

Date : 02/03/2021 – Rémi LAURENT – STAR FRUITS



INTERNAL BROWNING STUDY - STORAGE EFFECT IN EUROPE

INTRODUCTION

- ❖ Internal browning is a physiological disease that strongly affects the Pink Lady® apple.
- ❖ Several types of internal browning have been identified, and it is certain that its occurrence is the result of several factors combined. There is no doubt that weather conditions and technical part play a major role in the onset of the disease (see summary “BiblioSumUpEN” released). Among these different types, we find developments stimulated by the variation in the level of O₂/CO₂ or by the action of temperature.
- ❖ In the European market, end of last seasons had been highly impacted.
- ❖ In order to understand and prevent such issue at destination, it was decided to proceed to a specific survey on importing and storage practices in Europe
- ❖ Therefore, we focused on the European part, with the idea to provide information on the topic and try to identify recommendations that could reduce the appearance of the disease.



PROCESS REMINDER

- ❖ This study only concerns European storage and does not include production, climatic or conservation data from exporting countries.
- ❖ Over the past two years, we have asked you to complete traceability surveys for batches with or without internal browning.
- ❖ We also asked storage duration and temperatures as main parameters for vessel transit (via temperature readings).
- ❖ Surveys began in mid-August, which corresponds to the period of strong pressure from internal browning in Europe (observed over the past years). End of seasons are more conducive to the development of the disease.
- ❖ In total, 158 investigations concerning batches without internal browning, and 85 investigations on batches with proven presence of internal browning were analyzed, which represent a total of 243 partially exploitable data. We have targeted some parameters, such as packaging, batch status, transit times or temperature to base our statistical analyzes. In 2020, we requested the temperature readings of the probes during transport. We collected 85 data.

But the study was difficult. At the end, we have a lack of exploitable data to establish a solid statistical correlation.

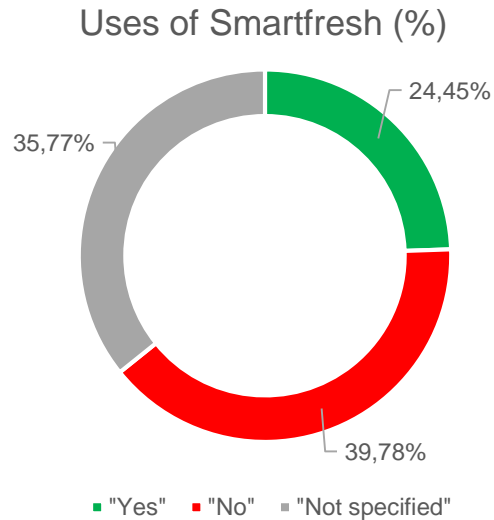




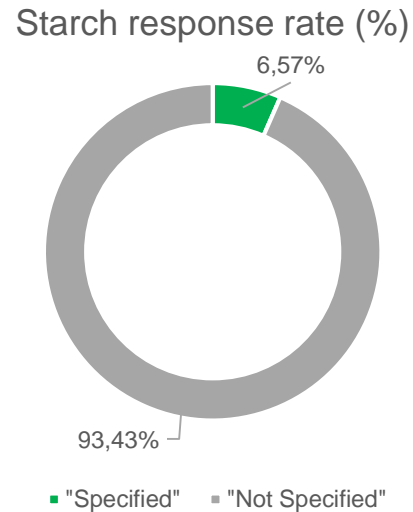
FROM THE VESSEL
TO THE PACKING STATION

BATCH CHARACTERISTICS

Out of a total of 274 lots, we have 174 responses for the Smartfresh treatment, 18 for the starch rate and 165 for the harvest date.

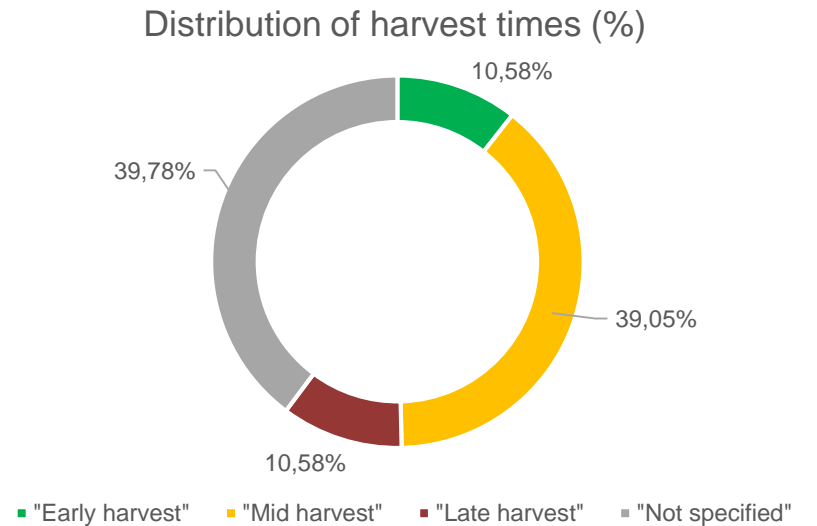


24.5% positive responses, against 40% negative responses, which is few considering the impact this molecule can have on post-harvest storage. As a reminder, the 1-MCP makes it possible to preserve the quality of the fruits and to prevent diseases in the case of long-term storage. However, application must be made within 7 days of harvest.



The starch rate provides information on the maturity of the fruit. **The appearance of internal browning is partly related to the advanced maturity of the fruit at harvest.**

This is an important information and we have very few answers.

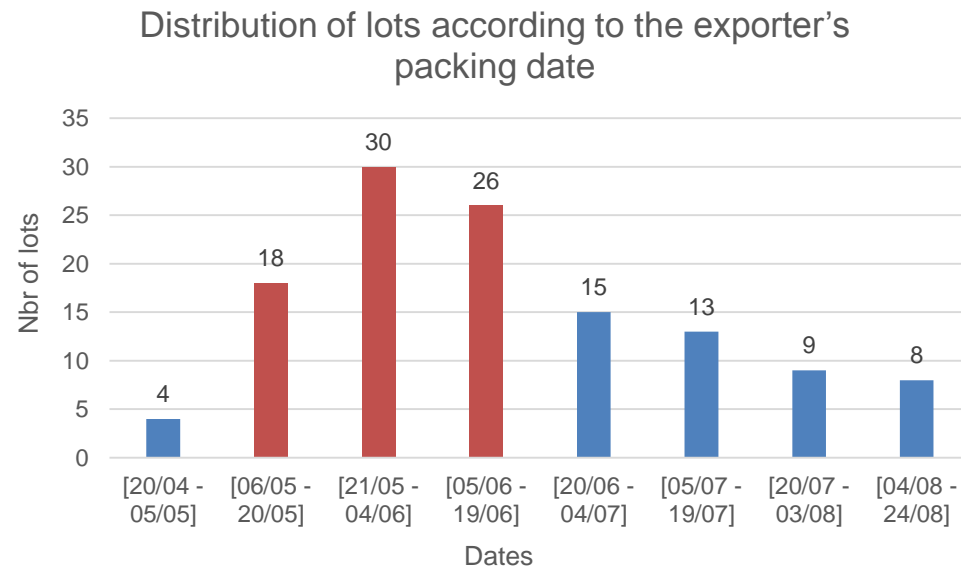


Mid-harvests dominate, and there are relatively few early or late harvests.

For a few years now, it has been observed that batches arriving at the end of the season in Europe develop more internal browning. **Watch out for late harvests.**

DISTRIBUTION OF LOTS ACCORDING TO THE EXPORTER'S PACKING DATE

Most of the lot packed between May and June. It should be considered that the study mainly focused on end-of-season risky lots (controlled in Europe at least mid-August).

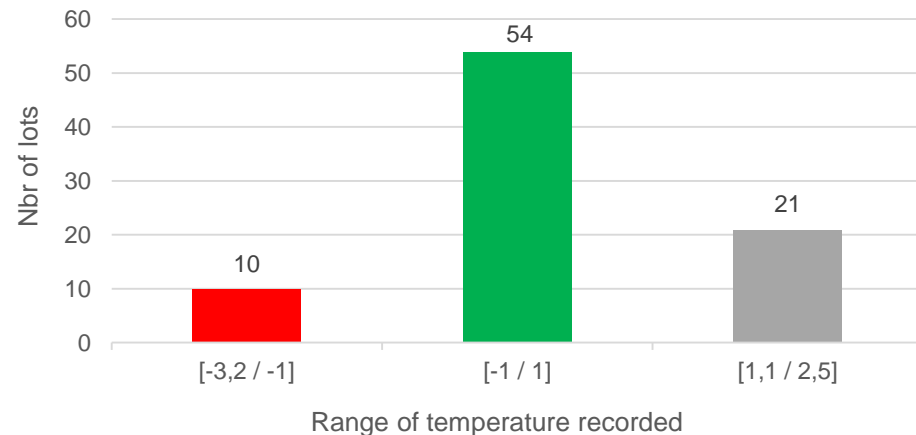


We were not able to get the precise harvest dates, we tried to get as close as possible by taking the exporters' packing dates. 123 lots traced over 243, other batches were mostly already repacked, or the date wasn't easily readable.

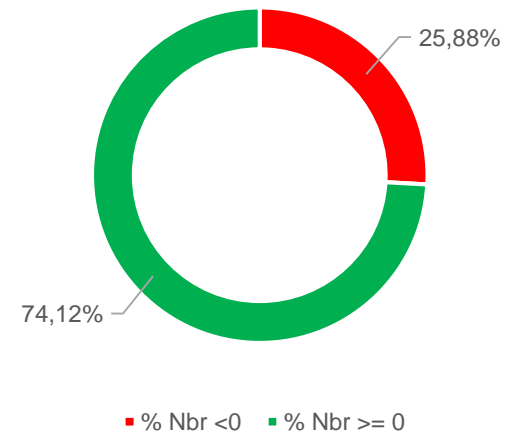
TEMPERATURE READING DURING TRANSPORT : LOWEST TEMPERATURE

We asked you for each survey to provide us the temperature readings of the containers during transport by boat. We were able to collect 85 temperature readings. Below is the data relating to the lowest temperatures recorded by the probes.

Distribution of lowest temperature recorded during shipment



Distribution of extreme low temperature (%)



Minimum recorded is -3,2°C, which is very low and does not correspond to the values expected for a long transport. Average is 0,33°C, which is also quite low. Consider the difference due to the temperature measurement of the probe.

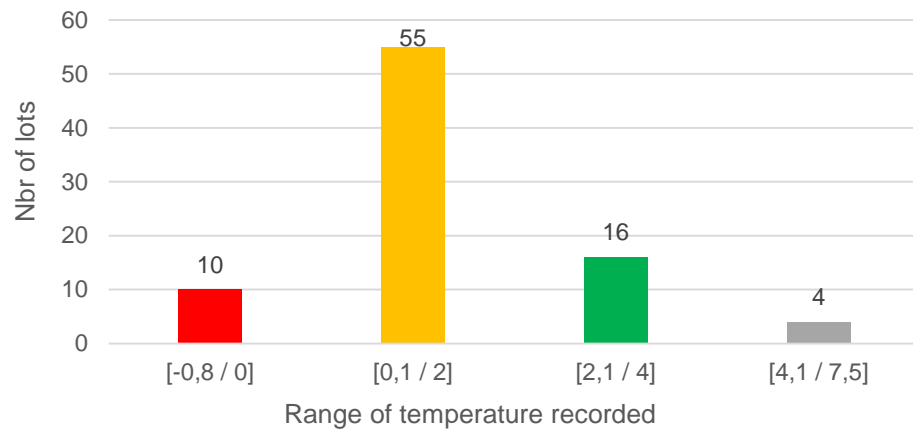
26% of 85 batches studied were subjected to negative temperatures during transport. Negative temperatures are not recommended for good conservation of Pink Lady. Prolonged storage can lead to diseases, such as internal browning.



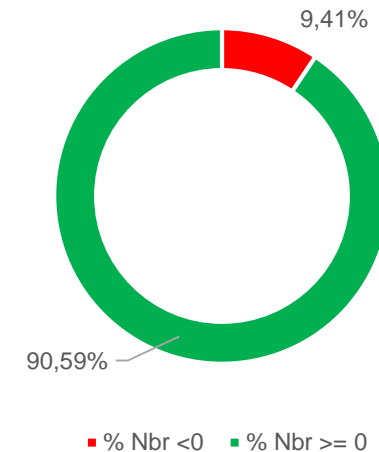
TEMPERATURE READING DURING TRANSPORT : AVERAGE TEMPERATURE

Below is the data relating to the average temperatures recorded by the probes.

Distribution of average temperature recorded during shipment



Distribution of average temperature (%)

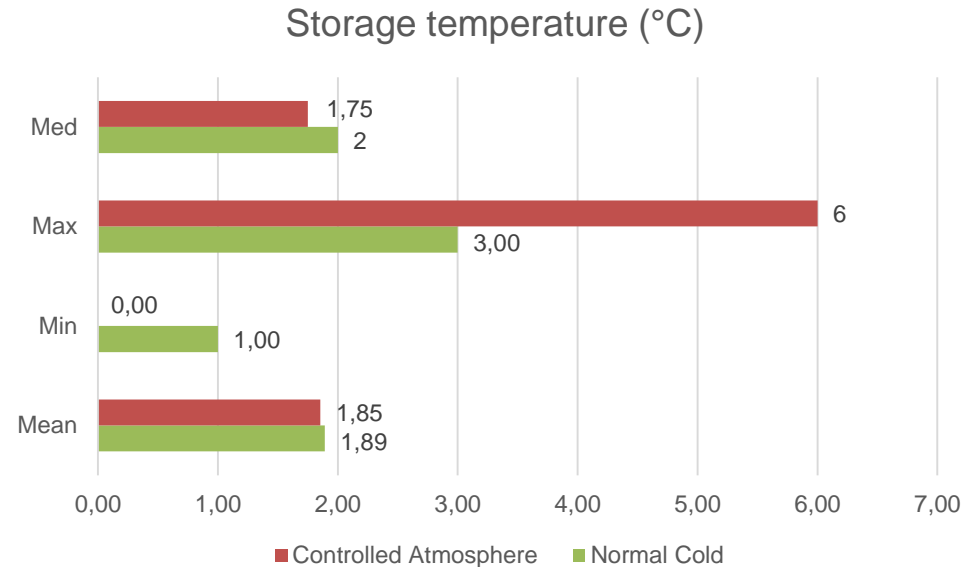
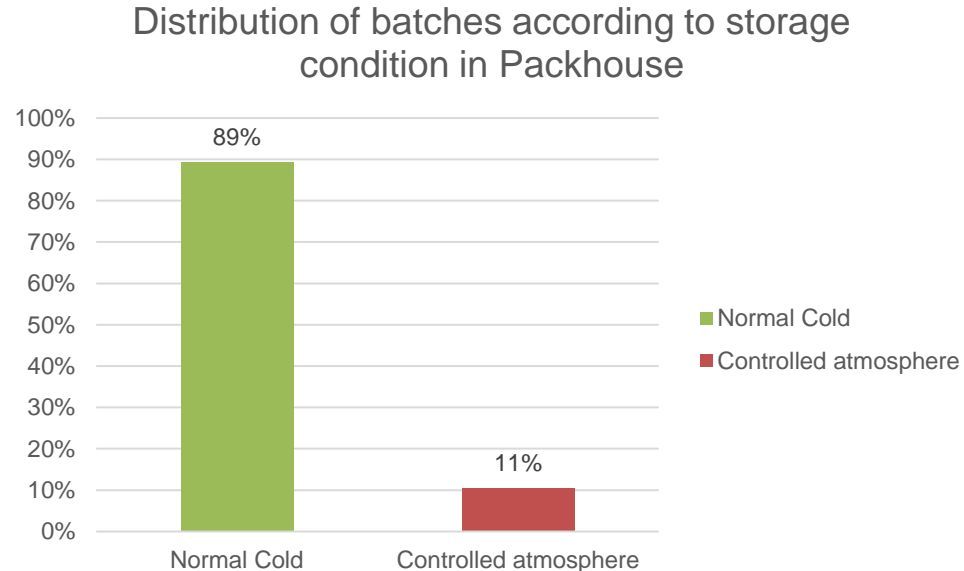


Minimum recorded is -0,8°C, which is low and does not correspond to the values expected for a long transport. Average is 1,46°C, which corresponds to recommendations in force.

9,41% of 85 batches have a negative average temperature during the whole transport (25/40 days). **Prolonged negative temperatures impact the quality of the fruit and can trigger the appearance of disease such as internal browning.**

STORAGE CONDITION IN PACKING STATION

We observed internal browning both in normal cold and controlled atmosphere.



Use of normal cold predominates, which reflects a desire to quickly evacuate new batches and avoid long storage periods conducive to disease development.

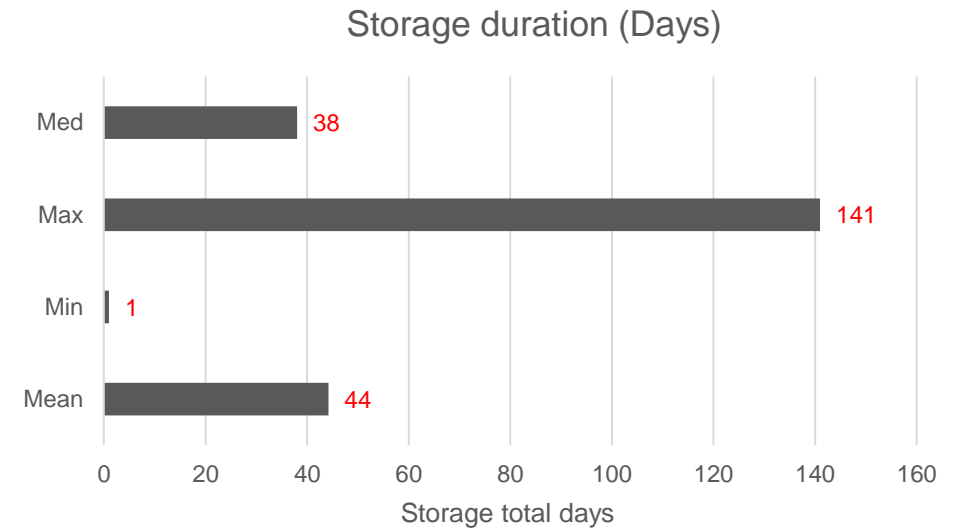
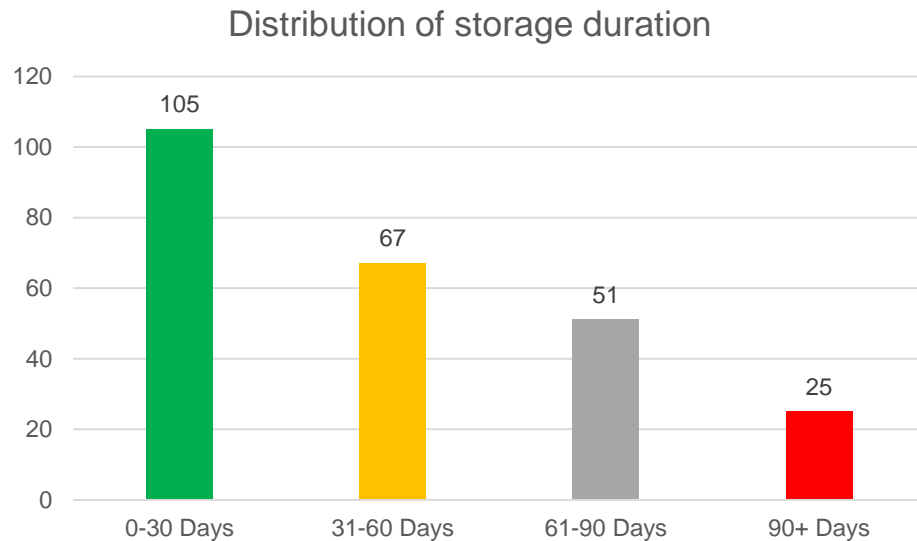
Graph on the right shows the average temperatures recorded (in Warehouse and Packhouse combined) during storage. The average temperature is around 2°C, which corresponds to the recommendations in force.



STORAGE PERIOD OF A BATCH IN EUROPE

Below is the distribution and the average transit time of a batch from its arrival at the port until its departure from the station.

Carried out on 228 lots.



Most of the batches are processed within 2 months after their arrival in Europe, the average being **44 days**.

Few lots stay more than 3 months. **Transit times are short, which justifies the use of normal cold rather than controlled atmosphere.**





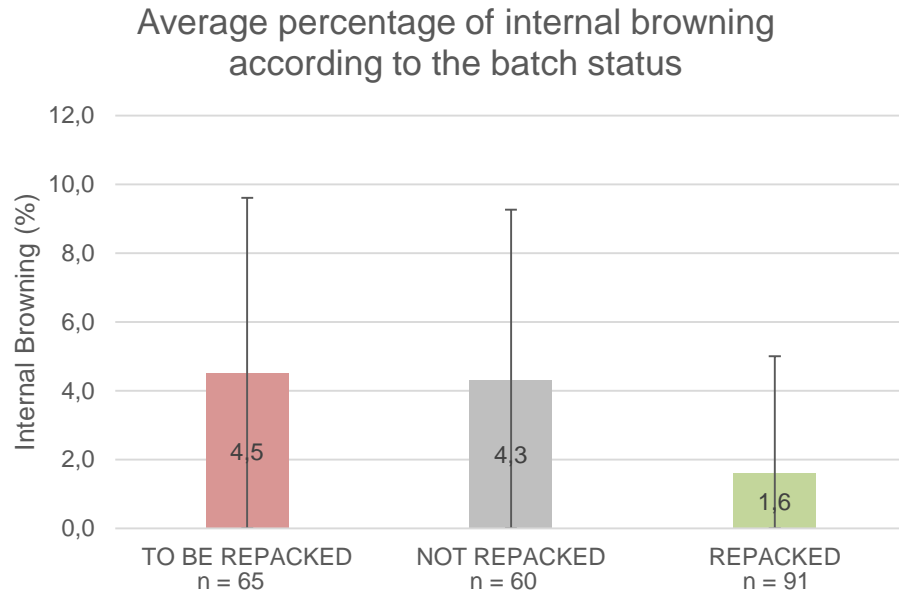
FOCUS ON PARAMETERS
INCREASING INTERNAL BROWNING
-
STATISTICAL ANALYSIS

KEY POINTS

- ❖ The purpose was to know whether the fruits according status “repacked”, “to be repacked” and “not repacked” showed different internal browning presence and risks : according to our dataset, there is no statistical correlation between the status of a batch and the percentage of internal browning. There is internal browning everywhere regardless of the type status.
- ❖ We wanted to know whether the fruits according the packaging they were in, showed different internal browning presence and risks : according to our dataset, there is no statistical correlation between the different packaging used and the percentage of internal browning. They all exhibit internal browning in almost similar proportions.
- ❖ We wished to see impact of fruit storage duration on internal browning presence and risks. Statistically, it is observed that most batches with internal browning spend 1 day or less in storage before being blocked. Despite this we observe some cases of late development of the disease later in the storage chain.
- ❖ We wanted to see impact of temperature (at all stage of the storage chain, packing station, warehouse, incoming check ...) on internal browning presence and risks : according to our dataset there is no statistical correlation between the temperature and the percentage of internal browning.



BATCH STATUS



Represent the standard deviation

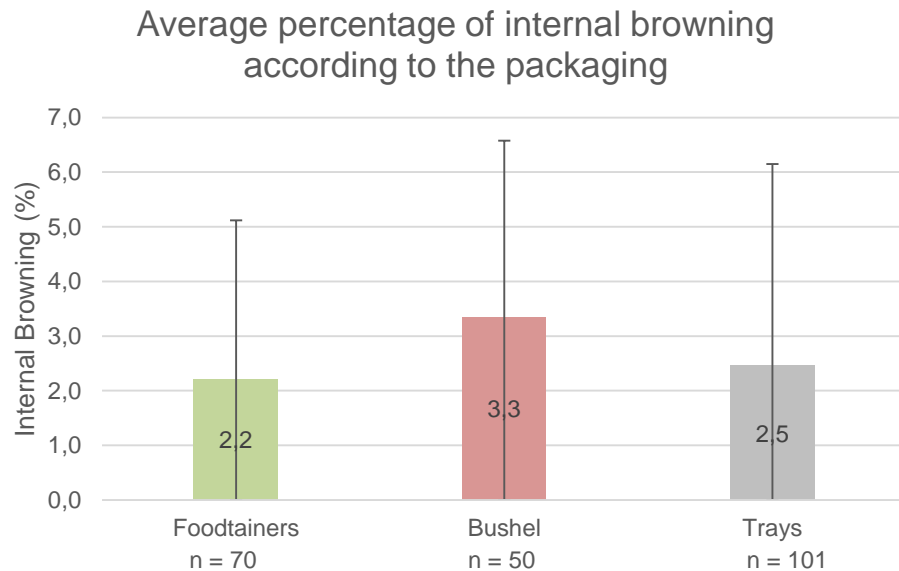
There is a slight trend that emerges, the "Repacked" status shows a little less internal browning, which seems logical. **But from the dataset, it is not possible to conclude on a potential link between internal browning and batch status.**

There are cases of internal browning whatever the status of the batch, a classic sorting is not enough to identify and eliminate all the risky apples.

New sorting techniques specific to internal browning exist, with infrared machines which make it possible to detect the presence or absence of internal browning. This equipment remains expensive.

PACKAGING

Below is the average percentage of internal browning according to the packaging. We wanted to see if there was a difference in the appearance of internal browning with the packaging changing.



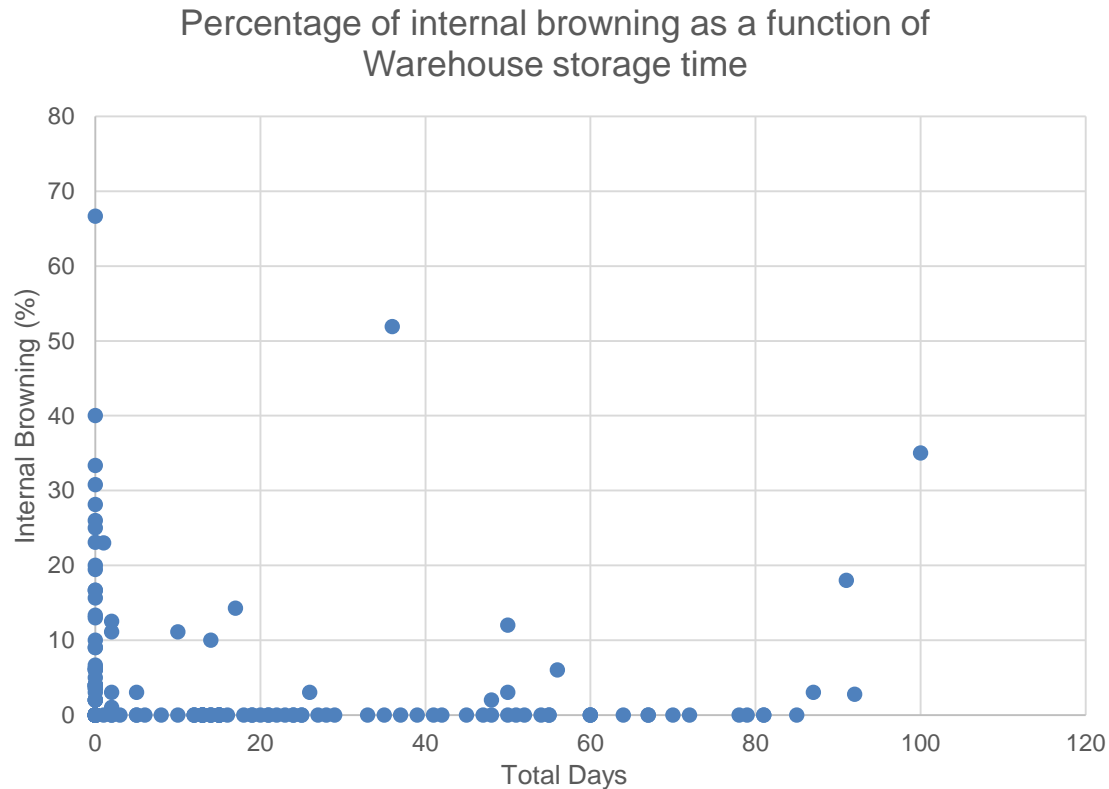
Represent the standard deviation

There is no significant difference between the 3 variables. They all exhibit internal browning in almost similar proportions.

There is a very slight trend in favor of foodtainers and trays which exhibit a little less internal browning than bushel.

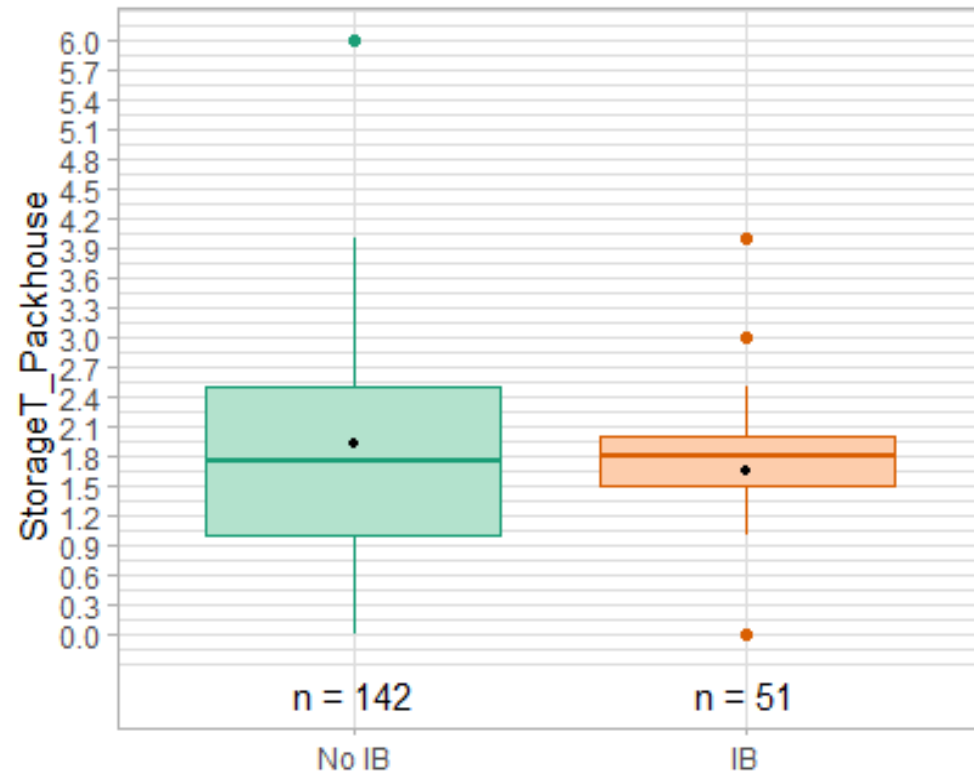
This seems logical since foodtainers and trays are most of the time packed and sorted, unlike bushel which is more a "raw" product.

PERCENTAGE OF INTERNAL BROWNING AS A FUNCTION OF STORAGE TIME



- Most batches with internal browning spend less than a day in Warehouse.
- The development of internal browning therefore **took place before the batch arrived in Europe**. This confirms that internal browning is **linked to several factors, including those of production and the meteorology**.
- This also means that the **batches are correctly blocked after a quality control on receipt or directed to the packing station for re-sorting**.
- **There are still cases of internal browning later in the storage chain**. There is a later onset of the disease, which can again be related to the production conditions or to poor storage conditions.

PRESENCE OF INTERNAL BROWNING AS A FUNCTION OF TEMPERATURE



- Corresponds to the mean

— Corresponds to the median, which divides the workforce into two equal parts: 50% of the workforce is above the line and 50% below

- The average storage temperature is similar between affected batches and healthy batches. According to our dataset, **there is no statistical correlation between the temperature and the percentage of internal browning.**
- Under similar storage conditions, a development of the disease is still observed.
- The temperatures observed correspond to the recommendations in force. Some exceptions are either too high or too low (6°C or 0°C).



Conclusions

CONCLUSION

- ❖ No very bad practices identified, most of storage temperatures correspond to the expected values. Beware of negative values during transport, some lots suffered negative temperatures.
- ❖ Few information on the lot. It is important information, which makes it possible to direct the batches more easily towards a short or long storage.
- ❖ Despite compliance with the recommendations, internal browning may appear, whether in controlled atmosphere or in normal cold. No modality makes it possible to eliminate the risk of the disease.
- ❖ No clearly established correlation between internal browning, storage time and temperatures. The risky potential for the onset of the disease is rather linked to the production part, and the storage conditions exacerbate the risks already present.
- ❖ We have an incomplete view of the situation. This study should be completed with data from exporting countries.

