



ATO-DLO

Expertise-Report to whom it may concern

**Assessment of asparagus in a Reefer
container from MS "S.A. Winterberg" at
Rotterdam, November 1998**

CONFIDENTIAL

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Introduction

A Reefer container CRLU 311309/0 loaded with white asparagus from South Africa arrived at Rotterdam at the end of November 1998 on the vessel "S.A. Winterberg". The asparagus spears showed a severe pitting along the stems, whereas the butts were soft and showed cavities. The produce of the container was severely reduced in commercial value or even worthless as a fresh crop. Mr M. Molenaar from ESIS International, Inc. and Mr H.F.J Oomens from Dutch Marine Consultants B.V. both in Rotterdam took samples of the container and asked ATO-DLO at Wageningen on 27th November 1998 to assess these samples. ATO-DLO was also asked to correlate, if possible, the assessment of the asparagus spears with the transport conditions during sailing from South Africa to the Netherlands.

ATO-DLO performed assessments of the asparagus spears, and determined CO₂ and O₂ contents in the packages. We present here the results of our investigations.

1 Transport asparagus

Mr M. Molenaar ESIS International Inc. and Mr H.F.J Oomens from Dutch Marine Consultants B.V. delivered information about the transport of the asparagus on 27th November 1998.

The spears were harvested and packed at the end of October 1998 in South Africa. The spears were tray-packed in cardboard boxes, which were put into the container CRLU 311309/0 on 20th October and shipped on 28th October 1998. The container was equipped with the CA system of Transfresh and the required carrying temperature was 20C. According to observations from H.F.J. Oomens, who measured temperatures in the empty container, some doubt has risen about the recorded temperatures on the Partlow chart. It may be that the temperature during sailing was not 2.50C (as indicated by the Partlow chart) but 20C higher. On the other hand: the measurements were done with the empty container without the load of much heat producing asparagus, which might have influenced the measured temperatures.

The air composition in the container was 10.5% CO₂ + 10.5%O₂ (as setpoints) according information from Transfresh to Esis International Inc. about CRLU 311309/0. The really measured contents of oxygen and carbon dioxide agreed well with the setpoints (annexe). The container was discharged from the vessel S.A. Winterberg presumably on 19th or 20th November 1998. It was received by the receivers and unloaded by them on 26th November 1998. The conditions were not changed between 19th and 26th November 1998.

The container was inspected and the asparagus spears showed soft butts with cavities and also pitting along the stems was observed. The asparagus spears were all MA-packed on trays in boxes with following indications: Cream of the Crops. Spargel, 500 g Product of South Africa. Benchmark Distributors P.O. Box 1124, Ficksburg 9730, tel +27 51 9332915.

2 Assessments of the asparagus spears at ATO-DLO

The samples consisted of several packages with Class I white/long and violet/short spears. Description of the symptoms took place on 28th November 1998. The packages were stored in a cold room at 20C till 30th November 1998. At that time the spears were assessed on some quality characteristics. Some packages were used for determination of CO₂ and O₂ contents within the packages.

The spears showed the following quality problems. Severe pitting parallel to the stems was observed as numerous sunken small mostly elliptical spots but also sunken long-shaped elliptical areas. The last ones always felt very soft by rubbing a fingernail on it. Pitting was found from the butt too the tip of the spear. The butts could easily be compressed, they were soft and cavities could be found in this part of the spears.

There was no difference in these symptoms between short-violet or long-white spears.

The assessments on the packed spears were done on 30th November and these observations are shown in table 1.

Table 1: Observations on white and violet asparagus spears in packages from the container CRLU 311309/0 on 30th November 1998.

Sample	Soft butt	Soft tip	Pitting Stem	Fungus mycelium	Place mycelium
Long/white					
Package 1	+++	-	++	+	Butt
2	+++	-	+	-	
3	+++	-	+	-	
4	+++	-	+	+	Butt
5	+++	-	+	-	
6	++	+	+	-	
Short/violet					
Package 1	+++	+	++	+	Butt
2	++	-	+	+	Butt
3	++	-	++	-	
4	++	+	+	+	Butt + tip
5		-	+	+	Butt

+ = present (++ and +++ = order of seriousness); - = absent

Pitting was found in all samples whereas soft butts were observed in 10 of 11 samples. White fungus mycelium was (visually) detected in 6 of the 11 samples mostly on the butts. In some cases soft tips were discovered

3 Carbon dioxide and Oxygen in the packages

CO₂, O₂ and N₂ concentrations were measured by ATO-DLO in 6 packages (3 short/violet and 3 long/white samples) on 1st December 1998. The results of these measurements are presented in table 2.

Table 2: Carbon dioxide, oxygen and nitrogen concentrations in packages with asparagus.

Samples	Oxygen (%)	Carbon Dioxide (%)	Nitrogen (%)
Short/violet 1	18.5	3.2	78.3
2	12.5	5.3	82.3
3	2.4	5.8	91.7
Long/white 1	2.6	4.5	92.9
2	5.0	5.5	89.5
3	2.6	4.8	92.6
Average short/violet	11.1	4.8	84.1
Long/white	3.4	4.9	91.7

The film which was used to pack the spears allows an accumulation of carbon dioxide and a decrease in the oxygen content in the packages.

4 Discussion

According to recommendations for storage of asparagus (Anon, 1984; Lutz & Hardenburg, 1977; Lidster et al, 1988; Saltveit, 1997) can be stored about 2-3 weeks at 0°C in normal air. CA conditions (5-10%CO₂ and 10-20%O₂) favour storability (Anon 1980, Saltveit 1997), although according to other research less than 3 weeks may be too long, if the storage period is followed by a shelf period of 3 days at 15°C (Schouten 1991).

The spears had been stored in MA-packages in the container almost 5 weeks and this must be considered as a long storage period even in MA packages.

The most serious quality problems of the investigated asparagus were pitting and softness of butts. The butts showed in many cases white fungus mycelium within 2 days at 20°C indicating that the asparagus tissue was already seriously damaged on 27th November 1998 when the samples arrived at ATO-DLO. Pitting as a result of CO₂ is described in the literature by Lipton (1964) as "sunken areas of various sizes: small, round pits, large pits elongated parallel to the spear, corrugated areas and discolorations" and "with increasing severity: small pits graded into deep long pits below the tip and in severe cases the entire spear became pitted and discolored". We did not see discolorations, but the rest of the description fits very well into the observed symptoms of the spears of the CRLU 311309/0 container. A warning for pitting by high CO₂ contents is given by Saltveit (1997) in his recommendations: 5-9%CO₂ at 3-6°C and 10-14%CO₂ at 0-3°C.

The asparagus spears are damaged most probably by too high carbon dioxide contents in the container. The atmosphere in the packages contained between 4.5 and 5.8%CO₂ (table 2) which meets recommendations. However the carbon dioxide content in the container was about 10%. MA packages in this atmosphere will show very high CO₂ contents of much more than 10% and then pitting is possible according to Saltveit (1997) even if the temperature is only 2.5°C.

Besides this carbon dioxide factor there is also the supposition of a higher temperature than 2.5°C as indicated above and the long storage period. The effects of a too high carbon dioxide content in the packages will be enhanced by both a high temperature and a long exposure period, because the injurious effects of CO₂ are temperature and time dependent.

5 Summary and Conclusion

Asparagus spears were transported in the CA-container CRLU 311309/0 on ms "S.A. Winterberg" from South Africa to Holland between the end of October and 26th November 1998. The asparagus spears were packed in MA packages. Severe pitting and soft butts were observed on arrival. Some days of storage at 20C in normal air after arrival at ATO-DLO resulted in the development of white mycelium, indicating that there was no shelf life left for these asparagus spears. Measurements of CO₂ and O₂ contents in the packages showed that the atmosphere within the packages contained 4.5-5.8%CO₂. The observed quality problems must be attributed primarily to the very high CO₂ content in the packages as a consequence of storage in a CA-container which contained 10.5%, which caused a CO₂ content of much more than 10% in the packages. The possibly higher temperature than 2.50C and the long storage duration will have strengthened this effect. This conclusion is based on the information given by ESIS International, Inc and Dutch Marine Consultants B.V. in Rotterdam and on ATO-DLO observations of the asparagus in the samples delivered by ESIS International, Inc and Dutch Marine Consultants B.V..

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