Feasibility of Increasing Cling Peach Yields by Early Thinning
1991 Cling Peach Report

T.M. DeJong, R.S. Johnson, K.R Day and R Beede

Over the past 5 years we have been developing a peach fruit growth and carbon economy model to gain a better understanding of the factors that control fruit growth and crop productivity of peach trees. This model indicates that, at any given time during the developmental pattern of fruit growth, peach fruit growth rate is a function of the current size of the fruit and the amount of carbohydrate the tree has available for supporting fruit growth. If an individual fruit does not attain its potential growth over a particular time interval because the tree does not have enough carbohydrate to support the potential growth of all the fruit on the tree, then the future potential growth of that fruit is limited because potential growth is a function of size at any given time. This is analogous to interest accumulation in a savings account; the interest accumulated over any period is determined by the principle and the interest rate. If the principle increases minimally during any given period it will affect the amount of interest accumulated in the future.

If this model for fruit growth is correct then logically fruit size and crop yield will be maximized when final crop is established as early in the growing season as is economically feasible. The purpose of this project was to test the feasibility and potential economic advantages of thinning early season (Loadel and Carson) cling peaches within 30 and 45 days of full bloom.

The experiment was conducted in 8-year-old conventionally pruned (open vase) blocks of Loadel and Carson cling peach orchards owned and managed by Dean Kautz located in the Kingsburg district. Forty-eight-tree experimental blocks were established in each orchard. Three thinning treatments were applied to each orchard using 8, 2-tree replicates for each thinning treatment in a randomized complete block design. The three thinning treatments involved thinning Loadel and Carson trees on April 10 (-30 days after full bloom), April 30 (-50 days after full bloom) and on May 23 (approximate reference date). All thinning was done by a commercial thinning crew and the time required to thin each 2-tree replication was recorded. Data on mean fruit weight and number removed was also collected. At harvest the total fruit weight per tree, the mean fruit weight and fruit number per tree were determined in the field and at least two random grading samples per replicate were graded at the receiving station for split-pits and other defects.

Mean fruit size on the first thinning date was only 6.3 and 8.8% of what it was 20 days later on the second thinning date for Loadel and Carson, respectively (Table 1). The small fruit size and the large numbers of fruit that had to be removed, more than doubled the thinning cost of the first Loadel thinning compared to the second. The second Loadel thinning took 40% more time than the reference date thinning, presumably because mean fruit size at the time of the reference date thinning was 2.8 times as large as on the second thinning date and fewer fruit had to be removed because of natural fruit drop between the two thinning dates.

The difference in thinning costs between the three thinning dates with Carson were not as striking as for Loadel (Table 1). This is partially because the trees in the April 30 thinning treatment had higher fruit loads and more fruit needed to be thinned to reduce all trees to a comparable fruit load. Fruit size of Carson at the time of the second thinning was also smaller than Loadel.

With both cultivars the total fresh weight of thinned fruit increased approximately 10 times between the first and second thinning times and nearly doubled between the second and third thinning times. Put another way, about 1/4 ton/acre of fruit was removed in the first thinning of both cultivars. During the second thinning about 2.8 and 3.6 tons/acre were removed on Loadel and

Carson, respectively. During the reference date thinning more than 5 and 7 tons/acre of crop were thinned from the Loadel and Carson trees, respectively. Much of the crop weight lost in these thinned fruit could have gone to increase the size of remaining fruit if the crop had been thinned earlier. These calculated losses don't account for the additional crop losses represented by fruit that grew to a significant size but dropped naturally prior to each thinning date.

The Loadel orchard was harvested on July 12, 17 and 24, 1991, and the Carson were harvested on July 24 and 29, 1991. Crop yields from the reference date thinning treatments were substantially less than the two early thinning treatments with both cultivars (Table 2). These reduced yields were primarily related to decreased fruit numbers per tree in the reference date treatments with equal or slightly smaller fruit size compared to the other two treatments. Although we attempted to thin so that all three treatments from each cultivar had the same fruit number at harvest it did not work out that way. With Loadel we attempted to thin so that there would be 1,000 fruit per tree ...t harvest. On the early thinning dates we left a few more than 1,000 because it was difficult to get accurate fruit counts when the fruit were small and we thought it would be better to have too many rather than too few in case there was some additional fruitlet drop between thinning and harvest. The early thinning prevented additional natural fruitlet drop and so fruit numbers were closer to 1,200 than 1,000. With Carson we were aiming for 1,200 fruit per tree at harvest but for the same reasons they ended up with more than 1,500 per tree. In retrospect these crop loads were nearly ideal for demonstrating the potential value of early thinning. With both cultivars the earliest thinned trees had large fruit size with comparable crop loads to the April 30 thinned trees. The differences in yields between the second and third thinning date treatments were approximately the same as the calculated thinned crop loss mentioned above (5 and 7 tons/acre for Loadel and Carson, respectively).

Most of the fruit harvested in this experiment was of very high quality with the exception of some undersize in all but the earliest Loadel thinning treatment (Table 3). With Loadel there were more split pits and undersize fruit in two later thinning treatments compared with the April 10 thinning treatment but no significant difference between the April 30 and May 23 treatments. With Carson split pit fruits were highest in the earliest thinned treatment and the least splits occurred in the May 23 treatment, however, split pit fruit were not a major problem in any of the treatments. In Carson there also tended to be higher percentages of undersized fruit in the two early thinned treatments compared to the May 23 thinned treatments. The occurrence of more undersize fruit in the early thinned Carson treatments probably occurred because these trees had more fruit and were thinned so early that it was not possible to distinguish defective fruit with limited growth potential from normal fruit at these early stages of development. More of this type of fruit was probably eliminated in the late thinning treatment. Apparently Carson had a greater propensity for development of this type of fruit than did Loadel. It is interesting that although there were greater percentages of undersize fruit in early thinned Carson trees the mean fruit weight of the April 10 thinned trees tended to be larger than the May 23 treatment (Table 2) although these differences were not significant.

A brief economic analysis of the results of this study clearly indicate an economic advantage to early thinning under the conditions of these experiments (Table 4). When yields were adjusted to eliminate offgrade and undersize fruit (offgrade fruit weight was simply subtracted from total yields because it was assumed that most of the undersize fruit would have been left in the field and total % offgrade would have been <8.0 %), and gross revenue was adjusted for thinning and harvest costs, the early thinning treatments yielded more than $800 more revenue per acre than the standard reference date thinning with both cultivars (Table 4). However, it should be pointed out that this is only one year's data and the increased yields were caused by maintaining or increasing fruit size with increased crop load. It is not clear what the results would have been if all trees had been

thinned to the same crop level. It is safe to predict that if all the Loadel trees had been thinned to 1,200 fruit per tree then the late thinned trees would have had more small fruit or if they had all been thinned to 1,000 fruit per tree, fruit size would have been even larger in the early thinned trees. Similar predictions could be made for Carson trees with 1,500 or 1,100 fruit per tree. However, the economic outcome of these scenarios is less easy to predict.

We also have some remaining concerns about split pits. Although we believe that by thinning early we can avoid major split pit problems this will have to be demonstrated over a number of years before we can be 100% sure of this. It is also possible that over thinning at early stages of fruit development could cause more split pit problems than we observed in this study with relatively heavy crop loads. Because of the outstanding results obtained from these experiments in 1991 we will be proposing to extend this research to more grower locations and varieties in 1992.

Table 1. Fruit thinning data from the Loadel and Carson orchards thinned on three different dates in 1991. Values indicate means + standard errors.

LOADEL			
MEASUREMENT	THINNING DATE		
	April 10	April 30	May 23
Thinning time (hours/tree)	1.12 ± 0.06	0.52 ± 0.03	0.37 ± 0.01
Fruit removed			
(KgFW/tree)	2.36 ± 0.13	20.73 ± 0.91	40.18 ± 3.05
(number/tree)	5383 ± 290	2961 ± 130	2051 ± 156
Fruit size			
(g FW/fruit)	0.44 ± 0.01	7.00 ± 0.33	19.59 ± 0.37
(g DW/fruit)	0.08 ± 0.00	0.78 ± 0.02	2.46 ± 0.06
CARSON			
MEASUREMENT	THINNING DATE		
	April 10	April 30	May 23
Thinning time (hours/tree)	1.06 ± 0.04	0.85 ± 0.03	0.64 ± 0.03
Fruit removed			
(KgFW/tree)	1.82 ± 0.11	27.15 ± 1.56	53.87 ± 3.06
(number/tree)	4636 ± 285	6104 ± 351	3110 ± 176
Fruit size			
(g FW/fruit)	0.39 ± 0.02	4.45 ± 0.25	17.32 ± 0.52
(g DW/fruit)	0.07 ± 0.01	0.61 ± 0.01	2.02 ± 0.06

Table 2. Fruit yield data from the Loadel and Carson orchards thinned on three different dates in 1991. Values indicate means and standard errors.

LOADEL			
MEASUREMENT	THINNING DATE		
	April 10	April 30	May 23
Fruit size (gFW/fruit)	149.8 ± 3.2	137.6 ± 2.7	134.6 ± 2.5
Crop load (fruit/tree)	1201 ± 80	1248 ± 55	969 ± 40
Fruit Yield (tons/acre)	23.8 ± 1.3	22.8 ± 0.8	17.3 ± 0.7

CARSON			
MEASUREMENT	THINNING DATE		
	April 10	April 30	May 23
Fruit size (g FW/fruit)	140.9 ± 8.4	132.4 ± 3.1	133.4 ± 3.4
Crop Load (fruit/tree)	1559 ± 148	1518 ± 44	1128 ± 43
Fruit Yield (tons/acre)	28.1 ± 1.6	26.7 ± 0.7	19.9 ± 0.5

Table 3. Summary of grading data regarding fruit maturity, split pits and size for fruit harvested from the 3 thinning treatments. Values are mean percentages + standard errors.

LOADEL			
CATEGORY	THINNING DATE		
	April 10	April 30	May 23
Green	0	0.01 ± 0.01	0.03 ± 0.01
Splits (visible)	0	0.11 ± 0.09	0.15 ± 0.02
Splits (invisible)	0.01 ± 0.00	0.50 ± 0.14	0.75 ± 0.59
#2 fruit (2 1/4" -2 3/8")	0.03 ± 0.01	6.28 ± 1.15	4.99 ± 2.58
#3 fruit	0.02 ± 0.00	1.23 ± 0.31	1.47 ± 0.94
Undersize (< 2 1/4")	0.01 ± 0.00	2.08 ± 0.33	2.61 ± 1.59
% Tonnage reduction	0.04	3.56	4.45

CARSON			
CATEGORY	THINNING DATE		
	April 10	April 30	May 23
Green	0.21 ± 0.17	0	0
Splits (visible)	0.11 ± 0.05	0.16 ± 0.10	0
Splits (invisible)	1.06 ± 0.61	0.29 ± 0.14	0.27 ± 0.09
#2 fruit (2 1/4" -2 3/8")	7.39 ± 1.68	11.79 ± 1.50	6.45 ± 0.80
#3 fruit	1.04 ± 0.33	1.27 ± 0.46	1.02 ± 0.30
Undersize (< 2 1/4")	8.69 ± 2.63	8.36 ± 1.40	5.23 ± 1.09
% Tonnage reduction	10.53	9.77	6.38

Table 4. Summary of thinning treatment effects on adjusted yields, thinning and harvest costs and adjusted gross revenue calculated on a per acre basis.

LOADEL			
CALCULATION	THINNING DATE		
	April 10	April 30	May 23
Adjusted Yield (tons/acre)	23.8	22.0	16.5
Gross Revenue ($239/ton)	5688	5258	3944
Thinning Costs (labor @ 6.28/hr)	823	402	283
Harvest Costs (picking and hauling @ $51.00/ton)	1214	1163	882
Adjusted Gross Revenue ($/acre)	3651	3693	2779

CARSON			
CALCULATION	THINNING DATE		
	April 10	April 30	May 23
Adjusted Yield (tons/acre)	25.1	24.1	18.6
Gross Revenue ($239/ton)	5999	5760	4445
Thinning Costs (labor @ $6.28/hr)	810	647	490
Harvest Costs (picking and hauling @ $51.00/ton)	1433	1362	1015
Adjusted Gross Revenue ($/acre)	3756	3751	2940