

**Quality Conditioning and Ripening of Bartlett Pears**  
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**Summary**

The effects of commercial handling on the rate of ripening of Bartlett pears and their need for Quality Conditioning was evaluated in pear samples from fourteen packinghouses. While fruit from some locations ripened faster following bin dumping and/or packing, nearly all samples failed to fully ripen within 7 days at room temperature, and therefore would have benefit from Quality Conditioning. A survey of California pear shippers indicated that no more than 30% of shipped fruit is currently being Quality Conditioned. Most shippers are still treating only at customer request, and are limited in how much they can treat due to space availability and pre-cooling capacity. There is considerable interest in Quality Conditioning "On the Road"; however, the demand for straight load volume in future years, particularly at the start of the season when Quality Conditioning is most needed, is uncertain.

Most shippers have not seen much pressure to develop HACCP plans, but many have or are planning soon to develop a plan. Several shippers have begun to chlorinate their water tanks and have their sorters wearing gloves in an effort to reduce food safety concerns.

**Introduction**

In recent years, the California Pear Advisory Board has increased efforts aimed at promoting Quality Conditioning by shippers and ripening by wholesalers and retailers in an effort to improve the quality and sales of California Bartlett Pears. Both programs have had positive results on pear marketing.

Contrary to earlier beliefs, our data has indicated that fruit from all growing regions in California can benefit from Quality Conditioning, particularly the earliest harvests from each region. Fruit from the first harvests in all three growing locations did not ripen during 7 days exposure to warm temperatures, while the same fruit treated with ethylene ripened fully within 7 days. Other data indicates that commercial handling can induce sufficient ethylene production in some cases to induce ripening without Quality Conditioning. In 2000, we collected fruit from most packinghouses in California and determined the effect of packing on fruit ripening without ethylene.

For many shippers, particularly with early season fruit, the 24 hours required for Quality Conditioning is very difficult to achieve because of the intense demands from the market. Unfortunately, this early season fruit does not move well through marketing channels because of its inability to ripen and, as a consequence, its poor quality. This can have a

significant negative impact on later sales. An alternative approach worthy of consideration is Quality Conditioning "On the Road", in the transportation vehicle. Our trial shipment of Quality Conditioning "On the Road" in 1999 was successful; however, the untreated fruit also ripened fairly rapidly as a result of commercial handling. We planned to repeat this trial in 2000, with at least one, possibly two different shipments of fruit from different growing locations.

We have also surveyed the industry to determine the extent of Quality Conditioning performed prior to shipment, the impediments to implementing Quality Conditioning on site, and the potential use of Quality Conditioning "On the Road". The goal from this process is to determine if further assistance is needed in Quality Conditioning of Bartlett pears. A brief survey of HACCP procedures was also included.

### **Objectives**

1. Conduct one to two trial shipments using Quality Conditioning "On the Road".
2. Determine the effects of commercial packing on wound ethylene production and subsequent pear ripening.
3. Canvass the California pear shippers regarding their current and future use of Quality Conditioning on site and "on the road".

### **Procedures**

*Quality Conditioning "On the Road".* We were unsuccessful in setting up a commercial truck shipment to test Quality Conditioning "On the Road". Despite numerous attempts, we were unable to find a receiver on the East Coast who was willing to accept a full load of pears due to poor market conditions early in the season. A straight load is necessary because of the ethylene treatment in route. We also attempted to arrange for sending a load of mountain fruit, but at that time the receivers were only accepting River fruit. It is unknown whether market conditions will improve enough next season to attempt a test shipment at that time. The marketers of the TransRipe Mobile Ripening System expressed an interest in a trial shipment to ripen pears en route to market. Such a test may be possible for next season.

*Effects of Commercial Packing.* We sampled Bartlett pear fruit from fourteen packinghouses representing the three main growing areas in California. Samples were collected from a field bin at the packinghouse just prior to dumping, immediately after that bin was dumped, and from packed boxes of fruit from the same bin. Marker fruit were used whenever possible in order to follow the progress of fruit from the particular bin being sampled and to collect fruit originating from that bin. This procedure was repeated three times. Samples were placed into cartons and lidded before transport to UC Davis. A sub-sample of fruit was monitored for respiration and ethylene production immediately upon arrival at the laboratory and daily thereafter for 10 days. The

remaining fruit remained in the sealed carton at 68°F and were sampled every two days for firmness and color.

*Industry Survey.* Beth Mitcham met personally with twelve of the California pear shippers to discuss their current views and use of Quality Conditioning, including any impediments to full implementation. We also discussed the potential use of Quality Conditioning “On the Road” and determined their interest in using this method and the percentage of straight loads of Bartlett pears shipped. One question on food safety was also included. The interviews on the River were conducted prior to the start of the harvest season and the interviews in the Mountain districts were conducted after harvest.

#### Questions asked in Interview

1. What percentage of your fresh market Bartletts are you currently QCing?
2. What are the limitations to treating more?
3. Do you QC packages other than tight-fill? Have you ever had problems with this?
4. Describe your current QC room? Do you monitor temperatures or ethylene concentration?
5. Do you only treat fruit for customers who request it?
6. Do you charge extra for QCed fruit?
7. Would you utilize QC treatment in route?  
Cost \$270.00 (\$200 is for cylinder that you could have mailed back to you for reuse)
8. How much straight load volume do you ship?
9. Is your straight load volume only at the start of the season?
10. What steps has your company taken in the area of HACCP/Food Safety?

#### **Results**

*Quality Conditioning “On the Road”* . We do not have results for this objective as we were unable to arrange for a commercial shipment.

#### *Effects of Commercial Packing*

Physical handling of fruit stimulates ethylene production by that fruit. The more rough the handling, the more ethylene produced. Previous studies have indicated that commercially harvested and packed Bartlett pears may ripen satisfactorily without Quality Conditioning. In an attempt to determine the effect of commercial handling on the need for Quality Conditioning, we sampled fruit from fourteen packinghouses. Fruit were collected from field bins at the shed, after dumping the bin, and from the packed carton. The rate of softening of these fruit during a ten-day period at 68°F is shown in graphic form. In addition, we statistically analyzed the difference throughout ripening in firmness, skin color and ethylene production between fruit sampled from the bin, post-dump and packed carton.

### River Packinghouses

Packed fruit from packinghouse A ripened only slightly faster than bin fruit while post-dump fruit was intermediate and all fruit remained fairly resistant to ripening (Fig. 1). In packinghouse B, the packed fruit clearly ripened faster than the bin or dump fruit that were similar to each other (Fig 2). Ethylene production was also higher in packed fruit (Fig. 18). There was a similar but smaller difference in fruit from packinghouse E (Fig. 5). There was essentially no difference between sampling locations for fruit from packinghouses C, D, F, and G (Figs. 3,4,6,7). All of the fruit from the River remained fairly resistant to ripening despite the commercial handling, except fruit from packinghouse D (Fig. 4), which were also the softest at harvest and the latest to be sampled. The average differences in firmness, skin color and ethylene production were also greatest in fruit from packinghouse B (Table 1).

### Mountain Packinghouses

The biggest differences in fruit firmness between sampling locations was observed in fruit from packinghouses D, F and G (Figs. 11,13,14). For packinghouses D and F, the greatest difference was between fruit from the bin and the post-dump fruit, and ethylene production was also higher for dump and packed fruit (Fig. 16 and 17). For packinghouse G, both the dumped and the packed fruit had significantly higher rates of softening (Fig. 14) and ethylene production (Fig. 18). The increase in the rate of softening with increased commercial handling in packinghouses D, F and G resulted in a more satisfactory rate of ripening as compared with fruit sampled from the field bin. For the other Mountain packinghouses, fruit remained fairly resistant to ripening, although they ripened faster than River fruit. The average differences in firmness, skin color and ethylene production were also greatest in fruit from packinghouses D, F and G (Table 1).

### *Industry Survey*

#### 1. What percentage of your fresh market Bartletts are you currently QCing?

With one exception, no shipper treated more than 30% of his fruit, and most of the treated fruit was grown in Sacramento but could have been packed in any of the three districts. Four of the twelve shippers treated essentially no fruit with ethylene (0 to 2%), and these were located in all three districts. There was some confusion between Quality Conditioning and partial ripening of fruit, which a number of shippers have experimented with at customer request.

#### 2. What are the limitations to treating more?

About one-half of the shippers indicated that space limited their ability to treat more fruit. In some cases, cold rooms were used at the start of the season, and once these were needed to store pears they were no longer available. Seven shippers indicated a lack of customer demand limiting the amount of fruit they treated; they indicated that some customers still want green pears. Two shippers indicated that the ability to pre-cool the fruit after treatment was a limitation. Limitations in personnel available to manage the process were also mentioned.

#### 3. Do you QC packages other than tight-fill? Have you ever had problems with this?

Approximately one-half of the shippers have Quality Conditioned fruit in wraps and trays as well as tight-fill. Most indicated no problems, but one shipper felt the wraps carried more ethylene into the cold room that affected other fruit in storage. In another case where fruit was not pre-cooled after Quality Conditioning, the wrapped fruit showed more ripening than the tight-fill.

4. Describe your current QC room? Do you monitor temperatures or ethylene concentration?

The treatment room temperature ranged from 50 to 70°F, with all but two in the 60 to 70°F range. Most felt the fruit temperature was near 80°F. Approximately one-half of the shippers have ethylene-measuring equipment. Some shippers measured ethylene when the treatment system was first developed and use the same number of ethylene generators and settings each year. Three of the shippers have developed a continuous treatment system that rotates pallets of fruit through a room held continuously at 100 ppm ethylene. This allows for a 24 hour treatment period as opposed to 21 to 22 hours which is more common in a batch-type operation.

5. Do you only treat fruit for customers who request it?

Nine out of eleven shippers treat only when the customer requests QC treatment. One shipper treats as much as possible for the first week, then treats according to request. Two shippers indicated that they tried to treat all their fruit. Some others were open to the idea of treating fruit without request to increase repeat sales.

6. Do you charge extra for QCed fruit?

All shippers indicated that they do not charge extra for QCed fruit. "Sometimes offering QC will help you get the sale at a higher price."

7. Would you utilize QC treatment in route?

Cost \$270.00 (\$200 is for cylinder that you could have mailed back to you for reuse)

Ten out of eleven shippers indicated they would utilize QC treatment in route. Two indicated they would utilize it if the customer requested it. Some felt it would be better than treating it themselves and the fruit would be committed to the customer at the time of treatment. One indicated that with this method, the customer is more assured that the fruit was treated.

8. How much straight load volume do you ship?

Ranges from 10 to 50%. Most customers who request QC want full loads. Most loads from Lake and Mendocino are full loads, but may be re-shipped as mixed loads from the valley.

9. Is your straight load volume only at the start of the season?

Most shippers indicated that they send straight loads throughout the season. In some cases, there are less straight loads at the very start of the season because of low fruit volume.

10. What steps has your company taken in the area of HACCP/Food Safety?

Three shippers indicated they have received some type of request from their customers related to food safety. Two shippers indicated they had developed a food safety plan and three others indicated they are planning to develop a plan in the near future. Five shippers indicated they have begun to chlorinate the dump tank water and three have sorters wear gloves in response to food safety concerns (the numbers could be higher than this as these were not specific questions asked of all shippers).

General Comments

“The selling offices view Quality Conditioning as a hassle, a delay in fruit availability. They need to be convinced of the benefits.” “A short brochure on Quality Conditioning for the sales offices and buyers would be useful.” It was suggested that we provide a service to check Quality Conditioning procedures for interested shippers.

**Discussion**

Caution should be exercised when comparing the effects of commercial handling on the ripening of Bartlett pears collected from various packinghouses. The response of the fruit could be affected by its harvest maturity and; therefore, its responsiveness to ethylene. Also, the effects of field handling were not documented in this study. If field handling were particularly rough for a bin of fruit, those fruit may not show much additional response from bin dumping or packing. Alternatively, if field handling was particularly gentle, the fruit may show significant effects of bin dumping and packing on ripening.

While there were some samples of Bartlett pears collected from packinghouses that ripened more quickly after dumping or packing, 80 to 90% of the samples collected did not ripen sufficiently within 7 days at 68°F indicating they would have benefited from Quality Conditioning. All samples, with one exception (River D), were collected within the first 7 to 10 days of harvest in that district. These data indicate that despite the effects of commercial handling in inducing some fruit ethylene production, early season fruit in each district can benefit from Quality Conditioning.

With one exception, no shipper treated more than 30% of their fruit and most of this was for Sacramento-grown fruit. Quality Conditioning of California Bartlett pears is still done essentially to order. Only a few shippers were attempting to treat as much fruit as possible at the start of the season, regardless of customer requests. Limitations to treating more fruit included space for treatment and lack of customer demand. However, a few shippers indicated that the ability to pre-cool all the treated fruit was a limitation.

For those shippers treating with ethylene, the conditions used for the treatment were generally appropriate. There were two shippers whose treatment room temperatures were less than 60°F. At these temperatures, it would take more than 24 hours to get a sufficient response to treatment in the fruit. I suggested that warm outside air be pulled into the room to warm the concrete and therefore raise the air temperature prior to the initiation of Quality Conditioning.

Nearly all shippers indicated an interest in Quality Conditioning "On the Road". This would reduce the need for space and pre-cooling capacity at the packinghouse and would commit the treated fruit to the customer. It would also give the customer better assurance the fruit was in fact treated. It seems this would be particularly useful for the chain stores. Shippers indicated that they send straight load volume 10 to 50% of the time and that this occurs throughout the season. Our inability to locate a straight load to the East Coast for our test shipment this season is a concern. It is unknown if these marketing issues will remain in future seasons thereby affecting the ability to treat straight loads at the start of the season when they are most needed.

Table 1. Average difference in firmness, skin color and ethylene production during ripening between fruit sampled from the field bin and fruit sampled after the dump, and between fruit sampled after the dump and from the packed box.

Packer	Average Difference in Firmness (lbs.)	Average Difference in Skin Color (Hue)	Average Difference in Ethylene Production
River			
A	0.89 bcd	1.00 bcde	3.32ab
B	1.30abc	1.45 bcd	4.34a
C	0.40 cd	0.34 e	-0.07 bcd
D	0.66 cd	1.09 bcde	2.44abc
E	0.85 bcd	1.16 bcde	-1.12 d
F	0.31 cd	0.53 de	1.16abcd
G	0.29 d	0.52 de	2.83abc
Mountain			
A	0.86 bcd	0.82 cde	0.58 bcd
B	0.93 bcd	1.12 bcde	2.36abc
C	0.78 bcd	1.13 bcde	-0.24 cd
D	1.67ab	1.67 bc	2.96abc
E	1.16 bcd	1.65 bc	-0.35 cd
F	2.24a	2.93a	1.87abcd
G	1.66ab	2.00ab	2.35abc

Values with different letters are significantly different from each other (P<0.05)

Fig. 1. River

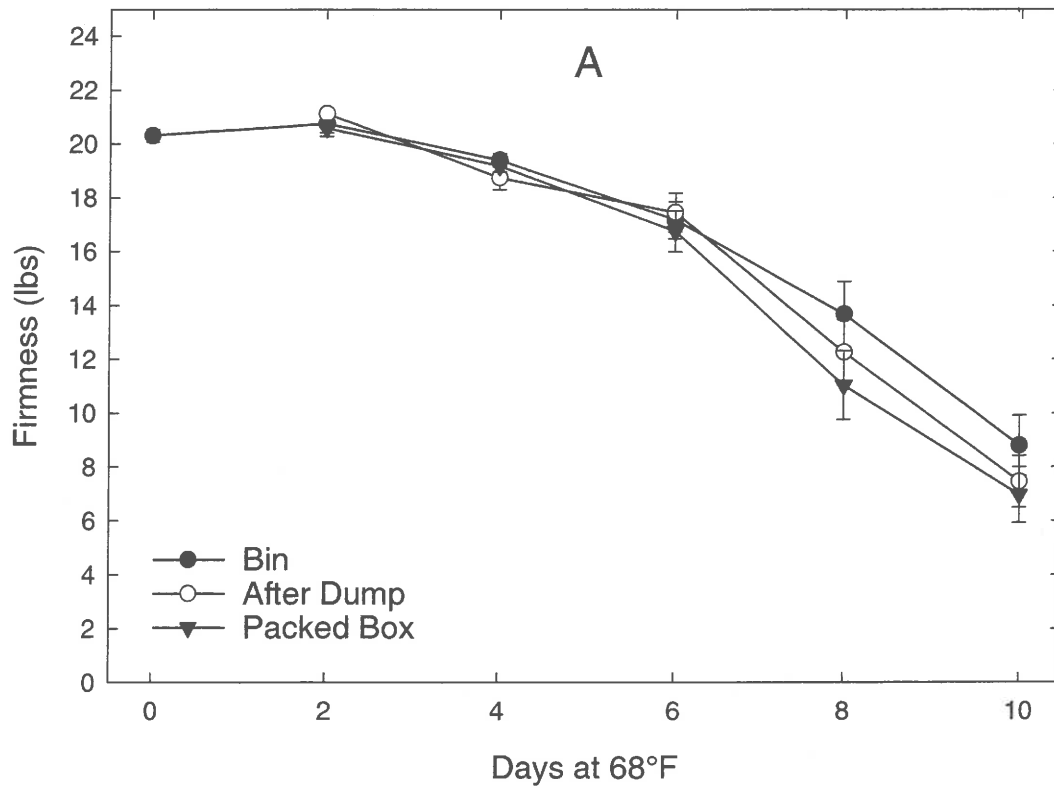


Fig. 2.

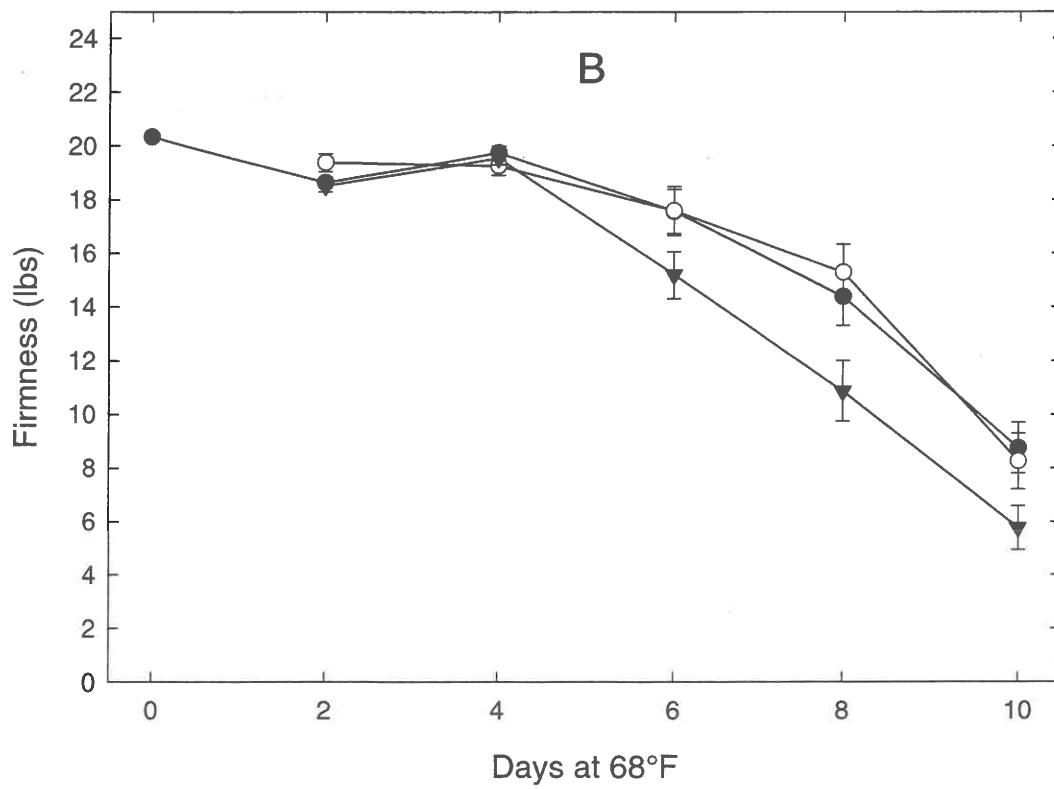




Fig. 3.

River

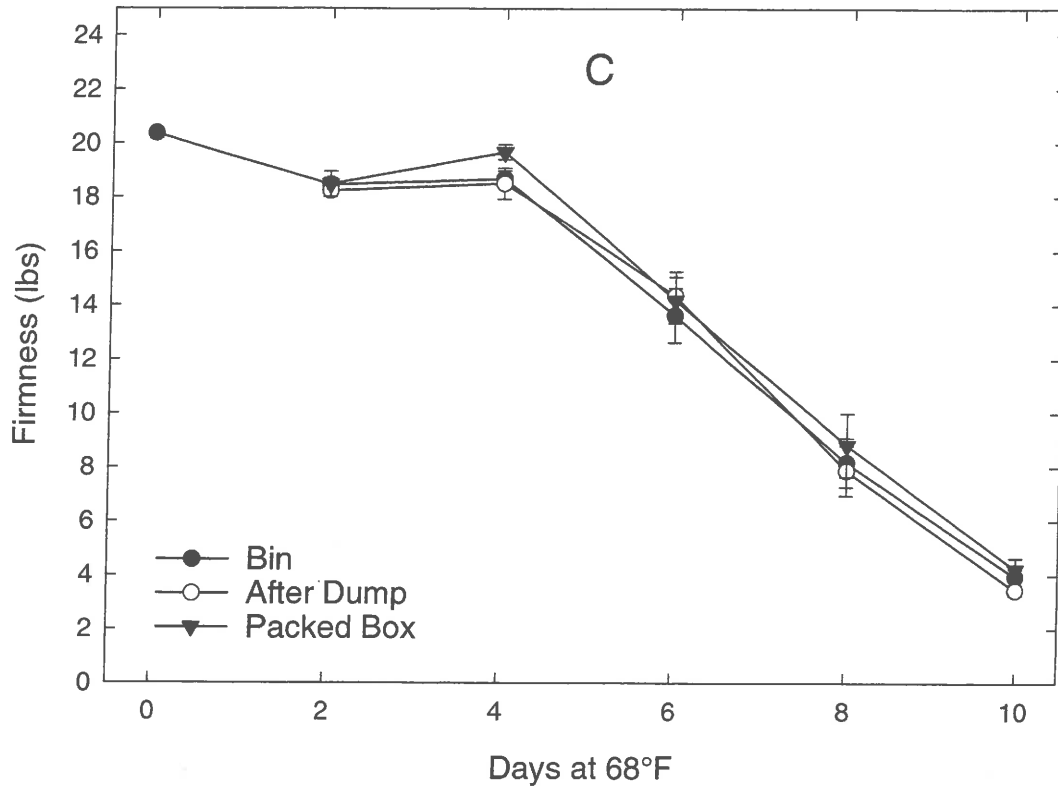


Fig. 4.

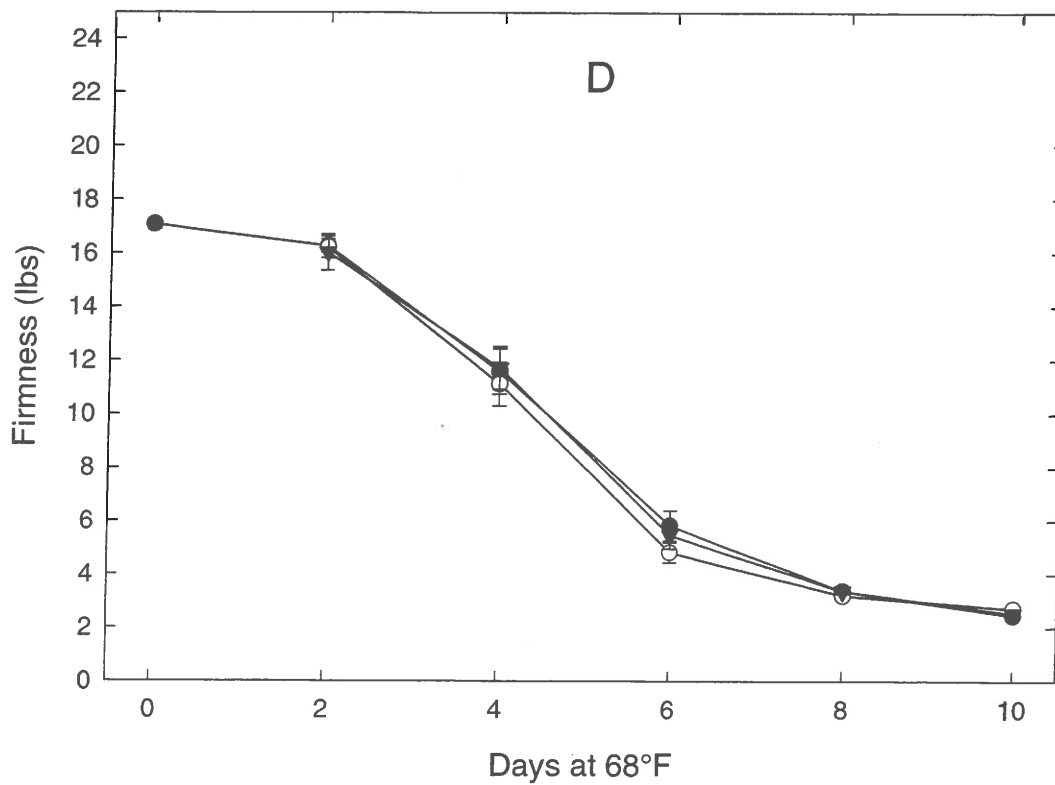


Fig. 5. River

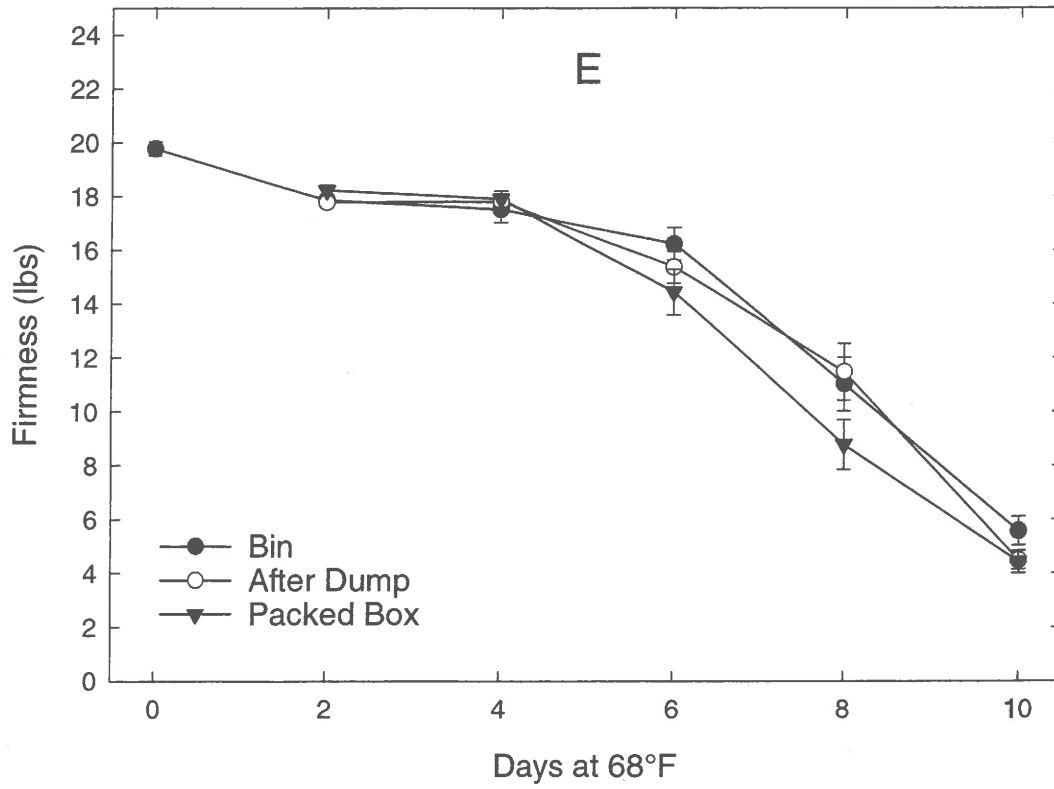


Fig. 6.

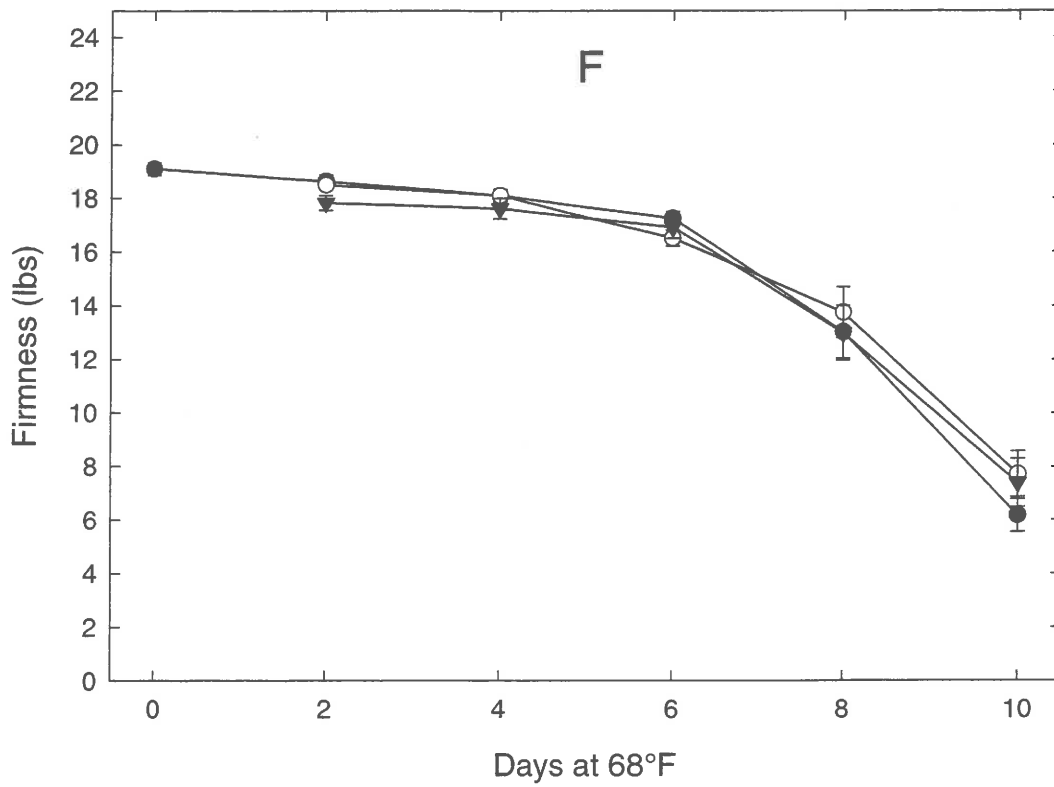


Fig. 7.

River

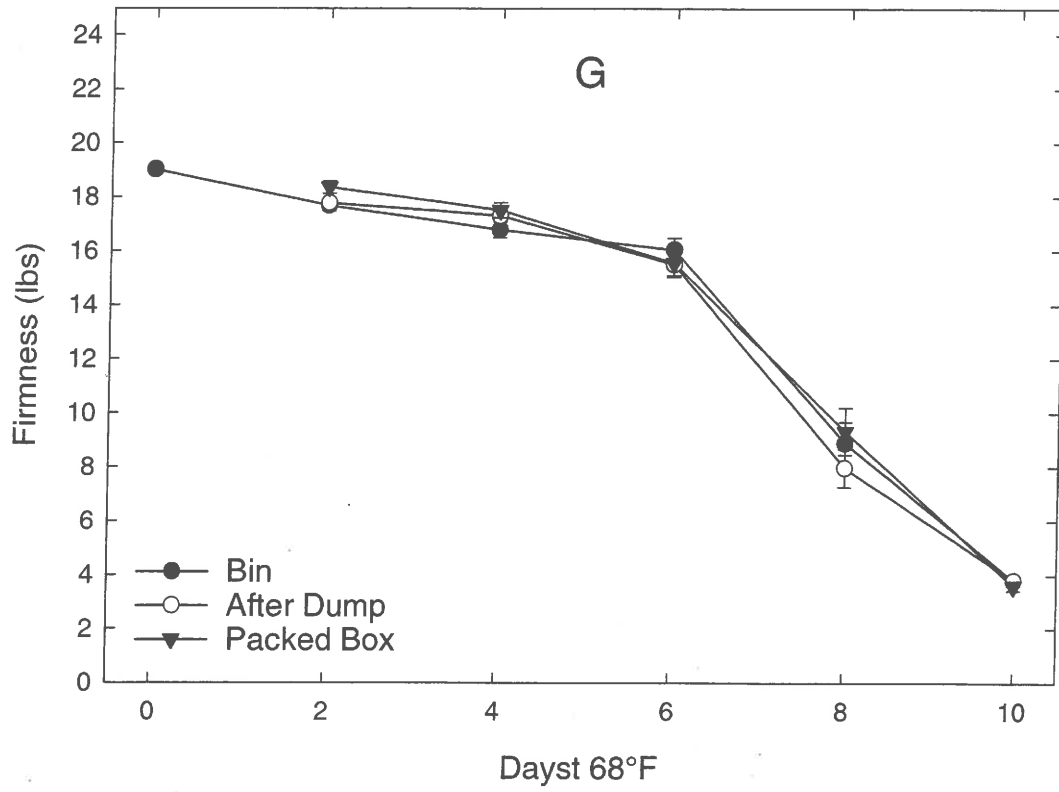


Fig. 8. Mountain

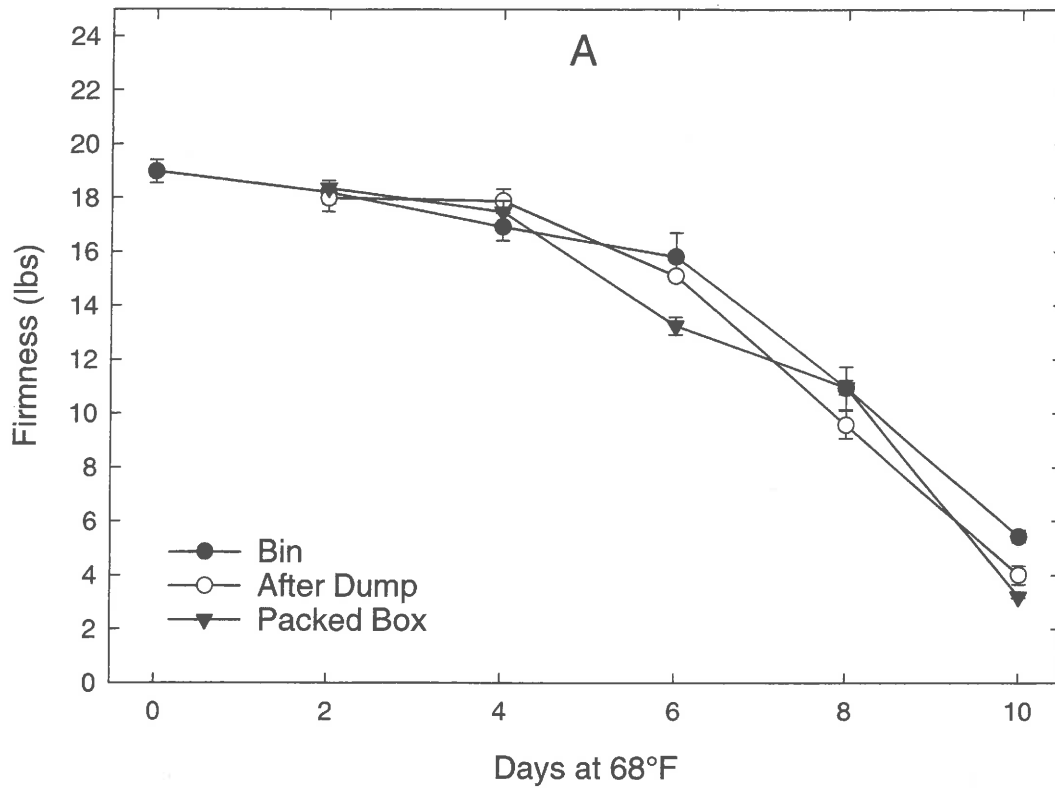


Fig. 9.

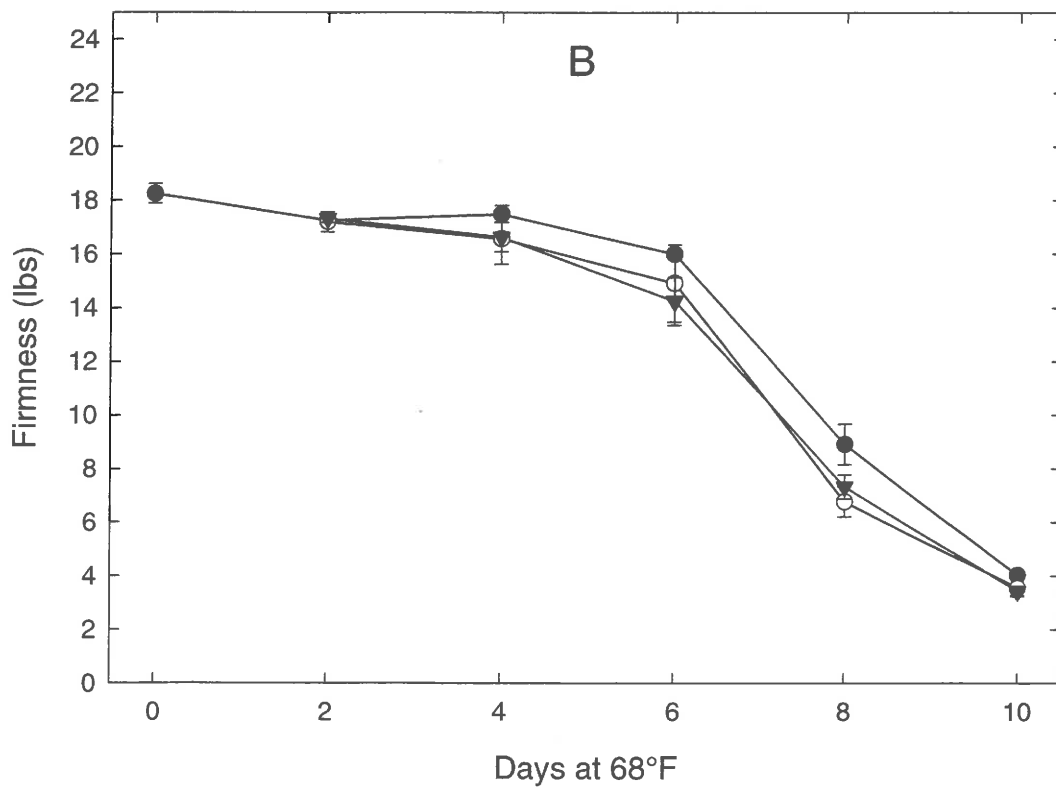


Fig. 10.

Mountain

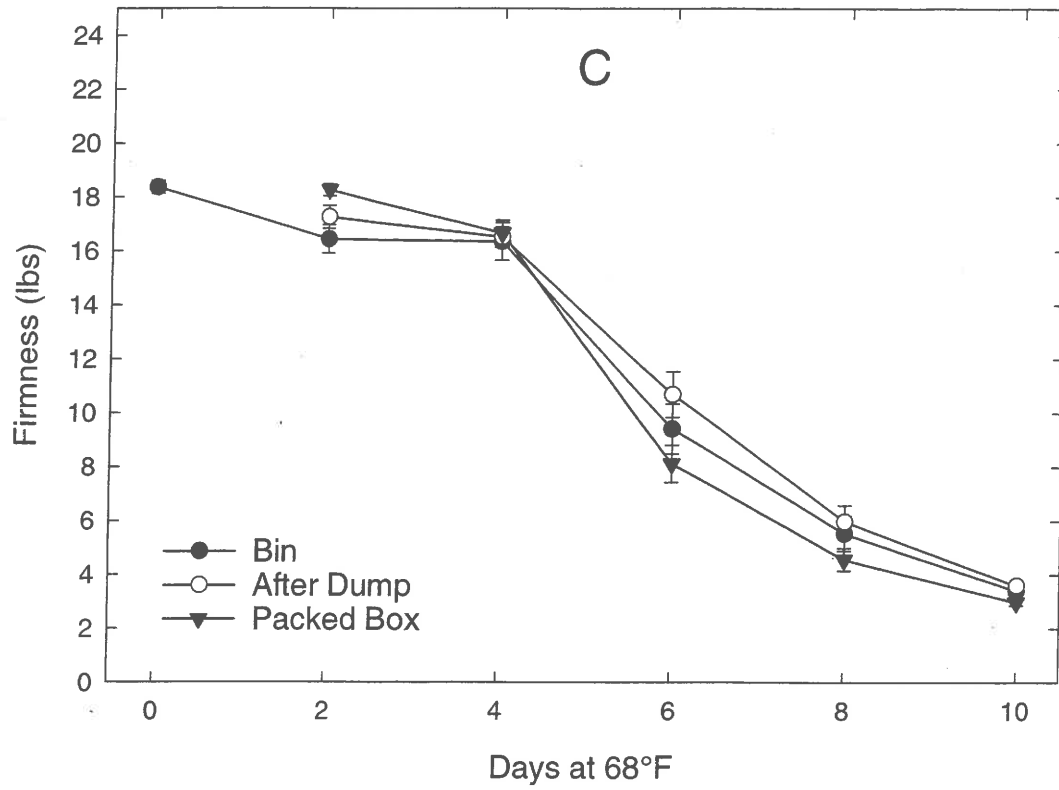


Fig. 11

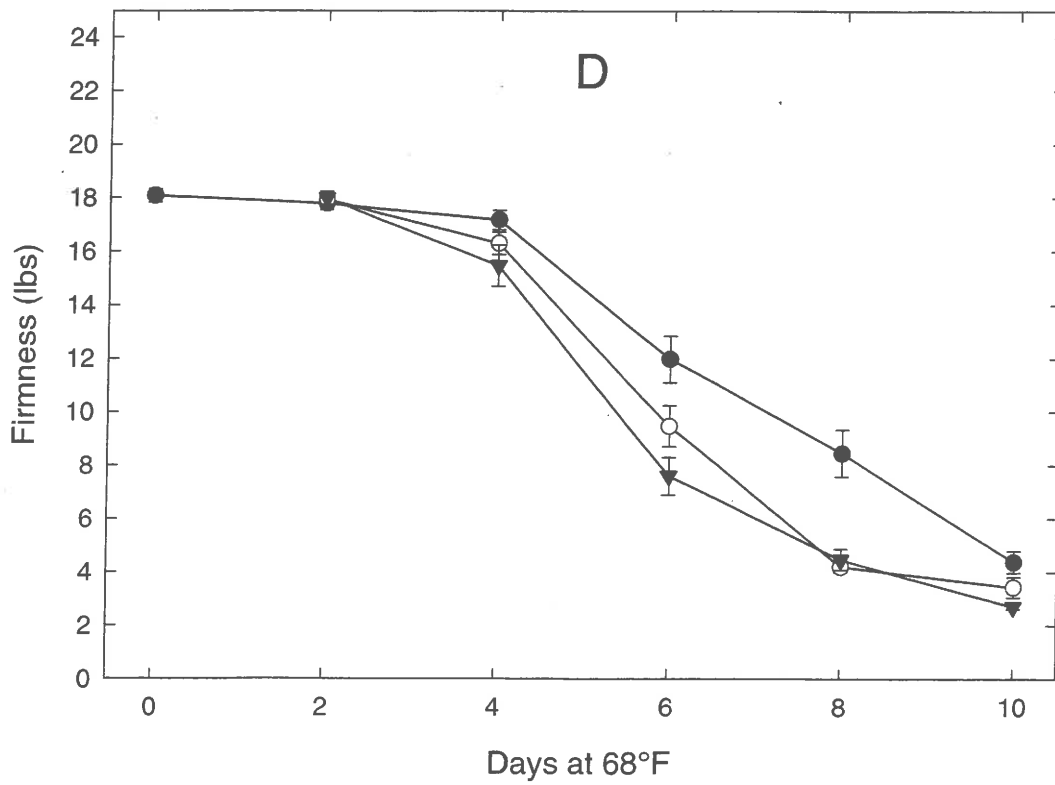


Fig. 12.

Mountain

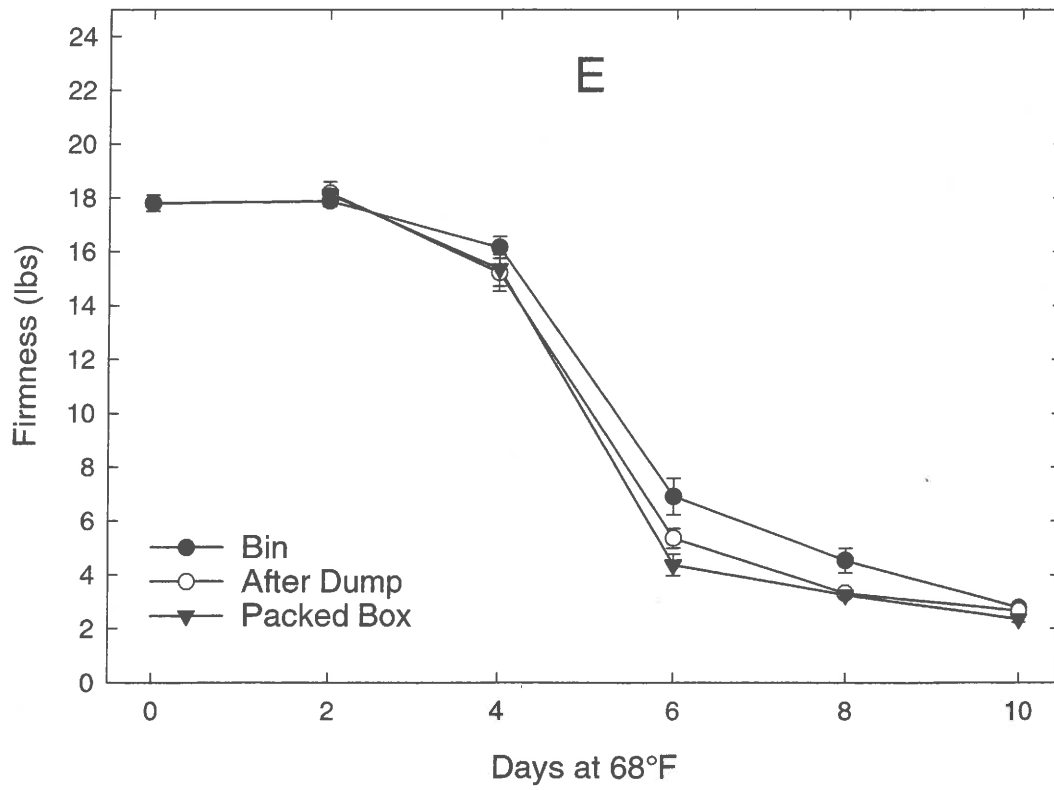


Fig. 13.

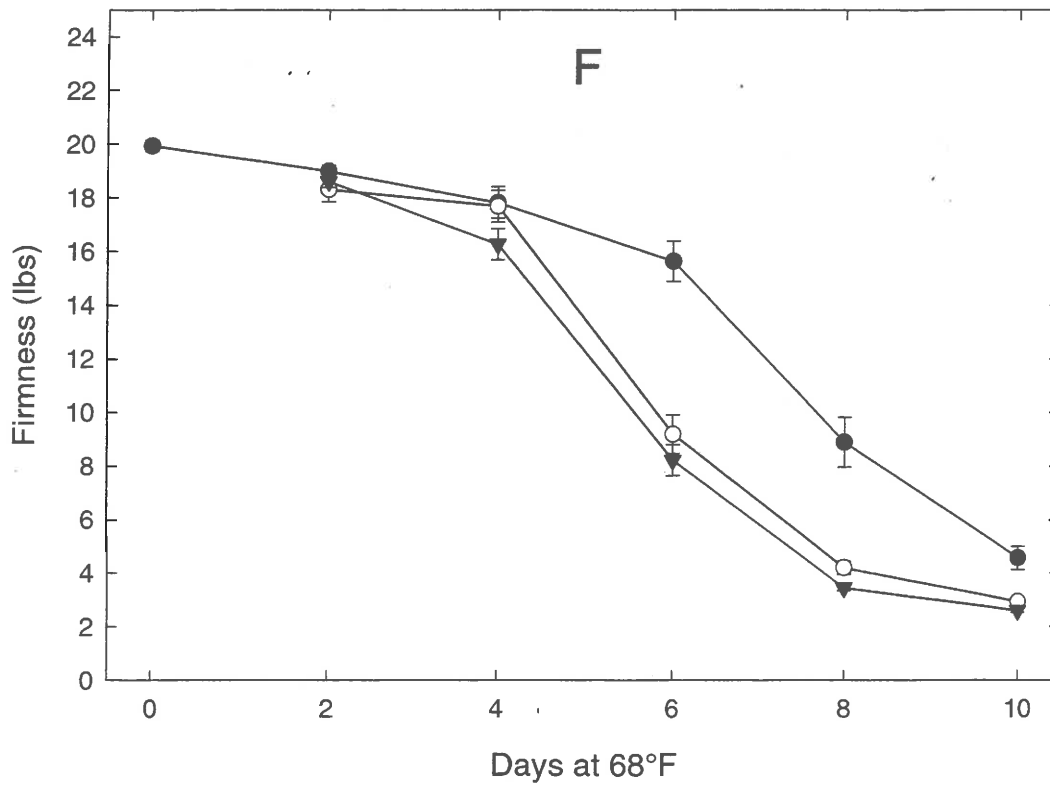


Fig. 14.

Mountain

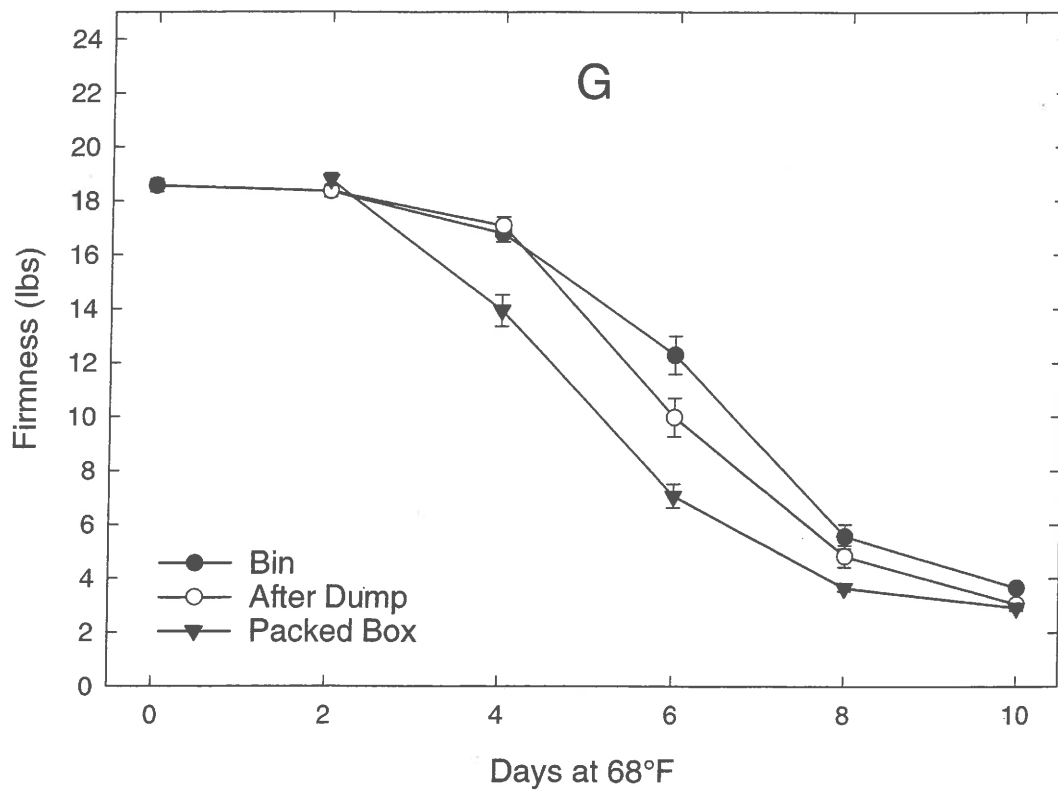


Fig. 15.

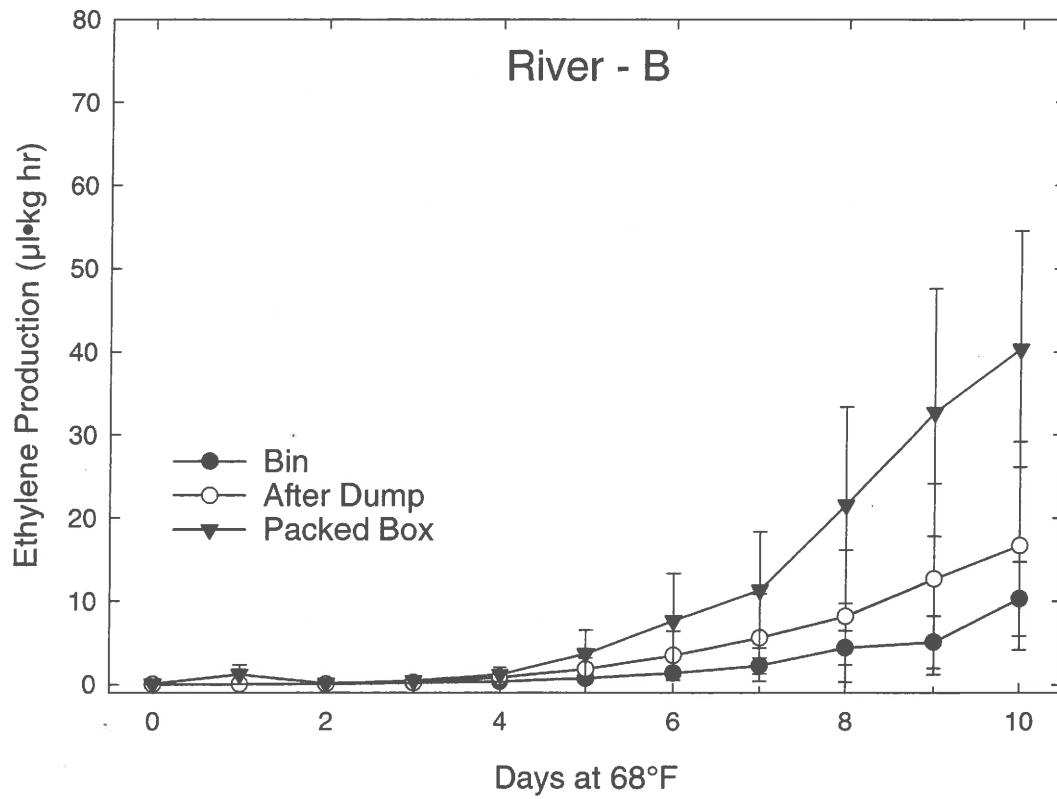


Fig. 16.

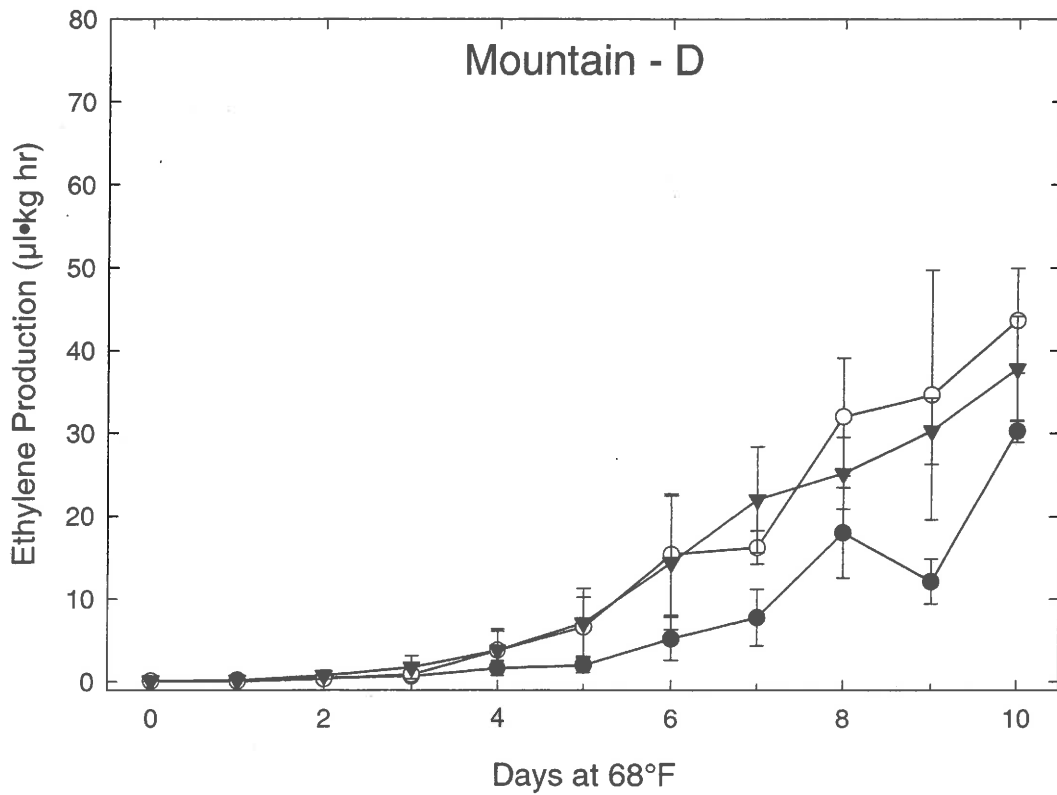




Fig. 17.

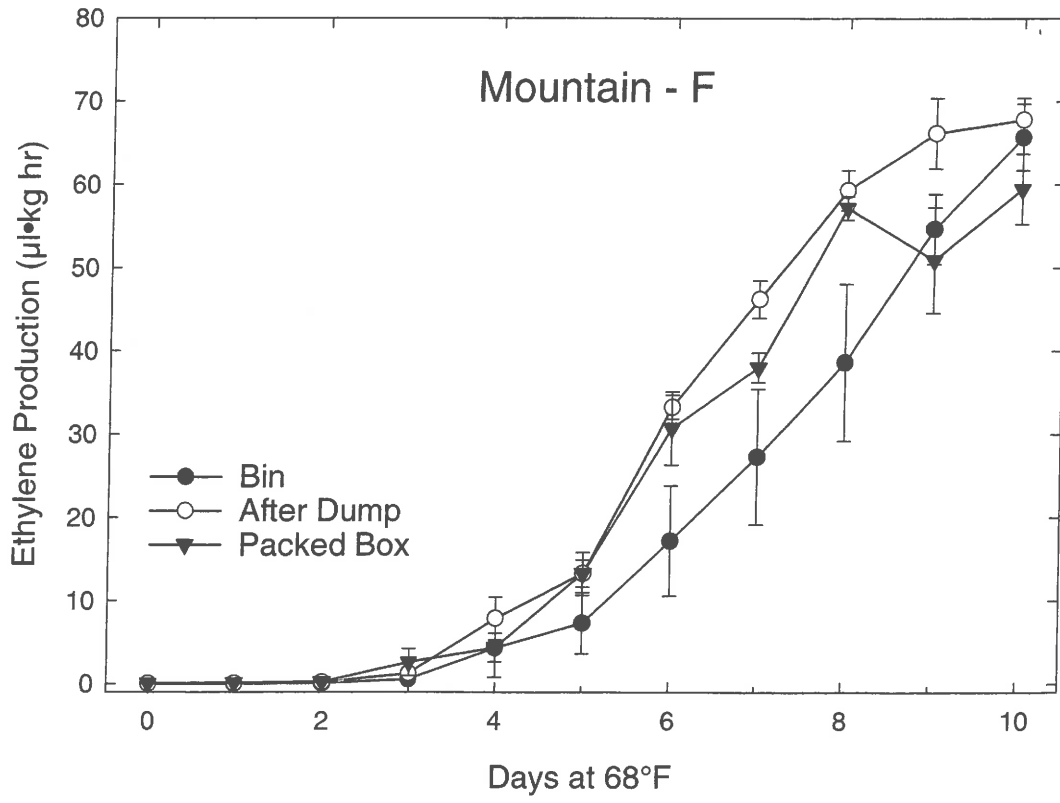


Fig. 18.

