APPLE (*Malus domestica* 'Golden Delicious')
Rot diseases; *Colletotrichum gloeosporioides, C. acutatum*
Botryosphaeria dothidea, B. obtusa

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EFFECTS OF ROTARY AND FLAIL MOWING ON FUNGAL REPRODUCTION ON APPLE BRANCH LITTER, 1996-1997: Apple litter was mowed with either a flail or rotary type mower, then assessed for the degree of bark removal and, later, the numbers of fungal reproductive structures. The experiments were conducted in six 4-year-old, 0.25-ha blocks of 'Golden Delicious' on M.26 EMLA rootstock. Treatments were implemented within a completely randomized design, with three blocks serving as replications for each treatment. After pruning in February, the brush was mechanically raked into hedge rows in the orchard row middles and then the rows were mowed twice with either mower moving at approximately 2 mph. The rotary mower was a Rhino G84 (Austin Products, Inc., Dallas, Texas). The flail mower was John Deere 300 Series heavy duty flail mower (John Deere, Columbus, Ohio). After mowing, litter was collected and then 100 pieces per replicate were chosen and classified into 7 groups based on the proportion of the bark remaining. The litter pieces were rated as: 0 = no bark removed, 1 = 1 to 10%, 2 = 11 - 25%, 3 = 26 - 50%, 4 = 51 - 75%, 5 = 76 - 90%, and 6 = 91 - 100% bark removed. Data on the proportion of the sample in each class were subjected to analysis of variance and means were separated with Fisher's LSD. Additional collections of mowed prunings from the litter destruction experiment were made from each of the plots and were arranged in 1 sq. meter miniplots under 'Golden Delicious' trees in an adjacent orchard. The miniplots were arranged randomly and corresponded to the replicate samples from the mower treatments. In May, June, and July, of each year, samples were collected from the miniplots and visually examined for fungal reproduction. To assess for fungal reproduction, 10 15.2 cm-long litter pieces within each of the seven bark removal classes were selected from the miniplots and then examined for macroscopic signs of fungal reproduction, including pycnidia, perithecia, and acervuli. No effort was made to distinguish among the various classes of fungi, and no effort was made to identify the fungi on the litter pieces. The diameter of each piece was used to estimate the surface area of each piece, based on the formula for a cylinder. The median range within each class was used to estimate the amount of intact bark surface area on each piece. Fungal reproductive structures were quantified as number of structures per square cm of the entire 15.2 cm-long piece and as number of structures per square cm of intact bark. The experiments were conducted twice.

Treatment of apple prunings by the two mowers resulted in a distribution of material across the seven bark removal classes, with only a few differences between treatments. Fail mowing resulted in a greater percentage of material in the 26 to 50% bark removal class (35.0 vs. 22.2% for flail and rotary, respectively), whereas, rotary mowing resulted in a greater portion of material in the 91 to 100% class (1.2 vs. 7.3% for flail and rotary, respectively). Stem pieces that were flail mowed supported about twice the number of fungal reproductive structures (1.1 vs. 0.5 structures per sq cm bark surface area for flail and rotary, respectively). When examined across bark removal classes, significantly fewer numbers of fungal structures were observed after treatment with either mower when compared to non-mowed prunings. The interaction between mower and bark removal class shows that significantly greater numbers of fungal structures were observed after flail mowing for classes 1 to 10%, 51 to 75%, and 91 to 99%. For other classes, fungal reproduction was similar on chopped material from the two mowers. Due to drier weather conditions in 1997, apple prunings supported fewer fungal structures than in 1996. The total amount of fungal reproduction on mowed twig and branch elements was inversely proportional to the amount of bark removed from twig and branch elements by mowing. The occurrence of physical damage to apple tissue that was mowed and damaged to any extent, even minimally (ca. 1 - 10%), with either mower, caused fungal reproduction to be reduced by about 40%. Additional levels of bark removal did not render the remaining attached bark any less desirable as a substrate for fungal reproduction. The mean number of fungal structures per square cm and the bark removal size class distributions were used to estimate the summed number of fungal structures across all bark removal classes following flail or rotary mowing. Based on this estimate, rotary mowing reduced total fungal reproduction by about one third when compared to flail mowing (102.3 vs. 61.8 fungal structures summed over removal classes for flail and rotary mowing, respectively). Mowing apple prunings reduces fungal reproduction on the chopped litter. For the type of flail and rotary mowers used in this study, our results demonstrated that there was no advantage to flail mowing over rotary mowing for inhibiting fungal reproduction. For management of apple rot diseases, in which the causal organisms colonize and reproduce on pruned litter, rotary mowing might offer a slight advantage for reducing inoculum levels. Additional studies are required to determine the advantages, if any, from this level of inoculum destruction. Also, a taxonomic characterization of apple litter microbes following mower treatments should be conducted to determine if incorporation of orchard floor clippings, as was observed with the flail mower, results in an altered fungal population structure.

	Bark removal class (%)						
Treatment	0	1 - 10%	11 - 25%	26 - 50%	51 - 75%	76 - 90%	91 - 100%
Flail	6.3 a* **	19.0 a	18.9 a	35.0 a	16.3 a	6.4 a	1.2 a
Rotary	14.0 a	23.4 a	18.4 a	22.2 b	11.2 a	10.6 a	7.3 b

* Each value is the percentage of stem pieces in each bark removal class, based on 600 stem pieces per treatment (3 replications of 100 stem pieces per treatment in each of 2 years).
** Mean separation by Fisher's LSD ($P \leq 0.05$).

Bark removal class	Fungal reproductive structures (per sq. cm)
0	1.50 a * **
1 - 10%	0.83 b
11 - 25%	0.78 b
26 - 50%	0.50 b
51 - 75%	0.72 b
76 - 90%	0.63 b
91 - 100%	0.91 b

* Each value mean number of fungal reproductive structures per sq. cm of intact bark surface (including pycnidia, perithecia, and acervuli) from 120 stem pieces per treatment (three replications of 10 stem pieces from two treatments in each of 2 years).
** Mean separation by Fisher's LSD ($P \leq 0.05$).

	Number of fungal fruiting bodies per square cm intact bark in various bark removal classes						
Treatment	0	1 - 10%	11 - 25%	26 - 50%	51 - 75%	76 - 90%	91 - 100%
Flail	1.6 a* **	1.4 a	0.9 a	0.8 a	0.8 a	0.9 a	1.5 a
Rotary	0.8 b	0.7 b	0.6 a	0.6 a	0.2 b	0.7 a	0.03 b

* Each value is the mean number of fungal structures from 60 stem pieces in each bark removal class, based on 3 replications of 10 stem pieces per treatment in each of 2 years). Data are from the July observations.
** Mean separation by Fisher's LSD ($P \leq 0.05$).