Evaluation of Contronics "Fresh in - Fresh out" fresh displays

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Colophon

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1 Introduction

Contronics Engineering BV is a company that designs and produces innovative, sustainable equipment in the areas of:

- Keeping food fresh
- Healthy living conditions
- Sensible use of natural resources

In 1999 the "Sanifogger" was developed: the first safe humidification concept which keeps fresh products fresh in refrigerated environments.
In 2002 the Sanifogger and Travelfogger (for trucks and containers) was awarded the European "Eureka" trophy.
In 2006 development continued: “Fresh in — Fresh out”.
This system ensured a colder, humidified environment for non-refrigerated displays of fruit and vegetables.

Through this research Contronics wants to have an independent evaluation by Wageningen UR of the effects of using this system.

2 Methods

In one large climate chamber, 3 complete displays of 7 fresh fruit/vegetable products were set up (Photo 1). These were fresh products intended for retail, originating from a regular wholesaler. There were 3 crates of each product per fresh display as shown in Table 1 below.
The products were kept in the displays for 48 hours, after which a quality assessment was carried out. The conditions of the climate chamber corresponded with supermarket conditions 20°C and 60% RH.
The 3 fresh displays compared were:

1) normal display: simulation 48 on the shelf at 20°C
2) re-cooling: normal display whereby the fresh products were covered and kept overnight (in total 2x12 hours) in another cold store at 8°C.
3) Contronics: display under standard supermarket conditions using the Contronics humidification system for fruit and vegetables, without re-cooling at night.

Photo 1: Test set-up of the three fresh displays. From front to back Contronics, re-cooling and normal display

carrot 3	tomato 3	grape 3	banana 3	chicory 3	tomato1	grapes 2
string beans 3	lettuce 3	string beans 1	chicory 1			
chicory 2	banana 1	carrot 2	lettuce 1			
string beans 2	lettuce 2	grapes 1	tomato 2	banana 2	carrot 1	

Table 1: Distribution of products among the displays

Once the test was completed, 500 ml of moisture was extracted from the Contronics humidification system and analysed for Legionella by a certified laboratory.

3 Results

3.1 Weight loss

Weight loss is almost entirely caused by moisture loss. The greater the moisture loss, the greater the risk of problems with wilting/wrinkling.
After 48 hours, the weight loss of all products was determined; see Table 1a, b, c and Figure 1.

Lettuce, carrot and string beans, the most sensitive products for weight loss

Re-cooling during the night generally produces half the amount of moisture loss compared with the *Normal display*. However the *Contronics "Fresh in - Fresh out" fresh display* has an extra, statistically proven reduction in moisture loss. Also see the photos 2-4.

Product \ Treatment	Normal	Re-cooling	Contronics
Lettuce	12.6	6.0	3.6
Carrot	11.6	5.0	3.2
String beans	9.2	4.4	3.2

Table la. % Weight loss after 48 hours display. A difference in colour of the treatment means that the treatment is statistically different.

Chicory, banana and grape, products that are somewhat less sensitive to dehydration.

For those products less sensitive to dehydration, display *Re-cooling* during the night provides a statistical reduction of weight loss compared to the *Normal* display. Statistically there was no difference between the *Re-cooling* and the *Contronics "Fresh in - Fresh out" fresh display*.

Product \ Treatment	Normal	Re-cooling	Contronics
Chicory	2.9	1.4	1.0
Banana	2.4	1.2	0.7
Grapes	2.2	1.1	0.4

Table lb. % Weight loss after 48 hours display. A difference in colour means that the treatment is statistically different. The same colour means: no statistical difference.

Vine tomatoes, less susceptible to dehydration.

The tomato is not very susceptible to dehydration. Only the stems are susceptible to dehydration and as they constitute a very small part of the weight of the tomato, this dehydration is not reflected in weight loss.

Product \ Treatment	Normal	Re-cooling	Contronics
Tomato	0.6	0.4	0.3

Table 1c. % Weight loss after 48 hours display. The same colour means no difference between the various treatment methods.

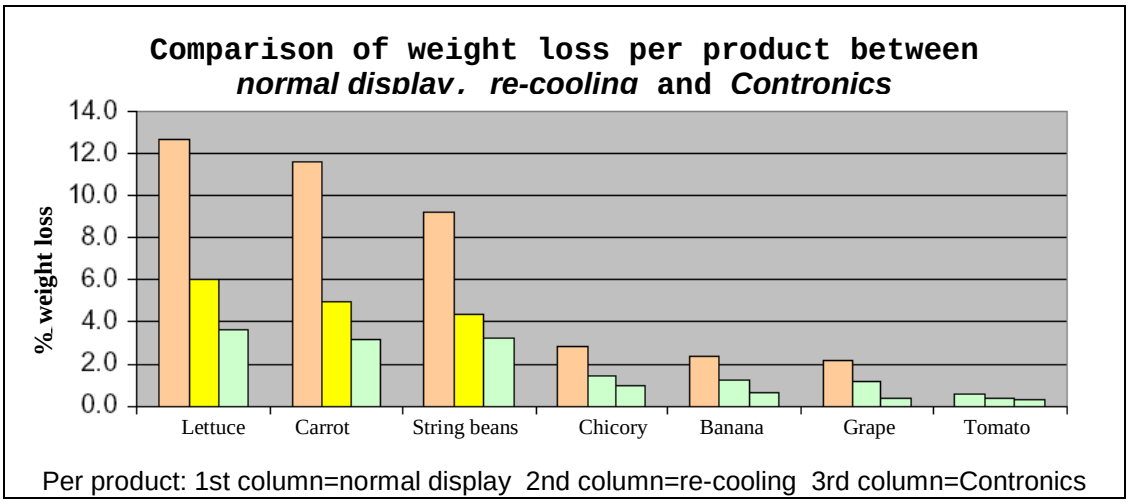

Figure 1: Weight loss after 48 hours display in the fresh displays. If within one product the column colour is different, then the method of display produces a significantly different percentage weight loss.

3.2 Other quality differences

Lettuce

For all three displays, an equal amount of stain was visible on of the underside of the heads of lettuce (see photo 5). There was a variation in moisture loss whereby the *Normally* displayed heads of lettuce (these could not be sold) were wilted. The lettuces that were *re-refrigerated* at night were slightly firmer, while the lettuce from the *Contronics* display had good turgidity. See photos 2-4.

Photo 2. Lettuce after 48 hours Normal display

Photo 3. Lettuce after 48 hours Display with Re-cooling

Photo 4. Lettuce after 48 hours in the Contronics fresh display

Photo 5. The same signs of stain are present in the Normal display (left) and the Contronics Display (right), but dehydration is greater in the Normal display.

Carrot

The carrot greens in the *Contronics* display were much fresher than those in the *Normal* display. There was also a clear difference in the carrot. The carrot in the *Normal* display felt "rubbery", while the one from the *Contronics* display was slightly "bendy". The quality of the carrot in the *Re-cooling* display was in between the *Normal* and the *Contronics* display.

String beans

After 48 hours, a little mould was visible in all containers with string beans. The development of the mould did not depend on the display type, but originated from a contamination at the beginning of the trial. The string beans in the top layer of string beans in the containers from the *Normal* display were clearly less firm than those in the *Contronics* display or in the *Re-cooling* display. There was no difference between the last two displays.

Chicory

Some of the chicory heads had brown edges after 48 hours display, but this was not dependent on the display method. With regards to firmness, there was no visible difference between the three different displays.

Photo 6 The chicory sometimes had brown edges, but this was not dependent on the method of display

Bananas

In one of the *Contronics* display containers, the bananas had moist spots, see photo 7. This was because the moisture content was not correct at the start. This was resolved after adjustment.
There was no visible difference between the bananas in the three different displays.

Photo 7 banana with moist spots

Grapes

For all three methods of display, the turgidity of the fruit was good. A difference could only be seen on the stems of the grapes in hydration and colour. The bunch in the *Normal* display had dehydrated stems. For the *Re-cooling*, the stems were also dehydrated but not as severely and with the *Contronics* display the stems were greener and fresher looking (photo 8).

Photo 8. left =grapes from the Normal display have dehydrated stems
Right =grapes from the Contronics display have fresher stems

Vine tomatoes

There was no difference between the tomatoes in the three different displays. Only the leaves on the tomatoes from the *Normal* display were slightly more dehydrated and yellower than the leaves on the tomatoes from the *Contronics* display or the R*e-cooling*. There was no difference between the last two.

After 48 hours in the Contronics fresh display, the quality of all the tested products was at least the same or better than the fresh display without humidification.

3.3 Legionella analysis

The humidification system for the Contronics fresh display does not re-circulate water, it has water filters for the correct operation of the ultra sound humidification that is also a barrier for micro organisms and is automatically disinfected every day using ozone. At the end of this test, the moisture was condensed and collected (500ml) using the cold plate technique and analysed by a certified lab. The analysis results are given below.

ANALYSIS REPORT

Characteristic report	EDE-401115-0
Replaces	-
Report date	12-07-2010
Contact person	Betsy Brinkman-Verburg
Page 1 of 1	

SILLIKER
Food Safety & Quality Solutions

Agrotechnology & Food Sciences Group
AFSG Finance & Control
Postbus 17
6700 AA Wageningen
NETHERLANDS

Received from
Wageningen UR Food & Biabased Research
(previously Agrotechnology & Food
Innovations B.V.)
Bornseweilanden 9, gebouw 118
6708 WG Wageningen NETHERLANDS

Date received	02-07-2010
Project number	AGROTE-L-EDE-100022
Your order number	307314

Sample data
No. 1382901

Product	: Water
Sample date	: -
Date analysis start	: 02-07-2010
Sampling by	: Customer
Condition received in	: Cooled
Tap point description	: Legionella test of water in vapour form
Condition of packaging	: Unopened

Analysis results

Q	Analysis Method	Result	Dimension	Guide value	Date complete
Q	Legionella in accordance with NEN 6265	<100	Kve/L	100	11-07-2010
	Sample handling costs for water	+	-	-	02-07-2010

Final Assessment of Research: No legionella shown
Source: Water Act Legionella

No Legionella was found in the retrieved vapour.

4 Discussion

The results of this research show that a fresh display equipped with Contronics humidifier can have a positive impact on the quality of fresh products in the display. The main effect of this application is on limiting weight loss, which is again related to quality aspects such as better firmness and crispness, less wrinkling and less dehydration.

In this research we specifically examined the quality after 48 hours of display simulation.
The fresh products which lost less moisture in this period will *also show a slower visible loss of quality to consumers* in these aspects.
In this research, it was not possible to make a realistic estimate of decay in a practical situation. The life cycle of products will vary greatly, but in the case of susceptible products and/or lead time, limitation of moisture loss will certainly have a positive influence through *less decay*.

Application of Contronics "Fresh in - Fresh out" fresh display gives better and/or at least similar product quality as a normal display with re-cooling at night. For this reason, the application offers potential for *labour savings* by avoiding transporting products to and from a cold store.

A limiting condition is that the humidification level is correctly adjusted. If the humidification level is too high, crates and products can become wet, with possible negative effects on product quality. This must therefore be prevented. The moisture given can easily be adjusted and it is also possible to adjust it locally by closing off the outflow opening.

5 Conclusions

For the sake of clarity, the conclusions have been divided into two sections, whereby 48 hour application of the Contronics "Fresh in - Fresh out" fresh display is compared with:

5.1) 48 hours normal display at 20°C/60%RH continuously

5.2) 48 hours normal display at 20°C/60%RH with return to cold storage to 8°C at night (2x12 hours) after covering.

5.1 Conclusions

Comparison of Contronics "Fresh in - Fresh out" fresh display for normal display at 20°C continuously.

In comparison to 48 hours normal display at 20°C/60%RH continuously, the application of the Contronics "Fresh in- fresh out" fresh display results in:

- Statistically significantly lower weight loss (3.6% as opposed to 12.6%) for **lettuce**, which is relatively **71%** less. This resulted in the lettuce from the Contronics display being firmer with good turgidity, compared with the normally displayed heads of lettuce. The amount of decay was the same.
- Statistically significantly lower weight loss (3.6% as opposed to 11.6%) for **carrots**, which is relatively **72%** less**.** The carrot greens were much fresher and the carrots were firmer. The normally displayed carrot was clearly rubbery.
- Statistically significantly lower weight loss (3.2% as opposed to 9.6%) for **string beans**, which is relatively **65%** less. The top layer of beans in the crates was clearly more dehydrated for the normal display. The decay found was the same and only dependent on the level of decay at the start.
- Statistically significantly lower weight loss (1% as opposed to 2.9%) for **chicory**, which is relatively **66%** less. No difference in other quality characteristics.
- Statistically significantly lower weight loss (0.7% as opposed to 2.4%) for **bananas**, which is relatively **71%** less. No difference in other quality characteristics.
- Statistically significantly lower weight loss (0.4% as opposed to 2.2%) for **grapes**, which is relatively **82%** less. The stems were fresh and the stems of the grapes in the normal display were dehydrated. The quality of the fruit was the same
- No statistically significant lower weight loss (0.3% as opposed to 0.6%) for **vine tomatoes.** The leaves were greener and less dehydrated then for the normal display.
- There are no indications that the application of Contronics "Fresh in - Fresh out" fresh display leads to a risk of spreading Legionella.

This research shows that the application of Contronics "Fresh in - Fresh out" fresh display offers a good solution for retaining weight and quality to a higher standard compared with normal display at 20°C/60%RH continuously.

5.2 Conclusions

Comparison of Contronics "Fresh in - Fresh out" fresh display at 20°C continuously with normal display at 20°C and re-refrigerating at night.

Compared with the display at 20°C/60%RH and coverage and re-refrigerating at night, the application of Contronics "Fresh in- Fresh out" fresh display during 48 hours results in:

- Statistically significantly lower weight loss (3.6% as opposed to 6%) for lettuce, which is relatively **40%** less. This clearly made the lettuce firmer. The amount of decay was limited and no different.
- Statistically significantly lower weight loss (3.2% as opposed to 5%) for **carrots**, which is relatively **36%** less**.** The carrot greens were fresher and the carrots were palpably firmer.
- Statistically significantly lower weight loss (3.2% as opposed to 4.4%) for **string beans**, which is relatively 27% **less**. No difference in quality. Decay found did not vary in the displays and was greater due to decay amount at the start.
- No statistically significantly lower weight loss for **chicory** (1% as opposed to 1.4%)**, bananas** (0.7% as opposed to 1.2%), **grape** (0.4% as opposed to 1.1) and **bunch of tomatoes** (0.4% as opposed to 1.1). No other quality differences found for these products either.
- There are no indications that the application of Contronics fresh displays produces any risk for spreading Legionella.

This research shows that (for tested products and conditions):

- **The application of Contronics "Fresh in - Fresh out" fresh displays is a good solution to retain weight and quality.**
- **Application of Contronics "Fresh in - Fresh out" fresh displays abolishes the need to refrigerate fruit and vegetables at night without loss of quality.**