Reduction in weed populations can reduce disease and insect pressure and drastically reduce costly hand-weeding. Different studies have evaluated chemical, mechanical, and biological control measures separately. Whereas commercial growers integrate these tools into a program approach. This project evaluated seven different weed management systems for strawberries. Treatments included the use of broadcast and banded herbicides, cultivation equipment, and inter-seeding of fescue grass in a variety of combinations. A banded herbicide, which results in a 50% reduction in herbicide use, plus cultivation treatment and use of inter-seeded fescue with broadcast herbicide treatment both had the greatest reductions in weeds. Results suggest that cultivation equipment did not have a detrimental impact on plant development and establishment. In 2007, yield data will be collected to determine differences between 2006 treatments.

5. Background and justification:

Strawberries are an important component of New York State's total fruit production value. In 2004, berries were grown on 1,500 acres and the crop was valued at 10.4 million dollars; the third highest valued fruit crop in the state (NY NASS, 2005). Weed control can be a major limiting factor in strawberries and without proper management; they reduce yields through competition for water, nutrients and light. Additionally, weeds are hosts for insects and diseases that decrease fruit quality. A recent survey of growers determined that weed control was the #1 priority for research needs.

During the planting year, 75% of growers surveyed apply a broadcast pre-emergence herbicide followed by one to two post-emergence applications. 83% of growers follow the pre-emergence application with cultivation and 85% utilize hand-weeding when herbicide effectiveness is lost. The necessity for an additional one to two herbicide applications dramatically increases the pesticide load on the environment. Two-thirds of growers surveyed stated that they do not band herbicides, mostly due to lack of knowledge (2006 Grower Survey). Competition from in-row weeds during establishment can dramatically decrease yields. Banded herbicides result in a reduction of 50% in herbicide use and can adequately maintain the row weed-free.

As previously stated, growers commonly rely on more than one type of weed control. The impact one control measure has on another has not been clarified in previous research. Despite utilizing a diversified management system, growers still have weed problems. The goal of this research was to determine the impact that integrated management practices have on the ability to minimize weeds. Through the monitoring of weed populations, strawberry plant development and establishment, and yields we intend to determine how more effectively these tools can be integrated.

6. Objectives:

1. Compare seven different weed management systems for their impact on plant establishment, subsequent plant growth, and daughter plant production/development.
2. Evaluate the impact that these various systems have on weed populations and species diversity.
3. Project Evaluation

7. Procedures:

The study was conducted at the H. C. Thompson Research Facility in Freeville, NY on a Howard Gravel Loam soil. Plants were transplanted on May 9 into plots containing one row each of 'Earliglow' and 'Jewel' varieties. The treatments were: A.) Standard Broadcast Herbicide, B.) Standard Broadcast Herbicide + Fescue, C.) Banded Herbicide + Cultivation(Between+In-row), D.) Banded Herbicide + Fescue, E.) Fescue + In-row cultivation, F.) Between + In-row cultivation only, and G.) Handweeded Check. All applications were made using a CO₂ sprayer that delivered 34 GPA. In-row cultivation was done with a Buddingh Finger Weeder (Buddingh Weeder Co., Dutton MI) and a torsion weeder (Bezzarides Brothers, Orosoi, CA). An s-tine cultivator was used between rows. The fescue variety 'Firefly' was seeded at 200 lbs/A between rows sixteen days after transplanting and was mowed as needed throughout the trial. Each treatment had four replications setup in a completely randomized complete block design. All treatments received a hand-weeding on July 7th. Four 0.25m² weed counts (June 8, 29, August 15, and September 6) by species were taken in all plots both in- and between-row and weed dry weights were collected on September 6. Runner number was separately counted for each variety in all treatments on August 15. All data were analyzed for treatment differences utilizing an ANOVA (PROC GLM, SAS Institute, 2006) and treatments were considered statistically significant if $p=0.05$.

8. Results and discussion:

This year was one of the wettest on record which resulted in extremely heavy weed pressure in even the standard herbicide plots. A hand-weeding event was needed across all treatments during the wettest portion of the summer. Plant development was also slowed because of the excessive moisture and cooler than normal temperatures in May. Inter-seeded fescue germinated poorly because of cooler temperatures immediately after seeding, and was re-seeded a week later.

Banded herbicides, which decreased herbicide use 50%, in combination with cultivation and the broadcast herbicide combined with fescue treatments, had the greatest reduction of total weeds when compared to the other treatments. By mid-season(July), the broadcast herbicide treatment combined with fescue reduced weed populations compared to broadcast without fescue. This resulted in a reduction in between-row and total weeds and weed dry weights for the season. These reductions can be attributed to competition from the fescue. Fescue suppressed between-row weeds as well as between-row cultivation. Some treatments, i.e. banded herbicide + cultivation, had fewer numbers of weeds, but those that escaped tended to be larger. Subsequently, there was no difference between in-row weed dry weights.

Horticultural data suggests that cultivation equipment did not have a detrimental impact on plant development and establishment. Fescue treatments reduced the number of established(rooted) runners by both varieties; although were only significantly lower than the hand weeded treatment.

Results suggest that adequate weed control and improved plant establishment occurred when herbicides were banded and combined with cultivation. This resulted from a decrease in weed competition. The adoption by growers to band herbicides could halve the amount of herbicides used and subsequently lower herbicide costs during the establishment year. This practice could be used by all growers who utilize a matted-row system (about 80% of growers surveyed used the matted-row system, 2006 Grower Survey). Previous studies determined that weed pressure during the establishment year resulted in a 50% yield reduction during the first fruiting year (Vézina and Bouchard, 1989). Growers can directly benefit from decreased weeds, improved plant growth, and increased yields. High weed densities can increase disease pressure by altering the microclimate around the strawberry plants. As a result, growers will indirectly benefit from more effective weed control through a reduction in disease incidence (i.e. gray mold).

Further refinement of the techniques described here are needed. First, testing the effectiveness of banded herbicides in a commercial field will further validate these findings. Secondly, further testing of inter-seeding of fine leaf fescue is necessary. The use of a permanent inter-seeded crop has many benefits to strawberries including increased soil health, reduction in between-row cultivation, and potential for weed reduction. Casual observations suggest planting fescue the year prior to planting and killing off in-row fescue prior to transplanting berries would result in better weed control between-row.

Table 1. Results From a Trial Evaluating Integrated Weed Management in Strawberries

Weed Count	1	2	3	4	Season			Weed Dry Weights		
Weed Location	Total ^a	Total	Total	Total	IR	BR	Total	IR	BR	Total
Treatment	-----weeds/0.25m ² -----									
Standard Broadcast	51.8 b	50.6 a	24.4 a	22.4 bc	18.4 abc	19.0 ab	37.3 a	65.3 a	29.1 ab	94.3 a
Standard Broadcast + Fescue	54.4 b	30.4 ab	10.2 b	11.4 c	13.6 bdc	10.8 b	24.4 bc	16.1 a	10.9 cd	27.0 b
Banded + Cultivation	44.5 b	9.8 c	7.5 b	14.0 bc	8.9 d	10.0 b	18.9 c	42.3 a	18.3 bcd	60.5 ab
Banded + Fescue	35.0 b	41.0 ab	23.4 a	21.0 bc	11.0 cd	19.1 ab	30.1 ab	26.4 a	33.6 ab	60.0 ab
Fescue + Cultivation (In-row only)	36.6 b	43.4 ab	27.0 a	44.6 a	21.5 ab	16.5 ab	37.9 a	25.7 a	25.2 abc	51.0 ab
Cultivation	71.0 ab	26.8 b	10.6 b	21.2 bc	19.0 abc	13.5 ab	32.4 ab	59.4 a	3.2 d	62.5 ab
Handweeded	99.8 a	36.8 ab	25.4 a	24.4 ab	23.9 a	22.7 a	46.6 a	22.0 a	19.2 abc	41.3 ab

^aTotal = In-row + Between-row

^bNumbers followed by different letters are considered statistically significant ($p=0.05$)

Table 2. Comparison of the Impact of Weed Management Treatments on Plant Establishment

Treatment	Number of Established (Rooted) Runners Per Plant	
	Jewel	Earliglow
Standard Broadcast	4.6 abc ¹	3.9 b
Standard Broadcast + Fescue	2.8 dc	3.8 b
Banded + Between-Row Cultivation	3.4 bdc	6.1 a
Banded + Fescue	2.8 dc	3.3 b
Fescue + In-Row Cultivation	2.2 d	2.7 b
In- & Between-Row Cultivation	5.2 ab	4.0 b
Handweeded	5.6 a	6.0 a

¹Means followed by different letters are considered statistically significant ($p = 0.05$)

Literature Cited

Vézina, L. and C.J. Bouchard. 1989. Competition de la petite oseille (*Rumex acetosella* L.) avec le fraisier cultivé (*Fragaria ananassa* Dcne). *Naturaliste Can.* 116:237-243.

9. Project location(s):

Tompkins County, Freeville, NY
Particularly in the Northeast but also Nationally

10. Samples of resources developed:

See below

