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### TN 101.3

### Test report for the characterization of lettuce batch cultures in HPC1

Prepared by/Préparé parTikhomirova, N. , Munganga, C. and Peiro, E.Reference/RéferenceMELiSSA Pilot Plant Frame Contract 19445/05/NL/CPIssue/Edition0Revision/Révision0Date of issue/Date d'édition29/07/11Status/StatutFinal

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#### APPROVAL

Title	Test report for the characterization of lettuce	Issue	0	Revision	0
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Approved by	Gòdia, F.	4	Date	18/08/11
Approuvé par		- F	Date	

Approved by customer	Lamaze, B.	Maure	Date	901 114 10
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### 1. Scope

This document reports the results and conclusions from the lettuce batch cultures carried out with 20 days of duration in the HPC1 in order to validate the reproducibility of the culture conditions in the chamber. These cultures followed a previous culture campaign of 38 days duration (reported in RD1) performed in the frame of the previous contract COO6.

### 2. Reference and applicable documents

### 2.1 Applicable documents

AD1 19071/05/NL/CP Memorandum of Understanding between MELiSSA Partners

AD2 COO9: HPC1 characterization phase in the MELiSSA Pilot Plant

AD3 TN 101.2: Protocol for batch culture experiments in the HPC1 of the MPP

AD4 TN 96.3 "Test Protocols and procedures for lettuce cultivation."

AD5 TN 96.4: "Sampling and analysis Protocols and Procedures for biomass, nutrient solution and gas phase."

### 2.2 Reference documents

RD1 TN 96.12: Cultivation as-run procedures, test results and final test report

RD2 Hanford et al (2006) Exploration life support baseline values and assumptions document. NASA Contract Report

RD3 Massot, A. (2007) Engineering Photosynthetic Systems For Bioregenerative Life Support. PhD Thesis.Universitat Autònoma de Barcelona

RD4 Waters et al (2002) Dynamic modeling of the higher plant chamber as a component of bioregenerative life support systems. PhD Thesis. University of Guelph, Canada





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Acronyms/Definitions

MELiSSA	Micro Ecological Life Support System Alternative
MPP-CCL	MELiSSA Pilot Plant – Claude Chipaux Laboratory
HPC	Higher Plant Chamber
COO	Call-Off-Order
IDCG	Integrated Daily Carbon Gain
NCER	Net Carbon Exchange Rate
UPC	Universitat Politècnica de Catalunya
OP	Operating Procedure

### 3. Testing facility contacts

### 3.1 Prime testing facility

#### 3.1.1 Name of the testing facility

MELiSSA Pilot Plant - Claude Chipaux Laboratory

#### 3.1.2 Address of the testing facility

Departament d'Enginyeria Quimica Escola d'Enginyeria (EE) Universitat Autónoma de Barcelona Bellaterra Campus, Barcelona Spain

#### 3.1.3 Contact for technical information

Enrique Peiro MPP – CCL Technical Manager Phone Number: 0034935818172 and 0034 935868101 Email: <u>Enrique.peiro@uab.cat</u>

### 3.2 Subcontractors

#### 3.2.1 Name of subcontractor

Controlled Environment Systems Research Facility





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#### 3.2.2 Address of the subcontractor

School of Environmental Sciences

University of Guelph Guelph, Ontario Canada

### 4. Customer contacts

### 4.1 Name of the Customer

European Space Agency

### 4.2 Address of the Customer

European Space Agency D/TEC-MCT P.O.Box 299, 2200 AG Noordwijk, The Netherlands

### 4.3 Contact person for the Customer

Brigitte Lamaze-Lefebvre ESA Focal Point for the MPP-CCL

### 5. Test items

### 5.1 Short description of the test item

The first Higher Plant Chamber was installed into the MELiSSA Pilot Plant facility at Universitat Autònoma de Barcelona in the frame of the contract COO6. The main contributions expected by integration of this photosynthetic compartment into the MELiSSA loop were oxygen, water, vegetable food production and CO<sub>2</sub> consumption. Production characteristics of lettuce *Lactuca sativa* L. (cv. Grand Rapids), as a MELiSSA candidate crop, were investigated in that work in the first crop experiments in the MELiSSA Pilot Plant facility. The plants were grown in batch culture and totalled 100 plants with a growing area 5 m long and 1 m wide in a sealed controlled environment. It was shown that after 38 days of lettuce cultivation in the chamber a good productivity was obtained, but accumulation of oxygen in the chamber, which required purging of the chamber, and decrease in the food value of the plants were observed. Reducing the duration of the tests to 20 days allowed uninterrupted test without opening the system and also allowed estimation of the crop's carbon balance. Several replicates of the experiments were carried out and



results of productivity, tissue composition, nutrient uptake and canopy photosynthesis of lettuce regardless of test duration are discussed.

### 6. Implemented test sequence

### 6.1 Objectives of the tests

Taking into account the results of the preliminary tests already performed in HPC1, and the corresponding protocols and procedures (i.e. including for sampling and analysis), a series of 2-3 replicate experiments of batch culture of lettuce in the HPC1 was performed, with the aim to optimize experimental variables, such as illumination, liquid medium feeding and circulation, air flow-rates and their distribution and assure culture homogeneity (See AD2).

### 6.2 Actual schedule of the tests

First 20 days Test: 04.01.10 – 01.02.10 Second 20 days Test: 01.03.10 – 01.04.10 Third 20 days Test: 12.05.10 – 11.06.10 Fourth 20 days Test: 27.06.10 – 23.07.10

### 6.3 Implemented test sequence

For all the batch culture experiment replicates, the sequence was as follows:

- Phase 1 : Cleaning of the chamber, air handling unit and liquid loop and preparation of the culture campaign
- Phase 2 : Seedlings phase from planting to 8 days growth
- Phase 3 : Maturity phase inside the chamber, from day 8 till day 28 and harvesting

See AD3 for further details on each phase.

### 7. Implemented data collection plan

### 7.1 Implemented analysis/measurement plan (both on-line and off-line)

The following files were generated:

 First test: HPC1 28 days test – phase 1-01012010.csv / HPC1 28 days test – phase 2-01012010.csv HPC1 28 days test – phase 3-01012010.csv

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- Second test: HPC1 28 days test phase 1-01032010.csv / HPC1 28 days test phase 2-01032010.csv HPC1 28 days test phase 3-01032010.csv
- Third test: HPC1 28 days test phase 1-09052010.csv / HPC1 28 days test phase 2-09052010.csv
   HPC1 28 days test phase 3-09052010.csv
- Fourth test: HPC1 28 days test phase 1-24062010.csv / HPC1 28 days test phase 2-24062010.csv
   HPC1 28 days test phase 3-24062010.csv

The dates of the files were the corresponding to the start of each phase of each test, according to the sequence described in Section 6.2 of this TN.

The files mentioned above were created as CSV text files by the HMI system and then translated into excel files for off-line analysis of process data.

- Calibration of instruments (see in Annex 2 the as-run procedures and, in particular, appendix 2 of the record corresponding to each test):
- pH and EC electrodes were calibrated at the beginning of each test using standard buffer solutions
- Gas analyser had been calibrated for the Functional tests (23.07.09)
- PAR sensors were calibrated during the mapping (by UPC, 30.06.10)
- For the rest of sensors, only the manufacturer's certificates were available.
- Deviations and non conformances (see in Annex 2 the as-run procedures and, in particular, Appendix 3 of the record corresponding to each test): as explained in Section 9.3, the main deviation was that the validity period for instruments calibration had not been defined, so that most of the instruments only had the manufacturer's calibration certificate.

### 7.2 Implemented sampling techniques :

For sampling purposes, the procedures described in AD5 were followed. Also when applicable, the procedures established by the external laboratories in charge of specific analysis were as well followed (elemental composition, minerals).

Sampling date and identification was performed in agreement with the MPP applicable procedures, and including always the date, the part of the crop (shoots/roots), the tray and the single crop when applicable. Also when applicable, according to the procedures of the external laboratories in charge of specific analysis.

For non available standard procedures, the traceability was assured through the technician logbook.





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- Place of sampling:
  - shoot and root samples were taken from the crops directly from the trays when harvested
  - hydroponic solution samples were taken in general from the bottom valve of the hydroponics tank, but some of them were as well taken from the top of this tank to check the homogeneity of composition inside the tank
  - gas samples for ethylene analysis were taken from the gas analysis loop (dedicated pipeline to the gas analyser)
- Conditions of sampling:
  - o the procedure described in AD5 was followed
  - in some cases several samples were mixed for the analysis (seedlings, roots)
- Deviations and non conformances: N.A.

### 7.3 Implemented analyses/measurements

According to AD5, the following analyses were performed:

- Biomass analysis: fresh and dry weight (MPP), previous drying of lettuce samples in the Animal and Food Science Laboratory, Veterinary School, UAB.
- Nutrient solution analysis: anionic composition of hydroponic solution by HPLC (Chem. Eng. Department, by MPP technicians) and colorimetry (MPP)
- Gas composition analysis: O<sub>2</sub> and CO<sub>2</sub> (on-line, MPP)
- Elementary composition and mineral composition of crops and nutrient solution (Servei d'Analisi Quimica, UAB; Serveis Cientificotécnics, UB)
- Ethylene, by GC (Chem. Eng. Department, by MPP technicians)
- Conditions of analysis/measurement
  - o Biomass analysis were performed according to AD5
  - Anionic composition of the hydroponic solution was performed according to the Chem. Engineering department procedures (HPLC) or MPP quality control procedures (colorimetry)
  - Elementary composition and minerals were analysed according to the dedicated procedures in UAB and UB services, compatible with the specification defined in AD5.

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• Ethylene was analysed by GC (Agilent Technologies 6890N Network GC System, FID detector).

In particular, additional detailed description of the analysis performed by the MPP is provided below:

#### **Biomass analysis**

batch cultures in HPC1

All lettuce plants were harvested 20-days after crop seedling tests start-up. Fresh weight of lettuce was recorded immediately after harvest. Then the plants were dried in an oven at 70°C with preliminary fixation at 103°C during 10 minutes in order to stop the enzymatic process. Plant dry weight was recorded after weight stabilization (3-4 days of drying) and expressed as g dw.plant<sup>-1</sup>. Finally total plant productivity (g.dw.m<sup>-2</sup>.d<sup>-1</sup>) was calculated as the total biomass harvested divided by the production area and by the total days in the chamber.

#### Nutrient solution analysis

Nutrient solution samples were analyzed using ion chromatography (ICS 2000 Dionex) to determine  $NO_3^-$  and colorimetry (Xion 500 Dr Lange) to determine  $NH_4^+$ . The results obtained were used for calculation of nitrogen uptake rates over the growth period. Nitrogen was chosen for nutrient mass balance estimation as main nutrient consumed by lettuce at the highest rate.

#### Atmospheric composition analysis

HPC1was equipped with a  $CO_2/O_2$  gas analyzer model 601P (California Analytical Instruments, Orange, CA, USA) which was used for online measurement of  $CO_2$  and  $O_2$  concentrations inside the chamber.  $CO_2$  consumption was calculated using the amount of  $CO_2$  injected by the  $CO_2$  mass flow controller in order to maintain the chamber at a constant 1000 ppm  $CO_2$  level.

- Deviations and non conformances:
  - Ethylene analysis was performed at the end of the second test, then it was cancelled as the obtained values were below the limit of detection of the equipment (1 ppm), when the adequate detection limit for the GC should be around 5 ppb for plant studies according to UoG experience.

### 7.4 Uncertainty budget evaluation



The uncertainty budget was not required for this particular test campaign.

### 8. As run procedures

#### Annotated test procedures

The annotated test procedures are shown in Annex 2, including the following pdf files, corresponding to the second, third and fourth tests:

MPP-REC-10-4101(0)-01 MPP-REC-10-4102(0)-01 MPP-REC-10-4103(0)-01 MPP-REC-10-4101(0)-02 MPP-REC-10-4102(0)-02 MPP-REC-10-4103(0)-02 MPP-REC-10-4101(0)-03 MPP-REC-10-4102(0)-03

For the first test (04.01.10 - 01.02.10), the standard MPP protocols and records had not yet been created, so the operations were recorded in the HPC logbook.

For the fourth test (27.06.10 - 23.07.10), the record corresponding to the first phase was not filled out as this phase was not performed.

### Deviations and non conformances

The deviations and non conformances are shown in Appendix 3 of the annotated test procedures files previously mentioned.

### 9. Non conformances and deviations summary

### 9.1 Deviations from the test plan

The following deviations were found in the tests:





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### 9.1.1 First 20 days Test: 04.01.10 - 01.02.10

N°	Deviation	Criticality	Corrective action	Due date	Status
1	11.01.10 Gas sampling without putting the analysis loop in OFF, creating perturbancies (CO2 level rised up to 1200 ppm)	Low	Issue the formal OP and REC to minimize the risk of wrong operations	01.03.10	Closed
2	21.01.10 Hydroponic loop stopped 1 hour for changing acid and base valves	Low	N.A. (not critical for the process)	N.A.	Closed
3	25.01.10 Temp./humidity loop stopped 10 min to change resistor in hot water	Low	N.A. (not critical for the process)	N.A.	Closed

#### 9.1.2 Second 20 days Test: 01.03.10 - 01.04.10

First phase: 10 deviations to the test protocol

N°	Deviation	Criticality	Corrective action	Due date	Status
1	Unforeseen volume of ethanol	Low	Modify new version of the protocol	End COO9	Open
2	Not using mask against vapours	Medium	Reminder in safety meetings; reconsider in new version of the protocol	End COO9	Open
3	Disinfection of hydroponic loop not	Medium	Modify new version of the	End COO9	Open





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	performed as agreed		protocol		
	with ESA		protocor		
4	Additional EC	Low	Reconsider in	End COO9	Open
	measurement (only pH		the new		_
	measurement was		version of the		
	foreseen)		protocol		
5	Id. Dev. 3				
6	Id. Dev. 4				
7	Rinsing nutrient tank	Low	Modify new	End COO9	Open
	with distilled water		version of the		
			protocol		
8	Id. Dev. 3				
9	Leak tests lasting 5	Medium	Write an OP	Oct 2010	Closed
	hours		before		
			staggered		
			culture		
			campaign		
10	Validity period for	Medium	To establish	Oct 2010	Open
	instruments calibration		an HPC1		
	not defined		maintenance		
			plan before		
			staggered		
			culture		
			campaign		

Second phase: 2 deviations

N°	Deviation	Criticality	Corrective action	Due date	Status
1	Some not critical tasks not performed when foreseen	Low	Increase flexibility in the new version of the protocol	End COO9	Open
2	No watering of seedlings as the cubes were still wet	Low	Reword the task to give more flexibility in the new version of the protocol	End COO9	Open



Third phase: 0 deviations

### 9.1.3 Third 20 days Test: 12.05.10 - 11.06.10

First phase: 3 deviations

N°	Deviation	Criticality	Corrective action	Due date	Status
1	Lights not switched on for cleaning to avoid hot conditions (ventilation not started)	Low	Modify new version of the protocol	End COO9	Open
2	Leak test failure (Module C door not tight)	High	Close tightly the door and repeat the leak test	07.05.10, performed and checked	Closed
3	Not defined validity period for instruments calibration	Medium	To establish an HPC1 maintenance plan before staggered culture campaign	Oct 2010	Open

#### Second phase: 6 deviations

N°	Deviation	Criticality	Corrective action	Due date	Status
1	Sterilisation in advance of Stock A and B tanks, not recorded	Medium	N.A. (task performed; recording to be improved)	N.A.	Closed
2	Preparation in advance of Stock A and B tanks, not recorded	Medium	N.A. (task performed; recording to be improved)	N.A.	Open
3	Checking of seedlings germination performed	Low	Introduce more	End COO9	Open





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	at a different time than initially scheduled		flexibility in the new version of the protocol		
4	Id. Dev. 3				
5	Regulation of pH with acid or base was not needed as pH was in good levels, but it was defined as non compliant	Low	N.A.	N.A.	Closed
6	Leak in the nutrient solution collector	Medium	Collector to be repaired	21.05.10, performed and checked	Closed

Third phase: 3 deviations

N°	Deviation	Criticality	Corrective action	Due date	Status
1	Ethylene analysis not performed (not available column and not adequate limit of	Medium	Search for alternative method/equipment	TBD	Open
2	detection) Several tasks considered not critical performed at different times than initially scheduled	Low	Increase flexibility in the new version of the protocol	9.1.4 End COO9	Open
3	Id. Dev. 1				

### 9.1.5 Fourth 20 days Test: 27.06.10 - 23.07.10

Second phase: 7 deviations

N°	Deviation	Criticality	Corrective action	Due date	Status
1	Test phase 1 not	Low	N.A. (test		Closed
	performed		oriented to		



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			communication)		
2	Not checking seedlings germination when foreseen but task performed	Low	Let more flexibility in the new version of the protocol	End COO9	Open
3	pH not checked and watering performed later than initially scheduled	Medium	N.A. (not critical)		Closed
4	pH of seedling solution not adjusted	Medium	Reconsider in the new version of the protocol	End of COO9	Open
5	Irrigation system was not stopped before taking the samples	Low	N.A. (not critical)		Closed
6	Samples not taken from the top	Medium	Define better the sampling procedure in new version of the protocol or corresponding OP	End of COO9	Open
7	Not defined validity period for instruments calibration	Medium	To establish an HPC1 maintenance plan before staggered culture campaign	Oct 2010	Open

Third phase: 10 deviations

N°	Deviation	Criticality	Corrective action	Due date	Status
1	Ethylene analysis not performed (adequate equipment not available)	Medium	Search for alternative method/equipment	TBD	Open
2	Id. Dev. 1				
3	Id. Dev. 1				
4	Id. Dev. 1				
5	Environmental	High	Remote alarm	End COO9	Open





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	conditions in the chamber failed (probable power cut during week-end)		system or presential supervision during week-end		
6	Some not critical tasks not performed when foreseen	Low	N.A. (not critical)		Closed
7	Placing only one scale for weighing	Low	To make the new edition of the protocol more flexible	End COO9	Open
8	Id. Dev. 6				
9	CO <sub>2</sub> control not disabled for ethylene determination	Low	N.A. (no impact on the experiment)		Closed
10	Weighing for dry weight determination not performed sequentially but in the end of drying	Low	N.A. (not critical)		Closed

### 9.2 Resolved non conformances and deviations

There were not non conformances created.

The following deviations were solved at the date of edition of the report:

- Gas sampling without putting the analysis loop in OFF (Section 9.1.1, deviation 1)
- Hydroponic loop stopped for 1 hour (Section 9.1.1, deviation 2)
- Temp./humidity loop stopped for 10 min (Section 9.1.1, deviation 3)
- Leak test failure (Section 9.1.3, First phase, dev. 2)
- Preparation of tanks in advance, not recorded (Section 9.1.3, Second phase, deviation 2)
- Regulation of pH not needed, defined as non compliant (Section 9.1.3, Second phase, deviation 5)
- Leak in nutrient solution collector (Section 9.1.3, Second phase, dev. 6)
- Test phase 1 not performed (Section 9.1.4, Second phase, deviation 1)
- Delayed check of pH and watering (Section 9.1.4, Second phase, deviation 3)
- Sampling without stopping irrigation loop (Section 9.1.4, Second phase, deviation 5)
- Some not critical tasks not performed when foreseen (Section 9.1.4, Third phase, deviation 6 and 8)

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- CO2 control not disabled for ethylene determination (Section 9.1.4, Third phase, deviation 9)
- Dry weight determination not performed sequencially (Section 9.1.4, Third phase, deviation 10)

Some of the deviations implied the preparation of new OP, issued before the staggered test campaign (October 2010):

- Leak test duration (section 9.1.2, First phase, dev. 9)

### 9.3 Unresolved non conformances and deviations

Most of the deviations were not corrected, as they imply the update of the protocol for batch cultures, proposed to be performed at the end of COO9.

Some of the deviations imply the update of the test protocol, proposed to be issued at the end of the present COO:

- Unforeseen volume of ethanol (section 9.1.2, First phase, dev. 1)
- Not using mask against vapours (section 9.1.2, First phase, dev. 2)
- Disinfection not performed as agreed with ESA (section 9.1.2, First phase, dev. 3, 5 and 8)
- Additional EC measurement (section 9.1.2, First phase, dev. 4 and 6)
- Rinsing with distilled water (section 9.1.2, First phase, dev. 7)
- Definition of validity period for instruments calibration (section 9.1.2, First phase, dev. 10; section 9.1.3, First phase, dev. 3; section 9.1.4, Second phase, dev. 7)
- Sterilization of tanks in advance, not recorded (Section 9.1.3, Second phase, deviation 1)
- Not critical tasks not performed when foreseen (section 9.1.2, Second phase, dev. 1; section 9.1.3, Third phase, dev. 2)
- No watering of seeds being wet (section 9.1.2, Second phase, dev. 2)
- Lights not switched on for cleaning (section 9.1.3, First phase, dev. 1)
- Not checking seedlings germination when foreseen (section 9.1.3, Second phase, dev. 3 and 4; Section 9.1.4, Second phase, dev. 2)
- pH of seedling solution not adjusted (section 9.1.4, Second phase, dev. 4)
- Sampling not from the top (section 9.1.4, Second phase, dev. 6)
- Placing only one scale for weighing (Section 9.1.4, Third phase, deviation 7)



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Another deviation implies the purchase of equipment, change of method, or implementation of new software, date to be defined:

- Ethylene analysis not performed for not available column and not adequate limit of detection (section 9.1.3, Third phase, dev. 1 and 3; section 9.1.4, third phase, dev. 1, 2, 3 and 4)
- Failure of chamber environmental conditions (section 9.1.4, Third phase, dev. 5)

### **10.** Verification matrix

batch cultures in HPC1

In the following Table, the summary of the executed tests vs planned, and the rationale about success of the tests are described, based on the objectives of the tests (Section 6.1 of this TN):

	<b>Objective/Planned tests</b>	Executed tests	Successful tests
1	Series of 2-3 batch culture experiments, demonstrating the capability to grow adequately lettuce biomass by control of the required culture conditions	4 batch experiments were executed	3 batch experiments were successful; the last experiment showed a failure wrt environmental control conditions
2	Optimisation of experimental variables	Experimental variables were controlled and recorded in all the tests	Conclusions about the maintenance of the variables and the impact of failure were drawn
3	Assure culture homogeneity	Culture homogeneity was foreseen by performing three replicates with the same duration and environmental conditions	3 batch experiments showed a good reproducibility of results, but the growth distribution along the chamber was non homogeneus; the last experiment, where the air flow distribution was modified, showed an improvement in growth homogeneity along the chamber
4	Demonstration of Cleanability of the chamber	Cleaning was performed as indicated in the protocols in all the tests	According to visual inspection and normal evolution of the culture, the cleaning was successful
5	Demonstration of tightness	Leak tests were performed	Tests were successful for the

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	for liquid and gas loops	both for liquid and gas loops	established critera
6	Capability of growing lettuce seedlings under controlled conditions	Seedlings were grown as foreseed within the chamber	Germination was successful; confirmed by visual inspection and posterior evolution of the culture

### **11. Interpretation of the results**

### 11.1 Experimental design

All experiments were performed with lettuce (*Lactuca sativa* L *cv.*, Grand Rapids). Lettuce seedlings were 28-days old for the three first tests and 26 for the last . The 4 experiments were performed according to the following table:

Experiment	Plant age	at	the	Total	days	in	the	Plant age at harvest
(B-20 stands for Batch	moment of the	ne tra	nsfer	chamb	er			
culture, 20 days)	to the chamb	er						
B-20/1	8 days			20 day	'S			28 days
B-20/2	8 days			20 day	/S			28 days
B-20/3	8 days			20 day	/S			28 days
B-20/4	8 days			18 day	'S			26 days

### 11.2 Results and discussion

#### 11.2.1 Biomass production

A previous lettuce batch culture of 38 days had been carried out and reported in RD1. This was followed by 3 replicates of lettuce grown in batch cultures for 20 days (plus 8 days employed for the growth and preparation of plants seedlings). In order to discuss the results obtained with these experiments, the previous results of 38 days are first described. Yield data for the edible biomass



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are expressed in two ways: 1) final dry matter per plant; and 2) rate of production or productivity (also called crop growth rate), incorporating both area and days inside the chamber. All data are expressed on a basis of  $5m^2$  available growing area.

#### a) Lettuce harvest results of previous 38-days Batch culture

The following table summarizes the main harvest data for the 38 day batch experiment in a  $5m^2$  area containing 100 plants.

	Leaves	Roots	Total Plant
Total dry weight, DW (g dw)	1725	141.8	1866
Total dry weight per plant, DW (g dw.plant <sup>-1</sup>	17.42	1.43	18.85
Plant growth rate (g dw.plant <sup>-1</sup> .d <sup>1</sup> )	0.460	0.040	0.500
Total productivity (g dw.m <sup>-2</sup> .d <sup>-1</sup> )	9.08	0.75	9.82

#### Table 1. Harvest data for lettuce grown in batch culture for 38 days

At the end of batch culture one plant did not grow thus only 99 plants were harvested. The 99 plants were analyzed by plant parts (shoots and roots). The total productivity for the culture was 9.82 g dw m<sup>-2</sup> d<sup>-1</sup>. The productivity was 34% lower than of the 14.92 g dw m<sup>-2</sup> d<sup>-1</sup> reported by A. Massot (RD3) and 35% higher than the 7,3 g dw m<sup>-2</sup> d<sup>-1</sup> reported by Handford et al (RD2), which represent an average value from different tests performed in higher plant compartment with different conditions than those used in the current batch experiment. Indeed, the differences in seedling growth duration, photoperiod and test duration could explain these different values.

#### b) Lettuce harvest results of 20-days Batch cultures





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#### First 20-days test (04.02.10-01.03.10)

The main observations during the harvest are here below described:

1) After plants harvest and preliminary data analysis, a decrease in total lettuce leaves biomass per tray was observed from tray #6 to tray#16 (see data in Annex 1).

2) Starting from tray #2, slight leaves yellowing was observed, but for the plants of the trays #8 - tray #15 most of the lowest oldest leaves were yellow (pictures are attached, Fig.1-7).

3) It was noticed that all the plants located next to spigots had some contamination on their leaves and started to rot (Fig.8).

4) Contamination (considering like that the presence of undesirable microorganisms in the crops, understanding that some bacteria are always coexisting with the plants) also could be seen inside the plants on young leaves (black spots, Fig.9) and it was noticed not only for the plants located next to spigots (where solution can be partially sprayed on plants and make favourable conditions for rotting), but also for the plants located in the other parts of the trays.

5) At the end of the test it was noticed that there was some contamination of water and some organic particles inside condensate tank. Since it's rather difficult to disconnect condensate tank for cleaning, it was not cleaned along 4 crop tests. This time the tank was disconnected, samples of water and organic particles were taken for analyses. The tank was also cleaned with soap and disinfected with ethanol.

6) In the end of the test it was found out that a vessel with water was left next to heat exchanger, used previously for HVAC mapping in order to decrease humidity in the chamber. Water also contained some organic particles after the test.

7) Contamination of Rockwool cubes, roots and trays with algae was not high after the test, mostly for the plants situated next to the spigots and in the part where liquid from a tray goes down





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to main collector (Fig.10).





Fig.1 tray1-3, from left to right

Fig. 2 tray4-6 from back to front



Fig.3. trays 7-9 from back to front



Fig.4. trays 10-12 from back to front

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Fig.5 trays 13-15 from back to front

Fig. 6. trays 16-18 from back to front



Fig.7. tray 19-20 from back to front

Fig.8 trays 5-6 from right to left





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Fig.9. leaves contamination

Fig.10 tray 17 roots

The results regarding fresh and dry weight of the harvested plants along the chamber are shown in Figures 11 (average per module) and 12 (average per tray). As it can be deduced from these data, the productivity in module B was clearly lower than in the other two modules.

For the second crop test, it was proposed to perform the test with the same duration but in order to eliminate potential risks for plants growth inhibition, the following actions were considered:

1) To conduct disinfection of HPC1 by means of products that would not prejudice hardware of HPC1 and would not be toxic for the plants. For all accessible surfaces of HPC1 it was proposed to use soap and ethanol. For the liquid loop, it was considered to use KOH. Finally, after



discussion with ESA, the use of KOH was not implemented, considering that a previous validation was needed, so it was only rinsed with water.

2) In order to eliminate nutritive potential reasons for plants inhibition, nutrient solution would be changed every 7 days and all steps to be taken during the test would be stressed and followed in a formal test protocol.



Figure 11. Lettuce shoot biomass (g) of plants #1,2,3,4,5, average per module: a – fresh biomass; b – dry biomass (trays #1-6 – module A, trays #7-14 – module B, trays #15-20 – module C)





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Figure 12. Lettuce shoot biomass (g) of plants #1-5 average per tray: a – fresh biomass; b – dry biomass (trays #1-6 – module A, trays #7-14 – module B, trays #15-20 – module C); c – dry biomass, 3D representation

#### Second 20-days test (04.03.10-01.04.10)

The results regarding fresh and dry weight of the harvested plants along the chamber are shown in Figures 13 (average per module) and 14 (average per tray). As it can be deduced from these data, the productivity in module B was again lower than in the other two modules.





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Figure 13. Lettuce shoot biomass (g) of plants #1,2,3,4,5, average per module: a – fresh biomass; b – dry biomass (trays #1-6 – module A, trays #7-14 – module B, trays #15-20 – module C)

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Figure 14. Lettuce shoot biomass (g) of plants #1-5 average per tray: a – fresh biomass; b – dry biomass (trays #1-6 – module A, trays #7-14 – module B, trays #15-20 – module C).

#### Third 20-days test (20.05.10-11.06.10)

The third test performed showed the same pattern of growth along the chamber (see Figure 15). As potential explanations for the different behaviour of Module B, the heterogeneity on the temperature profile inside the chamber (Fig. 16) and in the air velocity distribution along the chamber (Fig. 17) were proposed. The confirmation of these hypothesis would require further investigation and eventually additional modifications in the chamber.



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Figure 15. Lettuce shoot biomass (g) of plants #1-5 average per tray – dry biomass (trays #1-6 – module A, trays #7-14 – module B, trays #15-20 – module C)



Figure 16: Temperature values along the chamber (°C) and lettuce shoot dry biomass (g) during the third 20-days test





Figure 17: Air velocity along the chamber (m/s) during the third 20-days test, measured at the outlet of the 9 louvers communicating the plenum with the cultivation area.



## Figure 18. Lettuce shoot dry biomass (average per tray) after 4 crop tests with different duration of closure



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The following table summarizes the harvest data and yield data collection for the three first lettuce batch experiments with 20-days duration.

Lettuce Batch Harvest Data	B-20/1	B-20/2	B-20/3	Mean	% Std. dev.
Leaves					
Dry Weight, DW (g dw)	452	427	427	435,3	3,3%
Dry Weight, DW (g dw.plant <sup>-1</sup> )	4.52	4.31	4.40	4.41	2,4%
Plant growth rate (g dw.plant <sup>-1</sup> .d <sup>-1</sup> )	0.23	0.22	0.22	0.22	2,6%
Days in the chamber	20	20	20	20	0
Total plants	100	99	97	99	1,5%
Roots					
Dry Weight, DW (g dw)	98.26	84.32	71.08	84.55	16,1%
Dry Weight,DW (g dw.plant <sup>-1</sup> )	0.98	0.85	0.73	0.850	20,7%
Plant growth rate (g dw.plant <sup>-1</sup> .d <sup>-1</sup> )	0.05	0.04	0.03	0.0400	25,0%
Total					
Dry Weight, DW (g dw.plant <sup>-1</sup> )	5.50	5.16	5.14	5.27	3,8%
Plant growth rate (g dw.plant <sup>-1</sup> .d <sup>-1</sup> )	0.28	0.26	0.26	0.27	4,3%
Total Dry weight (g dw)	550	511	498	519	5,2%
Area Chamber (m <sup>2</sup> )	5	5	5	5	0
Total productivity (g dwm <sup>-2</sup> d <sup>-1</sup> )	5.50	5.11	4.98	5.20	5,2%

 Table 2. Harvest data for lettuce grown in three first batch culture

In Figure 18, the growth pattern obtained in all the three 20-days batch tests is compared with the growth profile of the 38-days one previously performed. Both Figure 18 and Table 2 evidence that no significant differences were found in lettuce plant growth rate among batch culture replicates. However in the frame of each replicate of 20 days batch culture, significant dispersion of plants biomass along the chamber was observed, showing a clear decrease within Module B, as previously discussed (see Figure 18). This dispersion could be caused by the fluctuation of air velocity along the chamber that varied between 0.2 and 2.7 m/s (measured at the level of the louvers).


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Nevertheless this irregular air flow pattern did not affect the global lettuce growth and the reproducibility of the experiment was rather good (see dispersion values in Table 2, mean data).

Average plant growth rate of lettuce obtained in B-20/1, B-20/2 and B-20/3 was 0.27 g dw.plant<sup>-1</sup> d<sup>-1</sup> (see Table 2) and two times lower in comparison with the B-38 where average plant growth rate was 0.5 g dw.plant<sup>-1</sup> d<sup>-1</sup>. This difference can be explained by the duration of the lettuce growth inside the chamber. Actually, the empirical model for plant growth is the exponential growth function (Massot. A, 2007) which can explain that at 20 days, lettuce are still in the early exponential growth phase whereas at 38 day they are at the late exponential growth phase. On top of that, the growth obtained with 38 days culture did not show any significant decrease within Module B, which has been previously explained by a progressive homogenization of the crops size in the last period of the culture, where the growth rate was probably slowed down in the bigger plants, although this hypothesis cannot be demonstrated.

The average total productivity obtained at 20-d test (5.20 g dw m<sup>-2</sup> d<sup>-1</sup>) was also two times lower than the 38-d one (9.82 g dw m<sup>-2</sup> d<sup>-1</sup>). However, in the later case, due to a large size of plants, crop density was high and air circulation between the plants was reduced, favouring the conditions for plants rotting. Plant rot led to a number of plants inedible biomass. Moreover, purging of excess oxygen accumulation may have influenced some test results. Reducing the duration of the test to 20-28 days, quite shorter than the 38-days test, allowed not to interrupt the test and gave a better estimation of the carbon balance of the crop which is relevant to characterize the HPC.

Taking into account the above described results with 20-days batch culture tests, a fourth test (B-20/4) with the same duration was performed, but in this case an additional restriction to the ventilation flow was installed in the louvers n° 5 and 6, the ones that provided a higher flow (see Fig. 17), so that the flow distribution was partially balanced.





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c) Comparison between batch cultures B-20/1, B-20/2, B-20/3 and B-20/4 harvest data

During test B-20/4, relevant anomalies took place between 11<sup>th</sup> and 14<sup>th</sup> days of culture:

- On days 11th and 12th , the cooling machine failed, which affected the proper control of humidity and temperature. Figure 19 (A and B) shows the loss of humidity control caused by this failure, and the corresponding effect on the chamber temperature is shown in Fig. 20.

- A power failure occurred on day 13<sup>th</sup>, as shown in Figure 19 and 20 (C), with the consequence of switching off the lamps, the blower and the cooling machine. During 17h, light was off and temperature and relative humidity in the chamber increased up to 36°C and 98% respectively. The main issue here is that the light was off so no photosynthesis or growth could occur and, on top of that, the stomata cannot open. As a consequence, since the stomata are closed, the plant has no way to transpire, photosynthesis and cool down, therefore heat could build up and bring irreversible tissue damages and/or protein denaturation.



Figure 19 .Humidity control in the HPC over 18 day period of closure at daytime and nightime

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Figure 20. Temperature control in the HPC over 18 day period of closure at daytime and nighttime

Table 3 summarizes the harvest and yield data for the four 20 days lettuce batch cultures. The mean of the three 20 day tests is compared with the data corresponding to the test B-4. As it can be seen from Table 3, relevant differences in the dry weight, plant growth rate and productivity value of lettuce plants grown in the last crop test compared with the three others was observed. Productivity of plants grown in the three repetitive tests (B-20/1; B-20/2; B-20/3) was 1.3 times higher in comparison with the last test (B-20/4). This difference can be explained by the anomaly in the system that did not allow the plant to grow well (3.2.1). This test was stopped two days in advance (18 days) than the others (20 days) which is an additional factor to explain the low results obtained in B-20/4.





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Lettuce Batch Harvest Data	Mean of B-20/1, 20/2 and 20/3	B-20/4
Lettuce Datch Harvest Data	20/2 and 20/3	
Leaves		
Dry Weight, DW (g dw)	$435\pm14$	279
Dry Weight, DW (g dw.plant <sup>-1</sup> )	$4.41\pm0.1$	2.79
Plant growth rate (g dw.plant <sup>-1</sup> .d <sup>-1</sup> )	$0.22\pm0.01$	0.15
Days in the chamber	20	18
Total plants	99	100
Roots		
Dry Weight, DW (g dw)	$84.55 \pm 13.6$	64.86
Dry Weight, DW (g dw.plant <sup>-1</sup> )	$0.850\pm0.1$	0.65
Plant growth rate (g dw.plant <sup>-1</sup> .d <sup>-1</sup> )	$0.0400\pm0.01$	0.04
Total		
Dry Weight, DW (g dw.plant <sup>-1</sup> )	$5.27 \pm 0.2$	3.43
Plant growth rate (g dw.plant <sup>-1</sup> .d <sup>-1</sup> )	$0.27\pm0.01$	0.19
Total Dry weight (g dw)	$519 \pm 27$	343
Area Chamber (m <sup>2</sup> )	5	5
Total productivity (g dwm <sup>-2</sup> d <sup>-1</sup> )	$5.20\pm0.3$	3.82

#### Table 3. Harvest data for lettuce grown in batch culture B-20/1-3 and B-20/4

However, the distribution of growth along the chamber in the test B-20/4 was clearly more homogeneous than the pattern obtained in the previous tests (see Figure 21), what is coherent with the fact that the ventilation flow pattern was improved by means of the modification of the louvers, as previously discussed.





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Figure 21. Shoot dry biomass distribution along the chamber in the tests performed before and after the louvers modification







Figure 22.  $CO_2$  and  $O_2$  (IDCG and O2 produced) in HPC over the 18 day period of closure at daytime and nighttime

Figure 22 shows the Integrated Daily Carbon Gain (IDCG), which represents the accumulated  $CO_2$  injected during the plant growth process and the accumulated  $O_2$  produced by the plant above nominal condition (20,9%) versus days in the chamber. Results point well the anomalies between the thirteen and fourteen day of the crop. Since the dark period lasted 17 hour, the  $CO_2$  concentration increased due to respiration since was not possible to remove  $CO_2$  from the chamber,  $CO_2$  measurement reached 2000 ppm inside the chamber, and the absence of light interrupted the photosynthetic process of plant that explain the significant decrease of the  $O_2$  production.





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#### 11.2.3 Nutrient solution composition and plant mineral content

The potential accumulation or depletion of nutrients in the hydroponic solution was evaluated along the 20-days culture. The results of mineral analysis regarding K and Na in the first two tests are shown in Figure 22.

As it can be deduced form this Figure, the concentration of K and Na measured at different moments after changing the solution are higher than the initial ones, indicating a certain accumulation of these ions. Therefore, the nutrients accumulation in the HPC1 nutrient solution would require an improvement of the nutrient solution feeding/control strategy in order to:

- Prevent plant growth inhibition (e.g. definition of limiting/inhibitory/toxicity levels)

- Decrease mineral accumulation (optimisation of the nutrient solution composition and composition control)

- Minimise operations





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#### Figure 22: K and Na concentration in the nutrient solution at different periods of 20-days crop test (mg/L) NOTE: Tests #1 and #2 stand for Tests B-20/1 and 20/2



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Regarding the mineral composition found in the crops, the results of the analysis performed on the shoots are shown in Table 4. These results are in average quite similar to the ones already obtained for the 38-days batch culture (RD1) and are as well quite close to the ones obtained by Masot (RD3) and fall within the range between the values obtained in field cultures and the ones reported by other authors for hydroponic cultures (Table 5).

Treatment	Na	к	Ca	Ρ	S	Mg	Fe	Si	В	Mn	Zn	Cu	Мо	N
Test #1	0.03	7.6	1.0	0.9	0.4	0.2	0.02	0.01	0.002	0.009	0.007	0.001	0.0003	5.0
Test #2	0.02	7.1	0.9	0.8	0.3	0.2	0.02	0.01	0.002	0.009	0.007	0.001	0.0002	5.3
Average of 2 tests	0.03	[7.3]	0.9	0.9	0.4	0.2	0.02	0.01	0.002	0.009	0.007	0.001	0.0003	5.2

Table 4. Mineral composition of lettuce shoot (% dw), harvested at the end of vegetation

	к	Са	Mg	Р	N
HPC1, 20 days tests	7.3	0.9	0.2	0.9	5.2
McKeehen, 1994	8.2	0.6	0.2	0.6	4.5
Wheeler et al., 1994	17.0	0.9	0.3	0.4	4.8
Masot et al., 2007	7.9	1.2	0.3	1.0	5.5
Field	3.9	0.7	0.2	0.6	3.0

Table 5. Content of main minerals in lettuce leaves, (% dw) in filed and hydroponic cultures



#### 11.2.4 MASS BALANCE

#### a) Carbon balance

The photosynthetic response data give a prediction of the control of carbon exchange in the HPC which is relevant to know the good functionality of plant process (photosynthesis) and to estimate the  $O_2$  production. Some authors have used an approximate photosynthetic quotient (mol  $O_2$ /mol  $CO_2$ ) of 1 (RD2, RD4), however a quotient of 1 is generally only found under ideal conditions in isolated chloroplasts. Actual net oxygen production can be substantially reduced due to respiration requirements, cultivar differences, cultural practices, and microbial activity. As  $O_2$  quantity is prominent for the survival of the crew in the loop, characterizing oxygen production for a variety of crops under various cultivation techniques is an important aspect of future study. The following graph shows the Integrated Daily Carbon Gain (IDCG) profile of the five lettuce batch experiments.



Figure 23.Integrated Daily Carbon Gain (IDCG) for lettuce batch culture (B-38 – 38 days test-, B-20/1; B-20/2; B-20/3, and B-18 –equal to B-20/4-)

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The IDCG which is also known as Net Carbon Exchange Rate (NCER) is the accumulation of  $CO_2$  at the end of the batch culture. It contributes to estimation of biomass production (DW) with knowledge of carbon content and to the assessment of the  $CO_2$  balances in the HPC.

Table 6 summarizes the carbon balance results obtained in the lettuce batch corrected by the estimated leak value (4.37 % per day or  $2\mu$ mol in the HPC per day)

Lettuce Batch Harvest Data	B-38	B-20/1	B-20/2	B-20/3	B-20/4
CO <sub>2</sub> consumption (mol)	84	19	23	16	21
C from $CO_2$ consumption (g)	1008	228	276	192	252
Carbon content (%)	40	39	40	42	42
C from DW at harvest (g)	690	176	171	180	117
C Balances (%)	68	77	62	93	46

### Table 6. Comparison between estimated biomass from $\mathrm{CO}_2$ injection and carbon content in biomass harvested

The harvested dried biomass (DW) carbon value is in general lower than the potential C production based on the  $CO_2$  injected. Some of the possible reasons are the lack of accuracy in the calibration of  $CO_2$  metered injection in the beginning of the first batch culture and the insufficient tightness of the nutrient tank in the second batch culture after the nutrient solution change-over. B-20/3 shows a better result due to the improvement of calibration techniques and operation by the MPP personal.

B-20/4 presented some events in the evolution of the culture (already described) that made necessary to open the chamber in order to recover the nominal humidity and temperature conditions as soon as possible. This fact at least made not possible to obtain a correct value of the C balance.



#### b) Nitrogen balance

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Nitrogen is the nutrient which is consumed by lettuce at the highest rate. That is why this nutrient was chosen for the mass balance analysis among the batch cultures. Besides it is the main nutrient produced by CIII in MELiSSA loop which feeds CIVa and CIVb. Nitrogen mass balance was determined by comparing the accumulated nitrogen (total nitrogen consumed by plant) as obtained through analysis of the hydroponics solution at every change over the period with the total nutrient content in biomass obtained from tissue analysis at the harvesting. The accumulated Nitrogen uptake in moles comprise also the Stock A/B and nitric acid volume injected at every change over.

Lettuce Batch Harvest Data	B-20/3	<b>B-20/4</b>
N total consumed by plant (mol)	2.1	1.2
N from DW at harvest (g) in roots	2.1	1.9
N from DW at harvest (g) in shoot	23.1	14.7
Nitrogen content (%) in roots	3	3
Nitrogen content (%) in shoot	5	5
N total measured in harvested plants (mol)	1.8	1.2
N Balances (%)	87	100

#### Table 7. Comparison between estimated biomass from accumulated nitrogen uptake and nitrogen content in the harvested biomass

Nitrogen mass balance of 20 days batch culture showed some deviation which could be explained by several factors that took place during the experiments such as some leaks in Acid and Base reservoirs. Besides it was quite difficult to separate completely lettuce roots from the Rockwool substrate. For this reason there was a loss of some data on nitrogen accumulation in lettuce roots. Moreover, it is necessary to mention that microorganisms and algae could consume some of the nutrient. Also not 100% mass balance of N could be connected with errors in analytical systems for analysis of nutrient solution composition or mineral composition of plants tissues. All those factors could lead to non-exact results.



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#### 12. Conclusions

- 1. The first series of lettuce batch cultures in the HPC1 of the MPP served to acquire relevant knowledge on the operation of the system and to have a first set of data on its operation at two operating conditions, ie, short (20 days) and long (38 days) plant growing period within the chambers. Such a characterization was done for *Lactuca sativa* L. cv. Grand Rapids cultivation inside the HPC.
- 2. The test at 20 days was performed in triplicate to analyse the reproducibility of the tests, and the growth pattern in the three batches was quite similar.
- 3. Regarding gas exchange, it was observed that the IDCG evolution is a good method for online estimation of plant growth and dry weight production inside the chamber without using destructive analysis. However, it is stressed that a proper calibration of instruments, and the determination of the leakage rate are very important for achieving accurate data on plant biomass values based on CO2 data.
- 4. Nitrogen uptake from nutrient solution has demonstrated the possibility to estimate biomass, since nitrogen nutrient content present in the harvest biomass matches with it.
- 5. In order to maintain life in a closed environmental system, the O<sub>2</sub> production should be relatively constant to be distributed uniformly to the crew. Staggered production systems should provide a more stable output of O<sub>2</sub>, H<sub>2</sub>O and food once a "steady state" is achieved. This is in contrast to batch production systems, where an entire crop is harvested at a single time. Nevertheless, most of the batch culture data obtained in the batch tests will be useful



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inputs for the characterization of the staggered production within the HPC, which is the aim of the future experiments in the HPC.

batch cultures in HPC1

- 6. Environmental control parameters were validated for the batch cultures performed at 20 days of duration, and high air velocity in specific area of HPC1 was detected, that may have affected plant growth in this area. The improvement of air distribution in the chamber to equilibrate this area might increase plants production by approximately 20 % or more.
- 7. Crop test performance during 38 days resulted in relatively high biomass production of lettuce and oxygen production, and apparently there was a positive evolution with time of the canopy with respect to the unfavourable environmental conditions, still to be investigated; however, a decrease of plants edible biomass value was observed.
- 8. Increase of test duration from 20 to 30 days would allow a considerabe increase in biomass and oxygen production and radiation conversion efficiency. Taking into account the results obtained with 20 and 38 days of culture, an intermediate duaration like 28-30 days will probably be the optimal for the lettuce cultures in the HPC, providing a balance among the desired parameters: oxygen production, biomass production and quality, etc. so this will be proposed for the staggered tests. However, maybe some measures should be taken for oxygen removal from the chamber when higher concentration would be achieved, in order to avoid any potential risk.
- 9. The level of minerals accumulated in the lettuce grown in HPC1 was wihin the normal values compared to the published data from other work on lettuce plants grown in hydroponics solution.



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10. Nutrients accumulation in the HPC1 nutrient solution indicated that in order to prevent plant growth inhibition and optimize both composition and operations, it is required to renew regularly the nutrient solution or to modify the feeding strategy in order to correct the different nutrient levels.

batch cultures in HPC1

11. Preliminary modification in the louvers to improve air distribution homogeneity along the chamber by balancing the air flow velocity in the modules resulted in increased crop growth homogeneity along the chamber, although the results should be confirmed with further measurements.



#### 13. Annexes

batch cultures in HPC1

#### Annex 1. Raw data of the crops weight and C content

Fresh and dry weight of lettuce, harvested on 1.02.2010

# of tray	# of plant	Fresh weight of shoots, g 1.02.2010	Dry weight of shoots, g 10.02.2010	Weight of dry roots*, g 10.02.2010
	1	83,1	4,64	0,84
	2	110,32	5,52	0,98
1	3	105,93	5,35	1,09
	4	120,56	6,19	1,31
	5	121,42	6,39	1,26
	1	87,13	5,24	1,2
	2	101,65	5,59	0,79
2	3	116,93	6,43	0,96
	4	106,33	4,97	1,17
	5	142,66	7,8	1,41
	1	80,06	5,04	1,1
	2	106,17	5,62	1,14
3	3	111,79	5,79	1,72
	4	144,92	7,42	1,21
	5	119,76	6,46	1,44
	1	99,87	5,8	1,38
4	2	108,85	6,03	0,7
	3	104,73	5,68	1,14

<sup>52</sup> 





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	nent Identific			Туре	•	Number	Issue	
	cultures in H	characterization of PC1	lettuce	TN		101.3	(0)	Page
	3	49,66	3,0	8		1,31		
	4	35,02	2,3	1		0,63		
	5	33,46	2,5	5		0,79		
	1	29,78	2			0,86		
	2	33,07	2,0	5		0,66		
11	3	51,78	3,2	2		0,89		
	4	50,78	3,0	7		0,76		
	5	51,75	3,2	5		0,73		
	1	4,02	0,3	2		0,93		
	2	62,25	3,5	4		0,68		
12	3	58,81	3,25			NA		
	4	73,3	3,89			0,9		
	5	67,23	4,38			0,92		
	1	39,2	2,4	5		0,83		
	2	49,79	3,1			0,67		
13	3	45,86	2,7	9		0,69		
	4	52,77	3,0	8		1,42		
	5	48,57	3,2	2		0,71		
	1	34,91	1,9	8		0,65		
	2	49,33	2,5	8		0,57		
14	3	73,49	4,2	5		0,89		
	4	66,15	3,9	4		0,93		
	5	65,76	4,0	9		0,62		
	1	75,14	4,4	5		1,19		
	2	57,35	3,6	6		0,72		
15	3	74,88	4,1	1		0,76		
	4	58,11	3,2	9		0,7		
	5	48,2	3,2	2		0,78		
16	1	63,11	3,9	6		0,83		





**Document Identification :** Number Issue Type Test report for the characterization of lettuce TN 101.3 (0)Page : 55 / 68 batch cultures in HPC1 76,18 4,43 2 0,98 3 85,71 4,75 0,87 4 4,24 83,43 1,03 5,45 1,33 5 89,52 1 38,15 2,74 0,64 77,01 2 4,37 0,95 1,22 3 17 3,46 69,83 4 116,4 6,25 1.09 5 110,63 6,35 1,4 1,23 1 80,66 4,83 2 4,75 0,82 87,03 18 3 100,46 5,43 1,2 4 99.4 5,51 1,57 121,26 6,75 1,41 5 1 3,89 0,76 66 2 79 4,05 0,96 3 99,46 19 4,99 0,82 4 99,17 5,09 0,84 1,38 5 131,26 6,95 1 3,32 67,14 0,97 2 111,59 5,79 0,66 122,13 5,75 3 0,75 20 4 88,35 4,22 1,18 5 1,02 99,04 5,39

\*includes some Rockwool particles



Document Identification :	Туре	Number	Issue	
Test report for the characterization of lettuce batch cultures in HPC1	TN	101.3	(0)	Page : 56 / 68

#### Fresh and dry weight of lettuce, harvested on 1.04.2010

# of tray	# of plant	Fresh weight of shoots, g 1.04.2010	Dry weight of shoots, g	Dry weight of roots, g
	1	52,56	2,35	-0,24
	2	102,24	4,1	0,11
1	3	121,43	4,93	0,25
	4	120,76	5,38	0
	5	133	6,33	0,25
	1	62,21	3,01	-0,17
	2	105,78	5,23	0,27
2	3	130,44	6,54	0,4
	4	128,61	6,01	0,2
	5	155	7,68	0,19
	1	71,02	3,93	0,24
	2	66,93	3,65	0,16
3	3	83	3,63	-0,05
	4	121,86	5,8	0,17
	5	117,24	6,28	0,4
	1	71,43	3,89	0,23
1	2	105,91	5,36	0,24
4	3	126,23	5,89	0,3
	4	123,96	6,09	0,44

<sup>56</sup> 





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		ent Identificat			Туре	Number	Issue
		oort for the ch altures in HPO	aracterization of le	ettuce	TN	101.3	(0)
I		5	122,57	6	64	0,02	
		1	81,39			0,02	
		2			23		
	Б		105,61		12	0,15	
	5	3	124,84		17	0,31	
		4	154,92		38	0,29	
		5	67,89		81	0,08	
		1	63,37		11	-0,08	
	0	2	82,52		25	0,33	
	6	3	95,93		,9	0,81	
		4	89,94		43	0,51	
		5	112,68		92	0,36	
		1	38,3		83	0,61	
		2	80,5		03	0,16	
	7	3	107,39	5,	22	0,2	
		4	114,63	5,	98	0,34	
		5	116,92	6,	28	0,24	
		1	50,53	2,	88	-0,14	
		2	37,18	1	,9	0,21	
	8	3	33,98	1,	46	0,29	
		4	77,83	3	,9	0,19	
		5	77,58	4	,3	0,67	
		1	47,31	2,	43	0	
		2	40,1	1,	96	-0,14	
	9	3	80,79	3,	95	0,41	
		4	69,29	3,	25	0,1	
		5	50,3	2,	57	0,32	
		1	41,27	1	,9	0,13	
	10	2	82,89		,3	0,06	
		3	75,14	3	,7	0,04	

<sup>57</sup> 





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	ent Identificat			Туре	Number	Issue	
	port for the ch ultures in HPC	aracterization of le	TN	101.3	(0)		
	4	74,59	3	,7	-0,09		
	5	50,34	2,	66	-0,07		
	1	6,89	-0,	21	-0,49		
	2	40,77	1,	87	-0,17		
11	3	88,28	4,	67	0,2		
	4	101,81	4,	99	0,07		
	5	80,97	4,	29	0,01		
	1	27,71	1,	24	-0,29		
	2	58,01	2,	97	-0,06		
12	3	62,86	3,	31	-0,05		
	4	70,05	3,78		-0,03		
	5	27,31	1,57		-0,31		
	1	37,61	1	,9	-0,24		
	2	49,36	2,47		0,03		
13	3	76,08	3,89		0,12		
	4	83,6	4,	07	-0,04		
	5	71,56	3,	93	0,18		
	1	51,66	2,	66	-0,12		
	2	66,1	3,	32	-0,03		
14	3	86,96	4,	35	0,11		
	4	65,53	3,	67	-0,08		
	5	81,36	4,	36	0,08		
	1	82,07	4,	46	0,04		
	2	77,26	3,	77	0,18		
15	3	71,31	3,	56	-0,15		
	4	90,69	4,	48	0,08		
	5	91,09	4,	95	0,04		
16	1	62,62	3,	08	-0,22		
10	2	97,23	4	,7	-0,07		

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	ent Identificat			Туре	Number	Issue
	port for the ch ultures in HPC	aracterization of le	ettuce	TN	101.3	(0)
	3	102,32	5,	04	0,31	
	4	110,91	4,	96	0,54	
	5	112,32	5,	75	0,28	
	1	66,19	3,	13	-0,19	
	2	123,54	6,	09	-0,13	
17	3	135,78	6,	64	0,26	
	4	123,72	6,	07	0,5	
	5	123,71	6,	55	0,23	
	1	65,79	3,4	43	0,08	
	2	121,4	5,96		0,11	
18	3	137,01	6,09		-0,27	
	4	79,62	4,04		0,13	
	5	106,35	5,	71	0,25	
	1	62	2,	82	-0,06	
	2	63,76	2,	96	0,05	
19	3	100,99	4,	85	0,06	
	4	126,02	5,	66	0,05	
	5	97,51	5,	08	-0,09	
	1	80,06	3,	84	0,14	
	2	97,79	3,	96	-0,01	
20	3	120,21	5,	09	-0,1	
	4	125,64	5,	53	0,03	
	5	103,69	5,	39	-0,01	





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Fresh and dry weight of lettuce, harvested on 11.06.2010

# of tray	# of plant	:	Fresh weight of shoots, g 1.06.2010	Dry weight of shoots, g	Dry weight of roots, g
	1		74,96	4,15	0,94
	2		96,44	4,54	0,95
1	3		104,22	4,49	1,41
	4		85,76	3,63	0,75
	5		126,9	6,65	0,88
	1		114,06	5,7	0,81
	2		87,89	4,07	0,35
2	3		98,06	3,46	0,64
	4		118,15	4,59	0,84
	5		120,11	6,33	1,33
	1		81,75	4,23	1,05
	2		93,3	4,8	1,02
3	3		109,93	5,07	0,72
	4		110,49	5,36	0,66
	5		138,79	7,24	1,49
	1		81,08	4,6	1,13
	2		116,44	5,98	1,07
4	3		120,01	6,12	1,16
	4		111,92	6,05	1,28
	5		89,43	4,46	0,81
F	1		83,7	4,41	1,46
5	2		102,58	4,04	1,33





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	cument Identi			Туре	Number	Issue
	Test report for the characterization of lettuce batch cultures in HPC1				101.3	(0)
	3		87,88	3.05	0.75	
	4			3,95	0,75	
			108,75	5,58	0,87	
	5		95,06	5,66	1,4	
	1		88,83	3,72	0,97	
	2		80,08	4,26	0,72	
6	3		89,03	3,57	0,60	
	4		98,85	5,16	1,16	
	5		103,96	5,67	1,36	
	1		67,58	3,51	0,66	
	2		84,38	3,43	0,71	
7	3		88,88	4,6	1,01	
	4		106,5	5,34	1,14	
	5		108,71	6,35	1,47	
	1		62,64	2,54	0,52	
	2		76,5	4	0,83	
8	3		89,15	3,12	0,91	
	4		85,51	4,52	0,97	
	5		0	0	0	
	1		63,06	3,39	0,77	
	2		63,79	3,05	0,75	
9	3		79,3	3,97	1,53	
	4		63,11	3,21	0,71	
	5		44,39	2,26	0,86	
	1		50,23	2,56	0,53	
	2		51,71	2,26	0,57	
10	3		59,53	1,98	0,74	
	4		62,84	3,29	0,98	
5 0		0	0	0		
11	1		24,20	0,91	0,24	

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	ocument Identi		Туре	Number	Issue
	st report for the tch cultures in	e characterization of lettuce HPC1	TN	101.3	(0)
	2	50,8	2,93	0,52	
	3	55,86	3,1	0,66	
	4	61,96	3,42	0,42	
	5 70,02		4,09	0,45	
	1	41,15	2,28	0,67	
	2	54,61	2,71	0,43	
12	3	50,84	2,56	0,52	
	4	62,68	3,32	0,36	
	5	45,85	2,69	0,28	
	1	60,52	3,11	0,63	
	2	80,26	6,16	0,75	
13	3	78,63	4,21	0,38	
	4	88,96	4,95	0,62	
	5	90,82	4,45	0,92	
	1	33,4	2,48	0,37	
	2	54,6	4,09	0,26	
14	3	72,95	3,18	0,5	
	4	85,66	4,43	0,53	
	5	85,88	4,76	0,31	
	1	69,07	4,16	0,49	
	2	86,12	4,54	0,4	
15	3	81,36	4,36	0,36	
	4	120,07	6,12	0,71	
	5	82	4,23	0,64	
	1	0	0	0	
16	2	80,78	4,04	0,41	
	3	100,14	5,18	0,59	
	4	113,89	5,15	0,72	
	5	128,68	6,79	1,01	

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	ument Identi		• •• • • • • • • •	Туре	Number	Issue	_
	h cultures in		rization of lettuce	TN	101.3	(0)	Page : 63 / 68
	1		81,27	4,19	0,7		
	2		79,76	3,98	0,43		
	3		95,43	5,51	0,76		
17	4: 2 plants	plant 1 = 24,78	04.04	0,76	0,51		
	in one cube	plant 2= 70,13	94,91 -	3,37			
	5		88,23	4,76	0,6		
	1		100,03	5,15	0,66		
	2		109,3	5,37	0,66		
18	3		143,86	7,19	0,64		
	4		132,41	6,24	0,62		
	5		126,53	6,2	0,49		
	1		95,98	4,89	0,5		
	2		89,17	6,35	0,32		
19	3		129,98	6,39	0,53		
	4		112,75	5,64	0,51		
	5		105,33	6,05	0,32		
	1		72,65	3,03	0,38		
	2		93,4	4,11	0,58		
	3		96,29	4,13	0,33		
	4		114,95	5,36	0,52		
20	5: 2 plants	plant 1 = 53,71	76.90	2,18	0,3		
	in one cube	plant 2= 23,18	76,89	0,97			





**Document Identification :** Туре Test report for the characterization of lettuce TN batch cultures in HPC1

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Fresh and dry weight of lettuce, harvested on 13.07.2010

# of tray	# of plant	Fresh weight of shoots, g 23.07.2010	Dry weight of shoots, g	Dry weight of roots, g
	1	59,72	0,5	0,1
	2	48,16	1,76	0,13
1	3	50,77	2,2	0,09
	4	41,18	2,1	0,12
	5	31,14	2,72	0,02
	1	58,49	1,17	0,12
	2	86,02	4,12	0,26
2	3	48,07	2,18	0,12
	4	69,61	3,94	0,11
	5	27	3,29	0
	1	55,09	2,64	0,27
	2	51,23	1,62	0,25
3	3	68,35	3,41	0,2
	4	42,76	2,65	0,23
	5	54,49	3,56	0,18
	1	46,02	2,93	0,08
	2	45,51	2,36	0,1
4	3	45,52	2,18	0,12
	4	55,23	1,89	0,18
	5	53,14	2,26	0,29

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<sup>65</sup> 





de Barcelona **Document Identification :** Type Number Issue Test report for the characterization of lettuce TN 101.3 (0)Page : 66 / 68 batch cultures in HPC1 5 34,28 3,25 0.07 1 77,60 2.3 0,45 3 2 83,62 0,39 11 3 64,97 1,98 0,31 4 61,91 3,77 0,39 5 47,86 3,98 0,18 1 2,25 72,38 80,0 2 71,28 2,14 0,35 12 3 62,27 3,1 0,24 4 43,15 3,79 0,15 5 58,22 3,81 0,4 3,74 0,21 1 67,15 2 64,88 2,87 0,4 3 3,8 13 76,04 0,2 4 2,24 68,53 0,36 5 70,78 3,24 0,15 1 59,7 3,51 0,24 73,18 2 2,14 0,33 3 3,43 0,2 14 68,4 4 3,88 58,28 0,28 5 66,75 3,29 0,26 1 71,04 3,62 0,5 2 68.1 3.51 0.27 15 3 64,55 3,27 0,27 4 69,99 3,54 0,2 5 67,01 3,97 0,48 1 43,61 2,22 0,28 16 2 84,83 4.53 0,3 3 3,49 0,2 69,63

<sup>66</sup> 





de Barcelona **Document Identification :** Number Issue Type Test report for the characterization of lettuce TN 101.3 (0)Page : 67 / 68 batch cultures in HPC1 4 81,98 3,62 0,49 0,14 5 85,05 3,91 0,25 1 49,25 2,14 0,3 2,49 2 51,06 1,52 39,74 17 3 0,22 0,11 4 47,94 2,41 35,41 5 1.63 0,14 1 49,43 2,72 0,2 0,08 2 43,03 2,09 2,25 3 0,19 18 45,88 4 52,15 2,63 0,22 5 54,08 2,64 0,1 1 31,62 1,43 0,1 2 40,97 1,78 0,19 19 3 46,38 1,76 0,2 4 48,75 2,16 0,2 51,82 0,12 5 2,37 0,18 1 53,22 2,78 0,27 2 42,99 1,84 20 3 47,93 1,86 0,22 1,58 0,17 4 47,88 5 50,28 2,59 0,21





Universitat Autònoma de Barcelona

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Document Identification :	Туре	Number	Issue	
Test report for the characterization of lettuce batch cultures in HPC1	TN	101.3	(0)	Page : 68 / 68

#### Annex 2: As-run annotated procedures

	MELis	SA Pilot	Plan	t	•		at Autòno arcelona	) ) )ma
	EST RECORD S	1	Гуре	Reference	Chrono	Pa	ge : Ef	2
			MPP-REC	10 -4101(0)	<u>0</u>	A	61/	17
	Co	ompartment : CIVb	o Test	t Phase: 1				
Tes	t title : Preparation of th	e chamber	· .			-		
Obje	ectives:				÷			
Арр	licable test plan and test prot	cocols TN 101.2	2					
Hard	dware: HPC1 compartment an	d control system						
Pers	on responsible for the test : I	Natalia Tikhomirova			<u> </u>			
	prerequisites :							<u></u>
-clea	an with ethanol 70% all surfac		:					
-clea	an with KOH liquid loop of HP	C1				. •		
Step No.	Action description	Expected results / Nominal behaviour	Date / Hour	calculated	ed results , / remarks - eviation		C/ Initi IC	ials
1	Switching on 1 MH lamp per module for manipulation	Lamps are switched on and environmental conditions in HPC1	01/03/10 14:50			6	2 C.	М
	inside the chamber	allow to perform manipulations inside the chamber						
	Putting on Personal Protective Equipment:	Personal Protective Equipment is put on	01/03/10 14:55			C	o Ch	и
2	goggles, lab coat, safety shoes, gloves, shoe covers	operator is ready to perform cleaning manipulations inside the chamber						
3	Removal of aluminium air balancing panels out of HPC1	Aluminium air balancing panels are removed in order to enter inside the	01/03/10 15:00		·,	C	CI	M
		chamber for free manipulation						
4	1.Demounting of plastic tips of spigots for further cleaning ; 2.pictures are taken	1. Tips are removed and can be cleaned separately 2. Pictures available	01/03/10 15:15			C	C	М
5	Cleaning of plastic tips of spigots with soap and distilled water and	Plastic tips of spigots are cleaned	3/03/10 16:00			C	6	M

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				Туре	Chrono		Page :	el
	IESI	RECORD	SHEEI -	MPP-REC	2 10 -4101(0)	1-01	J	2/7
		· Co	ompartment : CI	/b Tes	st Phase : 1	-		
6		of the bottom chamber with leaner	No dust can be observed inside the chamber $_{O}K$	0,1/03/295 15 <b>.35</b>	OK		C	Ċþ
7	ethanol, f	on of 3 L of 70% filling of bottles	There is no problem with supply of ethanol in sufficien quantity from department, tools are ready for disinfection	011001.00	it was pre A bottle of (70% elfanol	pared 500 ml )	C	Cn
8	inside for	on of the chamber disinfection: ys out of the oV-	Chamber is ready for entering inside and disinfection of the surfaces		1 rays wore	celveady charmer	Ċ	0
9	vapours a all access	n mask against nd disinfection of ible surfaces chamber with	All accessible surfaces in the chamber are treate with ethanol	01/03/200 a 16.00 02/03/200 9.30	needed. C	1	C	CA
10	Disinfection surfaces	on of HVAC	All accessible surfaces in HVAC of HPC1 are disinfected with ethanol	03/03/200 18.30	OK		C <sub>1</sub>	W
11	air balanc	on of aluminium ing panels with utside of the	Panels are disinfected and can be placed back into the chamber		(for dishwas) and product f	ner) or iterial	С	СЛ
12	balancing bottom of their nom prelimina	t of aluminium air panels on the the chamber to inal position ry putting on e shoes covers	Aluminium air balancing panels an placed in their nominal position	02/03/200 ≈ 12.00	TO A seal of All A	Hem	С	ел
13	Connectin plastic tip	g of spigots s	Tips are connected to spigot at their nominal position	02/03/2010 18:30	OK		C	cr
14		t of trays, ry cleaned with de the chamber	Trays are placed in the chamber in the nominal position	03104iac r 16.00	OK		С	Сл
15	tank with	of 120-L external soap and rinsing lcified water	Tank is clean and ready for further manipulation	02/03/20K S. 30	<del>Cleaned and</del> hipsed will water	f distilled	С	a

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M 6		M	ELISSA	Pilot	Plant		Universitat Aut de Barcelo	duouna	
7	EST	RECORD	SHEET	Type MPP-REC		rono 01(0) _ O (	Page	8	
		C	ompartment : Cl		it Phase : 1			3/4	
16	decalcified	xternal tank with I water and 2 % ing in external	Tank is filled and solution is mixed, left for 1 hour		Not de only with wate	h soop	erd NC	см	
17	Taking of 3 solution fo measurem		pH is measured, data is considered as experimental point 1		Not d	one	NC	СМ	
18	pump and to be used tank filling	n of external flexible tubing, for main nutrient , with solution of external tank	Pump and flexible tubing are disinfected		Not di only u		or NC	СМ	DEV 3
19	with decal measurem		Tank is rinsed well and pH of last sample from the tank is equal to pH of decalcified wate		tank w cleaned ethansl a	as with rd wa	iter NC	CAY	er
20	and tubing water unti going out c	external pump with decalcified l pH of water, of the pump and qual to pH of water	Pump is rinsed wel and pH of last sample from the tank is equal to pH of decalcified wate		Not de	me	Ne	CM	
21		external tank, pump with ater	Tank, tubing and pump are rinsed ar ready for further use	nd	Not c	lone	NC	СМ	)
22	B, Acid an by openin	stock A, stock ad Base tanks g electro valves in manual 4 minutes	Indicator of low level of liquid for a tanks can be seen from HMI	02/03/202 8:45 03/03/202 13:30	OVC.		С	CM X	
2́3	tanks is lo the rest of	el of water in the w, emptying of water manually ic cup and after te	No liquid can be observed on the bottom of the tank	02/03/200 \$`{50 s 03/03/2010 15:00	0K		C	CM .N	
24	stock B, A tanks with	n of stock A, cid and Base ethanol and h paper towel	Tanks are disinfected and no ethanol can be observed in the tanks	02/04200 \$155 032/	Only alig Ba For slock A B Ace no dove be	d cirol se with 1 and sto 34 CM V	valer C ck vcie	СМ	
					yone je	jou	•		

	eussa Co	M	ELiss/	Pilot	Plant	Universitat Auto de Barcelou	duoma	
	TEST	RECORD	SHEET	Type	Chrono	Page :	P	
		C	ompartment :		t Phase : 1	1	4/-+-	
25		of main nutrient soap and rinse mes with	Nutrient tank is cleaned with soa and ready for further manipula	3.03.2010 15:00-16.00	Tinsed with disbilled wate once	2 C	СМ	- 
26		nutrient tank with ed water until top sk	Approximately 2	3. <i>03.2010</i> 00 l <i>16.00</i>	Filled with distilled wat	in C.	¢М	, ,
27	water fro for pH me	3 samples of m nutrient tank easurements, pH g <i>Unu EC pharming</i>	pH is measured a will be a control point for further measurements	1.7.35	Sample 1 PH =753 sample 2 PH =7420 sample 3 PH =709F.9	EC =499 C EC =396 0=353 15/cm	M	
28	HPC1 liqu	sampling toop of id loop before B manipulations	8 Sampling loop is closed, values of and pH are not correct	EC 3.03.2010		is C une is AVA	M	
29	using pre-	on of KOH solution viously put on Protective It	4 kg of KOH for 2 L of water in nutrient tank	200		NC	СМ	
30		ernal pump mixing lving of KOH in the ank	KOH is complete dissolved in the nutrient tank, no pallet can be noticed in the nutrient tank			NC	СМ	DEV
31	solution f	3 samples of rom nutrient tank asurement	pH is measured a data will be used first experiment point	las		NC	CM.	
32		i nutrient tank ient tank líd	Nutrient tank is closed with screw	3:03,240 NS 17,30	, ØK	Ć	M	•
33		of irrigation in ode, water flow is	Irrigation is enab with given flow during 1 hour	17,45	flow route = 16,	L/min C	N	
34	Disabling	of irrigation mode	Irrigation mode i off	s 3/03/2010 s 18:50	OK	С	NT	

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*	NK NSSA	M	ELISSA	Pilot F	Plant	U B Universitat Autônc de Barcelona		
	TECT	RECORD	CUEET	Туре	Chrono	Page :	¥	
	IEƏLI	RECORD	JUELI	MPP-REC	10 -4101(0) - O.	AT S	17-	
		Cc	ompartment : C		Phase: 1	- 4		
35	solution fro	3 samples of om nutrient tank, asurements (1444 Swie Mungs DEV	pH is measured ar data will be the second experimen point		comple 1	28,5 10,3 C 110,5	N	
36	Empting of using drain	nutrient tank EP	Nutrient tank is almost empty but some liquid is observed on the bottom of the tan due to design of the tank	k 17:00	Below riusihe	С	СМ	there all notes
37	several tim decaleified measureme rinse until	nutrient tank hes with <i>distilled</i> water and pH ents after each pH value is equal point (see step	H of last sample taken from nutrie tank is equal to control point so ta is rinsed well	$\frac{17:30}{30} < \frac{17:30}{30} < 17$	Sample 1 $\pm pH - 9.58$ $EC = 50$ Sample 2 $\pm pH - 8.16$ $EC = 50$ Sample 3 $\pm pH - 7,56$ $EC = 7,56$ A + CH - 7,56 $EC = 7,56Sample 1 pH - 6,56 \pm CC = 7,56Sample 2 pH - 6,742 EC = 7,56Sample 3 pH = 6,39 EC = 7,56$	-3,02 - 1/-7,0/	M	* a flot, $\mu$ (main confi braditen (mas done sectore ab (2:40, but nicessary to do again, since (values vory) sample 1 $\mu$ = 2,34 somple 2 $\mu$ = 4,13 somple 3 $\mu$ = 7,27
38	decaleified	atrient tank with water and f irrigation mode utes	Rinsing of liquid loop from residue of KOH	s		NC	NT	$ \begin{array}{l} \textbf{F} \in C  o \in \mathcal{U} \setminus S \in \mathcal{U} \mid S \in \mathcal{U} \\  \forall v: v \in r = 0, 54 \text{ pryom} \\  \neq c  o \in \mathcal{M} : s = 0, 54 \text{ pryom} \end{array} $
39	from 3 ext module A a in total) ar	iquid samples reme spigots of and module C (6 nd from nutrient valve for pH ents	pH is measured ar data will be considered as 3d, and 5 <sup>th</sup> experimen points	4 <sup>th</sup>	<u> </u>	NC	VT	
40		of irrigation mode ing of nutrient	Irrigation mode is off, tank is almost empty		_	VC	VT	D.A. 8
41	until pH of	of steps No 38-40 the solution is ontrol value	pH of solution is equal to control value, so liquid lo is rinsed well fron KOH residues		· · · · · · · · · · · · · · · · · · ·	Ne	NT	
42	Taking of 3 distilled wa measureme	3 samples of ater and pH ent	pH is measured ar data will be the 2 control point	ıd d		10	NT.	
43	distilled wa	utrient tank with ater and enabling n mode for 15	Final rinsing of liquid loop			N	NT	- /

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<b>#</b> #	MELIS	SA Pilo	ot Plan	t		U M	tònoma	
	EST RECORD S	ucer	Туре	Reference	Chrono	Page	æ	
	LOI NEVOND d	717 <b>6</b> 6 6 1	MPP-REC	10 -4101(0)	Q1	16	64	
	Co	ompartment : (	CIVb Tes	t Phase : 1				
41	Repetition of steps No 38-40 until pH of the solution is equal to control value	pH of solution is equal to control value, so liquid is rinsed well fr KOH residues	l loop		•	M	NT	
42	Taking of 3 samples of distilled water and pH measurement	pH is measured data will be the control point				M	NT	
43	Filling of nutrient tank with distilled water and enabling of irrigation mode for 15 minutes	Final rinsing of liquid loop				M	NT	
44	Taking of liquid samples from 3 extreme spigots of module A and module C (6 in total) and from nutrient tank drain valve for pH measurements	pH is measured data will be considered as experimental po			. •	VC	NT	
45	Disabling of irrigation mode and emptying of nutrient tank	Irrigation mode off, tank is almo empty				NC	NT	bev. 8
46	In case pH of solution is equal to pH of distilled water, rinsing of liquid loop is finished. If it's higher	pH of water is e to 2d control po	vint,			NC		
	than 2d control point, repetition of steps No 43-45 until pH value is equal to control one.	rinsing of liquid is finished		-			NT	
47	Rinsing of external pump with decalcified water until pH of water, going out of the pump is equal to pH of decalcified water	Pump is rinsed w and pH of last sample from the tank is equal to of decalcified w	e pH			K	NT	
48	Rinsing of external tank and pump with distilled water, pH of water, going out of the pump is equal to pH of distilled water	Tank and pump rinsed and pH of sample from the pump is equal to of distilled wate	flast e ppH			W	NT	)

	US:A	MELIS	SA Pilo	ot P	lant	9 6			Autònoma velona	·
	CT D	ECORD S	LIEET	Тур	e	Reference	Chrono	Pa	<sup>ge :</sup> S	
. Raza	JI N		P B Baar Boor A	MP	P-REC	10 -4101(0)		-+	57/7	
		Co	mpartment : (	Ινь	Test	Phase : 1		L		- · ·
.9	probes from	f pH and EC m sampling loop ed water and el	pH and EC probe are rinsed and d					٨	Ľ	, <del>D</del>
Q	Leakage 1 injected ir in a closed (all sub-sy centrifuga excepted) 1500 ppm system to 1500 ppm allow time equilibrati passive air compensa is allowed decay thro chamber s hour perio leakage is the slope o 24 hour C	to a set-point of . Allowing the equilibrate at for 2 hours to 2 for on with the r pressure tion bags. $CO_2$ to passively bell over a 24 d. The rate of calculated as of a tangent to a	% Leakage of ( (relative to init value) per day less than 7% p day	CO <sub>2</sub> ial is		19:4 19:4 10:00 10:00 1415,5 1415,5 10:00 1415,5 10:00 11:23 10:00 11:23 10:00 1	10) - 13 102 (11) 102 (11) 1000 ( 1000 (	70,8 11 a toye 11 a toye 11 a toye 10 a (ppm) 12 (ppm) 12 (ppm)		Formatat: Sagnia: Exquerra: 0 cm Formatat: Subíndex Formatat: Subíndex Formatat: Subíndex
	value) per	elative to initial day ensors are calibi	EP cotod2			In order & Wills sowh Leakage a is 0, 3% 24hs shu	o place t seeds. for 5 ho then	ways wrs tow	Der	Formatat: anglès (EUA)

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Microbiological control of some locations?

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### MPP-REC 10-4101 (0)-01

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Conclusion for the Test	Name E.PERO	Signature Ehnjue Per	Date 30.04.10
Passed 🗆 Failed			
<ul> <li>Number of deviation</li> <li>All deviations have</li> </ul>			$\tilde{\mathcal{N}}$
Comments			2
Checked by	Name A.FOSPEN	Signature	Date 2/5/10
MELISSA Pilot Plant	HITCHEN	topach	2/1/20

## Appendix 1 for MPP-REC 10-4101 (0)-01

### Appendix 1 - record of implied personnel

Name	ORGANIZATION	Function	Initials
Natalia Tikhomirova	Visiting Researcher MPP	Plant Scientist	NT
Cynthia Munganga	MPP	Analysis Technician	CM
Enrique Peiro	MPP	Technical manager	ŧP
*			

Pope 1/1

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Appendix

Appendix 2 - record of calibration certificates for the test instruments

description		Inv. number	Laubration record	Date of	Calibration valid	Signature
pH sensor	AT_4107_01		NT Logbook	01.03.10	Novel tect	
Electrical	AT_4108_01		NT Logbook	01.03.10	61 1	
Conductivity of			)		NECT ASI	
nutrient						
Humidity A1	AT_4112_01					
associated with			INTATIUTACUUTET	26.09.07		
temp A1			certuricate			
Humidity B1	AT_4112_02					
associated with			INTAILUI ACIUTET	26.09.07		
temp B1			certuicate			
Humidity C1	$AT_4112_03$					
associated with			Manuracturer	26.09.07	22.	
temp C1			ceruncate		B/ .0/	J.
CO2 Analyser	AT_4113_01		TN 96.11	23.07.09		
O2 Analyser	AT_4113_02		TN 96.11	23.07.09		
CO2 Mass	FQRC_4113_01		Manufacturer	16 00 07		
Flow	99 P.C.		certificate	10.00.01		
Outlet nutrient	FT_4106_01		Manufacturer			Manage
flow sensor			certificate			
Air velocity	FT_4111_01		Manufacturer			
sensor			certificate			
Pressure sensor	PT_4102_01		Manufacturer	26.06.07		
for airlock A	1,11,11,11,11,11,11,11,11,11,11,11,11,1		certificate	·		
Pressure sensor	$PT_4103_01$		Manufacturer	26.06.07		
for airlock C			certificate			Ľ,
> Reaffected to						
External						f K
Pressure						ī

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	:				-							5/2
							N. C.					
26.06.07	26.06.07	26.06.07	26.06.07	26.06.07	26.06.07	July 2009		July 2009	26.09.07	26.09.07	26.09.07	26.09.07
Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	NTE-HPC_HVAC- RP-004	NTE-HPC_HVAC- RP-004	NTE-HPC_HVAC- RP-004	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate
PT_4114_01	PT_4114_02	PT_4114_03	PT_4114_04	PT_4114_05	PT_4114_06	RT_4104_01	RT_4104_02	RT_4104_03	TT_4105_01	TT_4105_02	TT_4105_03	TT_4109_01
Growing Area Pressure	PAR Sensor - A	PAR Sensor - B	PAR Sensor - C	Light Loft Temperature sensor A	Light Loft Temperature sensor B	Light Loft Temperature sensor C	Temperature sensor for solution reservoir					

Pape 2/4

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	Video				- 								NT V	B	Ċ.
						82									
							102								
ro- (	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	
ro- (a) 101 h -01	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer	
NDP-REC															
MN											-				
Dependix Z for MOP-REC	TT_4112_01	TT_4112_02	TT_4112_03	TT_4112_04	TT_4112_05	TT_4112_06	TT_4112_07	TT_4112_08	TT_4112_09	TT_4112_10	TT_4112_11	TT_4112_12	TT_4112_13	TT_4112_14	
	Temperature A1 associated with humidity	Temperature B1 associated with humidity	Temperature C1 associated with humidity	Temperature A2	Temperature A3	Temperature hambient	Temperature B2	Temperature B3	Temperature B4	Temperature C2	Temperature C3	Temperature ambient	Temperature for facility chilled water	Temperature	

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for facility hot water line Chilled coil T					
		certificate			
urface	TT_4112_15	Manufacturer	26.09.07		
		certificate			
temperature					
Heating coil T	TT_4112_16	Manufacturer	26.09.07		
surface		certificate		0	
temperature					
Outlet Air, T	TT_4112_19	Manufacturer	26.09.07	132/	
chilled		certificate		2	
exchanger					
Outlet Air, hot T	TT_4112_20	Manufacturer	26.09.07	- Tribura	
exchanger		certificate			
Inlet water T	TT_4112_21	Manufacturer	26.09.07		
Chilled		certificate			1
Exchanger				•	7 /
Inlet water Hot T	TT_4112_22	Manufacturer	26.09.07		
Exchanger	-	certificate			у Д

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Appendix 3 for MPP-REC 10-4101 (0)-01

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Appendix 3 - deviations list

	<u> Appendix 3 - deviations list</u>			
DEV. FORM #	Deviation: Preperchian of 1.5L Ethend in ste of 3L Corrective action:	ind	(1 M	ticality ow edium High Due date
	Take into account in the new ver of the protocol (End COOQ)	-570-	EP	Endo COO9
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Clos	ng Date
DEV. FORM	Deviation: Mask apainst vapours was not use as the pood ventilation of the allowed air removal	d	L	LOW
2	as the pood ventilation of the	room		edium) High
	Corrective action:		Resp.	Due date
	Reminder in safety meetings; reconsider the need in new version the protocol (End COOQ)	ol	Ē	End 0/ 0009
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Clos	ng Date
	,			
DEV. FORM	Deviation: Difinfection with NoOH/KOH we	s not		icality
#	performed according to was apor	eed		.ow edium)
3	performed, according to was aport with ESD (Ref. MOH-10-4101-AF-20100302	)	- H	ligh
	Corrective action:		Resp.	Due date
	Tette into account in the new of the protocol (End COO9)	ed non	P	Erido COO9
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Closi	ng Date

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Appendix 3 for MPP-REC 10-4101 10) - 01

Appe	endix	3 -	deviations	list

<u>Appendix 3 - deviations list</u>			
Not only PH but dos FC mean	revent	0	icality .ow edium
was taken.			ligh
Corrective action: Take into account the potential of this EC meas. in the new version i protocol (End COO9)	of the	Resp.	Due date End of COD9
Corrective action performed and checked: Ref. of retests:	Checked / approved by	Clos	ng Date
Deviation: See diviction 3			licality ow edium
Corrective action:		Resp.	Due date
Corrective action performed and checked: Ref. of retests:	Checked / approved by	Clos	ng Date
	Not only pH but also FC mean was taken. Corrective action: Take into account the potential of this FC meas. in the new version of protocol (End COO9) Corrective action performed and checked: Ref. of retests: Deviation: See deviation 3 Corrective action: N.D.	Not only pH but also FC measurement was taken. Corrective action: Take into account the potential need of this EC meas. in the new version of the protocol (End COO9) Corrective action performed and checked: Ref. of releasts: Deviation: See diviation 3 Corrective action: N.A.	Not only pH but dos EC measurement Was taken. Corrective action: Take into account the potential need of this EC meas. in the new version of the protocal (End COOG) Corrective action performed and checked: Ref. of retests: Deviation: See diviation 3 Corrective action: N.D. N.D.

dev. form #	Deviation: See deriction 4		L	icality ow edium ligh
	Corrective action: N・ム 、		Resp.	Due date
		cked / roved by	Closi	ng Date

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Appendix 3 for MPP-REC 10-4101 (0)-01

	Appendix 3 - deviations list			
DEV. FORM #	Deviation: Rinsing of untrient tent with distilled water in stead of decalcifie	d water		icality .ow edium figh
	Corrective action:		Resp.	Due date
	Take into account in the new of the protocol (End of COOQ)	version	EP	End of COOP
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Clos	ng Date
DEV.	Deviation:	I	Crit	licality
FORM #	See Deviation 3		M	.ow edium High
	Corrective action:		Resp.	Due date
	$N$ , $\Delta$ .			
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Clos	ng Date
DEV. FORM #	Deviation: The leak test was performed duri	J	L	icality .OW

DEV.	Deviation:		Cri	ticality	
FORM #	The leak test was performed duri	ef.	L	ow	
9	Shours instead of the 24 h foresee	й <sub>.</sub>		edium	
A second	The leak test was performed during Shours in stead of the 24 h foresee (can be acceptable if the measurementand is	at are		ligh	
	Corrective action:		Resp.	Due date	1
	Write an operating procedure def in detail the conditions for the leak before the staffered culture campai	vine test	EP	October	-
	before the staffered culture compai	fu		Zott.	EO ID
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Clos	ing Date	
Operating procedure issued on op February ZOII (MPP-OP-11-4103) EP				dz. 11	
<b></b>	Jannary				-

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Appendix 3 for MPP-REC 10-4101 (0)-01

	<u> Appendix 3 - deviations list</u>			
DEV. FORM 7	Deviation: The validity period for the calib of instruments is not defined	ovethen	Critical Low Med	dium
NO			High	
	Corrective action: To establish an HPCI maintene plan, including the validity period each caliboration performed on the	uce for feuforr.	Resp. R.H EP	Due date Before Storger
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Closing	Date
EV. ORM	Deviation:		Critical	ity
			Low Mec High	lium
	Corrective action:		Resp.	Due date
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Closing	) Date
EV. ORM	Deviation:		Criticali	
			Med High	
	Corrective action:		Resp.	Due date
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Closing	Date

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				уре	Reference	Chrono	Ι	age	:
TE	ST RE	ECORD S		APP-REC	10 -4101(0)	02	1	/6	
		Co	mpartment : CIVb	Test	: Phase : 1				
Test	t title : Pre	eparation of the	e chamber						
Obje	ctives:								
Appl	icable test p	lan and test proto	ocols TN-101.	2					
Hard	ware: HPC1	compartment and	d control system						
Pers	on responsib	le for the test : N	latalia Tikhomirova						
-clea	an with distil		es inside HPC1+HVAC oop of HPC1 Expected results /	Date /	Observ	red results	/	C/	Initia
No.		description	Nominal behaviour	Hour	calculated	/ remarks Deviation		NC	
1	module for	n 1 MH lamp per manipulation	Lamps are switched on and environmental conditions in HPC1	02:02:10 12:30	An Link	ed ou p with t	Devi te	)C 8	c٢
	inside the c	hamber	allow to perform manipulations inside the chamber	(1min)	lamps Room we	in the H	pc1 gh		
		Equipment:	Personal Protective Equipment is put on Operator is ready to				•	С	Cr
			T UDERALOF IS FEAOV TO	1					
2	safety shoe	ean lab coat, es, gloves, shoe irnet_clean lab	perform cleaning	05.05.10					
2	safety shoe			05.05.10 (5 min)					
2	safety shoe covers , ha trousers Removal of	s, gloves, shoe	perform cleaning manipulations inside the chamber Aluminium air balancing panels are removed in order to	05.05.10 (5 min) 15:50	-			с	CM
	safety shoe covers , ha trousers Removal of	s, gloves, shoe irnet, clean lab aluminium air	perform cleaning manipulations inside the chamber Aluminium air balancing panels are	05.05.10 (5min) , 15:50				С	C٢
3	safety shoe covers , ha trousers Removal of balancing p HPC1 1.Demountir of spigots	s, gloves, shoe irnet, clean lab aluminium air	perform cleaning manipulations inside the chamber Aluminium air balancing panels are removed in order to enter inside the chamber for free manipulation 1. Tips are removed and can be	05.05.10 (5 min) , 15:50 05.05.10 (15 min) 16:30				c c	CM
<u>,</u>	safety shoe covers , ha trousers Removal of balancing p HPC1 1.Demountir	es, gloves, shoe irnet, clean lab aluminium air banels out of ng of plastic tips for further	perform cleaning manipulations inside the chamber Aluminium air balancing panels are removed in order to enter inside the chamber for free manipulation 1. Tips are removed	05.05.10 (5 min) 15:50 05.05.10 (15 min)					

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	EST RECORD S	LIEET	Ту	/pe	Reference	Chrono		Page	•
		7 R. A. Jaco Real 2	Μ	IPP-REC	10 -4101(0)	<u>02</u>	2	2/6	
	Co	mpartment : Cl	Vb	Test	Phase:1				
6	Cleaning of the bottom inside the chamber with vacuum cleaner	No dust can be observed inside th chamber	he	15:35 05.05.10 (1h)			·	c	GY
7	Preparation of 1.5 L of 70% ethanol, filling of bottles with sprayers for disinfection of surfaces in HPC1	There is no proble with supply of ethanol in sufficie quantity from department, tool are ready for disinfection	ent	10::00 06:05:10 (smin)				С	CM
8	Preparation of the chamber inside for disinfection: taking trays out of the chamber	Chamber is ready for entering insid and disinfection of the surfaces	е	10:05 06:05:10	TRAYS WE out on 10.05.10 ->	12h = 12h	ng Apail 30	С	СМ
9	Putting on mask against vapours and disinfection of all accessible surfaces inside the chamber with ethanol	All accessible surfaces in the chamber are trea with ethanol	ted	10:15 06.05.10 (1h)	4			С	CM
10	Disinfection of HVAC surfaces Stainless Steel	All accessible surfaces in HVAC HPC1 are disinfected with ethanol	of	11h 15 06.05.(0 (25mm)				C	CM
11	Disinfection of stainless steel air balancing panels with ethanol outside of the chamber	Panels are disinfected and ca be placed back in the chamber		11 <sup>th</sup> 40 06.05.10 (20 min)					
12	Placement of aluminium air balancing panels on the bottom of the chamber to their nominal position preliminary putting on disposable shoes covers	Aluminium air balancing panels placed in their nominal position	are	17 <sup>h</sup> 00 06-05-10				C	RM
13	Connecting of spigots plastic tips	Tips are connecte to spigot at their nominal position	d	16:50 06.05.[0				С	RM
14	Placement of trays, preliminary cleaned with soap, inside the chamber	Trays are placed i the chamber in th nominal position		42:4 12:45 10.05.10	Trays we cleaned April.	ene priet on first	iminary 01	С	СМ

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			Ту	pe	Reference	Chrono	Page	•
	EST RECORD S	MEEI	M	IPP-REC	10 -4101(0)	02	3 / 6	
	Cor	mpartment : C	IVb	Test	Phase:1	II		
14	Emptying stock A, stock B, Acid and Base tanks by opening electro valves from HMI in manual mode for 4 minutes	Indicator of low level of liquid fo tanks can be see from HMI		.16:00 06.05.10 (4min)			С	СМ
15	When level of water in the tanks is low, emptying of the rest of water manually with plastic cup and after with pipette	No liquid can be observed on the bottom of the ta	nks	76:10 06:05:10 (10 min )			C	CM
16	Disinfection of stock A, stock B, Acid and Base tanks with ethanol and drying with paper towel	Tanks are disinfected and r ethanol can be observed in the tanks	10	86 05.05.10 <del>13:45</del> 16:15 (2mix)			С	сп
17	Cleaning of main nutrient tank with soap and rinse several times with decalcified water	Nutrient tank is cleaned with soa and ready for further manipula		06.05.10 16:20 (20min)		-	C	СМ
18	Filling of nutrient tank with distilled water until top of the tank	Approximately 2	00 L	16:45 06.05.10 (20 muir)			C	сM
19	Taking 3 samples of distilled water and pH, EC measurements	Done		amin)	$PI_1 = 8_13$ $PI_1 = 8_10$ $PI_2 = 7_18_1$	4 62=1 4 63=1	1,36 ps lonc 103 ps lon	cM
20	Taking of 3 samples of water from nutrient tank, pH, EC measurements	Done		17:02 06:05-10 (1 min)	$P_{H_{1}} = 7,98$ $P_{H_{2}} = 7,91$ $P_{H_{3}} = 7,91$	$\begin{aligned} G_{C,1} &= \\ G_{C,2} &= 1\\ G_{C,2} &= 9\\ G_{C,3} &= 9 \end{aligned}$	52,44,25(cm 8,44,25(cm 21,45(cm	CM
21	Closing of nutrient tank with nutrient tank lid	Nutrient tank is closed with screw	ws	17:07 06-05-10 (3muní)			C.	СМ
22	Putting on Personal Protective Equipment: goggles, clean lab coat, safety shoes, gloves, shoe covers , hairnet, clean lab trousers and entering into the chamber with several	Done		10:00 12:50 07.05-10 (1,5 mm)	At 10'0 escape f collector a bag ins the hole of	clock w poin the v because 1 allahou 16 main	nater marin of rolledor	CM RM

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			Туре	Reference	Chrono	P٤	ige	
	EST RECORD S		MPP-REC	10 -4101(0)	QZ	4	/ 6	<u></u> .
	Со	mpartment : CI\	/b Test	t Phase : 1		<u> </u>		
	sheets of paper, placement of paper under connection of main collector	10:10/13:11 07.05.20 (2min)				1	С	RM
3	Enabling of irrigation in manual mode, water flow is 15 L/min	Irrigation enabled flow =15L/min Duration :1hour	10:17 07.05.10 (14)	13:45 07.05.10	/ 17:00 / 10:05. 18:08	0 10	C	СМ
4	Disabling of irrigation mode	Irrigation mode is off	15:11 07.05.10				C	М
25	Taking of 3 samples of solution from nutrient tank for pH and EC measurements	pH is measured an data will be the fin experimental poin	rst 02.05.10	$PH_{4} = 6_{1}50$ $PH_{2} = 6_{1}7$ $PH_{3} = 6_{1}79$	+ & 1= 9 & 2= 9 & 2=	Sl14 pston 5814 pston 5916 pstu	r C m	СМ
.6	Empting of nutrient tank using drain valve	Nutrient tank is almost empty but some liquid is observed on the	15:15 07.05-10				C	сл
		bottom of the tan due to design of th tank						
7	Rinsing of nutrient tank several times with distilled water and pH, EC measurements after each rinse until EC value is not higher than 20 µS/cm	Done	15:45 07:05:10 17:15 10105110 18:20	$PH_{A} = 8_{1}7$ $PH_{Z} = 6_{1}92$ $PH_{Z} = 7_{1}25$ $E_{C1} = 5_{1}71$ $E_{C2} = 6_{1}95$ EC	$\begin{array}{l} F(1) = \\ F(2) = \\ F(3) $	20,64/5 31,8125/144 16,54125/1	č An	СМ
8	Entering into the chamber and checking the paper under the main collector whether it is dry or wet.	Done	13:00 07.05.10 18:00	+ <del>cr ( - 1/23</del>	,		C	СМ
9	In case the paper is wet, performance of main collector sealing and check the leak again until no leaks can be observed	No leaks	11:00 10:05:10 12:00	It was a paper was there was the main ca RGT scaled	water d	own	Ċ	RM
0	Cleaning of 120-L external tank with soap and rinsing with distilled water	Tank is clean and ready for further manipulation	5/05/2010 20:30			e	)	M

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	ET DECODD		Ty	pe	Reference	Chrono		Page	:
	ST RECORD	DHEEI	M	PP-REC	10 -4101(0)	<u>02</u>	ى	5/6	
	C	ompartment :	СІУЬ	Test	Phase: 1				
31	Taking samples from several locations in the chamber for further microbiological analysis			13:00 (0-05.10 13:30				С	СГ
	Chamber Shell Integrity Leakage Test. $CO_2$ is injected into the chamber in a closed configuration (all sub-systems off, main centrifugal blower			18:50 01.05.10 19:15	at all. the CO2	the decrea	ule osca De	C Z	
ars sr) ak * well } <b>32</b>	excepted) to a set-point of 1500 ppm. Allowing the system to equilibrate at	% Leakage of (relative to ini value) per day less than 7% p day	tial is		Au othe should be co2 shou in manue to 1500 2h and shop the and see	e done	ted de	9	
	chamber shell over a 24 hour period. The rate of leakage is calculated as the slope of a tangent to a 24 hour CO2 curve,			9:25 11-05-10	Switch	on CG= blower=	- ISOS PP Autos		a
	expressed as % Leakage of CO2 (relative to initial value) per day			11:25 12.05.10 11:25-1	switch The lest 2.31' 25	off of ( was a su ly 4,4 haves.	Dz aess 7. per	C	C
33	Disconnection and cleaning of condensate tank with soap and water, after with ethanol. After mounting back of the condensate tank	Done		45:30 07.05.10				С	RI

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4	MPP-REC 10-1	101 (0) -02		
Conclusion for the 1	Test Name E.PERO	signature Ehriftet Perty	Date 30,06,10	
Passed 🗆 Failed				
<ul> <li>Number of dev</li> <li>All deviations</li> </ul>	riations attached to the have been justified or (	ocument: 🖳 3 corrected ? YES 🎢	AF 36/10 NO	
Comments			<u> </u>	
Checked by MELISSA Pilot Plant	Name A . FOSTEN	Signature Stort	Date 30/6/10	

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# Dependix 1 for \$ MPP-REC 10-4101(0)-02

### Appendix 1 - record of implied personnel

ORGANIZATION	Function	Initials,	
Visiting Researcher MPP	Plant Scientist	N	
MPP	Analysis Technician	CM	
МРР	Technical manager	EP	
		·····	
	Visiting Researcher MPP MPP	Visiting Researcher MPPPlant ScientistMPPAnalysis Technician	Visiting Researcher MPP       Plant Scientist       M         MPP       Analysis Technician       CM

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Appendix

<u>Appendix 2 - record of calibration certificates for the test instruments</u>

					31	
Instrument description	HPCI IAG	Inv. number	Calibration record reference	Date of calibration	Calibration valid until	Signature
pH sensor	$AT_4107_01$		NT Logbook	05.05.10	Next test	
Electrical	AT_4108_01		NT Logbook	05.05.10		
Conductivity of nutrient					Next trol	
10, 10, 10, 10, 10, 10, 10, 10, 10, 10,						
Humidity A1 associated with	A1_4112_01		Manufacturer	26.09.07	•	
temp A1			certificate			
Humidity B1	$AT_{4112}02$		Manufactured			-
associated with temp B1			certificate	26.09.07		
Humidity C1	AT_4112_03				2	
associated with			Manutacturer	26.09.07		
temp C1			certificate		) R	
CO2 Analyser	AT_4113_01		TN 96.11	23.07.09	X A	
O2 Analyser	AT_4113_02	-	TN 96.11	23.07.09		
CO2 Mass	FQRC_4113_01		Manufacturer	16.08.07		
Flow			certificate	10.00.01		
Outlet nutrient	$FT_4106_01$	-	Manufacturer	-		
flow sensor			certificate			
Air velocity	FT_4111_01		Manufacturer			
sensor			certificate			
Pressure sensor	$PT_4102_01$		Manufacturer	26.06.07		
for airlock A			certificate			
Pressure sensor	PT_4103_01		Manufacturer	26.06.07		
for airlock C			certificate			
> Reaffected to						-
External						L)
Pressure						

Ferly

												ER L
							\$ 4	20				
26.06.07	26.06.07	26.06.07	26.06.07	26.06.07	26.06.07	July 2009	July 2009	July 2009	26.09.07	26.09.07	26.09.07	26.09.07
Manufacturer certificate	Manufacturer certificate	Manufacturer dertificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	NTE-HPC_HVAC- RP-004	NTE-HPC_HVAC- RP-004	NTE-HPC_HVAC- RP-004	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate
PT_4114_01	PT_4114_02	PT_4114_03	PT_4114_04	PT_4114_05	PT_4114_06	RT_4104_01	RT_4104_02	RT_4104_03	TT_4105_01	TT_4105_02	TT_4105_03	TT_4109_01
Growing Area Pressure	PAR Sensor - A	PAR Sensor - B	PAR Sensor - C	Light Loft Temperature sensor A	Light Loft Temperature sensor B	Light Loft Temperature sensor C	Temperature sensor for solution reservoir					

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02						8 6	AND AND							
zo- ( o) rorn -ar	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07
	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer
2 for MOD-DEC														
Appendix	TT_4112_01	TT_4112_02	TT_4112_03	TT_4112_04	TT_4112_05	TT_4112_06	TT_4112_07	TT_4112_08	TT_4112_09	TT_4112_10	TT_4112_11	TT_4112_12	TT_4112_13	TT_4112_14
	Temperature A1 associated with humidity	Temperature B1 associated with humidity	Temperature C1 associated with humidity	Temperature A2	Temperature A3	Temperature hambient	Temperature B2	Temperature B3	Temperature B4	Temperature C2	Temperature C3	Temperature ambient	Temperature for facility chilled water	Temperature

Ref 3/4

for facility hot		hartificate		Weight of the second se	
 2					
L	TT_4112_15	Manufacturer	26.09.07		
		certificate			
temperature					
Heating coil T	TT_4112_16	Manufacturer	26.09.07		
		certificate		(	
temperature					
Ţ	TT_4112_19	Manufacturer	26.09.07	26	
		certificate		22	
				A	
Outlet Air, hot T	TT_4112_20	Manufacturer	26.09.07		- And
		certificate			
L	TT_4112_21	Manufacturer	26.09.07		
		certificate			
				• =	
Inlet water Hot T	TT_4112_22	Manufacturer	26.09.07		N N
		certificate			ft /

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Appendix 3 for MPR-DEC 10-4101(0) - 02

Appendix 3 - deviations list

	<u> Appendix 3 - deviations list</u>			
DEV.	Deviation:	. > . 0	Criticality	
	Lights not switched on for clean as natural illumination was end from the room, and the ventilet	with	Medium	
1	from the your and the ventilet	why was	High	
	Gorrective action:	di fisus	Resp. Due date	
		neus		0
	d'has of the protocol to have	ventile-	EP Endo	ļ
	Take in to account in the n edition of the protocol to have tion on when lamps are used (end	of COD9)	C009	
	Corrective action performed and checked:	Checked /	Closing Date	
	Ref. of retests:	approved by		
DEV. FORM	Deviation: Dear of module ( not well closed,	so the	Criticality LOW	
	Door of module C not well closed, leak test failed.	-	Medium	
2	N N		High	
	Corrective action:		Resp. Due date	
	close tight the door of arboe then perform a new leak test.	кC,		_
	then perform a new leak test.		NT 07.05.10	נ
	Corrective action performed and checked: Ref. of retests:	Checked /	Closing Date	
		approved by		
	Action performed on the spot.	EP	28.0G.10	
			]	
DEV. FORM	Deviation:		Criticality	
	The validity period for the calibrance	Jen -	Low Medium	
3	The validity period for the calibrative of metroments is not defined		High	
	V Converting action:		Resp. Due date	
	To establish on HPCI memterance	e plan,	0. Before	
	including the validity period for	each	KM the	e d
	To establish on HPCI mentance including the validity period for celibration performed on the ter	reacs	EP culti	~~ ~ 1
	Corrective action performed and checked:	Checked /	Closing Date	د_•
	Ref. of retests:	approved by		

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TE	IS1	RECORD SH	Ty Ty	pe	Reference	Chrono :	Page	:
			МР	P-REC	10 -4102(0)	01	Λ	77
		Соп	partment : CIVb	Test P	hase : 2			
Tes	t title	e : Seedlings phase	-					
Obje	ctive	5:						
								•
Appl	cable	test plan and test protoco	IS TN LOL .2	7				
Harc	ware:							
Pers	on res	ponsible for the test : Nata	lia Tikhomirova		<del></del>	1		
Test	prere	quisites : phase 1 nominal	y executed					
							•	
tep No.	Day No.	Action description	Expected results / Nominal behaviour	Date / Hour	calculated	f results / / remarks - Deviation	C/N C	Initials
1	0	Sterilization of 2 flats of rockwool small cubes - Grodan AO 36/40 6/15W	Rockwool flats are sterilised and ready fo seeds sowing	or 3/03/00 16:20	OK		°C.	СМ
		using following procedure for Rockwool safe manipulation: OP- 10-4101 (0)		<i>A V</i> · <i>K V</i>				
2	0	procedure for Rockwool safe manipulation: OP-	30 minutes at 120°C	3103110	oK		C	СМ
2 3	0	procedure for Rockwool safe manipulation: OP- 10-4101 (0) Sterilization of 1 litre of distilled water in autoclave Sterilization of 10-litres tanks for stock A and stock B (2), 20-litres tank for seedlings solution in autoclave	30 minutes at 120°C 30 minutes at 120°C	3103110 16:20	ок		c	CM CM
		procedure for Rockwool safe manipulation: OP- 10-4101 (0) Sterilization of 1 litre of distilled water in autoclave Sterilization of 10-litres tanks for stock A and stock B (2), 20-litres tank for seedlings solution in		3/03/10 16:20 02/03/10 17:00	ok			

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	ŧs٦	record sh		Туре		Reference	Chrono :	Page	:	
	1			MPP-	REC	10 -4102(0)	01	2	17	1
	1	Con	npartment : (	СІУЬ	Test Pl	nase : 2				
		(until bleach covers all the seeds)								-
6	0	Placement of the seeds into a sieve and rinse with 1 L of distilled sterile water	Seeds are ster some lost of c be observed treatment wi	olour can I due to	4/03/10 16:206			С	M	
7	0	Sterilization 2 seed germination trays with 70% ethanol and paper towel	No ethanol observed on	the trays	4/03/00 15:52- -16:06			C	N	
8	0	Placement of 2 flats of rockwool small cubes - Grodan AO 36/40 6/15W into 2 seed germination trays	Each tray mus 98 cubes	t contain	4/03/10 16:06- 16:36			C	N	
9	0	Using tweezers, placement a single lettuce seed in each hole of Rockwool cubes	Attention shou paid during pr seeds sowing i not to sow mo seed per cube miss any cube	rocess of in order ore than 1 and not	4/03/00 16:37- -17:13			C	NO	
10	0	Measurement of pH of irrigation solution for seedlings, in case it's 5.8-5.9, watering of Rockwool cubes with this solution. If pH is higher	pH of seedling solution is 5.8 Rockwool cube wet, but not overwatered ( beneath Rocky	is -5.9, es are no liquid	4/03/10 EVIA 12:40	рH=6,	04	C	NAT CM	- - -
		than 6.0 or lower than 5.8 addition of about 1 mL of 0.5M HNO <sub>3</sub> or 1mL of 0.5M KOH (depending on pH if it's low or high) to the 10L of the solution, mixing well and checking of pH again. Repetition if necessary until pH is about 5.8-5.9.			19					
11	0	Taking photos of the trays.	Day <sub>0</sub> of crop te (Rockwool she without seedli	ets ngs)	4/03/10  7:17			C.	NT	
2	0	Addition of a plastic tray cover to each tray	Trays are cove order to maint humidity inside tray and enhar germination	ered in ain e the	4/03/10 17:17	: ·		C	15	

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T	<b>S</b> T	RECORD SH		Type		Reference	Chrono :	Page	-		
	l			MPP-	REC	10 -4102(0)	01	3	17		
		Com	partment : Cl	VЪ	Test Pl	nase : 2	· ·· · · ·	L		٦ ₹	R.
13	0	Activation of Schneider	Schneider contro		4/03/10	- In honor - 1	plut is off	,	{Su	primit: contoller	•
		controller of HPC1. Light mode: auto, 1 MH and 1 HPS lamps per module on. Day time - 16 hours, night time - 8 hours. Fan Mode: auto. Temperature and humidity mode: auto. T day and night set points = 20°C, day Rh =50%, night Rh=70%. Air Blower Mode: auto.	activated with environmental conditions set pu used for seeds germination and seedlings growth <u>Expected</u> measurements of sensors? EXALL WALLS FOR MARKED	n Bed Selasors DONE	17:08	Value of for pusclu = 125, for puscluse = 0 ME present for multice corr in puscle of multice of multice of multice mul	$ \begin{array}{c} \downarrow & \downarrow \partial A \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ \downarrow & \downarrow &$	C	, M	primit: contoller	
14	0	Placement of the germination trays into HPC1 and closing of the doors from both sides of HPC1.	Chamber is close all conditions in chamber corresp conditions for se germination	the cond to	4/03/10 18:25	Mal. A: 2 Ray star Ray end	430	C	NT		•
15	1	Opening of the chamber, taking photos of the trays with plastic cover and after without the cover,	Day <sub>t</sub> of crop test	t	<b>5</b> /03/90 10:36- 10:41-7	ОК		C	NT	-	
6	1	In case not more than 60% of seedlings in each tray can be observed , addition of plastic cover and closing the chamber	Check of seedlin germination, rep the afternoon		<b>5</b> /03/10 10:47	No seed be seen	Tings (agn	С	NIT	-	
17	1	In the afternoon checking of the seeds germination again. If more than 60% of seedlings are observed opening of the trays. If not the trays are left covered until next day	Check of seedlin germination		<b>5</b> ]03/10 18:35	No see can be	edling s seen	Ċ	dXT		
18	2	Opening of the chamber, taking photos of the trays with plastic cover and after without the cover.	Day₂ of crop test		1103110 20:30	to 1. 0 j ion be I couldn't	scedling seen taike phoho	C	СМ	The MO 2	ak 2
9	2	In case not more than 60% of seedlings in each tray can be observed , addition of plastic cover and closing the chamber	Check of seedlin germination, rep the afternoon		6/03/10	NO Chel Sadard Carly for	k as it i ay and to permination	SNC		DEN 1 EP	

F	, 1	×					•			· P
M		ssa - Me	Lissa	Pile	ot∵Pl	ant	Universit		<b>3</b> noma	ula formatada
	<b>N</b>							arcelona		
TI	ŧs⁼	record sh	IEET	Туре		Reference	Chrono :	Page	:	
			·	MPP-	REC	10 -4102(0)	01	- 4	17	-
		Con	npartment : CIV		Test P	hase: 2				
	2	In the afternoon checking of the seeds germination again. If more than 60% of seedlings are observed opening of the trays. If not the trays are left covered until next day	Check of seedlin germination	gs			· · · ·	AC	СМ	Dev.1
21	3	Checking the seeds germination and if more than 60% of seedlings are observed in each tray opening of the trays (taking out the plastic covers).	By this day usual germination percentage is mo than 60% per tra plastic covers ca removed from th	ore y and n be	7/3/10 20:50	70% 07 Could be	scentling scent	C	CM	
22	3	Taking photos of both trays	Day <sub>3</sub> of crop test		7.03.10	Nee me	78	C	CM	
23	3	Checking of pH of the seedlings nutrient solution and in case it's 5.8-5.9, watering Rockwool cubes with this solution, approximately 900 mL per each tray. Regulation of pH with acid or base in case it is higher than 6.0 or lower than 5.7 (see step No.10)	pH of seedlings solution is 5.8-5. Rockwool cubes a wet, but not overwatered (no beneath Rockwoo	are liquid ol)		Rockwa wet and bo water plassic were tem	h is ho held (since covers hoven boday	NC )	СМ	Dev.2
24_	-4	Taking photos of both trays	Day₄ of crop test		8 103/10	ok		C	15	
2	ļ				11:28	ļ			101	
25	4	In the afternoon watering of the plants with the solution if necessary, approximately 500 mL per tray.	Rockwool cubes a wet, but not overwatered (no beneath Rockwoo	liquid	\$[03]10 [4]:30	soomL seedlings per eac	ot solution h tray	, C	NT	
26	5	Taking photos of both trays. Watering of the plants with the solution if necessary	Day <sub>5</sub> of crop test. Rockwool cubes a wet, but not overwatered (no beneath Rockwoo	are liquid	9[03[10  3:31	DH 07 5800 = 6; 0,2 vatured Vig 500 mL of Sol jings one obs frag-1100 mL	ting solution but bray with -1, 94 seed end, 144 +3 seddings	1= C h -	NT	
27	6	Cutting of polypropylene film for trays covering against algae growth at maturity phase	198-stripes using template		10/03/10 10:00 - -14:20	,	0	C	Й	

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8 <i>6</i> /		у С	licea	Dila4.I	Nan4	U			ıla formatada
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TE	:ST	RECORD SH	EET	Туре	Reference	Chrono :	Page		-
ĺ				MPP-REC	10 -4102(0)	01	5	17	
		Com	npartment : CIV	'b Test	Phase : 2				
28	6	Taking photos of both trays. Watering of the plants with the solution if necessary	Day <sub>6</sub> of crop test Rockwool cubes a wet, but not overwatered (no beneath Rockwoo	are 15:2 liquid	10 hipter bray 21 ubb waber one is wax gooml of	sered with	C	IT	
29	7	Checking of pH of the seedlings nutrient solution and in case it's 5.8-5.9, watering Rockwool cubes with this solution, approximately 900 mL per each tray. Regulation of pH with acid or base in case it is higher than 6.0 or lower than 5.7 (see step No.10)	pH of seedlings solution is 5.8-5. Rockwool cubes a wet, but not overwatered (no beneath Rockwoo	9, <i>11/03</i> are /4!0 liquid	Sud lings Sud lings HS sead in Watered With 650 Hutter Sud for Sud obset	es are drive (eft fray m C off so seed/sups 73 seedings	ved,	NT Ni Sha	
30	7	Taking photos of both trays.	Day <sub>7</sub> of crop test.	14:0	0.		C	NT	
31	7	Addition of stock A, stock B, acid and base solutions into the appropriate tanks until a mark on each tank	Tank are filled fo maturity test star				C	NT	
32	7	Addition of 1.3 litres of stock A and 1.3 litres of stock B into the 120L external tank, mixing thoroughly solution in the 120L external tank using a pump	Solution is mixed ready for transfe HPC1 nutrient tar	r into 11.03	1,36 o Were ac the exte	1B Ided in	C	CM	
33	7	Transfer of 120 liters of the nutrient solution from external tank into HPC1 nutrient tank using a pump	Solution is transfe without any leak <u>Expected</u> measurements on sensor?	i level	10 120 L u transf in the e tank(i	uas erred rutrient no nore 40 we have to	C	(M lab)	anafter
4	7	Addition of 40 liters of distilled water into 120L external tank and transfer of 40 liters of distilled water from external tank into HPC1 nutrient tank using a pump	Water is transferr without any leak Level?	red 12.03. 8:15 8:45	Was the in the rank	anferred nutrient			
5	7	Taking the trays with seedlings out of the chamber	During 1 hour the are in HPC room u ambient condition	Inder 15.0	0	• •	C	V6-	in the bottom the ranks)

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TE	<b>5</b> 7	RECORD SH	IEET	Туре		Reference	Chrono :	Page		
	ĺ			MPP-	REC	10 -4102(0)	01	6	17	
	}	Con	npartment : C	СІУЬ	Test Pl	nase:2				
36	7	Taking 20 trays out of the chamber and wiping 20 trays with paper towel wetted with ethanol	Sterilization o trays	f the	110310 18705			C	Vs	-
37	7	Placement of 20 trays into the chamber	Trays are insid chamber in th nominal positi	eir	11/03/10 17:10-11:1	Áí		C	.VG	
38	7	Activation of irrigation system from HMI in auto mode in order to adjust pH and EC of the nutrient solution	Irrigation syste activated, wat is 10-11 L/min Flow reading	em is ter flow	12/03/10 10:54	Flow U is 10,0 - 4/min	uadi no - 1928	C	N	
39	7	Performance of leakage test of the main nutrient solution collector in the chamber	No leaks		12/03/10 10:55	OK		C	N	
40	7	When pH is equal to 5.9 and EC to 1.9, disabling of irrigation system	Irrigation syste no liquid circu the HPC1	lation in	12103/10	0-		C	NT	
41	7	Taking of 6 samples of nutrient solution from nutrient tank: a. Irrigation system is off.	Samples of the are taken acco the written pro- nutrient tank i closed	ording to ocedure,	12/03/10 12:00 13:30	Scimples Nutrien is close	arı baka 8 baa K 1	C	NT	•
		b. Opening of drain valve and filling a plastic cup with nutrient solution 3 times without closing the valve. Don't keep this				1 > 1/080	<i>•</i>		-	-
		solution but empty it into sewerage. c. After taking 3 samples continuously into 3 plastic cups (preliminary labelled) and placement		·		* • •				:
		them into the fridge. d. Taking 3 samples manually from the top of the nutrient tank and placement them into the fridge								
		f. Closing nutrient tank with plastic cover and screws, making sure it is airtight								

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	ĺ		•	MPP-REC	10 -4102(0)	01	717	
		C	ompartment : C	IVb Test	Phase : 2		1	
42	8		Day <sub>8</sub> of crop te	st.				-

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## MPP-REC 10-4102 (0)-01

Conclusion for the Test	Name E,PERO	signature Enrifue PEN	Date 30,04.10	
Rassed 🗆 Failed				
<ul> <li>Number of deviation</li> <li>All deviations have</li> </ul>			NO	
Comments				
Checked by	Mana	Cimet As	0.4	
MELISSA Pilot Plant	Name A.FOSIOV	Signatule	Date 2/5/10	

Appendix 1 for MPP-REC 10-4102 (0)-01

#### Appendix 1 - record of implied personnel

Name	ORGANIZATION	Function	Initials
Natalia Tikhomirova	Visiting Researcher MPP	Plant Scientist	NT
Cynthia Munganga	мрр	Analysis Technician	CM
Enrique Peiro	MPP	Technical manager	EP
When .			

Appendix Z: equal to Appendix Z for MPP. EC P

Appendix 3 for MPP-REC 10-4102(0)-01

	Appendix 3 - deviations list			
DEV. FORM #	Deviation: Some tasks were not performed they coincided with the weekend they were not critical (take pic check seeds), as they could be perform Corrective action: Take into account potential flexibility in the new version protocal for tasks not critical (ta Corrective action performed and checked: Ref. of retests:		∏ Resp.	ticality ow edium High Due date End of COD 9
DEV. FORM # 2	Deviation: No watering of scedlings in their rockwool cut Cubes were still wet No impact on the certure Corrective action: Reword the task to leave flexibility	es as the	M N	ticality ow edium High Due date Endof Coogl
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Clos	ing Date
DEV. FORM #	Deviation:		L M	ticality _OW edium High
	Corrective action:	-	Resp.	Due date
	Corrective action performed and checked:	Checked /	Clos	ing Date

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Ref. of retests:

Page1/1

approved by

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TE	EST	' RECORD SH	EET	Туре		Reference	Chrono :	Page	
·			1	MPP-	REC	10 -4102(0)	PT 02	Λ	17
		Com	partment : CIV	b	Test Pl	hase:2		AP olsin	
Test	t title	e : Seedlings phase							
	ctives								
					· ·	·			
Appl	icable	test plan and test protocol	15 TN - 101/2	Z					
Hard	lware:	na n							
Pers	on res	ponsible for the test : Nata	lia Tikhomirova						
Test	prere	quisites : phase 1 nominall	y executed						
Step No.	Day No.	Action description	Expected resul Nominal behav		Date / Hour	calculated	d results /   / remarks - Deviation	C/N C	Initials
-1-	0	Sterilization of 2 flats of rockwool small cubes - Grodan AO 36/40 6/15W using following procedure for Rockwool safe manipulation: MPP- OP-10-4101 (0)	Rockwool flats sterilised and rea seeds sowing	dy for	12.05.10 13:15 15:55			C	CM
2	0	Sterilization of 1 litre of distilled water in autoclave	30 minutes at 12	20°C	12.05.10 9:00 13:00			С	CM
3	0	Sterilization of 10-litres tanks for stock A and stock B (2), 20-litres tank for seedlings solution in autoclave	30 minutes at 12	20°C	04.05.10	Æ	J. D.	NC	СМ
4	0	Preparation of 10 L of stock A and 10 L of stock B solutions and 10 L of seedling solution according to TN 96.3. Solutions must be kept in a dark place in order to prevent algae growth	Solutions are pre	pared	03.05.10		er er	NC	СМ
5	0	Taking a bag with lettuce seeds <i>Lactuca sativa</i> L. cultivar Grand Rapids from the fridge and	Done		12:05:10 17:15- 17:30	0K	- 	C	LT

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TE	ES1	RECORD SH	IEET	Туре		Reference	Chrono :	Page	
				MPP-	REC	10 -4102(0)	01	Z	/ ユ
		Com	partment : CI	/b	Test Pl	hase:2	02 AF 2	6/5/10	
	- -	placement about 200 seeds into a glass. Addition of 5% hypochlorite to the glass with the seeds (until bleach covers all the seeds). Sterilization during 15 minutes							
6	0	Placement of the seeds into a sieve and rinse with 1 L of distilled sterile water	Seeds are sterili some lost of colo be observed d treatment with	our can ue to	12.05710 17:30	0 K		C	NT
7	0	Disinfection of 2 seed germination trays with 70% ethanol and paper towel	The trays a disinfected an ethanol can observed on the	id no be	16:05 12:05:10			С	NT
8	0	Placement of 2 flats of rockwool small cubes - Grodan AO 36/40 6/15W into 2 seed germination trays	Each tray must c 98 cubes	ontain	12.05.10 16:50			C	M
9	0	Using tweezers, placement of a single lettuce seed in each hole of Rockwool cubes	Attention should paid during proce seeds sowing in o not to sow more seed per cube ar miss any cube	ess of order than 1	12:05:10 17:40- -18:04			C	M
10	0	Measurement of pH of irrigation solution for seedlings, in case it's 5.8-5.9, watering of Rockwool cubes with this solution.	pH of seedlings solution is 5.8-5. Rockwool cubes wet, but not overwatered (no beneath Rockwoo	are liquid	72, 05.10 17:25		ase (O,SH') by of d they s Using solution	C	M
11	0	If pH is higher than 6.0 or lower than 5.8 addition of about 1 mL of 0.5M HNO <sub>3</sub> or 1mL of 0.5M KOH (depending on pH if it's low or high) to the 10L of the solution, mixing well and checking of pH again. Repetition if necessary until pH is about 5.8-5.9.	pH of seedlings solution is 5.8-5.	9		L Sie			





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TE	EST	RECORD SH	EET	Туре		Reference	Chrono :	Page :	
		,		MPP-	REC	10 -4102(0)			/ 구
		Com	partment : CIV	′b	Test Ph	nase:2	2 AF	w/5/	10
12	0	Taking photos of the trays.	Day <sub>0</sub> of crop test (Rockwool sheets without seedling	5	12/05/10 18!10	oK		e	M
13	0	Addition of a plastic tray cover to each tray	Trays are covere- order to maintain humidity inside t tray and enhance germination	d in n he	12/05/10 18 :15	OK		C	NT
14	0	Activation of Schneider controller of HPC1.	Schneider contro activated with environmental conditions set poused for seeds germination and seedlings growth Light mode: auto and 1 HPS lamps module on. Fan <i>I</i> auto. Temperatu humidity mode: a Day time - 16 hor night time - 8 hor	oints ; o, 1 MH per Mode: ure and auto. urs, urs, T	12/05/10 18:20 (hot HMI time, hor- muil)	at 12:00 start at Tand hi ok RAS SCM Measure RT_410 (modul 284,5	ments: 94-01 e A) 4E,	C	NF.
			day and night set points = 20°C, da =50%, night Rh=7 PAR sensors measurements:2 µE	ay Rh '0%,		RT_410 1 modul 2 30, 5 RT_4100 ( modu 266, 6	чеВ) ИЕ, 1-03	•	
15	0	Placement of the germination trays into HPC1 and closing of the doors from both sides of HPC1.	Chamber is close all conditions in chamber corresp conditions for se germination	the ond to	72/05/10 18:32	V	K	C	NT
16	1	Opening of the chamber, taking photos of the trays with plastic cover and after without the cover.	Day <sub>1</sub> of crop test		13/05/10 18:105	OK		e	NT
17	1	Check of seedlings germination, repeat in the afternoon	In case not more 60% of seedlings each tray can be observed, additi plastic cover and closing the cham	in ion of I	<b> 3</b>  05  0  8: 5	Almost h radion is	o permi- obsirved	С	NT





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TE	ES7	RECORD SH	EET	Туре		Reference	Chrono :	Page :	
				MPP-	REC	10 -4102(0)	<b>91</b>	4	17
	<u> </u>	Com	partment : Cl	Vb	Test Pl	hase:2	•2 AF 20	15/10	
18	1	In the afternoon checking of the seeds germination again. If more than 60% of seedlings are observed opening of the trays. If not the trays are left covered until next day	Check of seedlir germination	ngs		ð	EV.3 EP	NC	
19	2	Opening of the chamber, taking photos of the trays with plastic cover and after without the cover.	Day <sub>2</sub> of crop tes	t	14/05/10 18:20	01	ζ.	C	N
20	2	In case not more than 60% of seedlings in each tray can be observed, addition of plastic cover and closing the chamber	Check of seedlir germination, rep the afternoon	peat in			V.Y Jap	NC	
21	2	In the afternoon checking of the seeds germination again. If more than 60% of seedlings are observed — opening of the trays. If	Check of seedlin germination	igs	14/05/10 18:20	No gen (à) most trous are covered	210%	C	M
		not the trays are left covered until next day							
22	3	Checking the seeds germination and if more than 60% of seedlings are observed in each tray opening of the trays (taking out the plastic covers).	By this day usua germination percentage is m than 60% per tra plastic covers ca removed from th	ore ay and an be he trays		ti dy	gamination Seared vers are from s.	С	СМ
23	3	Taking photos of both trays	Day <sub>3</sub> of crop tes	t	15/05/10	No taken was not an	as comera ailaMe	С	СМ
24	3	Checking of pH of the seedlings nutrient solution and in case it's 5.8-5.9, watering Rockwool cubes with this solution, approximately 900 mL per each tray.	pH of seedlings solution is 5.8-5 Rockwool cubes wet, but not overwatered (no beneath Rockwo	are liquid	15/05/10	the trays, to water	idity in no heassery		СМ
25	3	Regulation of pH with acid or base in case it is higher than 6.0 or lower than 5.7 (see step No.10)	pH of seedlings solution is 5.7-6	.0	15/05/10	Not uce	ssery 10	e	CM





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TE	EST	RECORD SH	EET	Туре		Reference	Chrono :	Page :	
	e.			MPP-	REC	10 -4102(0)	MOL	5	/
		Com	partment : CI	/b	Test Pl	nase:2	AF 20/5/	0	
26	4	Taking photos of both trays	Day₄ of crop test	:		Sunday, 1	ot performing	C	NT
27	4	In the afternoon watering of the plants with the solution if necessary, approximately 500 mL per tray.	Rockwool cubes wet, but not overwatered (no beneath Rockwo	liquid		Sunday per Abron	hobud	C	NT
28	5	Taking photos of both trays. Watering of the plants with the solution if necessary	Day <sub>5</sub> of crop test Rockwool cubes wet, but not overwatered (no beneath Rockwo	are liquid	17105710 12:25	Pictures and Lett tray - Jerni watio Lay 200 mg De tray	57% of	C	р¥
29	6	Cutting of polypropylene film for trays covering against algae growth at maturity phase	100 stripes using template		20/05/10 11 : 00	do be tore,	CV. TILAL	C	NT
30	6	Taking photos of both trays. Watering of the plants with the solution if necessary	Day <sub>6</sub> of crop test Rockwool cubes wet, but not overwatered (no beneath Rockwo	are liquid	18/05/10 18:05	fictures und CEVMINATIO pray: 540 Not Warte Not Warte Not Sanu	Noten Wight-6th Led as not	C	NT
31	7	Checking of pH of the seedlings nutrient solution and in case it's 5.8-5.9, watering Rockwool cubes with this solution, approximately 900 mL per each tray.)	pH of seedlings solution is 5.8-5. Rockwool cubes wet, but not overwatered (no beneath Rockwo	are liquid	<b>19</b> [05]10 18:50	PH of Thu Pis 6, 4. W With 14	and sooml-	C	N
32	7	Regulation of pH with acid or base in case it is higher than 6.0 or lower than 5.7 (see step No.10	pH of seedlings solution is 5.7-6.	.0			Dev.5	NC	NJ
33	7	Taking photos of both trays.	Day <sub>7</sub> of crop test		19/05/10 18:25	Pictures and 62% of per-1 73% - Fight	taken, - left tray, tray	ć	M
34	7	Addition of stock A, stock B, acid and base solutions into the appropriate tanks until a mark on each tank	Tank are filled fo maturity test sta	irt up	16:20 20-05-10		0	C	CM
35	7	Addition of 1.3 litres of stock A and 1.3 litres of stock B into the 120L external tank, mixing thoroughly solution in the 120L external tank using a pump	Solution is mixed ready for transfe HPC1 nutrient ta	er into	16:30 20.05.10			С	CM





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TE	ST	RECORD SH	IEET	Туре		Reference	Chrono :	Page	•
				MPP-	REC	10 -4102(0)	IN OL		17
		Corr	partment : CI	/b	Test P	hase:2	AF 20/5/1	0	
34	7	Transfer of 120 liters of the nutrient solution from external tank into HPC1 nutrient tank using a pump	Solution is trans without any leak sensor does not indicate that the is low or high	k, Level	16:20 19:20 20.05.10			C	cm
35	7	Addition of 40 liters of distilled water into 120L external tank and transfer of 40 liters of distilled water from external tank into HPC1 nutrient tank using a pump	Water is transfer without any leak Level sensor doe indicate that the is low or high	k. es not e level	16:50 17:20 20.05.10			С	cM
36	7	Taking the trays with seedlings out of the chamber	During 1 hour th are in HPC room ambient condition	under			s 		
37	7	Taking 20 trays out of the chamber and wiping 20 trays with paper towel wetted with _ethanol	Sterilization of t trays	.he ,	12:10 90.05.10			С	CM
38	7	Placement of 20 trays into the chamber	Trays are inside chamber in their nominal position	r	15:15. 21-08-10		-	C	RM
39	7	Activation of irrigation system from HMI in auto mode in order to adjust pH and EC of the nutrient solution approximatey for 30 minutes	Irrigation system activated, water is 10-11 L/min		15-30 21-05 D	PH: SO EC: A	5 67	С	RM
40	7	Performance of leakage test of the main nutrient solution collector in the chamber by putting under the connection of the collector several sheets of paper. When the irrigation pump is	No leaks * & Wittle Len Under Conn	.K rection.	AS: AS. 2405/10	Dev	6	N/C	P di
41	7	off, take the paper and check if it is dry. When pH is equal to 5.9 and EC to 1.9, disabling	Irrigation system		16:00		5,13	6	<u>[</u> []
42	7	of irrigation system Taking of 6 samples of nutrient solution from nutrient tank:	the HPC1 Samples of the s are taken accord the written proc	olution ding to	21105/110 16:15 21105/110	uside 1	1.90 he fridge	C	R-F1

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# **MELiSSA** Pilot Plant



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TE	ES1	r Record Sh	EET	Туре		Reference	Chrono :	Page	:
				MPP-	REC	10 -4102(0)	Ma	7	17
	·· · .	Com	partment : CIV	/b	Test Pl	hase:2	AF 20/5/10	,	
		<ul> <li>a. Irrigation system is off.</li> <li>b. Opening of drain valve and filling a plastic cup with nutrient solution 3 times without closing the valve. Don't keep this solution but empty it into sewerage.</li> <li>c. After taking 3 samples continuously into 3 plastic cups (preliminary labelled) and placement them into the fridge.</li> <li>d. Taking 3 samples manually from the top of the nutrient tank and placement them into the fridge</li> <li>f. Closing nutrient tank with plastic cover and screws, making sure it is airtight</li> </ul>	nutrient tank is t	· · · · · · · · · · · · · · · · · · ·	16:13 21/05/10			. C	1243
43	8		Day <sub>8</sub> of crop test	•					

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# MPP-REC 10-4102(0)-02

Conclusion for the Test	Name E.PERO	Signature Eurjue Per	Date J ≥0.06, 10	
Passed 🗆 Failed				
<ul> <li>Number of deviation</li> <li>All deviations have</li> </ul>			NO	
Comments				
Checked by	Name	Signature	Date	
MELISSA Pilot Plant	A FOSSEN	total	30/6/10	

Appendix 1 for MPP-REC 10-4102(0)-02

### Appendix 1 - record of implied personnel

Name	ORGANIZATION	Function	Initials
Natalia Tikhomirova	Visiting Researcher MPP	Plant Scientist	M
Cynthia Munganga	MPP	Analysis Technician	OU
Enrique Peiro	MPP	Technical manager	eP

Appendix 2: equal to Appendix 2 for MPP-REC-10-410/10)-02

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Appendix 3 for MPP-REC 10-4102(0) - 02 Appendix 3 - deviations list Deviation: Criticality DEV. 10. litres tanks for stock A and B not sterilised when forreseen as they had been sterilised in advance (not recorded) FORM Low # Medium Λ High **Corrective action:** Resp. Due date N.D. ( the action was performed although recording should be improved ) Corrective action performed and checked: Checked / **Closing Date** approved by Ref. of retests: Criticality DEV. **Deviation:** FORM Low loL stock A and B preparetion of # ing solution not Medium 2 2DI High 1 40 Corrective action: Due date Resp. N.A. (the action was performed although recording should be improved) **Closing Date** Checked / Corrective action performed and checked: approved by Ref. of retests: Criticality DEV. Deviation: FORM Not checking feedlings permine then s foreseen in the protocol (during the afternoon), but done during the morning (Low ) # Medium as foreseen 3 High Corrective action: Resp. Due date lexible tasks in the new lexible ende Let more EΨ COOS moment of checking (end 0009) tical the **Closing Date** Corrective action performed and checked: Checked / approved by Ref. of retests:

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Page 1/2

# Appendix 3 Gr Mpp-REC-10-4102(0)-02 Appendix 3 - deviations list

	Appendix 5 - deviations list			
DEV.	Deviation:			ticality
<b>FON</b>			D	OW
	Some es Ders. 3		M	edium
			l I	-ligh
	Corrective action:		Resp.	Due date
			l ucah:	Due dale
	N.A.			
	Corrective action performed and checked: Ref. of retests;	Checked /	Clos	ing Date
		approved by		
			-	
DEV.	Deviation:	•	Cri	ticality
FORM	Robilston of all with a and we b	- Se		.ow
#	infrite inter and in a this att i	tes		edium
S	Repuletion of pH with acid or b was not needed as the pH i in food levels (it's not a non con	diancel		
		uphone)	ſ	ligh
	Corrective action:		Resp.	Due date
	N.A.			
	10, 14.			
	Corrective action performed and checked:	Checked /	Closi	ing Date
	Ref. of retests:	approved by		
DEV.	Deviation:		Crit	icality
FORM #	There was found a least in H	re	L	.ow
	V .		M	edium
6	mitrient solution collector			ligh
	Corrective action:		Resp.	Due date
	The lack should be repaired		RM	21.05.10
				C.I.W. (
	Corrective action performed and checked:	Checked /	Closi	ng Date
	Ref. of retests:	approved by		J
	last conired by in 10			
	rear inprise of voring	EP	28.	06.10
	Leak repaired by vering the appropriate glue.			Ì
	1 1 O			

Page Z/Z

}_ 388000000 	Ę	No test	- Phase 1 ba	Laulsi	of the	V. sit. no CML 25.0	5 clea 6.10	aniu
M		SSA ME	Lissa Pil	ot Pl	ant	Universit	tat Autò arcelon	noma
TE	ST	RECORD SH	EET <sup>Typ</sup>	e	Reference	Chrono :	Page :	
			MPI	P-REC	10 -4102(0)	03	1	/ ユ
		Com	partment : CIVb	Test Ph	ase:2			
Test	t title	: Seedlings phase						· · · · · · · · · · · · · · · · · · ·
	ectives icable	test plan and test protocol		writcethe	n ever	uts (ICE	S con	erenci
Hard	ware:							
Pers	on res	ponsible for the test : Nata	lia Tikhomirova		ankelsen and in			
Step No.	Day No.	Action description	Expected results / Nominal behaviour	Date / Hour	calculated ref. of	ed results / d / remarks - Deviation	C/N C	Initial
1	0	Sterilization of 2 flats of rockwool small cubes - Grodan AO 36/40 6/15W using following procedure for Rockwool safe manipulation: MPP- OP-10-4101 (0)	Rockwool flats are sterilised and ready fo seeds sowing	7:50			C	CH NT
2	0	Sterilization of 1 litre of distilled water in autoclave	30 minutes at 120°C	23.06.10 18:50			AVE	CN M
3	0	Sterilization of 10-litres tanks for stock A and stock B (2), 20-litres tank for seedlings solution in autoclave	30 minutes at 120°C	23.06.10 18:50	,		C C	CM MT
4	0	Preparation of 10 L of stock A and 10 L of stock B solutions and 10 L of seedling solution according to TN 96.3. Solutions must be kept in a dark place in order to prevent algae growth	Solutions are prepare	8:15			NE C	N N
5	0	Taking a bag with lettuce seeds <i>Lactuca sativa</i> L. cultivar Grand Rapids from the fridge and	Done	25.06.10			Ne C	UN NT

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TE	ESI	RECORD SH	EET	Туре		Reference	Chrono :	Page :	
				MPP-	REC	10 -4102(0)	03	2	/ チ
		Com	partment : CIV	/b	Test Ph	nase:2			
		placement about 200 seeds into a glass. Addition of 5% hypochlorite to the glass with the seeds (until bleach covers all the seeds). Sterilization during 15 minutes		· · · · ·	14:23	· · · · · ·		<del>Ax</del> C	CH NT
6	0	Placement of the seeds into a sieve and rinse with 1 L of distilled sterile water	Seeds are steriliz some lost of colo be observed du treatment with	our can ue to	14:38 26-05-10			<del>NC</del> C	CH M
7	0	Disinfection of 2 seed germination trays with 70% ethanol and paper towel	The trays a disinfected an ethanol can observed on the	id no be	14:00 26-05-1 <i>0</i>			<del>NC</del> C	UN M
8	0	Placement of 2 flats of rockwool small cubes - Grodan AO 36/40 6/15W into-2-seed-germination trays	Each tray must c 98 cubes	ontain	14:05 26:06:10			ALC 	NT NT
9	0	Using tweezers, placement of a single lettuce seed in each hole of Rockwool cubes	Attention should paid during processeds sowing in or not to sow more seed per cube ar miss any cube	ess of order than 1	14:40 26:06:10			AVE C	CM M
10	0	Measurement of pH of irrigation solution for seedlings, in case it's 5.8-5.9, watering of Rockwool cubes with this solution.	pH of seedlings solution is 5.8-5. Rockwool cubes wet, but not overwatered (no beneath Rockwo	are liquid	74:23 26:06-10	PH=5,30		RC C	CAY DA
11	0	If pH is higher than 6.0 or lower than 5.8 addition of about 1 mL of 0.5M HNO <sub>3</sub> or 1mL of 0.5M KOH (depending on pH if it's low or high) to the 10L of the solution, mixing well and checking of pH again. Repetition if necessary until pH is about 5.8-5.9.	pH of seedlings solution is 5.8-5.	9					





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TE	EST	RECORD SH	IEET	Туре		Reference	Chrono :	Page :		
		;		MPP-	REC	10 -4102(0)	03	3/	17	ł
		Com	npartment : Cl	iVb	Test Pl	hase:2				I
12	0	Taking photos of the trays.	Day <sub>0</sub> of crop tes (Rockwool shee without seedlin	est ets ngs)	14:50 25.06.10	2		AK C	CM M	
13	0	Addition of a plastic tray cover to each tray	Trays are cover order to mainta humidity inside tray and enhand germination	ain e the nce seeds	15:00 25.06.10	o <u>litch on (</u> switch on h	water (a	Ailled)=	MT NT see be	heret
14	0	Activation of Schneider controller of HPC1.	Schneider contr activated with environmental conditions set p used for seeds germination and seedlings growt Light mode: au and 1 HPS lamp module on. Fan auto. Temperat humidity mode Day time - 16 h night time - 8 h day and night-s points = 20°C,	points of th: uto, 1 MH ps per	25.06.10 1-2 Milinale 2 Achivale	e Rampsb	sors meuts:	C	Pred) the fuid	52×+-
15	0	Placement of the germination trays into HPC1 and closing of the doors from both sides of HPC1.	=50%, night Rh= PAR sensors measurements: μE Chamber is closed all conditions in chamber correst conditions for st germination	s:270-300 osed and in the espond to	15.25			ANC C	. CM M	
16	(1)	Opening of the chamber, taking photos of the trays with plastic cover and after without the cover.		÷st ī	12:00	3		RH-C	. U 117	
17	( <b>1</b> ) 3	Check of seedlings germination, repeat in the afternoon	In case not mo 60% of seedling each tray can l observed , add plastic cover a closing the cha	igs in be dition of and	12:05 26,20 AO			₽,€ C	= V.6 M	~





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TE	EST	RECORD SH		Туре		Reference	Chrono :	Page :	
-				MPP-RE	С	10 -4102(0)	03	4	( ユ
		Com	partment : Cl	Vb T	est Pl	nase:2			
18	(†) 3	In the afternoon checking of the seeds germination again. If more than 60% of seedlings are observed opening of the trays. If not the trays are left covered until next day	Check of seedlin germination	16	7.AO 8.06.10	>		C	Ъ М
19	2	Opening of the chamber, taking photos of the trays with plastic cover and after without the cover.	Day <sub>2</sub> of crop tes			sunday, performe		Ne	115
20	2	In case not more than 60% of seedlings in each tray can be observed , addition of plastic cover and closing the chamber	Check of seedlin germination, re the afternoon	peat in	N.2 3	Sunday, pertorme	net 1	NE	иř
21	2	In the afternoon checking of the seeds germination again. If more than 60% of seedlings-are observed opening of the trays. If not the trays are left	Check of seedlin germination	ngs	Ð	Sunday, perform	uet ed	ŇC.	NT
22	3	covered until next day Checking the seeds germination and if more than 60% of seedlings are observed in each tray opening of the trays (taking out the plastic covers).	By this day usua germination percentage is m than 60% per tra plastic covers ca removed from t	ore ay and an be		See step	1 /7	C.	пЯ
23	3	Taking photos of both trays	Day <sub>3</sub> of crop tes	t		See step	16	C	NT
24	3	Checking of pH of the seedlings nutrient solution and in case it's 5.8-5.9, watering Rockwool cubes with this solution, approximately 900 mL per each tray.	pH of seedlings solution is 5.8-5 Rockwool cubes wet, but not overwatered (no beneath Rockwo	are		Not pers there was construst or day 1 and	v		NT
25	3	Regulation of pH with acid or base in case it is higher than 6.0 or lower than 5.7 (see step No.10)	pH of seedlings solution is 5.7-6	.0	at	Not per to ohere wa configures on	Wmed as 3 a bliwein day	Ne.	IT



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# **MELISSA Pilot Plant**



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TE	EST	RECORD SH		Туре		Reference	Chrono :	Page :	
				MPP-	REC	10 -4102(0)	03	5,	17
		Com	partment : Cl	Vb	Test Pl	hase:2			
26	4	Taking photos of both trays	Day <sub>4</sub> of crop tes		19/06/10 10:40 16:25	Playtic con out Photos are	<del>irs are tak</del> taken	er C	M
27	4	In the afternoon watering of the plants with the solution if necessary, approximately 500 mL per tray.	Rockwool cubes wet, but not overwatered (no beneath Rockwo	o liquid	23/06/10	PH of second = 5, 87. N. is vejuired Each tray	Ui pås Solutio p pH connection (see step 2 is Watereg 12 of seed)	24 57	M
28	5	Taking photos of both trays. Watering of the plants with the solution if necessary	Day <sub>5</sub> of crop tes Rockwool cubes wet, but not overwatered (no beneath Rockwo	are o liquid	30/06/10 17:25	The photo No Water substrate	s were taken ung as the is were		N
29	6	Cutting of polypropylene film for trays covering against algae growth at maturity phase	100 stripes usin template		1/07/10	Will be p on 2/07/1	0	C	NT
30	6	Taking photos of both trays. Watering of the plants with the solution if necessary	Day <sub>6</sub> of crop tes Rockwool cubes wet, but not overwatered (no beneath Rockwo	are o liquid	1/07/10 17:15 17:20	The trong n	ari taken. 14 watured 1400 mb ot si 1400 mb ot si	erd.	M
31	7	Checking of pH of the seedlings nutrient solution and in case it's 5.8-5.9, watering Rockwool cubes with this solution, approximately 900 mL per each tray.)	pH of seedlings solution is 5.8-5 Rockwool cubes wet, but not overwatered (not beneath Rockwo	i.9, are o liquid	2/07/10 18:50	The plan	soume pe	ient	NT
32	7	Regulation of pH with acid or base in case it is higher than 6.0 or lower than 5.7 (see step No.10	pH of seedlings solution is 5.7-6	5.0	2/0+/10	Wors per a to check a ell as it i z days	ind leptilite vis doni apo	Her.	+ 20
33	7	Taking photos of both trays.	Day <sub>7</sub> of crop te		2/07/10 18:00	taken;	Hos are	C	NY
34	(7) 10	Addition of stock A, stock B, acid and base solutions into the appropriate tanks until a mark on each tank	Tank are filled maturity test st	art up	5707/10 11 23 Day 10	ok		C	15
35	(7) 10	Addition of 1.3 litres of stock A and 1.3 litres of stock B into the 120L external tank, mixing thoroughly solution in the 120L external tank using a pump	Solution is mixe ready for transf HPC1 nutrient t	fer into	5/07/10 11 Ray 10	OIC		С	NT





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	EST	RECORD SH	IEET	Туре		Reference	Chrono :	Page :	
				MPP-I	REC	10 -4102(0)	03	6	17
		Com	npartment : Cl	Vb	Test P	hase : 2			
34	(7) 10	Transfer of 120 liters of the nutrient solution from external tank into HPC1 nutrient tank using a pump	Solution is tran without any lea sensor does not indicate that th is low or high	ne level	5106770 11:50	- OK	-	Ø	μS
35	(7) 10	Addition of 40 liters of distilled water into 120L external tank and transfer of 40 liters of distilled water from external tank into HPC1 nutrient tank using a pump	Water is transfe without any lea Level sensor do indicate that th is low or high	erred ik. es not	5/06/10 13:00		0K	C	1X
36	(7) 70	Taking the trays with seedlings out of the chamber	During 1 hour th are in HPC room ambient condit	n under ions	5/06/W 8:20	0K		C	N
37	(7) 10	Taking 20 trays out of the chamber and wiping 20 trays with paper towel wetted with ethanol	Sterilization of trays	the	57.5671.0 10:00	OK		0	N
38	7	Placement of 20 trays into the chamber	Trays are inside chamber in the nominal positio	ir	i FU			Ne	M
39	(7)	Activation of irrigation system from HMI in auto mode in order to adjust pH and EC of the nutrient solution approximatey for 30 minutes	Irrigation system activated, water is 10-11 L/min		57.06740 14:00	OK		С	M
40	7	Performance of leakage test of the main nutrient solution collector in the chamber by putting under the connection of the collector several sheets of paper. When the irrigation pump is off, take the paper and check if it is dry.	No leaks		<b>9/</b> 07/10 13\30	Leakage disting before cul polypropyli any werry dianing (10,400-1)	test with water tong of end tilm end tank was perton 3: ob	C núl	Ň
41	7	When pH is equal to 5.9 and EC to 1.9, disabling of irrigation system	Irrigation system no liquid circula the HPC1	ation in	V-1	ep (Der	1.5	AC.	NT.
42	7	Taking of 6 samples of nutrient solution from nutrient tank:	Samples of the are taken accor the written pro	ding to	57.06HO 15:00	3 Samples From derain recessary to	are baken 1 Valve, und take samples	0	Ň

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# **MELISSA Pilot Plant**



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ľ E	ST	RECORD SH	EET	Туре		Reference	Chrono :	Page :	
				MPP-	REC	10 -4102(0)	03	7	17
		Com	partment :	CIVb	Test Pl	nase:2			
		<ul> <li>a. Irrigation system is off.</li> <li>b. Opening of drain valve and filling a plastic cup with nutrient solution 3 times without closing the valve. Don't keep this solution but empty it into sewerage.</li> <li>c. After taking 3 samples continuously into 3 plastic cups (preliminary labelled) and placement them into the fridge.</li> <li>d. Taking 3 samples manually from the top of the nutrient tank and placement them into the fridge</li> <li>f. Closing nutrient tank with plastic cover and screws, making sure it is airtight</li> </ul>	nutrient tank closed		87		vh is ous in th f bank		
13	<b>(8)</b> /0		Day <sub>8</sub> of crop	test.	51.00/10			C	M

# MPP-RZ 10-4102(0)-03

Conclusion for the Test	Name E.REIRO	signature Enrifue Per	Date 、30、ひみ、10
Passed 🗆 Failed			
<ul> <li>Number of deviation</li> <li>All deviations have</li> </ul>	사용 제공 방법에 있는 것은 것은 것은 것을 많이 있다.	ye fan se	٥)
Comments			2
Checked by	Name	Signature-A	Date
MELISSA Pilot Plant	Actosta	forter	30/7/10

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# Appendix 1 to MPP-REC 10-4102 (0)-03

### Appendix 1 - record of implied personnel

Name	ORGANIZATION	Function	Initials
Natalia Tikhomirova	Visiting Researcher MPP	Plant Scientist	M
Cynthia Munganga	MPP	Analysis Technician	CM
Enrique Peiro	МРР	Technical manager	EP

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Appendix,

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Appendix 2 - record of calibration certificates for the test instruments

1 100000						
Instrument	HPC1 TAG	Inv. number	Calibration record	Date of	Calibration valid	Signature
description			reference	calibration	until	
pH sensor	AT_4107_01		NT Logbook	25.06.10	Next test	
Electrical	$AT_{4108_01}$		NT Logbook	25.06.10	A Mo. 1 to - 4-	
Conductivity of					rest ter	
nutrient						
Humidity A1	AT_4112_01		Manufacturar			
associated with			INTALLULATION CL	26.09.07		
temp A1			certificate			
Humidity B1	$AT_{4112}02$					
associated with				26.09.07		
temp B1			certificate			
Humidity C1	$AT_{4112}03$		CIFA calibration	08.06.10		
associated with			report		-	
temp C1			4			
CO2 Analyser	AT_4113_01	-	TN 96.11	23.07.09	× / 1	
O2 Analyser	AT_4113_02		TN 96.11	23.07.09	3	
CO2 Mass	FQRC_4113_01		Manufacturer	16.09.07		
Flow			certificate	10.00.01	)	
Outlet nutrient	FT_4106_01		Manufacturer		-	
flow sensor			certificate			
Air velocity	FT_4111_01		Manufacturer			-
sensor			certificate			
Pressure sensor	PT_4102_01		Manufacturer	26.06.07		
for airlock A			certificate			
Pressure sensor	PT_4103_01		Manufacturer	26.06.07		
for airlock C			certificate			
> Reaffected to						
External						2
Pressure						ŕ Þ

Pape 1/4

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					$\langle$	×	. ma					
26.06.07	26.06.07	26.06.07	26.06.07	26.06.07	26.06.07	July 2009	July 2009	July 2009	26.09.07	08.06.10	08.06.10	08.06.10
Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	NTE-HPC_HVAC- RP-004	NTE-HPC_HVAC- RP-004	NTE-HPC_HVAC- RP-004	Manufacturer certificate	CIFA calibration report	CIFA calibration report	CIFA calibration report
			· · · · · · · · · · · · · · · · · · ·									
PT_4114_01	PT_4114_02	PT_4114_03	PT_4114_04	PT_4114_05	PT_4114_06	RT_4104_01	RT_4104_02	RT_4104_03	TT_4105_01	TT_4105_02	TT_4105_03	TT_4109_01
Growing Area Pressure	Growing Area Pressure	Growing Area Pressure	Growing Area Pressure	Growing Area Pressure	Growing Area Pressure	PAR Sensor - A	PAR Sensor - B	PAR Sensor - C	Light Loft Temperature sensor A	Light Loft Temperature sensor B	Light Loft Temperature sensor C	Temperature sensor for solution reservoir

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Pege 2/4

		1	1	1	1	T	1	T	1	1	1	1 1
												NT B
'n				t	(t:	20						
n- (0) zart.	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07
Sn- (0) ZARK for your while will a xnowling	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate
marx - las												
d dev	TT_4105_02	TT_4105_03	TT_4109_01	TT_4112_01	TT_4112_02	TT_4112_03	TT_4112_04	TT_4112_05	TT_4112_06	TT_4112_07	TT_4112_08	TT_4112_09
	Light Loft Temperature sensor B	Light Loft Temperature sensor C	Temperature sensor for solution reservoir	Temperature A1 associated with humidity	Temperature B1 associated with humidity	Temperature C1 associated with humidity	Temperature A2	Temperature A3	Temperature hambient	Temperature B2	Temperature B3	Temperature B4

Appendix 2 for MPP RET to 4102 (0) -03

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				(	(K.N.	R		-		
26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07	26.09.07
Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate	Manufacturer certificate
TT_4112_10	TT_4112_11	TT_4112_12	TT_4112_13	TT_4112_14	TT_4112_15	TT_4112_16	TT_4112_19	TT_4112_20	TT_4112_21	TT_4112_22
Temperature C2	Temperature C3	Temperature ambient	Temperature for facility chilled water	Temperature for facility hot water line	Chilled coil surface temmerature	Heating coil surface temperature	Outlet Air, chilled exchanger	Outlet Air, hot exchanger	Inlet water Chilled Exchanger	Inlet water Hot Exchanger

Perfer 4/4

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Appendix 3 to MPP-REC 10-4102(0)-03

#### Appendix 3 - deviations list

	<u> Appendix 3 - deviations list</u>			
DEV.	Deviation:		a starter of	licality
FORM #	Test phase 1 was not performed: deaning was performed and lead as well. (Test oriented to communi	No	· ·	.ow
1	deaning was performed and lead	r test		edium
	as well? (Test oriented to communi	cation)	분	tight er
	Corrective action:		Resp.	Due date
	Not necessary as the test is in to demonstrate operation for communi events in July.	tended		
	to demonstrate operation for communi	cather		
	events in July.			
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Clos	ng Date
		approved by		
	Devil-Man			
DEV. FORM	Deviation: Charte of sepatiments and Dictures	not		.OW
	pedocued ducke flie week-end	performed		edium
2	Check of seedlings and pictures performed during flue weekend ( daily when working days)			ligh
Trading and Analysis of Ana	Corrective action:		Resp.	Due date
	The increase Manibility for mon a	infred	nesp.	Endo
	to the date deed dont in	flue	Eφ	
	To increase plexibility for non a tasks not date-dependant in new edition of the protocol (	End (005)		CD09
	Corrective action performed and checked:	Checked /	Closi	ng Date
	Ref. of retests:	approved by	01031	
DEV.	Deviation:		Crit	icality
FORM	of was not directed in the metric	Int		.OW
<b>^</b>	colution and we terms but wa	enul		edium
3	Solution and watering but wat was performed on day 4, not a fleching th	e donte		ligh
	Corrective action:		Resp.	Due date
	N.A.			
		:		
	Corrective action performed and checked:	Checked /	Clos	ng Date
	Ref. of retests:	approved by	0.001	
		<u>.</u>	L	

Pope 1/2 P

Appendix 3 to MPP-REC 10-4102(0)-03 Appendix 3 - deviations list

	<u> Appendix 3 - deviations list</u>			
DEV. FORM #	Deviation: DH of sepating solution was not			licality .OW
4	pH of seedling solution was not adjusted.		· · · · ·	edium High
	Corrective action:		Resp.	Due date
	To define better in the new ver of the protocol the flexibility possib pt adjustment or the criticity (end	le for of COO9)	Eγ	End of COO9
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Closi	ng Date
DEV. FORM #	Deviation: Jritpation system was not stopp before taking the samples.	sed		icality .ow edium łigh
	Corrective action: ( IF is not critical for the process N.A.	)	Resp.	Due date
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Closi	ng Date
DEV.	Deviation:	l	Crit	Icality
FORM #	Samples were not taken from H as solution is homopeness in mutrient tank (previous results)	re top flue	Me	ow edium ligh
	Corrective action: To define differently the son procedure in the next edition of protocol or corresponding OP (end of	1 tut (009)	Resp.	Due date End 8 COD9
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Closi	ng Date

Pope 2/2 3

Appendix 3 to MPP- REC 10-4102 (0)-03

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DEV.	Appendix 3 - deviations list           Deviation:		Critica	lity
FORM #	The validity of second for the	_	Low	
71	Deviation: The validity of period for the calibration of instruments is not	1. G. d	Me	dium
Ŧ	canoration of mistromenis is not	acpuer	High	and the second se
	Corrective action: To establish an HPC1 mointener including the validity period for calibrated performed on the ser	lede	Resp. RM	Due date Befor Hie Stoppe
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Closin	g Date
DEV.	Devlation:		Critical	lity
ORM			Low	
			Med	dium
			High	l
	Corrective action:		Resp.	Due date
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Closing	g Date
IEV. ORM	Deviation:		Critical	ity
			Low	
			Mec	lium
			High	
	Corrective action:		Resp.	Due date
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Closing	Date

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Pope 3/3

		ssa r	/IELiss	sa f	Pilot	Plant	Universitat de Bard		) ) oma
TE	<b>ES</b> 1	RECORD SH	IEET	Туре		Reference	Chrono :	Page	:
				MPP-	REC	10 -4103(0)	01	1	111
		Cor	npartment : (	СІУЬ	Test P	hase : 3			
Tes	t title	e : Maturity phase	· · · · · · · · · · · · · · · · · · ·				-		
ОЬје	ective	5:							
		e test plan and test protoco	IS TN,	NON.Z	<b>*</b>				
	lware:								
		ponsible for the test : Nata	alia Tikhomirova	1					
Test	prere	equisites :			• 、			·	
tep No.	Day No.	Action description	Expected re Nominal beh		Date / Hour		sults / calculated ref. of Deviation	C/N C	lnitia Is
1	8	Use of procedure for Rockwool safe manipulation: OP-10- 4101 (0) in order to prepare rockwool large cubes – Grodan Delta 4G 42/40 for seedlings planting	cubes – Gr Delta 4G 42/ dampened and used for the fo	Rockwool large cubes – Grodan Delta 4G 42/40 are dampened and can be used for the following planting		ΟK		C	Cm
2	8	Taking trays with seedlings out of the chamber. Taking photos of the seedlings before starting transfer to bigger rockwool cubes.	t <sub>8</sub> of crop	test	12/04/10 10 : 20			C	N
3	8	Selection of 100 small rockwool cubes with seedlings that look similar (height of the plants, size and quantity of leaves). Taking photos of these plants.	practically the their morpholo will be used for	Selected plants are practically the same in their morphology and will be used for transfer to bigger rockwool cubes			· .	e	лъ
4	8	Taking 20 trays out of the chamber	Trays are prep planting		12/03/10 11:45			C	VG

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1	EST	RECORD SH	IEET	Туре	:	Reference	Chrono :	Page	:
				MPP-	REC	10 -4103(0)	01	211	
		Сог	mpartment : Cl	Vb		hase: 3			
5	8	Placement of 5 big Rockwool cubes into each tray, dampen with distilled water if necessary	Cubes are prepa planting	red for	12:00		·····	C	NI Vũ Ch
. 6	8	Covering of each tray with polypropylene nutrient film. Placement of small rockwool cubes with seedlings into each hole of big rockwool cubes	Attention should paid during trans process. Seedling not to be under nutrient film. Siz the holes in the nutrient film can increased if nece	sfer gs are the ze o <u>f</u> i be	12/03/10 12:00- 13:20			C	NT VG CM
7	8	Taking of photos of several trays with transferred seedlings. Placement of 20 trays with transferred seedlings into HPC1	Beginning of ma phase of crop		12/03/10 12:00- 13:20	· · ·	· · · ·	C	N
8	8	Activation of control system: Light Mode: auto, fan mode: auto, all lamps on, day/night=16hours/8hour s Temp. and Hum.mode: auto, air blower mode:	All activated loc running	ps are	12/03/10 13:00 - - 13! 37			С	NT
	· · · · · · · · · · · · · · · · · · ·	auto, day average temperature =26°C, night average temperature=20°C, day average humidity=50%, night average humidity=70%. Irrigation mode: auto, pH mode: auto, EC mode: auto, pH set point=5.9, EC set point=1.9 mS/cm, Condensate level: auto.	· · ·			· · ·	· · · · · ·		
9	8	When all lamps are on taking photos of all trays with seedlings inside the chamber before closing the chamber	View of the plant inside the chamb before tightening the system	er	12/03/W 13:45			С	15

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T	ESI	r record sh	IEET	Туре		Reference	Chrono :	Page	:
				MPP-	REC	10 -4103(0)	01	31	1/1
		Cor	npartment : Cl	Vb	Test F	hase : 3			
10	8	Closing of the inner airlock doors (curtains) and latching of the outer doors. Activating of $CO_2$ mode: auto, $CO_2$ setpoint= 1000 ppm	Chamber is tight closed and crop started		12/03/10 13:50	· .		C	NT.
11	.8	Addition of stock A, stock B, acid and base solutions into the appropriate tanks until a mark on each tank	Tanks are filled initial volume (2	.5L)	12/03/10 16 <sup>-28</sup>			C	NT
12	9	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants from 3 windows	Results are studi kept together wi protocol		15/03/10 11:00	History Winted Was Saturi Not taken	graphs wire ater cie it tay. photos	C	N
13	10	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants from 3 windows	Results are studi kept together wi protocol	ith test	15/03/10 12:00	DV: Word	propries were buttes as it	С	115
14		Disabling of CO <sub>2</sub> control for taking air sample from the chamber and subsequent ethylene analysis. After sample is taken enabling of CO <sub>2</sub> control	Use of peristaltic for taking a sam	ole	15/03/10 18:1-7- -18:23	0K		C	N
15	11	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants from 3 windows	Results are studi kept together wi protocol		<b> 5</b>  03 10  3:00  8:50		ere taken	C	NĬ
16	11	Analysis of ethylene concentration in the air sample with GC of the department at least with 5 replications	Results of analys presented as gra Max value?	phics	18:30		bje repetetive	С.	И СМ
17	11	Taking of 3 samples of nutrient solution from nutrient tank: a. Irrigation system is off. b. Opening of drain valve and filling a plastic cup with nutrient solution 3 times without closing the	Samples of the so are taken accord the written proce nutrient tank is t closed	olution ing to edure, ightly	15/03/10 19:38- -19:57	OK		C	NT

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TI	EST	RECORD SH	EET	Туре		Reference	Chrono :	Page	:
		•		MPP-	REC	10 -4103(0)	01	4	/ \ \
		Сог	npartment :	СІУЬ	Test F	hase : 3	· · · · · · · · · · · · · · · · · · ·		
	1	valve. Don't keep this						1	
		solution but empty it							
	[	into sewerage.	ł						
		c. After taking 3 samples	Ì	,					
		continuously into 3							
		plastic cups (preliminary						1	
		labelled) and placement							
	1.	them into the fridge.							
		d. Enabling of irrigation							
		system in auto mode	· · · · ·		- Al-		· · · · · · · · · · · · · · · · · · ·		
8	12	Printing history graphs	Results are stu		10/03/10	prinning	history praph	E, C	N
		for all loops for the	kept together	with test	13:30-	Vesult & a	are nominal	10	10.
		period of 24 hours. Taking	protocol		17:30-	taking 1	Junders		
	<u> </u>	photos of the plants	Desulte ave atu	أرجح أرجائك	-11:51	DANNING	1 ydari		
9	13	Printing history graphs for all loops for the	Results are stu		+1-410	prinding	luft are		NT
		period of 24 hours.	kept together protocol	with test	12:30-	graphs	Mults one	C	101
		Taking photos of the	procococ		13:40	0 non	nnn		
		plants			18:45-	taking	shotas		
0	14	Printing history graphs	Results are stu	died and	18/03/10		WHOM AMA	5	1.5
•	1 1 7	for all loops for the	kept together		i Hind C	usutts	history graph	10	M
		period of 24 hours.	protocol		16:20		1 10		
		Taking photos of the	-		18:15.	Photos	taking		
		plants					0		
1	15	Changeover of the	Solution is cha		19/03/10	Colution	n is	C	i7
		nutrient solution:	samples of solu		HIDE.	ENTRO.	n is 1 and 25 are		APRI
		disabling of irrigation	before and after		11:05-	[/nwnjel	y write		VG
		mode, closing with	changeover are	e taken.	12:25	cample	es are		
		manual valves inlet and outlet of the liquid in the				Swill			
		chamber. Opening				taken.		-	
		nutrient tank and taking				v ·		1	
		3 samples of nutrient							
		solution from the top of							
		the tank (manually) and							
		from the bottom using							
		drain valve (after						1	
		outpouring first 3							
		samples into sewerage).							
		Emptying of nutrient		:					
		tank using drain valve.						}	1 '
		Rinsing of nutrient tank with distilled water.							1
		Preparation of nutrient							
		solution in external tank						1	
		(see TN 96.3) and						1	
		transfer into nutrient							
		tank. Taking 6 samples of							
		nutrient solution: 3 from						1	

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TI	EST	RECORD SH	EET	Туре		Reference	Chrono :	Page	:
				MPP-	REC	10 -4103(0)	01	51	11
		Con	npartment : Cl	٧b	Test P	hase : 3			
		the top and 3 from the bottom. Sealing of nutrient tank. Opening of inlet and outlet of liquid in the liquid loop. Sealing Enabling of COP control.	1			not cep	neasure Tesults at eatable	e C	Сл
22	15	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi kept together wi protocol	th test	19/03/10 17:23 12:23 19:25,	- usults	history, are hominal Dictures	C	M
23	16	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi kept together wi protocol	th test		Since Solu Manual on digitation didy Mude c Air Har Sc	19/03 some 19/03 some in the issure in the observe hsor docsn's		Ň
24	17	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi kept together wi protocol	th test	22/03/10 10:46- -11:21	Air How Rocsn't		Ċ	Ň
25	18	Disabling of CO <sub>2</sub> control for taking air sample from the chamber and subsequent ethylene analysis. After sample is taken enabling of CO <sub>2</sub> control	Use of peristaltic for taking a samp	ble	\$2  03 10 17:57- - 18:05	CO2 mir O2 min	pheric control : max values? max valules?	C	СМ
26	<u>18</u>	Analysis of ethylene concentration in the air sample with GC of the department at least with 5 replications	Results of analys presented as gra	es are , phics	82/03/10- 18:10- -19:45	/	are not Me	C	СМ
27	18	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi kept together wi protocol	th test <sub>.</sub>	11:43 16:45	WORK	sensor deesn't borking	¢ C	M
28	18	Taking of 3 samples of nutrient solution from nutrient tank: a. Irrigation system is off. b. Opening of drain valve and filling a plastic cup with nutrient solution 3 times without closing the	Samples of the so are taken accord the written proce nutrient tank is t closed	ing to ' edure,	12/03/10 17 : 19 	3 sampl	es arc bake	r C	NT

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T	EST	RECORD SH	IEET	Туре		Reference	Chrono :	Page	:
				MPP-	REC	10 -4103(0)	01	6	11
· ·		Cor	npartment : Cl	Vb	Test F	hase: 3			
		solution but empty it into sewerage. c. After taking 3 samples continuously into 3 plastic cups (preliminary labelled) and placement them into the fridge. d. Enabling of irrigation			36.		, ·		
29	19	system in auto mode Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi kept together wi protocol	ed and th test	23/03/10 18:16 1 <i>9</i> :27	Printimh air veloci work. Torking	ostory graphs, by sensor doesn't e Phobos	e C	NT
30	20	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi kept together wi protocol		24/03/10 20:00 20:50	Taking Py win	photos • Listory par	C hs nink	NT
31	21	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi kept together wi protocol		\$5\$03\$10 18:10  8:30	Printipp velocity se	history, asr insor dough't won	k C	NT
32	22	Analysis of ethylene concentration in the air sample with GC of the department at least with 5 replications	Results of analys presented as gra						
33	22	Changeover of the nutrient solution: disabling of irrigation mode, closing with manual valves inlet and outlet of the liquid in the chamber. Opening nutrient tank and taking 3 samples of nutrient solution from the top of	Solution is chang samples of soluti before and after changeover are t	on	Ц.03.10 Л1:00 Л1:20	3 samp taken top an from # valve preparal	les are from the of 3 others he drain how of of nutrient	С	СМ
		the tank (manually) and from the bottom using drain valve (after outpouring first 3 samples into sewerage). Emptying of nutrient tank using drain valve. Rinsing of nutrient tank with distilled water. Preparation of nutrient				Solutio Problem	n he wilk there is not the in the		CH

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TI	ESI	RECORD SH	EET	Туре		Reference	Chrono :	Page	:
				MPP-	REC	10 -4103(0)	01	، ך	11
		Con	npartment : Cl	Vb	Test F	hase : 3			
		solution in external tank (see TN 96.3) and transfer into nutrient tank. Taking 6 samples of nutrient solution: 3 from the top and 3 from the bottom. Sealing of nutrient tank. Opening of inlet and outlet of liquid in the liquid loop>quertion Enabling of CO2-control.		eur bariar Whin	1 Node			C C	ey GY
34	22	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi kept together wi protocol	th test	15:30 19:45	Air Vela ileespib Phobos	iby sensor work	C	<i>KT</i>
35	23	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi kept together wi protocol						
36	24	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi kept together wi protocol	th test					
37	25	Disabling of CO <sub>2</sub> control for taking air sample from the chamber and subsequent ethylene	Use of peristaltic for taking a samp		,29.03.13 19:30	OK	ć .	C	en
		analysis. After sample is taken enabling of CO2 control							
38	25	Analysis of ethylene concentration in the air sample with GC of the department at least with 5 replications	Results of analys presented as gray	phics -	29/03/10 19:30	A Calis of ethyle and gas was rat	rshion lurve ne was done som ple cen for bC	C	сМ
39	25	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studie kept together win protocol	th test	16:30	Takiy p	hodos	С	N
40	25	Taking of 3 samples of nutrient solution from nutrient tank: a. Irrigation system is off.	Samples of the sc are taken accord the written proce nutrient tank is t closed	ing to ' edure,	23/03/10 16 : 44	1		C	ĸŢ

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TE	:51	r Record Sh	EET	Туре		Reference	Chrono :	Page	•	
				MPP-	REC	10 -4103(0)	01	81	M	
		Cor	npartment : C							
		<ul> <li>b. Opening of drain valve and filling a plastic cup with nutrient solution 3 times without closing the valve. Don't keep this solution but empty it into sewerage.</li> <li>c. After taking 3 samples continuously into 3 plastic cups (preliminary labelled) and placement them into the fridge.</li> <li>d. Enabling of irrigation system in auto mode</li> </ul>				•	· · · · · · · · · · · · · · · · · · ·			
41	26	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are stud kept together w protocol	rith test	3 <i>0 0</i> 5  0 18:00	Taking	i coures	C	N	
42	26	Labeling of 100 paper bags for drying lettuce leaves, 100 paper bags for drying lettuce roots, 100 plastic bags for storing rockwool roots with roots	Done	2	0.05.10	iveighhing bags.	b'c <i>bures</i> babelling of labelling of paper			
43	27	Inside in a fridge Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are stud kept together w protocol		31/03/10 10:45- 11:15 15:20		istory graphs, s due to pow 30.03 Fam-son Dictures	"C	N	
44	27	Labeling 6 plastic cups for taking samples of nutrient solution in the end of the test.	Done		31.03.10 17:32	01		С	ct	
45	27	Placing of 2 scales to HPC room from the department and their adjustment.	Done		31.03.10 17:15	0	K	С	C	

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### MELiSSA Pilot Plant



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Туре Reference Chrono: Page : TEST RECORD SHEET MPP-REC 10 -4103(0) 01 9 111 **Compartment : CIVb** Test Phase : 3 Done 46 27 Weighing of each 30.03 С rM OK paper bag for leaves 10:59 and roots drying and recording its weight (special template is ready for that) 1/*04*/1À Use of peristaltic pump Somm 43 Disabling of CO<sub>2</sub> control 28 Ċ M for taking a sample for taking air sample 8:52 but W2 is from the chamber and enobled as crapted is timished subsequent ethylene analysis. After sample is taken enabling of CO2 control Results of analyses are 44 28 Analysis of ethylene presented as graphics concentration in the air sample with GC of the department at least with 5 replications Plants are harvested, 28 Disabling of all control 45 1/04//0 0K ΙĂ control system is C loops. Opening the 8:57 disabled nutrient tank and taking -11:13 6 samples of nutrient solution: 3 from the top and 3 from the bottom of the tank. Opening the chamber and taking pictures of the plants. Harvesting of the plants 1 using procedure for rockwool safe manipulation. Taking pictures of plants in each tray. Writing down fresh weight of lettuce shoots (TN 96.4). Putting of lettuce shoots into preliminary weighed labeled paper bags. Weighing of paper bags for roots drying. Beginning of lettuce 1/04/10 28 Delivery of paper bags ØK Ņ shoots drying with lettuce shoots into 18:00-Veterinary School and 20:00 plants drying in the oven at 70°C with preliminary

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Type Reference Chrono: Page : **TEST RECORD SHEET** MPP-REC 10 -4103(0) 01 NO 1 **Compartment : CIVb** Test Phase: 3 fixation at 103°C during 10 minutes. Rockwool cubes are stored in a cold cabinet at 4 °C. Roots are separated \$104110 47 29 Delivery of rockwool M C and put into the oven cubes with roots inside 3:30-VG for drying at 70°C into Veterinary School -16:30 and roots separation from rockwool using Procedure for Rockwool safe manipulation 1/04/10 Travs are clean and C 48 30 Cleaning of the trays VG 2:30 stored in the chamber with soap and water СM Weight of 3 samples of 32 Checking of shoots and 7/04/10 49 Ĉ ١Ť shoots and 3 samples roots dry weight in 16:00 of roots from each Veterinary School level in the oven, it 17:30 total 24 samples Weight of 3 samples of 35 50 Checking of shoots and shoots and 3 samples roots dry weight in of roots from each Veterinary School level in the oven, it total 24 samples Weight of 3 samples of 51 36 Checking of shoots and shoots and 3 samples roots dry weight in of roots from each Veterinary School. In level in the oven, it case weights of the total 24 samples samples don't change, final records of dry biomass should be done next day. 12/04/10 Dry weights are 37 Recording of dry weight 52 หั C OK recorded, samples are of lettuce shoots and 30 taken back to MPP roots :00 Samples are prepared Mixing of dry samples of 53 38 3/04/10 for further milling CM lettuce shoots in order to  $\mathcal{C}$ OK 12:00 have 1 average sample per tray, filling of plastic 14:00 cups with samples Samples are prepared 54 39 Mixing of dry samples of 16/04/19 CM C for storage lettuce roots in the OK 9:00 10:00 extraction cabinet of the Department in order to have 1 average sample

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per tray, filling of plastic
ncijsn



Type Reference Chrono ': Page : **TEST RECORD SHEET** MPP-REC 10 -4103(0) 01 NIN Test Phase : 3 Compartment : CIVb cups with samples 55 40 Delivery of shoots С samples to Veterinary Mī School for milling

Conclusion for the Test	Name E.PEIRO	Signature EMJUU 9	Date 30.04.10
▶ Passed □ Failed		<b>F</b>	
<ul> <li>Number of deviation</li> <li>All deviations have b</li> </ul>	**************	····· \	
Comments			
Checked by <del>TechnoMembranes →</del> 근쑤 MELISSA Pilot Plant	Name A . FO SSER	Signature	Date 2/5/10

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Appendix 1 for MPD-REC 10-4103(0)-01

#### Appendix 1 - record of implied personnel

Name	ORGANIZATION	Function	Initials
Natalia Tikhomirova	Visiting Researcher MPP	Plant Scientist	NT
Cynthia Munganga	MPP	Analysis Technician	ON
Enrique Peiro	MPP	Technical manager	EP

Appendix 2: equal to Appendix 2 for MPPREC 10-4101(0)-01

EP

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Appendix 3 for MPP- REC 10-4103/0)-01

Appendix 3 - deviations list

	Appendix 3 - deviations list		
DEV.	Deviation:	Cr	ticality
FORM #			_ow
		М	edium
			High
	Corrective action:	Resp.	Due date
	Corrective action performed and checked: Ref. of retests: Checked / approved by	Clos	Ing Date
DEV,	Deviation:	Cri	ticality
FORM #		I	_ow
		M	edium
			High
	Corrective action:	Resp.	Due date
	Corrective action performed and checked:     Checked / approved by       Ref. of retests:     approved by	Clos	ing Date
DEV.	Devlation:	Cri	ticality
FORM #		1	.ow
		М	edium
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			ŀ	High
	Corrective action:		Resp.	Due date
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Clos	ing Date
	Ref. of refests:	approved by		
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M (		e Ssa n	IELISSA	Pilot	Plant	UP Universitat A de Barco	utòno	ma
TE	EST	RECORD SH		pe	Reference	Chrono :	Page :	
				P-REC	10 -4103(0)	pr 02	11	11
		Con	npartment : CIVb	Test P	hase:3	AP, C		
Test	t title	e : Maturity phase				<b>_</b>		
Obje	ctives	•	······································					
Appl	icable	test plan and test protoco	s TN 201.	z				
Hard	ware:							
Pers	on res	ponsible for the test : Nata	lia Tikhomirova					
Step No.	Day No.	quisites : Action description	Expected results / Nominal behaviour			esults / calculated ref. of Deviation	C/N C	Initi Is
1	8	Use of procedure for Rockwool safe manipulation: OP-10- 4101 (0) in order to prepare rockwool large cubes – Grodan Delta 4G 42/40 for seedlings planting	Rockwool large cubes – Grodan Delta 4G 42/40 ard dampened and can b used for the followin planting	e 🛛	6	РК	C	17
2	8	Taking trays with seedlings out of the chamber. Taking photos of the seedlings before starting transfer to bigger rockwool cubes.	t <sub>8</sub> of crop test	20/05/W 11 \ 00	- - - -		C	Ň
3	8	Selection of 100 small rockwool cubes with seedlings that look similar (height of the plants, size and quantity of leaves). Taking photos of these plants.	Selected plants are practically the same their morphology and will be used for transfer to bigger rockwool cubes				C	p
4	8	Taking 20 trays out of the chamber	Trays are prepared f planting	or 12:00-			E	GA

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TE	EST	RECORD SH	EET	Туре		Reference	Chrono :	Page	:
				MPP-	REC	10 -4103(0)	OF 02	21	11
		) Cor	npartment : Cl	VЬ	Test P	hase: 3	AF 20/5/10	)	
5	8	Placement of 5 big Rockwool cubes into each tray, dampen with distilled water if necessary	Cubes are prepa planting	red for	\$\$105/10 15130	OK		e	NT VEi
6	8	Covering of each tray with polypropylene nutrient film. Placement of small rockwool cubes with seedlings into each hole of big rockwool cubes	Attention should paid during trans process. Seedling not to be under nutrient film. Siz the holes in the nutrient film can increased if nece	sfer gs are the ze of n be	20/05/10 15:35- 17:30		τ	e	18
7	8	Taking of photos of several trays with transferred seedlings. Placement of 20 trays with transferred seedlings into HPC1	Beginning of ma phase of crop		Lolostho 15:35- 17:30			e	NG
8	8	Activation of control system: Light Mode: auto, fan mode: auto, all lamps on, day/night=16hours/8hour s Temp. and Hum.mode: auto, air blower mode:	All activated loc running	ops are	20/05/10  7:145- 18:110	Cuntrol activai feak o bion sys the the was de	system is ted, but + iniga- etem inside amber telbed ter afmost resided to te plants	C	13
		auto, day average temperature =26°C, night average temperature=20°C, day average humidity=50%, night average humidity=70%. Irrigation mode: auto, pH mode: auto, EC mode: auto, pH set point=5.9, EC set point=1.9 mS/cm, Condensate level: auto.				so art 3 how was de leave of inside with f Vaterin distille uppilnex	rei oleel to the plants within at weliminory weliminory of water to marking es are	· · · · · · · · · · · · · · · · · · ·	
9	8	When all lamps are on taking photos of all trays with seedlings inside the chamber before closing the chamber	View of the plan inside the chamb before tightening the system	ts ber g of	30/05/1.0 17:30	licolum taken	es and F	Ċ.	15

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ΓE	ST	RECORD SH	EET	Туре		Reference	Chrono :	Page :			
				MPP-	REC	10 -4103(0)	-		11		
		Con	npartment : C	СІУЬ	Test P	hase: 3	AF 20/5/	10			
10	8	Closing of the inner airlock doors (curtains) and latching of the outer doors. Activating of $CO_2$ mode: auto, $CO_2$ setpoint= 1000 ppm	Chamber is tigh closed and crop started		A1 <i>[05[</i> 10 16 <i>':00</i>	With 1000	was storted by delay as a problem cak in the fill that time for the plant	р 1 цан - 2	RN		
11	8	Addition of stock A, stock B, acid and base solutions into the appropriate tanks until a mark on each tank	Tanks are fillec initial volume (		<u>A6:20</u> 2005.10		914	C	ليها		
12	95	Disabling of CO <sub>2</sub> control for taking air sample from the chamber and subsequent ethylene analysis. After sample is taken enabling of CO <sub>2</sub> control	Use of peristalt for taking a sar	nple	d2/05/10	isho eq apa /y sis anol with departement	Klu ors bhin Wipment for (100 co/umn t, Ci S o + the t, not possible bece)	2 DE		) E	
13	9 3	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants from 3 windows	Results are stud kept together v protocol	with test	22/05/10	Not per ; f's So	Hormool as	C	M	)	
14	9 <u>/</u> 	Analysis of ethylene concentration in the air sample with GC of the department at least with 5 replications	Results of analy presented as gr	raphics	22/05/00	Net Bit's Sc no equi	erformed as where and ments invertable	<sup>3</sup> C	ns		
15	10 \$	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants from 3 windows	Results are stud kept together v protocol	with test	3/05/10	be done	ndery. W;11 on Tuesdery	ı ı	NT I		
16	114	for taking air sample from the chamber and subsequent ethylene analysis. After sample is taken enabling of CO <sub>2</sub> control	Use of peristalt for taking a sar	nple	24/us/10	no legu ouritabl (see po			T	( ba	<u>v</u>
17	111	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants from 3 windows	Results are stud kept together v protocol	with test	24/05/10	it is a will be a The	sdawy.		it		
18	111Q A	Analysis of ethylene concentration in the air sample with GC of the document is confidential property	Results of analy presented as gr	raphics	04/05/10	no equip	ment (see	C	NT T	र् स	

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#### Type Reference Chrono: Page : TEST RECORD SHEET MPP-REC 10-4103(0) Qr 02 4 111 2015/10 -AF **Compartment** : CIVb Test Phase: 3 department at least with 5 replications Not performed as if is a holiday, will be done on Tuesday Samples of the solution 24/05/10 19 11% Taking of 3 samples of ΪĬ C are taken according to nutrient solution from the written procedure, nutrient tank: nutrient tank is tightly a. Irrigation system is closed off. b. Opening of drain valve and filling a plastic cup with nutrient solution 3 times without closing the valve. Don't keep this solution but empty it into sewerage. c. After taking 3 samples continuously into 3 plastic cups (preliminary labelled) and placement them into the fridge. d. Enabling of irrigation system in auto mode Results are studied and $\frac{25}{(5)}$ kept together with test $\frac{25}{5}$ Printing history graphs Photos ou taken. 121 20 M History craphs to 21.05.10 are saved. Is samples of with out sol-u give taken. Pictures are taken, History praphs to 22.05-25.05.10 are saved. C for all loops for the period of 24 hours. Taking protocol photos of the plants Results are studied and 26/05/0kept together with test 75'75'Printing history graphs C N 13¥ 21 for all loops for the period of 24 hours. Taking protocol photos of the plants Use of peristaltic pump $\frac{1}{27/05/10}$ Not performed as an equipment for analysis is not analyane Disabling of CO<sub>2</sub> control 14 N 22 for taking air sample C for taking a sample ħ from the chamber and subsequent ethylene analysis. After sample is taken enabling of CO2 control See Step 22. 1413 Analysis of ethylene Results of analyses are 27/05/10 M 23 C concentration in the air presented as graphics sample with GC of the department at least with 5 replications 1418 Printing history graphs Results are studied and 27/05/10 Iraphs from History Ĉ N 24 25.05-26.05.10 and sovied kept together with test 17:30 for all loops for the period of 24 hours. protocol The pictures are 18:00 Taking photos of the plants

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M	EL C	66W	/IELiSS	A P	ilot	Plant	Universitat de Barc	Autòno		
TE	EST	RECORD SH	EET	Туре		Reference	Chrono :	Page	:	,
		5. •		MPP-	REC	10 -4103(0)	,0102	51	ΛΛ	
		Cor	npartment : Cl	lVb	Test P	hase: 3	AF 20/110			
25	1478	Changeover of the nutrient solution: disabling of irrigation mode, closing with manual valves inlet and outlet of the liquid in the chamber. Opening nutrient tank and taking 3 samples of nutrient solution from the top of the tank (manually) and from the bottom using drain valve (after outpouring first 3 samples into sewerage). Emptying of nutrient tank using drain valve. Rinsing of nutrient tank using drain valve. Rinsing of nutrient tank with distilled water. Preparation of nutrient solution in external tank (see TN 96.3) and transfer into nutrient tank. Taking 6 samples of nutrient solution: 3 from the top and 3 from the bottom. Sealing of nutrient tank. Opening of inlet and outlet of liquid in the liquid loop.	Solution is chang samples of solut before and after changeover are	ion taken.	11:05 28:05-13 12:30	in the till 2,5	ase solution epared uten was after from orgo		СН	
26	15 <i>附</i>	Enabling of $CO_2$ control. Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	protocol	inti test		con Mond	formul as it is ettivillike don lorg	e	ix	
27	163	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are stud kept together w protocol		29/05/10	Not per it's South done on	nterned as atyriay Will be Monday	e C	л	
28	17/4		Results are stud kept together w protocol	lied and rith test	30/05/10 <del>18:40</del>	History p -31,05410 Photos are	Hore swed. taken 2	C	NT T	Wotperformed -it's sunday
29	18/7		Use of peristalti for taking a sam		31/05/10 18:40	Not per equipment	formed a s t for analysis waiter ble	Ċ	NT	

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TE	EST	RECORD SH	EET	Туре		Reference	Chrono :	Page	:
		5 3 		MPP-	REC	10 -4103(0)	91° 02_	6	11
		Cor	npartment : Cl	Vb	Test P	hase: 3	AF 2015/10	>	
30	1874	subsequent ethylene analysis. After sample is taken enabling of CO <sub>2</sub> control Analysis of ethylene concentration in the air sample with GC of the	Results of analys presented as gra		31/05/10	Not perfi	iormed as no for analysi vai lable	S C	M
		department at least with 5 replications							
31	1877	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi kept together w protocol	ied and ith test	31/05/10 18:40	26,05,10 Ale sovred taken.	e raphs from bo 31.05.10 Pictures are		Ň
32	18 <i>4</i> 19	nutrient solution from nutrient tank: a. Irrigation system is off. b. Opening of drain valve and filling a plastic cup with nutrient solution 3 times without closing the valve. Don't keep this solution but empty it into sewerage. c. After taking 3 samples continuously into 3 plastic_cups (preliminary labelled) and placement them into the fridge. d. Enabling of irrigation system in auto mode	Samples of the s are taken accord the written proc nutrient tank is closed	ding to redure, tightly	1/06/10 17:22		day delay re was m w?th tes.		NA
33	1978	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi kept together w protocol	ith test		1	paphs one are taken	С	14
34		Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are stud kept together w protocol		9. [06]10 17:15	Photos i History Not save	are taken, graphs are asifix esn y work	C	M
35	21,40	Disabling of CO <sub>2</sub> control for taking air sample from the chamber and subsequent ethylene analysis. After sample is	Use of peristaltion for taking a sam		3/06/10	Not per equipmen anuly si's ;	formed as to for cohylun s int availabl	C	M

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TI	EST	RECORD SH	EET	Туре		Reference	Chrono :	Page	•
			,	MPP-	REC	10 -4103(0)	PT 02	7/	$\mathcal{M}$
<u> </u>		Con	npartment : C			hase: 3	AF COSTIN	,	
		taken enabling of CO <sub>2</sub> control							
36	21%	Analysis of ethylene concentration in the air sample with GC of the department at least with 5 replications	Results of analy presented as gr	aphics			armed, see	e	N
37	21%	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are stud kept together v protocol	died and with test	10110		1991is for the 1105.10-3.06,1 4. <u>K. taken</u>		15
38	200	01	Solution is char samples of solu before and afte changeover are	ition er	4/06/10 15:21 -17:52	Mutrien is chi samples	<u>A Solution</u> Angeol <sub>i</sub> S'are faken	C	ŃT
39	223	for all loops for the	Results are stu- kept together v protocol	died and with test	H/06/10 18:00-	Mistory saved.	graphs are herease of PH of From 3,06.11 rre baken	C	NĬ
		period of 24 hours. Taking photos of the plants			18:30	chorus 1	vie faken	? <b>,</b>	

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Type Reference Chrono: Page : **TEST RECORD SHEET** MPP-REC 10 -4103(0) NOL 811 AF 20/5/10 Test Phase: 3 Compartment : CIVb A base follhou Kolt Printing history graphs Results are studied and 232 40 ſ 7.06.10 for all loops for the kept together with test was piepared 4L. Farik C Cr filled Base period of 24 hours. protocol Pelore with Base Taking photos of the W1 1 how hill 2,5 L plants Sole 0 Printing history graphs Results are studied and 24% (bli 41 HORMAN as C N for all loops for the kept together with test Will period of 24 hours. protocol Taking photos of the plants Disabling of CO<sub>2</sub> control Use of peristaltic pump 42 25科 as C 1X for taking air sample for taking a sample for from the chamber and net subsequent ethylene analysis. After sample is 3 taken enabling of CO<sub>2</sub> ß control Analysis of ethylene Results of analyses are  $\mathcal{C}$ 43 25次 7106110 M concentration in the air presented as graphics sample with GC of the department at least with 5 replications 7/06/10 Printing history graphs Results are studied and Mistor 44 25% 7.106.10 ane for all loops for the kept together with test 4.06,18 15:30-C Ň period of 24 hours. protocol 17:00 SONU Taking photos of the 17:30 plants 7/06/10 Samples of the solution 45 25头 Taking of 3 samples of Samples are are taken according to NĪ nutrient solution from 18:00 Ċ the written procedure, nutrient tank: nutrient tank is tightly a. Irrigation system is closed off. b. Opening of drain valve and filling a plastic cup with nutrient solution 3 times without closing the valve. Don't keep this solution but empty it into sewerage. c. After taking 3 samples continuously into 3 plastic cups (preliminary labelled) and placement them into the fridge. d. Enabling of irrigation system in auto mode

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TE	EST	RECORD SH	EET	Туре		Reference	Chrono :	Page :	
		4 · · · ·		MPP-	REC	10 -4103(0)	Noz	91	$\lambda \Lambda \mid$
		Con	npartment : Cl	Vb		hase: 3	AF 20/5/10		
46	26%	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi kept together wi protocol				ruphs are re baken	e	NT
47	27%	Printing history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi kept together wi protocol			History saved, Photos d	graphs are	C	NT
48	28%	Disabling of CO <sub>2</sub> control for taking air sample from the chamber and subsequent ethylene analysis. After sample is taken enabling of CO <sub>2</sub> control	Use of peristaltic for taking a sam	ple .	<i>401</i> 0 14.106/40	Not	done	NC	СМ
49	2837	Analysis of ethylene concentration in the air sample with GC of the department at least with 5 replications	Results of analys presented as gra			Not	done	NC	CM
50	2827	Disabling of all control loops. Opening the nutrient tank and taking 6 samples of nutrient solution: 3 from the top and 3 from the bottom of the tank. Opening the chamber and taking pictures of the plants. Harvesting of the plants using procedure for rockwool safe manipulation. Taking pictures of plants in each tray. Writing down fresh weight of lettuce shoots (TN 96.4). Putting of lettuce shoots into preliminary weighed labeled paper bags. Weighing of paper bags for roots drying.	Plants are harve control system is disabled		м lob/ х			C	cri

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Reference Chrono: Type Page: TEST RECORD SHEET **MPP-REC** JY 02 10 -4103(0) N/M 20/5/10 AF Test Phase : 3 **Compartment** : CIVb Beginning of lettuce 51 282 Delivery of paper bags 110610 C aM shoots drying with lettuce shoots into Veterinary School and plants drying in the oven at 70°C with preliminary fixation at 103°C during 10 minutes. Rockwool cubes are stored in a cold cabinet at 4 °C. Roots are separated this was done 29% Delivery of rockwool 52 11061+ NC CM and put into the oven cubes with roots inside for drying at 70°C in MPP into Veterinary School and roots separation from rockwool using Procedure for Rockwool safe manipulation Trays are clean and 302) Cleaning of the trays K 53 stored in the chamber with soap and water Weight of 3 samples of 323 54 Checking of shoots and Not done C shoots and 3 samples ÔH roots dry weight in of roots from each Veterinary School level in the oven, it total 24 samples Weight of 3 samples of 55 353 Checking of shoots and shoots and 3 samples roots dry weight in Not done Ć CM of roots from each Veterinary School level in the oven, it -total-24 samples-Weight of 3 samples of 56 3635 Checking of shoots and shoots and 3 samples Not obre roots dry weight in ip C of roots from each Veterinary School. In level in the oven, it case weights of the total 24 samples samples don't change, final records of dry biomass should be done next day. Dry weights are 15/06/10 57 37% Recording of dry weight ίM C recorded, samples are of lettuce shoots and taken back to MPP roots Samples are prepared 3834 58 Mixing of dry samples of 20.09-1P for further milling lettuce shoots in order to C M have 1 average sample per tray, filling of plastic

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cups with samples

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### **MELiSSA Pilot Plant**



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TE	EST	EST RECORD SHEET	EET	Тур	e	Reference	Chrono :	Page	:
				MPP	-REC	10 -4103(0)	PT 22	111	11
		Cor	npartment :	CIVb	Test P	hase : 3	AF Cols/10	,	
59	3954	Mixing of dry samples of lettuce roots in the extraction cabinet of the Department in order to have 1 average sample per tray, filling of plastic cups with samples	Samples are p for storage	repared			in npp	C	СН
60	40¥	Delivery of shoots samples to Veterinary School for milling		-	28/06/1 <u>1</u>	•		C	CM

Conclusion for the Test	Name E, PEIRO	signature Ehripue Peij	Date 30.06.10
▼Passed □ Failed			
	s attached to the docu been justified or corre		
Comments			
Checked by <del>TechnoMembranes -</del> EP MELISSA Pilot Plant	Name A, FOSSEN	Signature	Date 30/6/10

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Appendix 1 for MPP-REZ 10-4103(0)-02

#### Appendix 1 - record of implied personnel

Name	ORGANIZATION	Function	Initials
Natalia Tikhomirova	Visiting Researcher MPP	Plant Scientist	M
Cynthia Munganga	MPP	Analysis Technician	СМ
Enrique Peiro	MPP	Technical manager	也

Appendix Z : equal to Appendix Z for MPP-REC 10-4101(0)-02

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Appendix 3 - deviations list

	<u> Appendix 3 - deviations list</u>			
DEV. FORM	Deviation:		Crl	ticality
#	Analysis of Ethylene not perfor	med		_OW
]	for not available column and v	stade-	(M	edium)
//	Analysis of Ethylene not perfor for not available column and n quete limit of detection of the available i	nethod		High
	Corrective action: Search for an alternative method ment for ethylene analysis (It coul a high investment) Corrective action performed and checked:	1 loouin	Resp.	Due date
	Search for an alternative method	a regup-	. ~	
:	mont for ethylene analysis (It coul	d invelv	k EP	
	a high investment)			
			Clos	ing Date
	Ref. of retests:	approved by		
DEV.	Deviation:		Cri	ticality
FORM #	as they coincided with week-end See deviz print hystory graphs of critical to be performed at the	mean		low
A second	as fully conclared with week-men	·protures	M	edium
2	Be action to be performined at the	( NOT		High
	Corrective action:		Rosn	Due date
	Potential increase the flex Notes of non critical tacks for EP dates in new version of prot	ibility		End:
	as a man notical tacks for	forme	er	2002
	Te l'han à man her c'an al prot	bud land	nar	
		-		
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Clos	ing Date
·				
DEV.	Deviation:		Crl	ticality
FORM #			L	.ow
	See Der. 1.		M	edium
3			ł	ligh
	Corrective action:		Resp.	Due date
-	N,A.			
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Clos	ing Date
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TE	ST	RECORD SH	EET	уре	Reference	Chrono :	Page	•
				PP-REC	10 -4103(0)	03	Λ /	10
		Com	npartment : CIVb	Test F	hase:3	II	,	
Test	: title	: Maturity phase						
Obje	ctives	:						
Appl	icable	test plan and test protocol	ls					
Hard	ware:							
Pers	on res	ponsible for the test : Nata	lia Tikhomirova	,				
		quisites :			Observed -	esults / calculated	C/N	Ini
Step No.	Day No.	Action description	Expected results Nominal behaviou			· ref. of Deviation	C	
1	10	Use of procedure for Rockwool safe manipulation: OP-10- 4101 (0) in order to prepare rockwool large cubes – Grodan Delta 4G 42/40 for seedlings planting	Rockwool large cubes – Grodar Delta 4G 42/40 a dampened and can used for the follow planting	n <i>11.00</i> ire be ring	OK		e-	- it
2	10	Taking trays with seedlings out of the chamber. Taking photos of the seedlings before starting transfer to bigger rockwool cubes.	t <sub>10</sub> of crop test	5707/10 10: 00	OK		e	
3	10	Selection of 100 small rockwool cubes with seedlings that look similar (height of the plants, size and quantity of leaves). Taking photos	Selected plants are practically the same their morphology ar will be used for transfer to bigger rockwool cubes	e in   10/30	° OK		C	
		of these plants.					ł	

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T	ES1	RECORD SH		Туре		Reference	Chrono :	Page	•
				MPP-	REC	10 -4103(0)	03	21	lo lo
		Cor	npartment : C	IVb	Test P	hase:3			
5	10	Placement of 5 big Rockwool cubes into each tray, dampen with distilled water if necessary	Cubes are prepa planting		5/07/10 12:00	OK		C	NT
6	10	Covering of each tray with polypropylene nutrient film. Placement of small rockwool cubes with seedlings into each hole of big rockwool cubes	Attention should paid during tran process. Seedlin not to be under nutrient film. Si the holes in the nutrient film can increased if nec	sfer gs are the ze of n be	5707710 12:00 - 15:00	ΰK		C	N
7	10	Taking of photos of several trays with transferred seedlings. Placement of 20 trays with transferred seedlings into HPC1	Beginning of m phase of crop		5707/10  2:00-  3:00	OK		C	NT
8	10	Activation of control system: Light Mode: auto, fan	All activated loc running	ops are	5/07/10	ØK		C	M
		mode: auto, all lamps on, day/night=16hours/8hour s Temp. and Hum.mode: auto, air blower mode: auto, day average temperature =26°C, night average temperature=20°C, day average humidity=50%, night average humidity=70%. Irrigation mode: auto, pH mode: auto, EC mode: auto, pH set point=5.9, EC set point=1.9 mS/cm, Condensate level: auto.							
9	10	When all lamps are on taking photos of all trays with seedlings inside the chamber before closing the chamber	View of the plan inside the chaml before tightenin the system	ber	5107110 13:55	ØK		C	NT



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### **MELiSSA Pilot Plant**

UIPAB Universitat Autònoma de Barcelona

TE	EST	RECORD SH	EET	Туре		Reference	Chron	o :	Page :	
. 5				MPP-	REC	10 -4103(0)		03	B /	D
		Con	npartment : C	IVb	Test P	hase:3	•			
10	10	Closing of the inner airlock doors (curtains) and latching of the outer doors. Activating of $CO_2$ mode: auto, $CO_2$ setpoint= 1000 ppm	Chamber is tight closed and crop started		5/07/10 13 57	-	OK		C	IN
11	11	Saving history graphs for all loops for the period of 24 hours. Taking photos of the plants from 3 windows	Results are stud		6/07/10 18:30	Photos a	ne ba		C	NT .
12	12	Saving history graphs for all loops for the period of 24 hours. Taking photos of the plants from 3 windows	Results are stud		7/07/10 16:55	Results Photos a	ure ba	vĸ. ken	C	N
13	13	Disabling of CO <sub>2</sub> control for taking air sample from the chamber and subsequent ethylene analysis. After sample is taken enabling of CO <sub>2</sub> control	Use of peristalti for taking a sam		\$/07/10	Vet per not possib low ebby washions ment ohn	llene with	leteet concen- the equip	Me	M
14	13	Saving history graphs for all loops for the period of 24 hours. Taking photos of the plants from 3 windows		Ŧ	\$/07/10					
15	13	Analysis of ethylene concentration in the air sample with GC of the department at least with 5 replications	Results of analy presented as gr	aphics	-R/07/10	sec ste	p 13	(	Der	1.2
16	13	<ul> <li>Taking of 3 samples of nutrient solution from nutrient tank:</li> <li>a. Irrigation system is off.</li> <li>b. Opening of drain valve and filling a plastic cup with nutrient solution 3 times without closing the valve. Don't keep this solution but empty it into sewerage.</li> <li>c. After taking 3 samples continuously into 3</li> </ul>	Samples of the are taken accor the written pro- nutrient tank is closed	ding to cedure,	8/07/10 13: 30	The sam terken	рНS	Were	C	K





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TE	:ST	RECORD SH		Туре		Reference	Chrono :	Page :	
				MPP-	REC	10 -4103(0)	03	4 / h	0
		Con	npartment : Cl	Vb	Test P	hase:3			
		plastic cups (preliminary labelled) and placement them into the fridge. d. Enabling of irrigation system in auto mode			8/7/10 17:30	photos. photos to	laken		•
17	14	Saving history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi		13/7/10 (03/07/10)	fhotos to	akin		
18	15	Saving history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi						
19	16	Saving history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi						
20	17	Changeover of the nutrient solution: disabling of irrigation mode, closing with manual valves inlet and outlet of the liquid in the	Solution is chang samples of soluti before and after changeover are t	ion	12/2/10 9:10	ΰκ		W	
•		chamber. Disabling of CO <sub>2</sub> mode. Taking 3 samples of nutrient solution from the bottom of the tank using drain valve (after outpouring first 3 samples into sewerage). Emptying of nutrient tank using drain valve. Preparation of nutrient solution in external tank (see TN 96.3). Opening inlet of the liquid in the chamber by the manual valves and transfer of nutrient solution through drain valve into nutrient tank. Taking 3 samples of nutrient solution from the bottom. Opening of inlet and outlet of liquid in the liquid loop. Enabling of CO <sub>2</sub> control.							



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# **MELISSA Pilot Plant**

**U**MB Universitat Autònoma de Barcelona

TF	EST	RECORD SH	EET	Туре		Reference	Chrono :	Page :	i.
				MPP-J	REC	10 -4103(0)	03	51	Ŵ
		Con	npartment : Cl	iVb	Test P	Phase:3			
21	17	Saving history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi		tit loss file	57		1	
22	18	Saving history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi		15/07/10		besare bak		NT
23	19	Saving history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are studi		14/07/10 18:35	The les	tos are tarke sults are e	ok	NT
24	20	Disabling of $CO_2$ control for taking air sample from the chamber and subsequent ethylene analysis. After sample is taken enabling of $CO_2$ control	Use of peristaltic for taking a sam	nple	15707/10	presino	stormed a ble to de fine contr instrument		$\downarrow \downarrow \overbrace{\epsilon}$
25	20	Analysis of ethylene concentration in the air sample with GC of the department at least with 5 replications	Results of analys presented as gra			see st	/		
26	20	Saving history graphs for all loops for the period of 24 hours. Taking photos of the plants					obos wie bak		CM
27	20	<ul> <li>Taking of 3 samples of nutrient solution from nutrient tank:</li> <li>a. Irrigation system is off.</li> <li>b. Opening of drain valve and filling a plastic cup with nutrient solution 3 times without closing the valve. Don't keep this solution but empty it into sewerage.</li> <li>c. After taking 3 samples continuously into 3 plastic cups (preliminary labelled) and placement them into the fridge.</li> <li>d. Enabling of irrigation system in auto mode</li> </ul>	Samples of the s are taken accor the written proc nutrient tank is closed	rding to ocedure,	15/07/10 16:45 17:10	Drigation in order The san takey.	or, mode i o to take sam mples are	ott c Mis	M





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TE	EST	RECORD SH	EET	Туре		Reference	Chrono :	Page :	
				MPP-	REC	10 -4103(0)	03	61	Ø
		Со	npartment : (	CIVb	Test P	hase: 3	<b>.</b>		
28	21	Saving history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are stu		16:20 16:20	Base solu and filled photos	hion preparece Lin the Base has aken	al C	Ø
	22	Saving history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are stu	died		Week	end		
30	23	Saving history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are stu	died		Week a			
31	24	Analysis of ethylene concentration in the air sample with GC of the department at least with 5 replications	Results of analy presented as g	-		See	step 24 Du.	4 20	U
32	24	Changeover of the nutrient solution: disabling of irrigation mode, closing with manual valves inlet and	Solution is char samples of solu before and afte changeover are	ition er	19.04.10 9:00 15:15		Fallen	C	cm
te ou tus m shock and	AB Base	outlet of the liquid in the chamber. Disabling of $CO_2$ mode. Taking 3 samples of nutrient solution from the bottom of the tank using drain valve (after outpouring first 3 samples into sewerage). Emptying of nutrient tank using drain valve. Preparation of nutrient solution in external tank (see TN 96.3). Opening inlet of the liquid in the chamber by the manual valves and transfer of nutrient solution through drain valve into nutrient tank. Taking 3 samples of nutrient solution from the bottom. Opening of inlet and outlet of liquid in the liquid loop. Enabling of $CO_2$ control.				Av Temp and Pour during to 18. 14:15	) 17h starti 07.15 at 2120-1000	S.C.	



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### **MELISSA Pilot Plant**



TF	EST	RECORD SH	EET	Туре		Reference	Chrono :	Page :	
K.				MPP-I	REC	10 -4103(0)	03	71,	10
<u> </u>		Con	npartment : C	.IVb	Test P	hase:3		• • • • • •	
33	24	Saving history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are stud		,19.07.(0		4 ·	NC	СМ
34	25	Saving history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are stud	lied	20,02-60	see she photo	p29er os raken	NC	CV
35	25	Labeling of 100 paper bags for drying lettuce leaves, 100 paper bags for drying lettuce roots, 100 plastic bags for storing rockwool roots with roots	Done			Should I -> nefill : OK	A J Based A J Stock B taken ago for Rock peen done	NC	CM
36	26	inside in a fridge Saving history graphs for all loops for the period of	Results are stud	Jied		o see st		NC	СМ
		24 hours. Taking photos of the plants							
37	26	Weighing of each paper bag for leaves and roots drying and recording its weight (special template is ready for that)	Done		16:30	photos	taken	ANC	CM
38	26	Labeling 3 plastic cups for taking samples of nutrient solution in the end of the test.	Done		22.07.10	0K		NC.	СМ
39	27	Saving history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are stud	died	22.07-10	See S	Hept 24 BP	NC	СМ
40	27	Placing of 2 scales to HPC room from the department and their adjustment.			22.07-10 15:30	(only is place	K ed) (De	NC NC	CM
40	28	Taking of 3 samples of nutrient solution from nutrient tank:	Samples of the are taken acco the written pro nutrient tank is	ording to ocedure, is tightly		and duplicated n		æ	

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TI	ES1	RECORD SH	EET	Туре		Reference	Chrono :	Page	:
				MPP-	REC	10 -4103(0)	03	81	10
		Cor	npartment : (	CIVb	Test F	hase: 3		I	
		<ul> <li>a. Irrigation system is off.</li> <li>b. Opening of drain valve and filling a plastic cup with nutrient solution 3 times without closing the valve. Don't keep this solution but empty it into sewerage.</li> <li>c. After taking 3 samples continuously into 3 plastic cups (preliminary labelled) and placement them into the fridge.</li> </ul>	closed		23.07.10	OK	Æ	NC.	CM
41	28	Saving history graphs for all loops for the period of 24 hours. Taking photos of the plants	Results are stu	died	23.07.10 8:25	See St	Der.8	) INC	CM
42	28	Disabling of CO <sub>2</sub> control for taking air sample from the chamber and subsequent ethylene analysis. After sample is taken enabling of CO <sub>2</sub> control	Use of peristalt for taking a sar		22.07-10 10:30		abled Der chylene	A NC	CM
43	28	Analysis of ethylene concentration in the air sample with GC of the department at least with 5 replications	Results of analy presented as gr		82.0)-19 11:00	ok but only (hime of pl	y 3 Replico anning-> Op	tions NC	CI
44	28	Disabling of all control loops. Opening the chamber and taking pictures of the plants. Harvesting of the plants using procedure for rockwool safe manipulation. Taking pictures of plants in each tray. Writing down fresh weight of lettuce shoots (TN 96.4). Putting of lettuce shoots into preliminary weighed labeled paper bags. Weighing of paper bags	Plants are harve control system disabled		25.07.10 8:30				



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### **MELiSSA Pilot Plant**



TE	EST	RECORD SH	EET	Туре		Reference	Chrono :	Pa	ge :	
5°	. <b>5</b> e			MPP-	REC	10 -4103(0)	03	9	1	S
		Com	npartment : Cl	Vb	Test P	hase:3				
		for roots drying.								
45	28	Delivery of paper bags with lettuce shoots into Veterinary School and plants drying in the oven at 70°C with preliminary fixation at 103°C during 10 minutes. Rockwool cubes are stored in a cold cabinet at 4 °C.	Beginning of lett shoots drying		13:00 23.07.k			1	IC.	C
46	28	Cleaning of the trays with soap and water	Trays are clean stored in the ch		11:00 23.07.10	or			vc_	<u> </u>
47	29	Delivery of rockwool cubes with roots inside into Veterinary School and roots separation from rockwool using Procedure for Rockwool safe manipulation	Roots are separa and put into the for drying at 70°	oven	02/08/10 08:00 04/08/10 13:30	usi's l				2
48	32	Checking of shoots and roots dry weight in Veterinary School	Weight of 3 sam shoots and 3 sar of roots from ea level in the over total 24 samples	nples ich n, it	28/07/10 9:00	was do	r shooks ne -s W	eight	VC	(
49	35	Checking of shoots and roots dry weight in Veterinary School	Weight of 3 sam shoots and 3 sar of roots from ea level in the ove total 24 sample	mples ach n, it s			done f	Der.th	ANC -	CI
50	36	Checking of shoots and roots dry weight in Veterinary School. In case weights of the samples don't change, final records of dry biomass should be done next day.	Weight of 3 sam shoots and 3 sam of roots from ea level in the ove total 24 sample	nples ach n, it		Not	1		VC	C
51	37	Recording of dry weight of lettuce shoots and roots	Dry weights are recorded, samp taken back to M	les are	281071(0 9:00	Ok			NC 	
52	38	Mixing of dry samples of lettuce shoots in order to have 1 average sample per tray, filling of plastic	Samples are pre for further mill		20/09/10	)			C	Cr

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T	TEST RECORD SHEET		Туре	2	Reference	Chrono :	Page	:	
				MPP	-REC	10 -4103(0)	03	101	Ŵ
		Cor	npartment : (	CIVb	Test P	hase: 3	•		
		cups with samples							
53	39	Mixing of dry samples of lettuce roots in the extraction cabinet of the Department in order to have 1 average sample per tray, filling of plastic cups with samples	Samples are pr for storage	epared	21.09.10			C	CM
54	40	Delivery of shoots samples to Veterinary School for milling			0.09.lo			С	CM

Conclusion for the Test	Name E, PEIRO	Signature Ehripu Pelj	Date ∃0.57.10
Passed 🗆 Failed			
- Number of deviations - All deviations have be			
Comments			
Checked by TechnoMembranes	Name A Epsilon I	Signature	Date
MELISSA Pilot Plant	AITUDEN	Stores	30/7/10

Dependix 1 for MPP-REC 10-4103(0)-03

#### Appendix 1 - record of implied personnel

Name	ORGANIZATION	Function	Initials
Natalia Tikhomirova	Visiting Researcher MPP	Plant Scientist	NT
Cynthia Munganga	МРР	Analysis Technician	СМ
Enrique Peiro	MPP	Technical manager	ŧP

# Appendix Z: equel to Appendix Z for MPP-BEC 10-410210)-03

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Sppendix 3 to MPP-REC 10-4103(0)-03

	Appendix 3 - deviations list			
DEV.	Deviation:		Crit	ticality
FORM #	Ethylene measurement not perfor	ned		.ow
			(M	edium
$\Lambda$			<del> </del>	ligh
	Corrective action:		Resp.	Due date
	Complete alteria the method /	himment		
	Starter the Dird Merrie the start	=prop min	ep	
	(It could require a by investment)			
	Corrective action performed and checked:	Checked /	Clos	ing Date
	Ref. of retests:	approved by		
DEV.	Deviation:		Crit	ticality
FORM #			L	.ow
2	See Dev. 1		M	edium
	fue Boy, h			ligh
	Corrective action:		Resp.	Due date
	Ν.Δ.			
	Corrective action performed and checkeds	Checked /	Clear	ng Date
	Corrective action performed and checked: Ref. of retests:	approved by	CIOSI	ing Date
1				

DEV. FORM #	Deviation: See Dev. 1		L	icality ow edium
	Corrective action: $\mathcal{N}\cdot\Delta$ .		Resp.	Due date
		Checked / approved by	Closi	ng Date

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Appendix3 to MPP- REC 10-4103(0)-03

Appendix	3	-	de	via	itic	ns	list

Appendix 3 - deviations hat			
viation:	-	Crit	licality
		L	.ow
See der. 1		C Me	edium?
			ligh
rrective action:		Resp.	Due date
N,A.			
rrective action performed and checked:	Checked /	Closi	ing Date
f. of retests:	approved by		
	-		
viation,	1 ~	Crit	icality
Qui mener to conditions in the chan	ber		
Euveronia ditu 97%	•		.ow
alla owner off, woundary	il iom	Me	edium
Temp. 35°C Since 18.07 of 14:15 UTIT	11 17.07	(F	ligh)
			Due date
rective action:	cout	Hesp.	1
The reson was probably a powe		EP	End
uning the week-end, so on blan	n remore		6000
system is needed for the HPC, and	to contra	ler	0.001
resencial supervision every day as after	ative		
rrective action performed and checked:	Checked /	Closi	ng Date
. of retests:	approved by		
dation		Crit	icality
C . use adding tasks inter mot	Dec-		~
Some more anneal vester but of	1. 12.0	-	.ow)
formed, like lating or fronts or p		Me	edium
		F	ligh
merther the objective of the the	1.		-
rrective action:		Resp.	Due date
Ν.Δ.			
$N \cdot A$ .			
Ν.Δ.			
rrective action performed and checked:	Checked /	Closi	ng Date
	Checked / approved by	Closi	ng Date
rrective action performed and checked:		Closi	ng Date
rrective action performed and checked:		Closi	ng Date
rrective action performed and checked:		Closi	ng Date
	viation: See des. A rrective action performed and checked: N.A. rrective action performed and checked: i. of retests: viation: Euriponnental conditions in the chan failed : blower OFF; hundity 97% tamp. 35°C Since 18.07 at 14:15 unt Me marning (17h) rrective action: The reson was probably a power untp the week-end, so an blar system is needed for the HPC, and system is needed for the HPC, and testencial specifican every day as after rective action performed and checked: . of retests:	Viation: See dev. 1 rective action: N.A. rective action performed and checked: i. of retests: Viation: Environmental conditions in the chamber ailed : blower OFF; hundity 97%; temp. 35°C Since 18.07 at 14:15 until 19.07 In the marine (17h) rective action: The reason was probably a power cut unip the week-end, so on blarm remote system is needed for the tIPC, and to confid wistion: Some won which talkasks were not per- formed, like taking pictures or orniting trapposeds. They didn't sifect, the process	viation: See dev. 1 See dev. 1 N. A. N. A. rrective action performed and checked: . of relests: viation: Europownental conditions in the chamber Europowed by viation: Europownental conditions in the chamber Europowed by viation: Europower of F; hundity 97%; Me Europower OFF; hundity 97%; Me Europower of F; hundity 97%; Checked / approved by Feelve action performed and checked: . of relests: Viation: Some non critical tasks were not per- formed, like taking pictures or printing Me Some wen critical tasks were not per- (Interest); Me Europower of F; hundity approved by Feelve action performed and checked: . of relests: Viation: Some non critical tasks were not per- (Interest); Me Europower of F; hundity approved by Feelve action performed and checked: . of relests: Feelve action performed and checked: . of re

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Appendix 3	to	MPP-REC	10-4103	(0) -03
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Appendix 3 - deviations list
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Appendix 3 - deviations list				
Deviation: Placing only one scale for weighing (not critical for the process)			Criticality Low Medium High	
Corrective action: To flexibilise the protocol in the new version if the Ep two scales a mandetory for the task (end e	re not f coo)	Resp.	Due date	
Corrective action performed and checked: Ref. of retests:	Checked / approved by	Clos	ing Date	
Deviation: See Dev.6		Criticality Low Medium High		
Corrective action: $N \cdot \Delta$ .		Resp.	Due date	
	Placing only one scale for weight (not critical for the process) Corrective action: To flexibilise the protocol in the new version if those two scales a mandetory for the tast (end e Corrective action performed and checked: Ref. of retests: Deviation: See DeV.6 Corrective action:	Placing only one scale for weighing (not critical for the process) Corrective action: To flexibilise the protocol in the new version if thoosp two scales are not mandetory for the tast (end of COO) Corrective action performed and checked: Ref. of retests: Deviation: See DeV.6 Corrective action:	Placing only one scale for weighing (I         (not cified for the process)         Corrective action:         To flexibilise the protocol in the new version if the for the test (end of COO)         Corrective action performed and checked:         Ref. of retests:         Deviation:         Corrective action:         Corrective action performed and checked:         Ref. of retests:         Corrective action:         Corrective action:         Ref. Of retests:         Corrective action:	

DEV. FORM #	Deviation: Oz control not disabled for ethylene determination.	L	icality .ow edium ligh
	Corrective action: Not bill impact on the experiment, especially for communication purposes. N.A.	Resp.	Due date
	Corrective action performed and checked: Checked / approved by Approved by	Closing Date	

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Appendix 3 to MPP-REC 10-4103(0) -03

	Appendix 3 - deviations list			
DEV. FORM #	Deviation: Weighing for dry weight defen	me the	6	ticality .ow
NO	not performed sequencially, only		Medium High	
	Corrective action: N.A. (not relevant, as final doesn't change)	weight	Resp.	Due date
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Clos	ing Date
DEV. FORM #	Deviation:		Criticality Low Medium High	
	Corrective action:		Resp.	Due date
	Corrective action performed and checked:	Checked / approved by	Closi	ing Date
DEV. FORM #	NA020-100		Criticality Low Medium High	
	Corrective action:		Resp.	Due date
	Corrective action performed and checked: Ref. of retests:	Checked / approved by	Closi	ng Date

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