This is a supplement to the Good to Know column in Good Fruit Grower's August 2020 issue: Mechanical fruitlet thinning, by Laurent Roche, a horticultural engineer at CTIFL, the French institute for research on fruit and vegetables.

Methods and results of mechanical fruitlet thinning

The Eclairvale is a mechanical fruitlet thinner for stone and pome fruits, owned and trademarked by French company La Canne Valle.

An Eclairvale effectiveness test was performed on Ariane trees (planting distances of 3.5 m x 1 m) which had been fruit wall (mur fruitier) trained for 13 years and reached the 35 mm stage (+/- 3 mm). This stage of the fruit's development had proved optimal during previous experiments on the Ariane.

Figures 1 and 2 display the initial results of the thinning at slow speeds ranging from 1.5 to 3 kilometers per hour (km/h). Each speed was applied to entire rows of 45 trees. Eclairvale reduces the number of fruits in the hedge. More fruit is thinned as the device speeds up (figure 1). Higher speeds also tend to increase the quality of the thinning (number of fruits per cluster, figure 2).

Figure 1: Number of fruits/m² and speed at which Eclairvale advances at fruit stage 35 mm (without chemical and manual thinning) – (CTIFL)

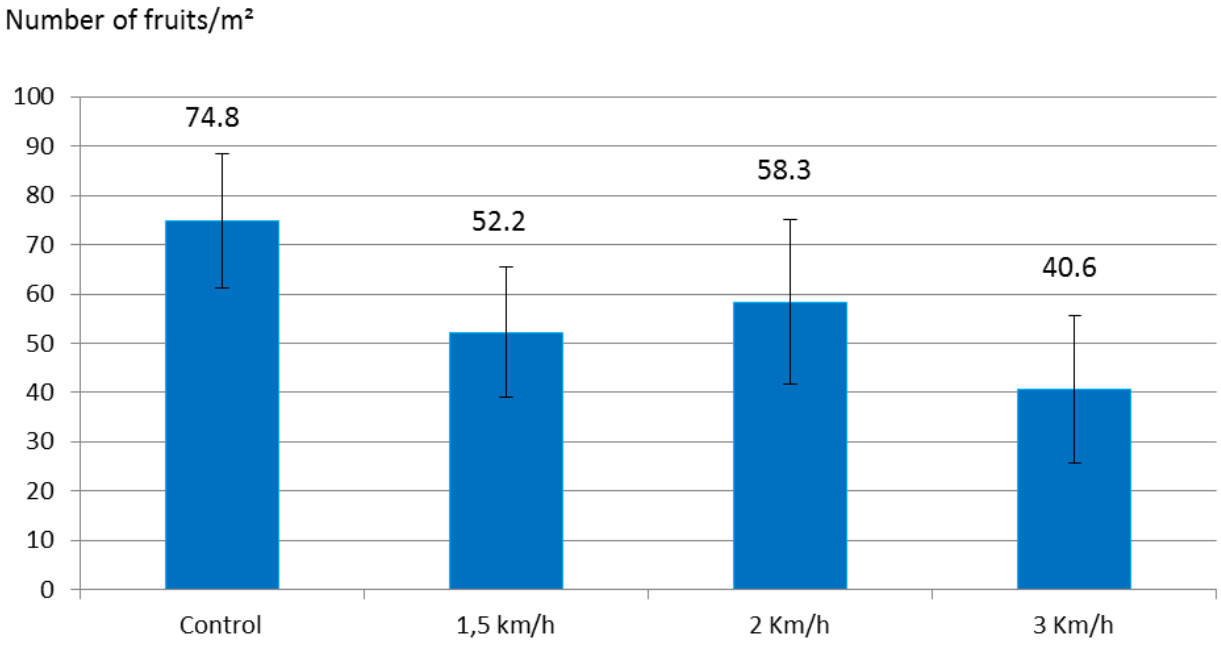
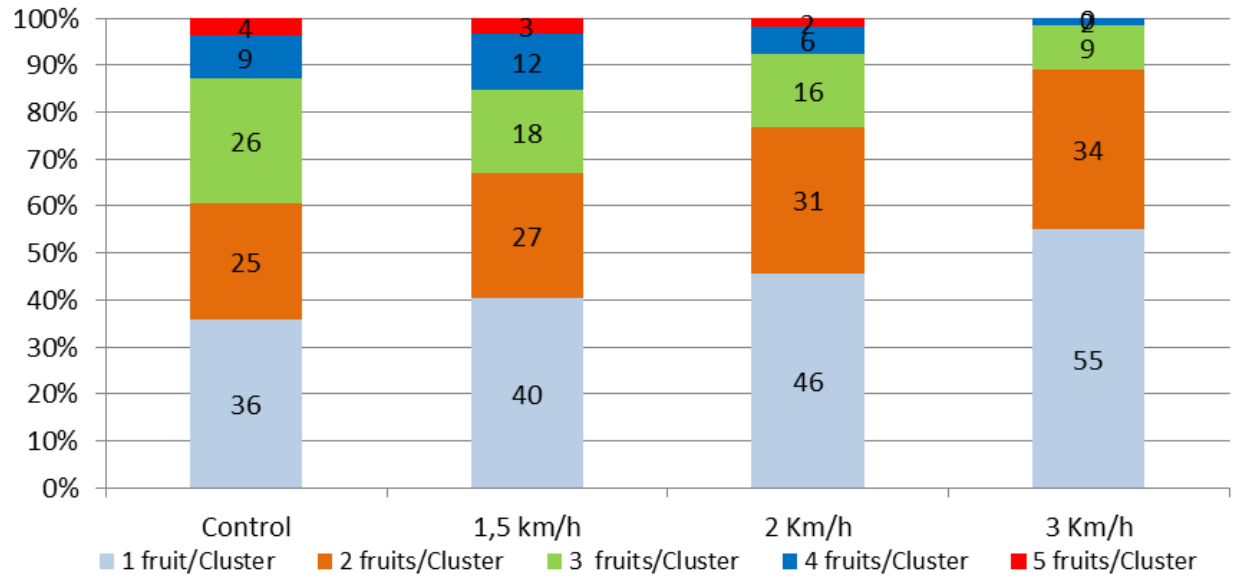


Figure 2: Ariane quality of thinning and speed at which Eclairvale advances at fruit stage 35 mm (without chemical and manual thinning) - (CTIFL)



A few days after the thinning, the total number of bruises ascertained on Ariane was as follows: 6.4 percent at a speed of 1.5 km/h, 10.9 percent at a speed of 2 km/h, and 15 percent at a speed of 3 km/h.

In addition, the size of the bruises tended to increase as the tractor sped up. Nevertheless, it is important to note that bruises (6 percent) also appeared in the group which was not thinned with Eclairvale. Furthermore, many bruises caused by Eclairvale were superficial and no longer visible once the fruits were harvested.

Buckeye Gala results

Eclairvale was tested on Buckeye Gala trees in 2017. These trees were grafted on Pajam 2 Cepiland rootstocks, Aximum and fruit wall trained, and in their sixth year of production. Aximum is a narrow fruit tree training system that grows without mechanical pruning, while fruit wall is a narrow system which is mainly pruned by mechanical means.

In this orchard, the planting distances between the rows and the trees were 3.5 m x 1 m for both training systems. Several different methods were tested on each system, some of which were identical for both the Aximum and fruit wall (table 1). For each method, 2 rows of 26 trees were tested.

Table 1: The methods

	Aximum		Fruit Wall
T1	(NAA + BA) + BA with manual thinning	T9	Darwin + (NAA + BA) + BA + Eclairvale (G) (2 km/h)
T2	(NAA + BA) + BA: without manual thinning (except for the tips above the top wire)		
T3	Darwin + (NAA + BA) + BA with manual thinning	T3	Darwin + (NAA + BA) + BA with manual thinning
T4	Darwin + Eclairvale (G) 44 mm (2 km/h)	T4	Darwin + Eclairvale (G) 44 mm (2 km/h)
T5	Eclairvale (Y) 32 mm (5 km/h) + Eclairvale (G) 44 mm (3 km/h) + manual thinning	T6	Eclairvale (Y) 32 mm (6 km/h) + Eclairvale (G) 44 mm (3 km/h) + manual thinning
T7	Eclairvale (G) 44 mm (2 km/h) + manual thinning	T8	Eclairvale (Y) 40 mm (3 km/h) + manual thinning

Chemical thinning: (150 g/hl NAA + 375 ml/hl BA on 04/21) + (250 ml/hl BA on 05/03)

Manual thinning: performed on 06/27/2017

Darwin: speed of 6 km/h and rotation speed of 300 rpm

Eclairvale (Y) = yellow Eclairvale rods, used on 06/01 (32 mm stage) and 06/14 (40 mm stage). The yellow rods are slightly more rigid than the green rods (G).

Eclairvale (G) = green Eclairvale rods, used on 06/21 (44 mm stage)

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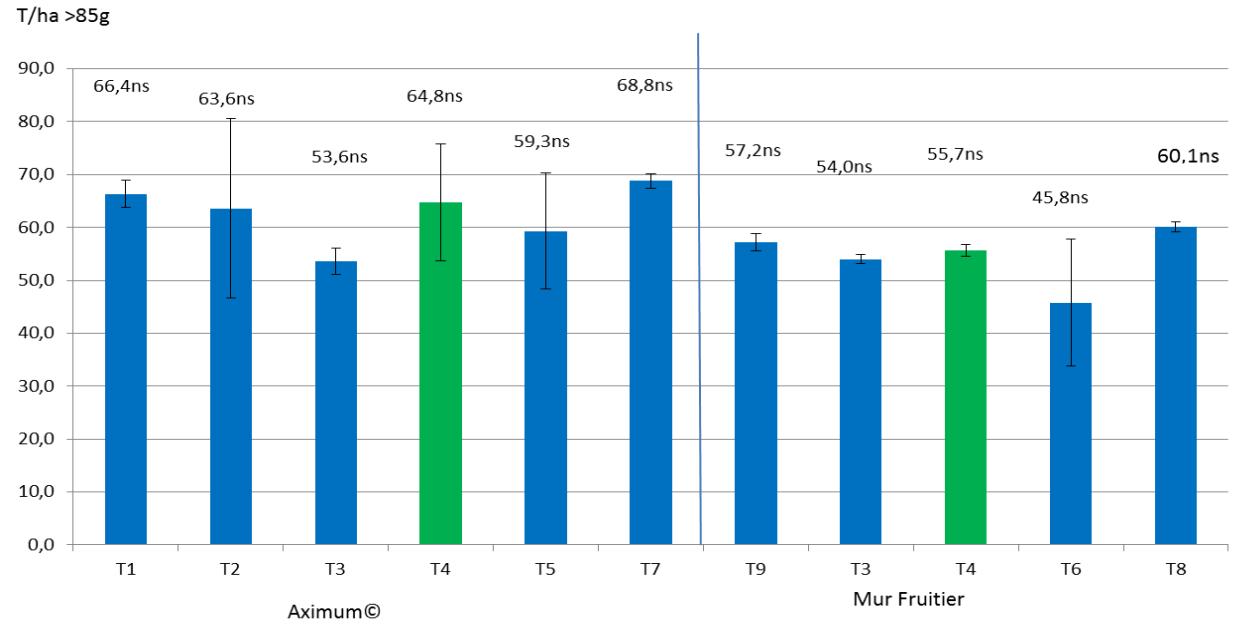
According to the results (figure 3), production ranged from 53.6 tons per hectare (t/ha) to 68.8 t/ha for the Aximum training system, and 45.8 t/ha to 60.1 t/ha for the fruit wall. Each method provided for properly adjusted crop loads, except for T6 (45.8 t/ha), which was on the low side, and T7 (68.8 t/ha), which was quite high. For both systems, no significant differences were ascertained amongst the methods.

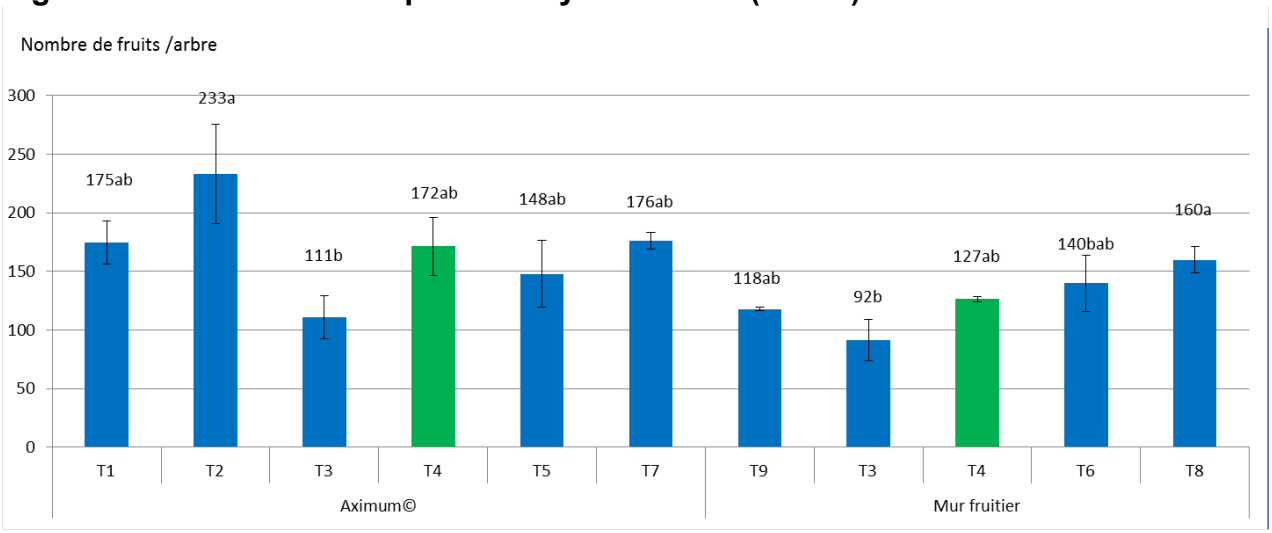
One single thinning with Eclairvale (methods T7 and T8) proved insufficient for properly adjusting the crop loads. On the other hand, the entirely mechanical T4 methods (prebloom Darwin + postbloom Eclairvale with no additional thinning) worked extremely well for both the Aximum and fruit wall systems.

Figure 3: Buckeye Gala production (CTIFL)



The average number of fruits per tree (figure 4) varied greatly for each method. The T2 method ((NAA + BA) + BA without manual thinning) resulted in the largest number of fruits per tree (233). Conversely, the T3 methods (Darwin + (NAA + BA) + BA with manual thinning) resulted in the fewest number of fruits per tree (111 and 92) for both training systems. The entirely mechanical method, T4 (Darwin + Eclairvale) resulted in a similar number of fruits per tree as the T1 method ((NAA + BA) + BA with manual thinning).

Figure 4: Number of fruits per Buckeye Gala tree (CTIFL)

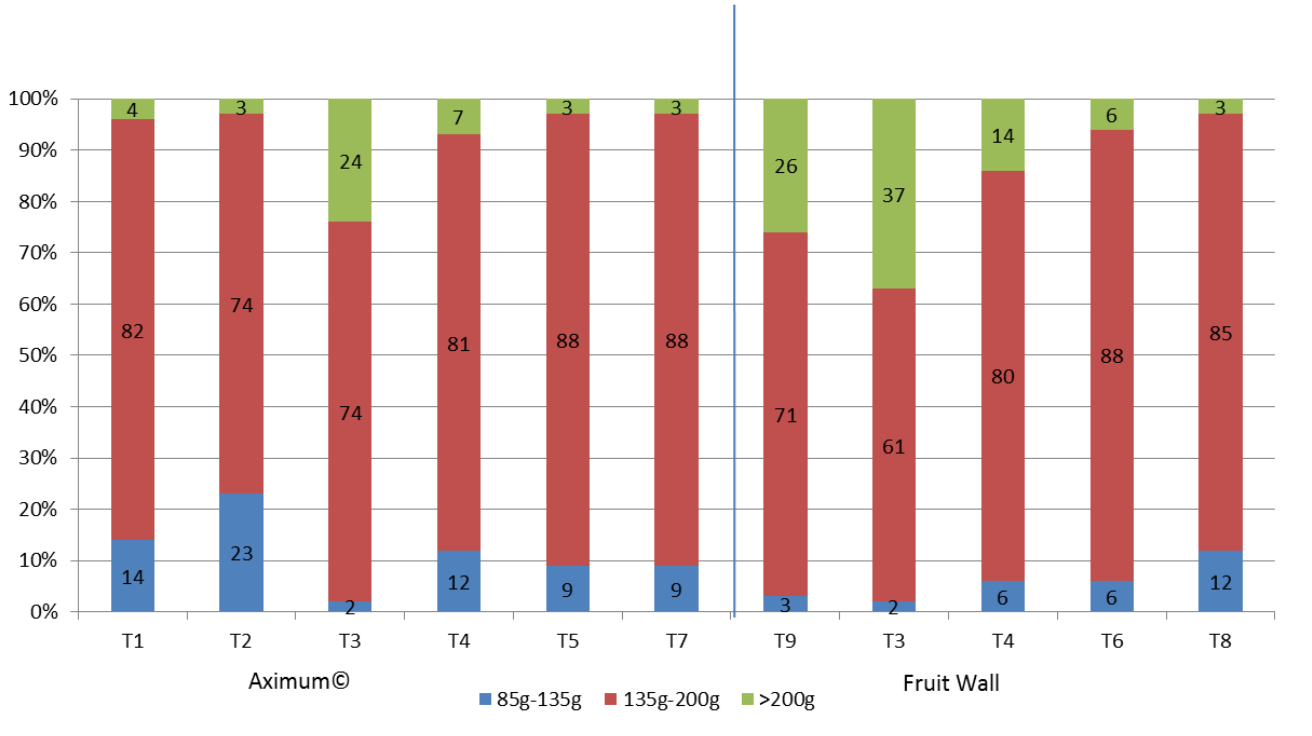


In qualitative terms: fruit weight (g); according to figure 5, the best results were obtained by the T3 methods (Darwin + (NAA + BA) + BA with manual thinning) for both training systems.

In the fruit wall training system, the T9 method (Darwin + (NAA + BA) + BA + Eclairvale) without manual thinning produced very good results. Eclairvale does not completely eliminate the need for manual thinning (T3), but considerably increases the fruit size despite its late application (the 44 mm stage on Buckeye Gala. At earlier stages, Eclairvale thinning is insufficient for this variety.

Finally, the entirely mechanical T4 methods (Darwin + Eclairvale) produced extremely promising results without any additional chemical or manual thinning. These methods produced heavier fruits than the T1 ((NAA + BA) + BA + manual thinning) and T2 ((NAA + BA) + BA) methods, as well as the T7/T8 (one Eclairvale application) and T5/T6 (two Eclairvale applications) methods.

Figure 5: Fruit weight (g), Buckeye Gala (CTIFL)



For each method, 200 of the fruits were checked for bruises (figure 6). Overall, the tests on the Buckeye Gala trees resulted in little to no bruises less than 1 cm² (0 to 1.5 percent) and little to somewhat more bruises larger than 1 cm² (2 to 8 percent). Two methods (T5 and T6) produced larger bruises. These methods involved two Eclairvale applications, the first of which was done at too high a speed (5 km/h in the Aximum system and 6 km/h in the fruit wall).

In this test on Buckeye Gala, the percentage of bruises produced by the T3 (Darwin + chemical + manual) and "entirely mechanical" T4 (Darwin + Eclairvale) method is nearly the same for both training systems. The fruit wall training system produced heavier fruits than the Aximum system (methods T3, T4). These results are due to the training of the trees and the higher number of rigid branches used in the fruit wall system.

Finally, bruises were also produced by methods T1 and T3, which did not involve the use of Eclairvale. These bruises were the natural result of fruits colliding with other fruits or branches.

Figure 6: Fruit bruising percentage in Buckeye Gala