Evaluation of Assorted Bags for Insect and Disease Control in Apple 2018

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Introduction

Fruit bagging is a technique that physically protects fruit from pests. It is common in Japan for production of gourmet apples. It has also been used by organic growers, small fruit growers, and backyard orchardists who wish to reduce pesticide applications during the growing season. The practice has also been adopted for other fruits such as grape and peach. Previous research has confirmed the efficacy of Japanese fruit bags (also called oriental fruit bags) for management of late-season pests, stink bugs and codling moths. This project expanded the range of bag types and the damage by a range of pests to better understand potential for bagging in Kentucky orchards.

Materials and Methods

Three trees each of two cultivars were selected for demonstration. 'Gala' represented early/mid-season harvest; bags would remain on trees for approximately 12 weeks. 'Fuji' represented mid/late-season harvest; bags would remain on trees for approximately 20 weeks. Ten fruit were selected per treatment/bag type per tree. Early season fungicides and insecticides were applied according to University of Kentucky recommendations (ID-232: Midwest Fruit Pest Management Guide, 2018). A final insecticide spray was applied one week prior to bagging.

Four types of bags were used for the experiment (Table 1) and applied on 4 June when fruit were approximately 0.5 inch to 0.75 inch (1.3 cm to 1.9 cm) in diameter. Bi-layer Oriental/Japanese fruit bags (Table 1) were used according to directions and secured around fruit stems (pedicels) using the embedded wire. Paper lunch bags were cut to 5 inch to 6 inches long with a 2.5 inch slit down one side; fruit stems were slipped through this slit and twist ties were used to secure the pleated bag. Clemson bags (Table 1) were used according to directions; the branch of the tree was aligned between slits, and the bag was secured around the spur bearing the fruit with the embedded wire. Plastic freezer bags (Table 1) were "zipped" up to the fruit stems and further secured with staples; corners were cut from the bottoms of bags for condensation drainage.

'Gala' and 'Fuji' fruit were harvested on 20 Aug and 10 Oct, respectively. Bags were left on fruit until harvest. Each fruit was rated for bag retention, as well as for a range of insect and disease damage. Results were analyzed using Fisher's LSD.

Results and Discussion

Bag retention (Fig 1). There was no significant difference in bag retention in the 'Gala' (Aug) plots, but retention was significantly lower in the lunch bag treatment in the 'Fuji' (Oct) plots.

Table 1. Treatments (bags), source, and approximate costs.

Treatment/ Bag Name	Bag Description	Source	Approx. cost/bag
Oriental, Japanese	double layer paper/wax paper	Wilson Orchard and Vineyard Supply	$0.35
Clemson	single layer paper	Clemson University	$0.10
Lunch	white paper lunch bag	Good Value brand, Walmart	$0.05
Zip	plastic freezer bag	Ziploc brand, Walmart	$0.10

Stink bugs (Fig 2). There was a significantly lower percentage of stink bug damaged fruit in the Oriental fruit bag treatment in the 'Fuji' (Oct) plot compared to other bag types.

Coddling moth (Fig 2). All bag treatments had significantly lower incidence of codling moth than non-bagged treatments in both 'Gala' (Aug) and 'Fuji' (Oct) plots.

Sooty blotch/fly speck (Fig 3). There was significantly less flyspeck incidence with Oriental fruit bags in the 'Gala' (Aug) plots. There was significantly less sooty blotch and flyspeck incidence with Oriental fruit bags and the non-bagged control in both the 'Gala' (Aug) and 'Fuji' (Oct) plots.

Fruit rots. There was significantly less bitter rot in all treatment/bag types compared to the non-bagged control in both 'Gala' (Aug) and 'Fuji' (Oct) plots. There were significantly fewer "other" rots in bagged treatments compared to the non-bagged treatments in the 'Fuji' (Oct) plots.

Summary and Discussion

Bag retention was equivalent for all bags in the earlier-harvested plots, but lunch bags were less resilient later in the season. During the course of the season, lunch bags degraded more quickly than the other bags made of paper. Stink bug damage was highly variable, so it was more difficult to separate treatment efficacy. Codling moth was controlled with all bag types in both early- and late-season plots. Sooty blotch and fly speck were more severe in Clemson, lunch, and plastic bags by the late-season harvest. Plastic bags held more condensation and may explain high incidence of sooty blotch/flyspeck in these treatments. Fruit rots were more severe in non-bagged fruit; all bag types were effective in managing fruit rot.

References

Bessin, R. and Hartman, J. 2004. Bagging Apples: Alternative Pest Management for Hobbyists. University of Kentucky College of Agriculture, Food, and Environment.

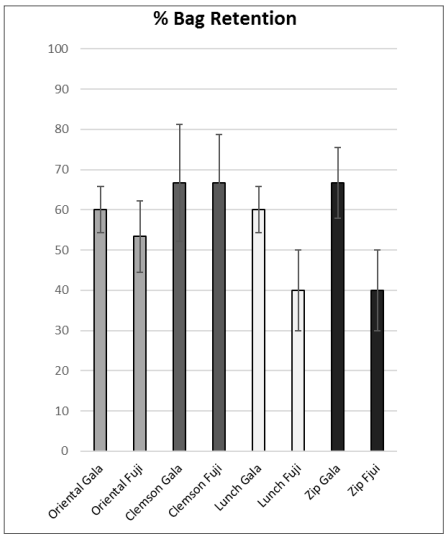

Figure 1. Percent bag retention for treatments (bags) and for host cultivars Gala and Fuji. Error bars indicate variation among replications.

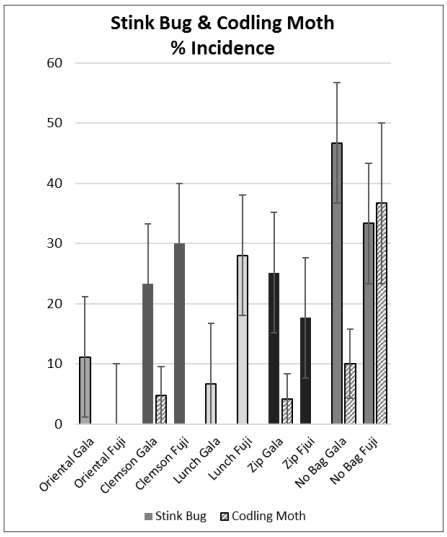

Figure 2. Stink bug and codling moth incidence (%) for treatments (bags) and host cultivars. Error bars indicate variation among replications.

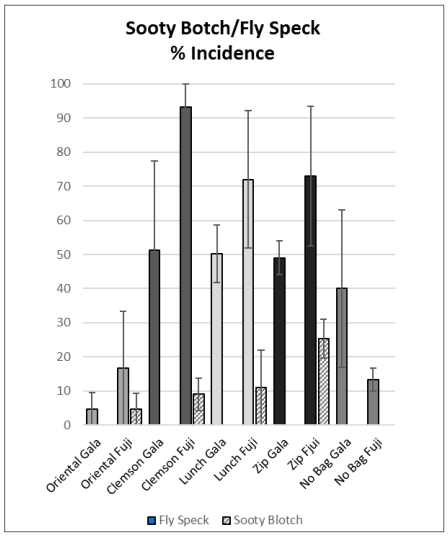

Figure 3. Sooty blotch and fly speck incidence (%) for treatments (bags) and for host cultivars. Error bars indicate variation among replications.

Figure 4. Insect damage for treatments (bags) and for host cultivars. Means with asterisk* in the same column are statistically different from those without an asterick* (Fisher's LSD p≤0.05).

Treatment	Stink Bug Incidence %	Stink Bug Punctures per Fruit	Codling Moth Incidence %	Codling Moth Strikes per Fruit	Plum Curculio Incidence %	Plum Curculio Strikes per Fruit	San Jose Scale Incidence %
Gala Harvest 8-29-18							
Oriental	11.11	0.22	0.00	0.00	5.56	0.06	0.00
Clemson	23.28	0.27	4.76	0.05	0.00	0.00	0.00
Lunch	6.67	0.07	0.00	0.00	0.00	0.00	0.00
Zip	25.12	0.63	4.17	0.04	4.17	0.04	0.00
Control, non-bagged	46.67	1.97	10.00*	0.10	0.00	0.00	0.00
Fuji Harvest 10-10-18							
Oriental	0.00*	0.00	0.00	0.00	4.67	0.05	0.00
Clemson	30.00	1.90	0.00	0.00	3.67	0.07	0.00
Lunch	28.00	0.95	0.00	0.00	0.00	0.00	0.00
Zip	17.67	0.27	0.00	0.00	9.33	0.09	0.00
Control, non-bagged	33.33	1.07	36.67*	0.90*	10.00	0.10	0.00

Figure 5. Disease damage for treatments (bags) and for host cultivars. Means with asterisk* in the same column are statistically different from those without an asterick* (Fisher's LSD p≤0.05).

Treatment	Fly Speck Incidence %	Fly Speck Clusters per Fruit	Sooty Blotch Incidence %	Bitter Rot Incidence %	Bitter Rot Lesions per Fruit	Other Rot Incidence %
Gala Harvest 8-29-18						
Oriental	4.76*	0.05	0.00	0.00	0.00	0.00
Clemson	51.32	1.10	0.00	0.00	0.00	0.00
Lunch	50.16	0.68	0.00	0.00	0.00	0.00
Zip	49.05	1.06	0.00	0.00	0.00	0.00
Control, non-bagged	40.00	0.40	0.00	16.67*	0.23	0.00
Fuji Harvest 10-10-18						
Oriental	16.67*	0.25	4.67*	4.67	0.05	0.00
Clemson	93.33	4.95	9.00	3.67	0.04	0.00
Lunch	72.00	2.22	11.00	11.33	0.33	0.00
Zip	73.00	3.15	25.33	4.67	0.19	0.00

This article is an excerpt from UK *Fruit and Vegetable 2018 Annual Research Report*, PR-757 (pp. 12-13)