

## Final report

### Novacell

Order number: 0306-L-07/3 Ref.: KVZ/GZ

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**Subject** : determination of resistance to root penetration

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**Report date** : 2011.05.16

**Rapporteur** : K. van Zee

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**Initials** :



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## 1 Introduction

By order of Kimmenade Nederland B.V., BDA Keuringsinstituut B.V. has performed an investigation on the resistance to root penetration on a 'Novacell' liquid applied roof waterproofing kit.

On 27 April 2009 the test specimens have been set at disposal by Kimmenade Nederland B.V.

The following information has been set at disposal by the principal.

- \* Brand name : Novacell root resistant
- \* Article code : Novacell root resistant (wortelwerend)
- \* Intended use : extensive and intensive roof gardens
- \* Type of material : Liquid applied roof waterproofing kit resistant to root penetration
- \* Thickness : 4,5 mm dry thickness (fleece included)
- \* Product design/structure : Novacell root resistant / Novaplast / Polyester fleece (70 g.m<sup>-2</sup>)
- \* Year of manufacture : 2009
- \* Installation method : Spray applied (seamless)
- \* Addition of radicial agents : Preventol



## 2 Investigation

### 2.1 General

The resistance to root penetration has been determined according to EN 13948:2007 – Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Determination of resistance to root penetration.

The protection against root penetration of sheets is tested in containers containing the test plants under specified conditions. The test specimens of the sheet are installed in six test containers, above a protection felt. They shall have several joints as specified in EN 13948:2007 <sup>1)</sup>. Two reference containers do not include any sheet.

The containers receive a layer of growing substrate and a dense covering of vegetation. This produces a high growing pressure from the roots, emphasized by a limited amount of fertilizer and a moderate watering. The test containers are exposed in a climate-controlled greenhouse, in which the parameters having an influence of the growing of the plants can be controlled. The growing period is two years. This period is the minimum time necessary to obtain reliable results when shrubs are tested in a greenhouse. After the growing period, the growing substrate is taken away and the behaviour of the test samples verified to observe if any root penetration or perforation has occurred.

The definitions of root penetration and root perforation are as follows.



### 2.2 Root penetration

Roots that have grown into and/or through the surface or joints <sup>1)</sup> of a sheet under test where the underground parts of the plants have actively created cavities and thus damage the sheet.

<sup>1)</sup> The investigated product is a liquid applied roof waterproofing kit (LARWK) and as a consequence without any joint.

### 2.3 Root perforation

Not to be evaluated as root penetration, but to be mentioned in the test report are:

- a. roots that have grown  $\leq 5$  mm into the surface or joint <sup>1)</sup> of sheets containing radical agents (root retardants) as the root retardant effect cannot develop until after the roots have penetrated. In order to facilitate this kind of evaluation, these sheets shall be clearly defined as 'containing radicidals' by the manufacturer at the beginning of the test.
- b. roots that have grown into the surface of products consisting of several layers (e.g. bitumen sheets with copper foil carrier or PVC sheet with polyester non-woven carrier) if the layer providing the penetration protection has not been damaged. In order to facilitate this kind of evaluation, this layer shall be clearly defined by the manufacturer at the beginning of the test.
- c. roots that have grown into the joint seals <sup>1)</sup> (without damaging the joint). A joint seal is considered to be either fluid material pressed out from the joint during welding or a liquid material applied to secure the joint flange.

The test has been started on 27 April 2009 and has run for two years.



<sup>1)</sup> The investigated product is a liquid applied roof waterproofing kit (LARWK) and as a consequence without any joint.

### 3 Test specimens

On 27 March 2009 the test specimens have been sprayed by Mr R. Jansen of Kimmenade Nederland B.V. in the presence of Mr K. van Zee of BDA Keuringsinstituut B.V.

Description of the test specimen (0,80 m × 0,80 m × 0,25 m):

#### Containers:

- \* Stainless steel container, dimensions 800 mm × 800 mm, with a transparent base (glass) to allow observation and constructed as a tray with a 20 mm rim support for constant water storage.

#### Moisture layer:

- \* 50 mm of layer composed of expanded slate/clay (granulation 8-16 mm).

#### Protective fleece:

- \* Synthetic fibre felt  $\geq 170 \text{ g.m}^{-2}$ .

#### Test material:

- \* Novacell, liquid applied roof waterproofing kit.

#### Growing substrate with plants:

- \* 150 mm of growing substrate with four pieces of *Pyracantha coccinea* 'Orange Charmer' (firethorn) are placed in each corner (see figure 1 in annex B).

A photo report of the buildup and of the progress of the test is given in annex A.





## 4 Results

### 4.1 Measurements made during the test

#### 4.1.1 Root penetration

Container	Observation through the transparent base			
	6 months	12 months	18 months	24 months
Test specimens				
1	no penetration	no penetration	no penetration	no penetration
2	no penetration	no penetration	no penetration	no penetration
3	no penetration	no penetration	no penetration	no penetration
4	no penetration	no penetration	no penetration	no penetration
5	no penetration	no penetration	no penetration	no penetration
6	no penetration	no penetration	no penetration	no penetration
Reference containers				
7	no penetration	no penetration	root penetration	root penetration
8	no penetration	no penetration	root penetration	root penetration



**4.1.2 Mean height and stem diameter at a height of 200 mm of vegetation**

Measurement	Height [mm]			Stem diameter [mm]		
	at the start	after 1 year	at the end of the test	at the start	after 1 year	at the end of the test
1 (test container)	640	1310	1380	5,8	8,8	10,1
2 (test container)	600	1160	1180	5,5	9,0	11,1
3 (test container)	600	1300	1350	5,5	9,4	11,7
4 (test container)	630	1290	1400	5,6	8,9	10,3
5 (test container)	610	1180	1510	5,4	9,5	10,3
6 (test container)	620	1210	1490	6,1	9,3	10,7
7 (reference container)	660	1210	1550	6,3	9,3	11,4
8 (reference container)	600	1010	1290	4,9	8,3	10,3



**4.2 Measurements made at the end of the test**

At the end of the test none of the test specimens showed root penetration nor root perforation.

**Remark:**

It shall be emphasized that this survey only provides an indication at a given moment of the properties of the tested products and/or systems and it does not give evidence regarding the scope of the variations over the course of time.

These results are interpreted:

- either in the framework of a certain project, valid for the tested batch;
- or in the framework of an admittance procedure for certification for a general statement, involving the manufacturer's quality assurance.

Gorinchem, 2011.05.16

The laboratory

K. van Zee



BDA Keuringsinstituut B.V.

prof. ir N.A. Hendriks





**Photo 1**

A wooden mould has been covered with a thin glass fleece in order to be able to release the Novacell afterwards.



**Photo 2**

The Novacell waterproofing is produced by spraying two components together as a mixture on to a substrate.



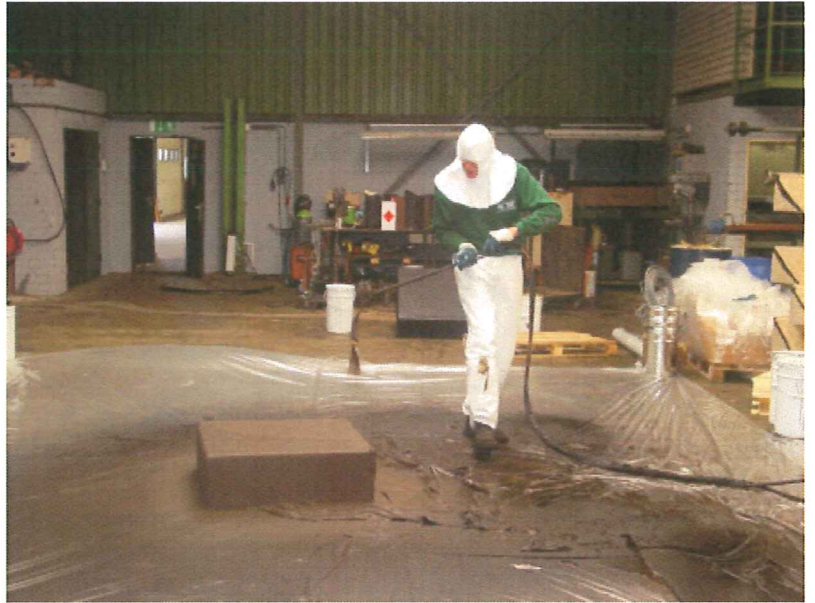
**Photo 3**

The two Novacell components are sprayed on to the mould.



**Photo 4**

The mould is fully covered with the liquid components.



**Photo 5**

Water is secreted due to breaking of the emulsion.



**Photo 6**

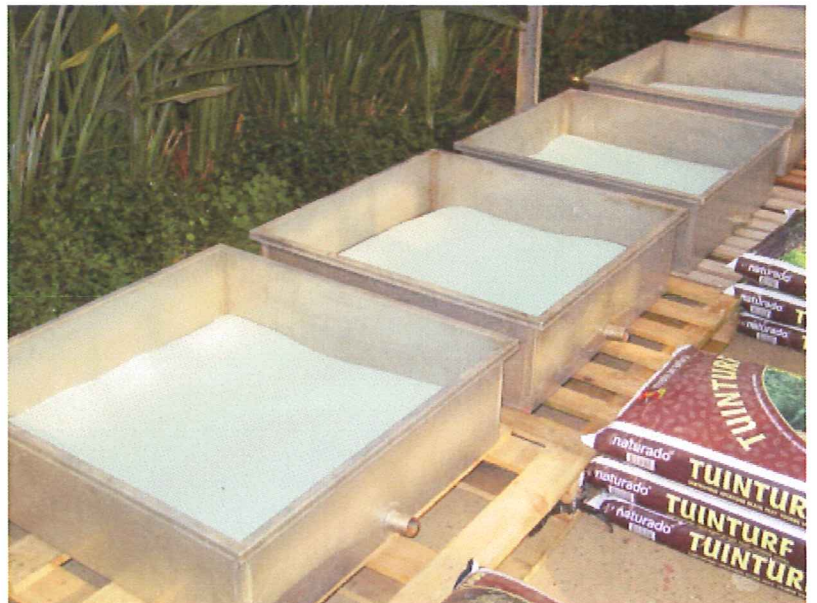
The test container with transparent base.



**Photo 7**  
The moisture layer is placed in the test containers.



**Photo 8**  
The protective fleece has been placed on top of the moisture layer.



**Photo 9**  
The test specimen has been placed on top of the protective fleece.



**Photo 10**  
Planting of the shrubs.



**Photo 11**  
The growing substrate and four shrubs have been placed on the test specimen.



**Photo 12**  
Overview of the test containers in the greenhouse.



**Photo 13**  
One of the test containers after one year.



**Photo 14**  
One of the test containers after one year.



**Photo 15**  
One of the reference containers after one year.



**Photo 16**  
Overview of the test containers after two years.



**Photo 17**  
Overview of the test containers after trimming the test plants down to the ground.



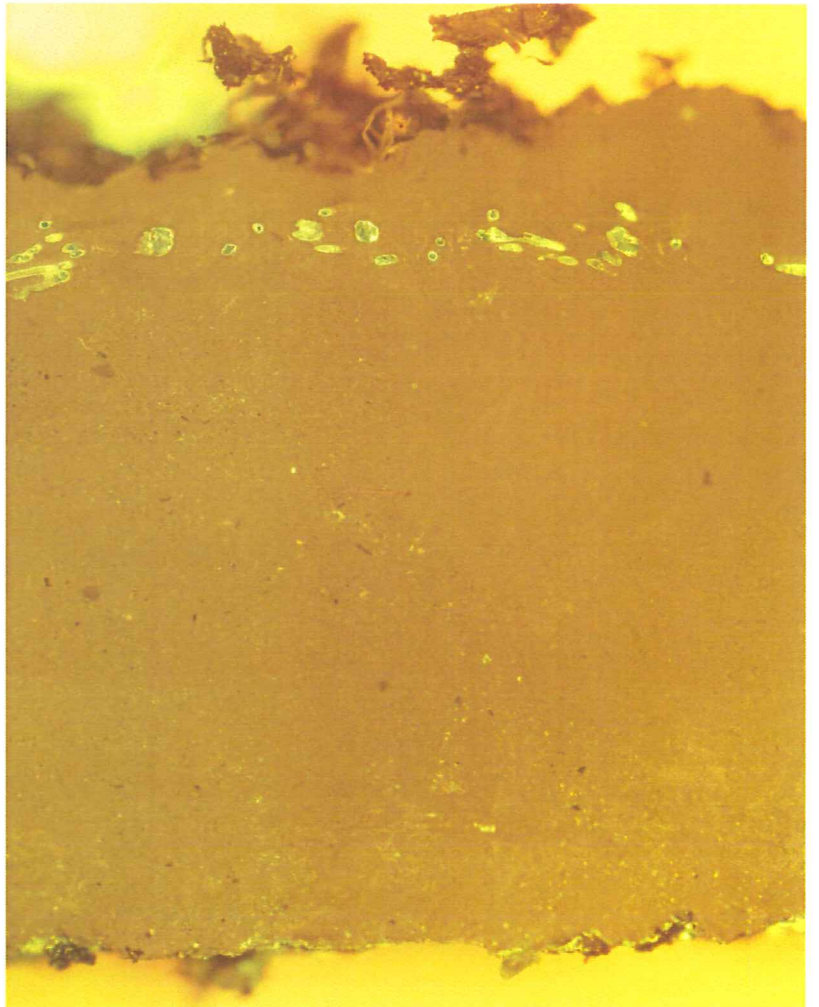
**Photo 18**  
Root perforation in one of the reference containers.



**Photo 19**  
No root penetration or perforation at the test containers.



**Photo 20**  
No root penetration or perforation, judged on a cross cut by fluorescent microscopy.



**Figure 1 – Position of the test plants and the tensiometer in the growing substrate for an 800 mm × 800 mm container**

Dimensions in millimetres

