

## Cranberry Fruitworm Study

*Very good results!*

Requested by Ted Sparrow (\$1,600 SARE Farmer/Grower Grant awarded)

**Abstract (copied from the grant):** This study seeks to explore the value and effectiveness of using a polypropylene fabric row cover spread over commercial organic cranberry vines to physically prevent Cranberry Fruitworm moths from getting to the berries during their egg-laying period. A preliminary test was done during the 2003 season. The findings from that test are tantalizing and have convinced me and the Cranberry Professional with the University of Maine Cooperative Extension to broaden the scope of the experiment. We're hoping to perform a 2004 study on a 0.83-acre organic cranberry bed of Early Black variety and an adjacent 1-acre cranberry bed of Stevens variety. In early July, the row cover material will be spread over the entire Early Black cranberry bed and kept on 24 hours per day for roughly 28 days. Data on yield, fruit rot and cranberry fruitworm infestation will be taken. It is expected that at least for small, organic cranberry growers the value of the cranberries saved from destruction by fruitworm larvae will more than pay for the cost of the cover and the labor involved with it.

**For additional background information, and to see more of the 2003 results, see "Cranberries" magazine, July 2004 issue or ask me for a report that I can send you.**

### NOTES:

The out-of-bloom count was 56% on July 22nd, and the cover was applied the very next morning. The cover was removed on August 19th and so was on for 27 days.

### Sampling Methods Used

**Frame:** A 1-ft square wooden frame was randomly tossed and all of the berries within the frame were sampled. This was done numerous times in the sample areas to give better results.

**5-Step:** Every 5 steps along a straight line, the 5 nearest berries to the sampler's foot (right foot) were sampled.

### FINDINGS (Cranberry Fruitworm and Rot):

Table 1

Sample Area	Sample Method	Date Sampled	Sample Size	# of Rotten Berries	# of Berries Damaged by CFW	Difference in CFW Statistically Significant? (p=0.05)
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Covered Area (Early Black)	sq. ft. (Frame)	9/25/2004	622 berries	1	0	Yes
Uncovered edges (Early Black)	sq. ft. (Frame)	9/25/2004	1014 berries	4	16	
Covered Area (Early Black)	sq. ft. (Frame)	9/25/2004	622 berries	1	0	Yes
Uncovered adjacent Stevens bed	sq. ft. (Frame)	9/25/2004	248 berries	1	6	

### Key:

**CFW** = Cranberry Fruitworm

**p** = Probability (p=0.05 means there is only a 5% chance or less that the difference observed could be due entirely to chance alone)

**Key Economic Question:** Are enough cranberries saved by using the cover to justify the expense of the cover?

**Quick Answer:** At Sparrow Farms, it was worth it in 2003 (net gain of \$1,619.98) but not in 2004 (net loss of \$529.70).

**Why the big difference?** It all depends on the level of fruitworm pressure and on the total yield. At Sparrow Farms, the key factor was by far the difference in fruitworm levels between 2003 and 2004--very high in 2003 but very low in 2004 (see Table 6).

Estimates of Cranberry Fruitworm (CFW) damage at harvest time

Uncovered Areas - Sept. 26, 2003: 147 berries damaged out of 585 (25%)

Uncovered Areas - Sept. 25, 2004: 22 berries damaged out of 1262 (1.7%)

**Table 6. Cost / Benefit (Sparrow Farms)**

Year	Percent Loss to CFW		Percent of Crop Saved by Cover	Number of Barrels Saved	Value of Barrels Saved (Organic Fresh-Pick)	
	With Cover	No Cover				
2003	12.40%	25%	12.6%	7.90	\$2,369.98	\$2,764.98
2004	0%	1.7%	1.7%	0.90	\$270.30	\$315.35
Price of berries per pound:					\$3.00	\$3.50

  

Year	Cost of Cover / Ac.	Net Difference	
	2003	\$750.00	\$1,619.98
2004	\$800.00	-\$529.70	-\$484.65
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**Table 7. Break-Even Points (Sparrow Farms)**

Year	% Crop Loss to CFW (if no cover used) Needed To Pay for the Cover at Sparrow Farms		
	At \$3.00 per lb.	At \$3.50 per lb.	At \$4.00 per lb.
2003	4.0%	3.4%	3.0%
2004	5.0%	4.3%	3.8%

\*\*\* NOTE \*\*\*

These percentages would be cut in half if one were to reuse the same cover for an additional year (as Ted has been able to do at Sparrow Farms).

**Table 8. Cost / Benefit (All Growers)**

**Question for All Growers:** Assuming 0% loss to Cranberry Fruitworm using the cover, how much crop would otherwise need to be lost in order for someone to recover the cost of the cover?

**Answer:**

Yield Bls / Ac.	% Crop Loss to CFW (if no cover used) Needed in Order to Pay for the \$800 / acre Fabric Cover (i.e. Break-Even Point) at Various Berry Prices				
	\$0.40 per lb.	\$0.55 per lb.	\$2.00 per lb.	\$3.00 per lb.	\$4.00 per lb.
50	40.0%	29.08%	8.00%	5.34%	4.00%
100	20.0%	14.54%	4.00%	2.67%	2.00%
150	15.0%	10.91%	3.00%	1.78%	1.50%
200	10.0%	7.27%	2.00%	1.34%	1.00%

## Conclusion/Discussion

**Damage by Cranberry Fruitworm larvae:** It is easy to believe that placing a cover over one's cranberries and leaving it on 24 hours a day during July and August would prevent fruitworm eggs from being deposited on the berries. What wasn't known, however, was whether the use of this cover would have any adverse effects on various aspects of the crop, such as the three aspects we monitored: berry size, number of berries, and fruit rot levels. Since the fruit rot numbers from the 'cover' areas were exactly equal to—and in 3 out of 5 cases lower than—those taken from uncovered areas, there was no need to do any statistical tests on those values. It is clear from Table 1 that the use of the cover did not cause an increase in fruit rot. We feared it might, due to suspected higher temperatures and humidity levels beneath the cover. With additional manpower, we could have measured temperature and humidity, but having seen no problems with fruit rot or berry size in our 2003 preliminary study, we felt it was enough just to look at fruit rot and berry weights as our indicators.

**Possible Yield Reduction from Using the Cover** (Uncertainties Regarding Reduction of Sunlight and Pollination): Things get a bit murky and unclear regarding this question. Although Table 5 points out that there was no significant difference in the number of berries per sq. ft. between the covered area and the edge area, the t-value (not shown in the table) was very close to giving a "yes" answer to that comparison, and observationally, one can see a noticeable difference. It may be, however, that it is normal for there to be more berries along the edges of a bed versus the interior. This is something I do not know but will try to find out from staff at the UMass Cranberry Experiment Station. Edges certainly have different microclimates than interior areas, and so within any given bed there are likely to be all sorts of anomalies unique to that bed. Still, our findings here could be an indicator of a possible slight reduction in yield resulting from the cover so that possibility should be kept in mind in the context of the remainder of this report. The same uncertainty can be found with the matter of berry size between the covered and edge areas. Looking at Table 3, the fact that there was a significant difference in berry size between the covered area of 2004 and uncovered areas of 2003 (located in the same bed) may be a warning sign as to a negative impact that the cover may have. But given that the comparison is between two different years, there is only so much, if anything, that can be gleaned from the results because of likely differences in the two growing seasons that would affect the rate of development of the berries leading up to their respective sample dates. Things progressed very slowly in 2004, for example, and so the berries may not have been as mature on Sept. 25th, 2004 as they were on Sept. 26th, 2003.

**Cost / Benefit to Using the Cover:** Setting aside the slight uncertainties regarding possible cover-induced yield reductions, the question of whether or not it is profitable to invest in a cover depends on the size of one's harvest, the population of fruitworm, and berry price (Table 8). Our findings dramatically illustrate this fact. As Table 6 demonstrates, in 2003 there was a net gain of \$1,619.98 when fruitworm pressure was very high (25% of uncovered berries were destroyed). In stark contrast, in 2004 there was a net loss of \$529.70 for having used the cover material. However, Ted at Sparrow Farms says he is able to use the cover material for at least 2 years. Thus, anyone who would be content to reuse the cover material for an additional year would obviously be halving the cost of the cover. Therefore, it would take two back-to-back years of unusually low fruitworm populations (so low as to be able to destroy no more than roughly 3% of the crop) for an organic cranberry grower such as Ted—yielding roughly 50 to 60 barrels per acre—to end up with a net loss from having used the cover. Given the extent to which cranberry fruitworm exists in the wild in Maine, witnessing two consecutive years of no more than 3% crop loss to the fruitworm would, in an organic environment, be highly unlikely. Ted estimated a crop loss of 15% to the fruitworm in 2001, and we already know how high it was in 2003 (25%), so for at least two of the last four years, the percentage was significantly more than 3%. I would consider that sort of occurrence to be the norm, so it becomes readily apparent that for a grower with similar yields and similar berry prices to those of Sparrow Farms, the practice of covering one's cranberries as Ted has done appears to be a very good money-saving cultural practice. Even for 2004, as Table 7 demonstrates, there would only have needed to have been an additional 3.7% loss of crop than what we witnessed for Ted to have broken even financially ( $1.7\% + 3.7\% = 5\%$ ).

Lastly, there has been no mention of labor regarding the use of the cover, but for any grower capable of doing mildly-demanding jobs around the farm, this work can easily be done by the grower on his or her own, requiring only 3 to 4 hours per acre on just two different days (spreading it out once, and then taking it off 4 weeks later). And labor costs vary so much from grower to grower, it is probably best to leave the burden of that element of the cost-benefit question for the grower to figure out independently.

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**FINDINGS - continued (Yield Differences):**

**Table 2. Year 2004 Berry Weights.**

Sample Area (0.83-acre Early Black Bed)	Sample Method	Date Sampled	Sample Size	Avg. Weight of 10 Berries (in grams)	Difference in Berry Weights Significant? (p=0.05)
Covered Area (most of the bed)	sq. ft. (Frame)	8/19/2004	540 berries	4.11	Yes
Uncovered edge (along 2 sides)	sq. ft. (Frame)	8/19/2004	750 berries	6.00	
Covered Area (most of the bed)	sq. ft. (Frame)	9/25/2004	420 berries	6.78	Yes
Uncovered edge (along 2 sides)	sq. ft. (Frame)	9/25/2004	420 berries	9.20	

**NOTES:**

I think it may be normal for berries along the edge of a bog to be larger in size than those in the interior areas, at least in July and August. But by late September (Sept. 25th in this case), I would have expected any difference in berry weight to have declined to the point of there being no more visual difference and certainly no statistically significant difference. But that was not the case. In 2003, no significant difference was found (see Table 4), but the majority of the berries being compared with one another were from interior sections (as they should have been). Thus, I would tend to trust those results more in terms of answering the question as to whether the use of the cover reduces berry size, but for the sake of curiosity, I decided to also compare the weights of the 'interior' berries that were *not* covered in 2003 with those that were covered in 2004 (see Table 3), understanding that there would be other factors at play given two very different growing seasons, but still worth examining (see Conclusion/Discussion section for an interpretation of this result). I also compared the berry weights from the covered areas from both years to see if they would be different from one another (and they were not, as you would expect them *not* to be).

**Table 3. Berry Weights ('03 vs. '04).**

Sample Area (0.83-acre Early Black Bed)	Sample Method	Date Sampled	Sample Size	Avg. Weight of 50 Berries (in grams)	Difference in Berry Weights Significant? (p=0.05)
Covered Interior (2004)	sq. ft. (Frame)	9/25/2004	150 berries	33.92	Yes
Uncovered Interior (2003)	sq. ft. (Frame)	9/26/2003	150 berries	49.07	
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Covered Area (most of the bed)	sq. ft. (Frame)	9/25/2004	14 locations	44	No
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## Are enough cranberries saved by the cover to justify the cost of it?

**Quick Answer:** At Sparrow Farms, it was worth it in 2003 (net gain of \$1,619.98) but not in 2004 (net loss of \$529.70).

**Why the big difference?** It all depends on the level of fruitworm pressure and on the total yield. At Sparrow Farms, the key factor was by far the difference in fruitworm levels between 2003 and 2004--very high in 2003 but very low in 2004 (see Table 6).

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