

Are Differences in Fruit Damage Only Skin Deep?

Cynthia A. Rougour¹, Rebecca Hallett², Mary Ruth McDonald³ and Adam Dale¹

¹Department of Plant Agriculture, University of Guelph, Simcoe Research Station, Simcoe, ON, N3Y 4N5

Tel: 519-426-7127 ext 345 crougour@uoguelph.ca

ext 333 adale@uoguelph.ca

²Department of Environmental Biology, University of Guelph, Guelph, ON, N1G 2W1 Tel: 519-824-4120 ext 54488 rhallett@uoguelph.ca

³Department of Plant Agriculture, University of Guelph, Guelph, ON, N1G 2W1 Tel: 519-824-4120 ext 52791 mrmcdona@uoguelph.ca



INTRODUCTION

In Ontario, tarnished plant bug (*Lygus lineolaris*) is a major pest in strawberry production, *Fragaria ananassa*. Adults and nymphs feed on the soft developing seeds and fruit tissue causing the fruit to become deformed and unmarketable, Figure 1. As the strawberry fruit develops the seeds are initially clustered together. During development the seeds produce a growth hormone that causes the fruit to swell and the seeds to separate. As the nymph feeds on the fruit it damages the seed preventing hormone production and causing abnormal fruit development, Figure 1 (Cermak and Walker, 1992).

Typically plant bug populations are controlled with insecticides such as Thiodan; active ingredient endosulfin (Cermak and Walker, 1992).

However, there are no registered insecticides available for dayneutral strawberry production since their days-to-harvest requirements are incompatible with the continuous fruit harvest. Thus, dayneutral strawberry cultivars that are resistant to tarnished plant bug damage will be a critical component of the dayneutral production system. Of the commercial varieties available to growers Fort Laramie, Tribute and Tristar show some resistance to plant bug damage, while the variety Seascape is highly susceptible to plant bug damage (Dale et al., 2000). The purpose of this study is to assess the agronomic performances of these four strawberry varieties in different regions of Ontario. Adoption of dayneutral cultivars with resistant qualities by Ontario growers will result in better crop quality and yield, and could potentially double the value of Ontario June bearing and dayneutral strawberry production.

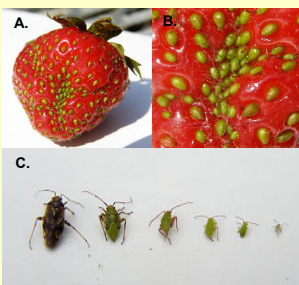


Figure 1: Fruit deformation caused by tarnished plant bug. **A)** Full view of tarnished plant bug damage on strawberry fruit, **B)** Close up of apical seediness caused by plant bug, **C)** Developmental life stages of tarnished plant bug. Adults are small in size (6-7mm in length) and identified by their tarnished colour appearance, while nymphs are bright green in colour.

HYPOTHESES

• There will be no significant differences among geographical locations in tarnished plant bug damage levels.

• Fort Laramie will have the least amount of plant bug damage, while Seascape will have the most.

METHODS

The field study was conducted at three commercial field sites in southern Ontario: Simcoe, Vineland and Bowmanville. In May 2006, four commercial varieties (Fort Laramie, Tribute, Tristar and Seascape) were planted on plastic raised mulch beds that were 1.5m apart. Plants were planted with 20cm within row spacing. Rows were 1.5 feet wide and 15 feet long. A randomized complete block design was used, with eight replications per site. Four plants were sampled from the twelve plants per plot. Buffer rows were planted around and between each plot using the variety Seascape. Natural populations of tarnished plant bug colonized the field sites. Sites were monitored once a week using a flower tapping technique (Dale et al., 2000). The same plants were sampled every week and the number of adults and nymphs were recorded as well as total fruit number and the number of damaged fruit. Buffer plants were monitored to determine population levels. Plants at all sites were watered using trickle irrigation systems and fertilized according to Ontario recommendations; no insecticides were applied but fungicides and herbicides were applied by the cooperating growers as needed. At Vineland plants were planted in two staggered rows and covered with black plastic. At Bowmanville plants were planted in four staggered rows. Half the beds were covered with black plastic and half with white plastic. At Simcoe plants were in four staggered rows and covered with white plastic.

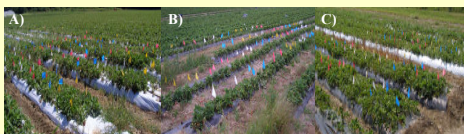


Figure 2: View of field sites. **A)** Simcoe, **B)** Vineland and **C)** Bowmanville.

RESULTS

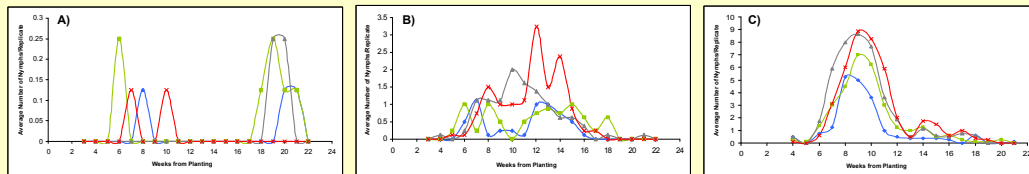


Figure 3: Average Weekly Nymph Count per Replicate for all Field Sites. The average number of nymphs sampled every week for Fort Laramie (◆), Seascape (■), Tribute (▲), and Tristar (×) during the 2006 growing season from the **A)** Simcoe, **B)** Vineland and **C)** Bowmanville sites. The number of nymphs were sampled using a flower tapping technique (Dale et al., 2000). Each site consisted of eight replicates of four plants per variety in a randomized complete block design.

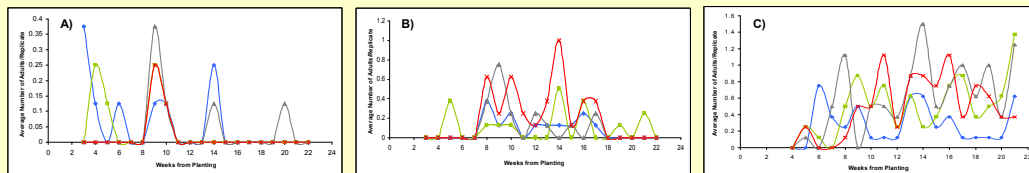


Figure 4: Average Weekly Adult Count per Replicate for all Field Sites. The average number of adults sampled every week for Fort Laramie (◆), Seascape (■), Tribute (▲), and Tristar (×) during the 2006 growing season from the **A)** Simcoe, **B)** Vineland and **C)** Bowmanville sites. The number of adults were sampled using a flower tapping technique (Dale et al., 2000). Each site consisted of eight replicates of four plants per variety in a randomized complete block design.

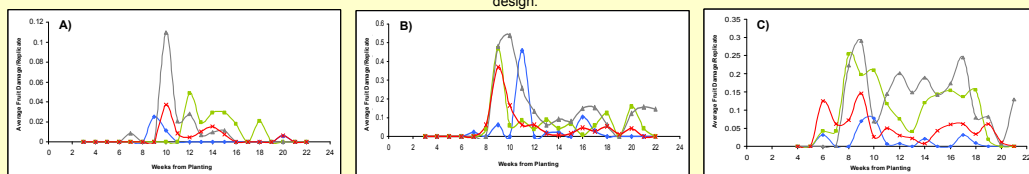


Figure 5: Average Weekly Damage Ratio per Replicate for all Field Sites. The average damage ratio per plant per replicate sampled every week for Fort Laramie (◆), Seascape (■), Tribute (▲), and Tristar (×) during the 2006 growing season from the **A)** Simcoe, **B)** Vineland and **C)** Bowmanville sites. Ripe fruit was picked and assessed for tarnished plant bug damage (Dale et al., 2000). Fruit damage was normalized to yield for comparison between varieties. Each site consisted of eight replicates of four plants per variety in a randomized complete block design.

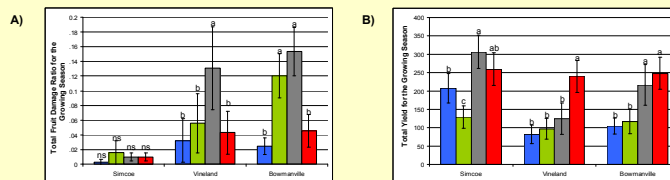


Figure 6: Total Fruit Damage Ratios and Fruit Yield for the Growing Season for all Field Sites. **A)** The total average damage ratio and **B)** the total fruit yield per plant per replicate sampled every week for Fort Laramie (◆), Seascape (■), Tribute (▲), and Tristar (×) during 2006 growing season from all field sites. Ripe fruit was picked and assessed for tarnished plant bug damage. Fruit damage was normalized to yield for comparison between varieties. Each site consisted of eight replicates of four plants per variety in a randomized complete block design. Lowercase letters indicate statistical difference between varieties at each site using Tukey's Protected HSD_{0.05}. ns = not significant.

Tables A and B: Differences in Damage Ratio and Strawberry Yield Among Sites. **A)** Total damage ratios and **B)** total yield counts for the 2006 growing season. Amount of damage was normalized to total berry production. Each site consisted of eight replicates of four plants per variety in a randomized complete block design. Means in the same row followed by the same lowercase letters are not statistically different, Tukey's Protected HSD_{0.05}.

Variety	Field Site		
	Bowmanville	Vineland	Simcoe
Fort Laramie	0.025 ± 0.011 ab	0.032 ± 0.030 a	0.003 ± 0.004 b
Seascape	0.120 ± 0.030 a	0.056 ± 0.040 b	0.016 ± 0.016 b
Tribute	0.153 ± 0.033 a	0.131 ± 0.057 b	0.010 ± 0.006 b
Tristar	0.045 ± 0.022 a	0.043 ± 0.029 a	0.010 ± 0.006 b

Variety	Field Site		
	Bowmanville	Vineland	Simcoe
Fort Laramie	104 ± 22 b	82 ± 2 b	207 ± 40 a
Seascape	117 ± 33 ns	97 ± 29 ns	135 ± 31 a
Tribute	216 ± 56 b	125 ± 43 c	306 ± 46 a
Tristar	248 ± 44 ns	240 ± 44 ns	265 ± 45 ns

Weekly population data by site are presented for nymphs (Fig. 3) and adults (Fig. 4), as well as weekly fruit damage ratios (Fig. 5). Within site data for proportion of total fruit damaged and yields are presented in Fig. 6, while among site comparisons are presented in Tables A&B.

Simcoe: Plant bug populations were lowest at this site. Adult populations fluctuated greatly while there were two peaks of nymphs between weeks 5-11 and 17-22. As a result, the damage ratio peaked at weeks 9-16 indicating that nymphs damage fruit early and there is a delay until the effect is seen on ripened fruit. There were no significant differences in damage among varieties, but Tribute had the highest yield, and Seascape the lowest. **Vineland:** Plant bug populations fluctuated, but peaked between weeks 5-17, with peak damage occurring in weeks 8-12 due to nymph and adult pressure. Tribute had significantly more damage than all other varieties and Tristar had the highest yield. **Bowmanville:** Nymphal populations were synchronized among varieties and peaked at weeks 6-13 while adult populations fluctuated over the season. Peak damage started at week 7, just after the nymph population peaked, indicating nymphs cause significant fruit damage. Seascape and Tribute had significantly more damage than the other two varieties, while Tribute and Tristar had the highest yields.

Simcoe had significantly lower levels of damage than the other sites for all varieties, except for Seascape at Vineland. Yields of Fort Laramie and Tribute were significantly higher at Simcoe than at the other two sites. Yields of Tribute were significantly lower at Vineland than at the other sites.

CONCLUSIONS

• Significant differences in damage between sites? Simcoe had less damage, due to low population pressure. Bowmanville and Vineland were not significantly different from each other, but there was more damage on Seascape at Bowmanville.

• Fort Laramie resistant and Seascape susceptible? Fort Laramie did have significantly lower damage than Tribute but did not exhibit higher resistance levels than Seascape and Tristar at all sites.

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