



## ATO-RAPPORT 156

OVERRIPENESS IN PEARS AND BITTER PIT  
IN APPLES, DETERMINED IN SAMPLES OF  
THE LOAD OF M.V. MIDELT ARRIVED IN  
ROTTERDAM AT 27-03-1991

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ATO AGROTECHNOLOGIE

Overripeness in pears and bitter pit in apples, determined in samples of the load of m.v. MIDELT arrived in Rotterdam at 27-03-1991.

Submitted to: Marine Survey Bureau  
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1991 = 1990628



Firmness (Effe-Gi penetrometer): measurements in kg  
4.0 3.0 2.4 2.2 2.2 5.0 3.2 3.2 3.0 3.8 2.8 2.6 4.3 2.8 3.4 2.8 5.2 2.2 3.2 1.9 1.6 3.3 2.4 1.8 2.3  
Average: 2.984

Internal disorders:  
3 from the 25 fruits showed a beginning of brownheart.  
Remarks:  
5 from the 25 fruits showed a mild form of superficial scald.

Sample 2

Variety: Williams  
Packing date: 23-01  
Quality: cat I Elegido  
Size: 90  
Package: the same as mentioned for sample 1.  
Brand: RICAFRUIT  
Connossement: 10

Colour:  
8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 7 7 7 7 7 7 6 6  
Average: 7.600

Firmness:  
2.7 3.4 3.0 4.2 3.0 3.8 3.5 3.7 3.2 3.5 3.3 3.2 3.1 4.3 3.3 4.0 4.6 2.8 4.6 5.3 1.8 3.6 3.2 3.3 2.2  
Average: 3.464

Internal disorders:  
1 from the 25 fruits showed a beginning of brownheart.

Sample 3

Variety: d'Anjou  
Packing date: 09-02  
Quality: cat I  
Size: 110  
Package: the same as mentioned for sample 1.  
Brand: DOLE  
Connossement:16+17+18

Colour:  
4 4 4 4 3 3 3 3 3 3 3 3 3 3 3 3 2 2 2 2 2 2 2 2  
Average: 2.840

Firmness:  
5.3 6.3 6.8 4.5 5.3 4.3 5.3 5.2 5.1 6.8 5.8 7.0 5.5 6.0 5.3 6.8 6.0 5.8 5.3 5.4 5.8 7.0 6.5 6.0  
Average: 5.800

Internal disorders:  
none

Sample 4

Variety: Packham 's Triumph  
Packing date: 12-02

Quality: cat I Elegido  
Size: 80  
Package: the same as mentioned for sample 1.  
Brand: DOLE  
Connossement: 16+17+18

Colour:  
5 5 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 3 3 3 2 2 2  
Average: 3.720

Firmness:  
5.3 7.0 5.8 6.3 6.8 5.0 6.0 5.3 5.3 5.4 5.8 5.5 5.3 5.3 5.0 5.5 5.0 5.5 5.8 5.3 5.1 5.3 5.0 5.7 5.1  
Average: 5.536

Internal disorders:  
none

Sample 5

Variety: Williams  
Packing date: 22-01-1991  
Quality: cat I commercial  
Size: 120  
Package: the same as mentioned for sample 1.  
Brand: RICA FRUIT  
Connossement: 10

Colour:  
8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 7 7 7 7 7 7 7 6 Average: 7.6

Firmness:  
4.3 5.5 5.6 4.4 4.0 4.0 5.8 4.3 5.0 4.8 4.8 5.0 4.3 4.0 4.7 4.3 4.3 3.3 3.5 3.7 4.0 4.0 4.5 4.3 4.5  
Average: 4.436

Internal disorders:  
none

Sample 6

Variety: Red Delicious  
Packing date: 15-02  
Quality: cat I  
Size: 100  
Package: layered packing on trays, half of the fruits individually packed in blue paper.  
Brand: RECORD  
Connossement: 8

Colour:  
not to be assessed in the same way as pears as a consequence of red colour.  
Impression: variation between 7 and 5

Firmness:  
2.8 4.2 4.8 5.2 4.8 4.8 5.0 6.0 6.0 4.5 4.7 4.3 4.3 5.1 5.8 6.4 5.3 4.5 5.3 4.8 5.2 4.2 4.2 6.8 5.3  
Average: 4.972

### Bitter pit:

	external	internal
apple 1:	none	none
apple 2:	light	none
apple 3:	moderate	light
apple 4:	light	light
apple 5:	light	light
apple 6:	none	none
apple 7:	none	none
apple 8:	light	none
apple 9:	none	none
apple 10:	moderate	moderate
apple 11:	none	none
apple 12:	none	none
apple 13:	none	none
apple 14:	moderate	light
apple 15:	moderate	moderate
apple 16:	moderate	moderate
apple 17:	light	light
apple 18:	moderate	moderate
apple 19:	light	light
apple 20:	none	none
apple 21:	none	none
apple 22:	none	none
apple 23:	none	none
apple 24:	light	none
apple 25:	none	none

In total: external: 12 times none, 7 times light and 6 times moderate.  
internal: 15 times none, 6 times light and 4 times moderate.

### Discussion

#### Pears

During ripening of pears many things are changing. Amongst others chlorophyll, responsible for the green colour is being broken down. Firmness is decreasing as a consequence of the increased activity of several enzymes, which break down cell wall components. Especially polygalacturonase is important in this respect as it dissolves the pectine middle lamellae in the cell wall.

During ripening many chemical changes also occur: production of volatile compounds is increasing strongly for example the production of esters. Total acidity is decreasing during ripening, and starch is being hydrolyzed giving a rise in the amount of sugars.

Overripeness is characterized by a very yellow peel, a soft texture, development of disorders as brownheart and finally pathological breakdown.

For practical assessments of ripeness colour and firmness can be used.

Ripening of pears may be influenced by several factors before and during storage. The picking date is very important for storage life. If the fruits are picked from the tree too late, ripening will proceed quickly and storage life will be shortened. Also delays in cooling of the harvested fruits may lead to the same quick ripening. During storage a too high temperature may promote ripening. In the opposite case : picking on the right moment, prompt cooling and storage on the right temperature will lead to an optimal storage life.

Finally the genetic background of the pears is off course also very important for the storage life for example storage lives of Williams, d'Anjou and Packham's Triumph are 3.5, 4-6 and 5-6 months respectively at -1°C (Lit 1,2).

The results given above show that:

- Williams pears are all very yellow and soft (see Table 1) and in some fruits a beginning of brownheart became visible. We state, that they showed a very advanced stage of ripening i.e. the fruits may be indicated as overripe. It must be expected that these fruits would cause serious problems during distribution.
- Packham's Triumph and d'Anjou pears showed a much greener appearance. They were also firmer. These varieties were therefore in a much better condition than Williams. It must be expected that d'Anjou and Packham's Triumph will not cause quality problems during distribution.

Table 1: Average colour and firmness of 5 pear samples.

Sample No	Variety	Colour*	Firmness**
1	Williams	7.960	2.984
2	Williams	7.600	3.364
3	d'Anjou	2.840	5.800
4	Packham's	3.720	5.536
5	Williams	7.600	4.436

\* 1 = dark green; 8 = yellow

\*\* kg

As indicated above a safe storage duration for Williams is 3.5 months. This means that pears picked on the right moment, cooled down without delay and stored at the right temperature may be stored up till 3.5 months at -1°C.

A storage period of 34 instead of 20 days will therefore have minimal consequences concerning ripening. So it is impossible, that this delay of 14 days has caused overripeness in the Williams pears on the m.v. MIDELT, assuming that no cooling delay has occurred at San Antonio and the storage took place at the right temperature.

MIDELT was loaded from 19-02-1991 at 7.00 hours until 21-02-1991 at 11.35 hours. The ship left San Antonio on 21-02-1991. Pulp temperatures of the fruits ranged between 6 and 10°C upon loading. From MIDELT's temperature readings we see that temperatures in the pear rooms were between 2 and 6°C on 21-02-1991 at 00.00 hours, whereas the temperatures in the same rooms were between +0.5 and -1°C on 23-02-1991 at 00.00 hours. This indicates an adequate cooling of the fruits.

The temperatures during the rest of the voyage ranged between -1 and 0°C, indicating the right storage temperature for the pears.

### Apples

Bitter pit in apples is a disorder, which is caused by a mineral imbalance in the fruit flesh. Especially low calcium levels are important as they increase chances on the development of bitter pit. Also magnesium and potassium have some influence on the disorder. Bitter pit may already appear in the fruits on the tree before harvest. Many cultural conditions favour bitter pit and especially early harvest enhances the problem. Bitter pit may also develop in storage. Storage conditions, that minimize bitter pit include prompt cooling, high relative humidity and CA storage.

However also under the most favourable storage conditions bitter pit will develop to a certain extent.

In our research we found an average of 52% apples with external and 40% of the fruits with internal bitter pit. This must be regarded as a serious attack.

From the ship's readings of the temperatures of the rooms, in which the fruits were stored during the voyage we saw a prompt cooling after loading. During the whole voyage a temperature of 0-1°C was maintained.

These conditions do not favour further development of bitter pit. The cause of the bitter pit in the Golden Delicious apples must be sought in cultural conditions and not in the storage.

### Conclusions

- Overripeness was found in 3 samples of Williams pears, which were transported from San Antonio Este to Rotterdam by the vessel m.v. MIDELT. This conclusion could be drawn after measuring colour and firmness of the fruits. The ripeness of 1 sample d'Anjou and 1 sample Packham's Triumph was much less advanced.

- Bitter pit was found in 1 sample Golden Delicious apples, which were transported on the same vessel.

- The cause of the overripeness of Williams pears must be sought in events before the storage on m.v. MIDELT. Cooling and storage of the pears has been done correctly and it can be excluded that the prolongation of 14 days of the voyage from San Antonio Este to Rotterdam has caused the overripeness.

- The cause of bitter pit in Golden Delicious must be sought in cultural and not in storage conditions.

### Summary

On request of the Marine Survey Bureau H.A. van Ameyde at Rotterdam ATO Agrotechnologie assessed the quality of 5 samples of pears (3 Williams, 1 Packham's Triumph and 1 d'Anjou) and 1 sample of apples (Golden Delicious). Overripeness was found in Williams pears and bitter pit in Golden Delicious. The cause of both quality problems must not be sought in a longer duration of 14 days of the voyage with the vessel m.v. MIDELT. The cause of the overripeness and of bitter pit should be found in cultural conditions or events between harvest and loading on the ship.

### Literature

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