ATO-DLO

Expertise-Report for Cunningham Marine B.V. at Rotterdam

Assesment of damage on Sweet Corn in a Reefer container at Rotterdam, November 1998

CONFIDENTIAL

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1. Introduction

A Reefer container loaded with Sweet Corn from Israel arrived at Rotterdam on 5th November 1998. The cobs showed frequently fungus growth especially on the decapitated ends of the cobs, which resulted in a decrease of the commercial value of the crop. Cunningham Marine (Marine Surveyors & Carriers Liability Adjusters) took a sample of the load from the container and asked ATO-DLO at Wageningen to assess this sample. ATO-DLO was also asked to correlate, if possible, the assessment of the sweet corn with the transport conditions during travelling by truck from Israel to the Netherlands.

2. Transport Sweet corn

Mr H.L.H.M Braam from Cunningham Marine delivered information about the sweet corn. The crop was harvested in the period 27-28 October 1998 in Israel. The cobs were packed immediately after harvest and stored in a cold room until 29th October. The cobs were put into a Reefer container on 29th October. The temperature was set at +0.5^{0}C, but the product temperature was 2-6^{0}C. The air temperature rose to 10^{0}C on the third day after loading the container in Israel and finally it decreased to about 4^{0}C. The container arrived in Rotterdam on 5th November 1998, where fungus growth was discovered at inspection. The product temperature at arrival was: 23.5^{0}C (highest measured pulp temperature) to 16.5^{0}C (lowest measured pulp temperature). A sample of the load of the container was taken by Mr Braam from Cunningham Marine and brought to ATO-DLO for assessment.

3. Assessment of the corn

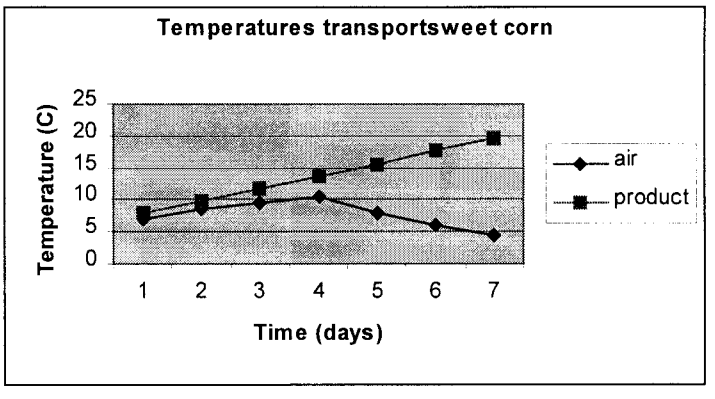
All the cobs (2 cobs per traypack in a box with the text: Jordan Valley Produce, Zemoeh Israel, Class I, Mais Doux – Sweet Corn, Count L12, Recommended temperature 0-1^{0}C, Exported by Tropygarden (3000) LTD, Fax 972-3 – 578733) in the sample showed fungus growth on the removed tips of the cobs. Some cobs also showed discoloration and fungus growth on the butts or small damaged places. Removal of tips is done to make the cobs fit into the tray package(see annexe) . This handling has seriously wounded the cobs and has delivered an excellent possibility for fungus growth, since the juice from the seeds contains about 10-15% of sugars (Schouten, 1991). The process of fungus growth is strongly enhanced by higher temperatures.

4. Discussion

According recommendations for the storage of sweet corn (Anon, 1984; Lutz & Hardenburg, 1977; Lidster et al, 1988; Saltveit, 1997) corn can be stored not much longer than 8 days at 0^{0}C. MA storage, especially an elevation in CO2 content may extend the storage time (Schouten, 1991; Schouten & Lips 1993). An extremely important condition is, that the cobs are cooled, for example with hydrocooling, as soon as possible after harvest. This is necessary because of the very high respiration rate (Lutz & Hardenburg, 1977; Lidster et al, 1988).
The temperature at loading was between 2 and 6^{0}C and that may have been too high for controlling the temperature at 0^{0}C. Transport containers generally can maintain temperatures but can mostly not lower product temperatures.
The heat of respiration at 0^{0}C is between 6.6 and 11.22 Btu per ton per day, whereas it is at 4.4^{0}C 9.46 to 18.26 and at 15.5^{0}C 33.22 to 38.50 Btu per ton per day (Bartsch &

Blanpied, 1990). We may assume that the increase in heat of respiration is almost linear between 0 and 6^0C. It can be calculated that heat of respiration will be more than 80% higher at 6^0C than at 0^0C. The heat production may have been even higher in the involved container than the mentioned data, since the cobs were decapitated. Respiration activity is always increased strongly as a result of wounding. However the cobs were MA-packed, which means an increase in carbon dioxide content within the package and this may reduce respiration activity and heat production.
Heat production of the crop was possibly too high to control the temperature in the container from the beginning of travelling and this may have resulted in the observed rising of the air temperature to 10^0C in the container during travelling. An idea on the course of the temperatures is given in Figure 1, assuming that a linear increase in product temperature has occurred during transport. The decreasing air temperature during the last days of travelling, may be due to the place, where the container was at that time.

Figure 1: influence of transport time on the air and product temperature during transport in a Reefer container from Israel to The Netherlands.



The rising product temperature up to between 16.5 and 23.5^0C at arrival will have enhanced fungus growth, which was also promoted by the presence of sugars from the wounds.

5. Summary and Conclusion

Sweet Corn was transported in a Reefer container from Israel to Rotterdam in the Netherlands in the period 29th October and 5th November 1998. Fungus growth, especially on the decapitated ends, was detected on the cobs and the product temperature was much too high at arrival. It must be concluded, that the respiration heat was too high at the beginning of travelling because of a too high product temperature at loading and the wounding of the cobs. This may have lead to a rise in product temperature during travelling, resulting in a promotion of fungus growth on the wounded heads of the cobs. This conclusion is based on the information given by Cunningham Marine and on ATO-DLO observations of the sweet corn in the sample delivered by Cunningham Marine.

6. Literature

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Annexe