M ELiSSA

Technical Note

Memorandum of Understanding 19071/05/NL/CP

MELiSSA Food Characterization: phase 1

Technical note 98.5.1

Preliminary trade-off of food processing technologies: Test plan and procedures.

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List of Abbreviations

AOAC	International scientific association providing official methods of analysis
BT	Bench test
ETHZ	Eidgenössische Technische Hochschule Zürich
FPWG	Food Processing Working Group
HZPC	Company specialized in breeding and selecting potato cultivars. www.hzpc.nl
MELiSSA	Micro-Ecological Life Support System Alternative
UCL	Université Catholique de Louvain
UGent	Ghent University

1 PRESENTATION

- This work package directly follows up on the TN 98.3.31 which :
  - Presented a review of the food preparation processes to be applied to the four selected crops, grown in controlled environment chambers,
  - Identified the limits of the current knowledge concerning the characterization of the processes, applied to these crops,
  - Proposed a methodology for selection of the processing technologies,
  - And a first selection of the most relevant processed products, on each of the four considered crops.
- The aim of TN 98.5.1 is to define, in accordance with the selection method elaborated in Task 3310, the test plan and procedures which will allow selecting the appropriate technologies for the four selected crops.
  The test plan will include:
  - Identification of the criteria which are necessary to be tested, because they are relevant and because the resulting value for each criteria (using Melissa crops) is not known
  - The definition of the test plan to measure these criteria, when processing the Melissa crops.
- The test plan is to be considered as a first evaluation of the processing technologies available at the involved labs and their possible selection for follow-up experiments (The selection framework of 3310 is applicable to a broader selection of processes, for which possible future strategies were outlined).
  The tests will be realized on the hydroponics crops, when available; some experiments, when useful, may be done with market field samples; correlation between hydroponics crops processing results and market crops results (literature/lab scale) is included "where relevant".
  Preliminary information on the effect of crop harvest storage, when obtainable given timing of the harvests (alternatively from market samples?) will also be gathered.
- The number of cultivars (3 or 4 available from bench test experiments) per crop that are considered for the initial processing depends on the priorities set by the different labs (choices have to be justified by the respective labs) e.g. potato will only do processing tests on 1 cultivar. It also depends on the quantities available for tests processing (samples from field or hydroponics).
- Among the different processes which have been selected for future processing tests in TN98.3.31, top one or top two selected processes will be considered in the present TN 98.5.1:
  - Potato based: microwave cooked potato and boiled potato will be considered.
    These products can be processed with existing equipment; the results will also give indications for mashed or sterilized processing; fried potatoes and flakes will not be considered here because of equipment and reduced availability of samples.

– Wheat based : freekeh, wheat sprouts and bulgur have been priorized in TN98.3.31, because they appear well suited considering the selection criteria. However, freekeh processing needs green milky stage wheat which may not be available inthe next two months (if possible, tests will be done from market samples). Due to its extraordinary nutritive profile (i), expected small number simplified processing operations (ii) and the expectation to also generate increased efficiency in hydroponic cultivation, freekeh will be considered in further detail, even though a validated technology is not yet available. However there is good chance to succeed. It is therefore proposed to process a flour based product: bread from bread wheat: this will allow to consider milling and kneading unit operations.
In the case that no enough hydroponic wheat would be available, the main test would target the wheat milling, in order to have a good knowledge of the technological potential of the obtained flour.

– Soya based: soya juice, okara, and soy sprouts have been selected in TN98.3.31. Soy sprouts, considering the study of wheat sprout processing, will only be studied through literature references. a literature review will be included

Proposed processes to be carried out on available harvests:

Potato
- microwave cooked
- boiled

Bread wheat: for each of the 4 cultivars, a total of 2 x 100g bench test (hydroponic) harvest is available.
- flour/bread (for bread, only field-based material is available)

And, if enough hydroponic wheat available :
- sprouts, bulgur
- freekeh if possible (field-based material from Australian harvest)

Durum wheat: 1,5 kg harvest and 3 kg harvest (2 cultivars) available from bench test 1
-bulgur
-flour/bread

Soy
-soya juice + okara

- Water losses (e.g. drying, soaking, boiled potato cooking) have not been considered as a criteria to be measured in these first analyses. But as we have nutritional information for raw products and cooked products, we can expect that de difference will indicate all

losses. We should be able to perform more accurate analyses of water losses in the future stages of the project.

- Some processing steps include a mechanical treatment (e.g. cutting, milling, kneading, thrashing, grinding,…), which may have as a side effect an increase in temperature of the product. It would be relevant to consider this aspect in the future establishment of the energy balance (heat transfer). However at this time the kitchens of our FPWG partners are not equipped for such measurements. This point was discussed with ETHZ (Erich Windhab) and in phase 2 of the MELiSSA Food Characterisation project, all food processing partners will obtain adequate equipment from ETHZ to enable analysis of criteria such as heat, vibration….

2 HARVEST CHARACTERISTICS AND STORAGE CONDITIONS

Table 1 indicates conditions and their timing during post-harvest preprocessing and conditioning of the bench test 1 harvests.
For field-derived harvest, standard conditions are ‘assumed’ (conservation at room temperature).

Wheat kernel drying treatments can affect germination efficiency, and thus also the sprouting process. To allow efficient germination, 45 degrees is established in industry as a maximum drying temperature. Hence the available durum BT1 harvest kernels might not be well suited for this process as they were dried at 60 degrees.

Tab. 1 Bench test 1 postharvest conditions

FC1		Seed / Tuber					Harvest	Harvest	Harvest	Process	Post-process
BT1 Hydroponic harvest		postharvest condition	postharvest condition	harvest preprocess	harvest preprocess condition	harvest preprocess condition	Storage	Storage	nutritional analysis		nutritional analysis
FC1_harvest-protocols_10		T	Time			Time	T	condition			critical steps
Ubern	Bread Wheat	Ambient		dry kernel/chaff separation	Ambient		Ambient		Elemental (Ubern)	ETHZ	
				TN4.12 2.3.9					Proximate (ETHZ)		ETHZ
UoGuelph	Durum wheat	**dry 60 °**	7-14 days	wet kernel/chaff separation	**dry 60 °**	2 days	Ambient	Sealed in plastic bag	UoGuelph	Unapoli	Unapoli
				TN4.12 3.2.5					Unapoli		
Ugent	Potato	Hardening protocol	7days	N/A	N/A	N/A	4	IPL	IPL	IPL	IPL
		TN4.12, 4.3.9	FC1_Potato-postharvest-protocol-HZPC.doc								
UCL	Potato	Hardening protocol	7days	N/A	N/A	N/A	4	IPL	IPL	IPL	IPL
		TN4.12, 4.5.2	FC1_Potato-postharvest-protocol-HZPC.doc								
Unapoli	Soybean	ambient	7-14 days				ambient	paper bags	Unapoli	Unapoli	Unapoli

3 CRITERIA AND TEST PLAN

3.1 Potato based products

Chemical analyses will be done on the following cultivars: Desirée, Innovator, Bintje, Saline and Annabelle. The Saline cultivar will not be grown hydroponically during the UGent and UCL bench tests. The Saline cultivar was not analysed because it has certain interesting characteristics, but only because consultant HZPC provided a sample for analysis. Due to the limited amount of the sample, only one analysis could be done, in this case on the raw crop. There was no more sample left to do analysis on processed Saline.
Processed analyses will be done on the following cutlivars: Désirée, Annabelle and Bintje varieties.

Tab. 2 Microwave cooked potatoes

Processing step	**Process device**	**Control parameters**	**Criteria to be measured**	**Remarks**
Raw crop		Size and unit weight of raw potatoes	Min 50g per piece. All samples have the same size to standardize cooking time	
		Weight (before cooking)	Same, may differ if peeled potatoes	45 g per piece
		Chemical food analysis (macronutrients, fibers, cations) (AOAC)	Cfr. AOAC methods	
cooking	Microwave-oven : Whirlpool Input 2500 W Frequency 2450 Mhz	Cooking time	3 to 7 minutes. To be tested to obtain the perfect cooking result. It will depend on potato size, number of pieces cooked at once, power delivery…	Cooling conditions = Ambient air or cooling machine
		Cooking temperature	High (micro-wave)	
		Delivered power	Energy consumption By watt meter* (analyzed during process)	
End product	Sensorial analysis (based on a small panel of testers) (questionnaire)		➢ Visual aspect ➢ Cfr. sensorial analysis sheet	Possible seasoning (not in first step)
			➢ Taste ➢ Cfr. sensorial analysis	Potato (or puree by

			sheet ➢ Flavor ➢ Cfr. sensorial analysis sheet ➢ Palatability ➢ Cfr. sensorial analysis sheet	fork)
		Chemical food analysis (macronutrients, fibers, cations) (AOAC)	Global Processing yield for each main component	
Wastes		Peelings, … Water Losses (water, nutrients)	Weight Nutritional compounds	

Tab. 3 Boiled potato

Processing step	Process device	Control parameters and tools	Criteria to be measured	Remarks
Raw crop		Unit size and weight of raw potatoes	Min 50g per piece. All samples have the same size to standardize cooking time. Weight may differ if peeled potatoes	45 g per piece
		Chemical food analysis (macronutrients, fibers, cations) (AOAC	Cfr. AOAC methods	
	Electric cooker	Cooking time	10 – 20 minutes. To be tested to obtain the perfect cooking result. Will depend on potato size, number of pieces in the pot, quantity of water used. Cooking process: potatoes placed in boiling water (100°C), in a pot with a cover. No salt added to the water. Min 1000	10-15 minutes depending on the variety. When a fork can enter the potato (and proven by taste).

			ml water for a maximum of 500g of potatoes.	
cooking		Delivered power	Energy consumption By watt meter* (not possible to analyze)	No water recycling
		(process optimization based on sensory testing results)		Cooling conditions = Ambiant air or cooling machine
End product		Chemical food analysis (macronutrients, fibers, cations) (AOAC)	Global Processing yield for each main component	
		Sensorial analysis (based on a small panel of tester) (questionnaire)	Visual aspect Taste Flavor Palatability -> Cfr sensorial analysis sheet	Possible seasoning (not in a first step) Potato or puree (by fork)
		Water chemical analysis	Yield analysis	Some soluble components are in the cooking water
Wastes		Peelings, … Water Losses (water, nutrients)	Weight Nutritional compounds	

** The energy consumption will be measured by using a Watt-meter. This Watt-meter indicates minimum energy consumption, peaks of energy consumption and the average energy consumption. IPL can only determine the energy consumption in case microwaves are used, because the hotplates in their kitchen are a completely embedded system without reachable electric points (sockets). In phase two of the MELiSSA Food Characterisation project the hotplate system would be rebuild and replaced by induction plates with accessible electrical points.*

Conclusions concerning qualitative or quantitative aspects of the different studied processes for potato will be summarized answering the following questions:

Macronutrients preservation
Micronutrients preservation
Sensory analysis
Energy consumption evaluation per Kcal obtained end product
Necessary room and laboratory equipment weight
Risks to human

3.2 Durum wheat based:

The tests would have been realized on two cultivars. Unfortunately, the seeds sent by UGuelph were blocked at customs and despite all efforts it was not possible to have them. So no processing tests were run in Napoli.

Tab. 4 Bulgur

Processing step	Process device	Control parameters (and tools)	Criteria to be measured	Additional Aspects
Raw product		Chemical food analysis (macronutrients, fibers, cations)		
pre-cooking	SAMSUNG Mikrowave CE 1185 UB Power: 900 W	- cooking time (stopwatch): 10-15 min. cracked-, 30-35 min. whole grain - swelling time (stopwatch): 5 min.	Energy consumption	
drying	Heraeus drying chamber Funcion Line UT6, (heat power 1.27 kW)	drying temperature (Pt 100 thermometer) drying air velocity (hotwire anemometer) drying air humidity (Li-hygrometer)	Energy consumption	(evtl. also cutting – see Frekeeh)
bran separation	Laboratory disk mill “pulverisette 13” power 1.5 kW	gap size (1.5 - >2mm adjustable) rotational velocity (fixed 440 rpm)	Energy consumption Yield	stone mill or roller mill evtl. more efficient but too heavy
(cutting)	El. Cutter: Krups G VA2 Speedy Pro Plus (power 400 W	rotational speed (stepwise prefixed) residence time (stopwatch)	Energy consumption	Different particle size distributions to be decided / fixed
cooking	SAMSUNG Mikrowave CE 1185 UB Power: 900 W	- cooking time (stopwatch): 10-15 min. cracked-, 30-35 min. whole grain - swelling time (stopwatch): 5 min.	Energy consumption	process optimization based on sensory testing results
End		chemical food analysis (AOAC methods) (macro-/micronutrients, fibers)	macro-/micronutrients, fibers	main part done at Bern U.(U. Feller)

product (bulgur, bulgur burger)			Process yield on macronutriments, fibers	
		sensory characteristics (sens. panel tests)	Flavor	
			Palatability	
			Taste	

Conclusions concerning qualitative or quantitative aspects of the different studied processes for durum wheat will be summarized answering the following questions:

Macronutrients preservation
Micronutrients preservation
Sensory analysis
Energy consumption evaluation per Kcal obtained end product
Necessary room and laboratory equipment weight
Risks to human

3.3 Bread wheat based:

Tests will be realized on the following cultivars: Greina, Florina, CH Rubli, Aletsch field samples (2 kg) and hydroponic samples (250g)

Tab. 5 Bread (whole wheat flour)

Processing step	Process device	Control parameters (and tools)	Criteria to be measured	Additional Aspects
Raw product		Chemical food analysis (macronutrients, fibers, cations)		
whole wheat flour milling	Häussler grainmill ROSI (stone mill) power: 360 W, 1300 rpm	milling speed (fixed:1300 rpm) milling gab size (adjustable)	Energy consumption Power peaks, temperature	kitchen size throughput (5-7kg/h)
kneading	SANTOS 10 Quart Dough Mixer (Kneader) Power 600 W, 1800 rpm	kneading speed (stepwise adjusted) kneading time (10-20 min)	Energy consumption	
fermentation	climate cabinet, Weiss VB VB 0512	temperature (Pt-100 thermometer) 25°C humidity (hygrometer) fermentation time (stopwatch) 18h		
portioning	dough cutting plate			
relaxation	ambient condition cabinet			
fermentation	climate cabinet, Weiss VB VB 0512	temperature (1 Pt-100 thermometer) 25°C humidity (hygrometer) fermentation time (stopwatch) 2h		
baking	MANZ baking oven type 30/2 power 2.6 kW 50-270°C	baking temperature (Pt-100 thermometer) 240°C/200°C baking time (stopwatch) 10 min / 35-40 min humidity (hygrometer) 15-30%	Energy consumption Yield	process optimization based on sensory testing results
End product (bread)		Chemical food analysis (AOAC methods) (macro-/micronutrients, fibers)	micronutrients,	main part done at Bern U.(U. Feller)

			macronutrients fibers	Done at ETHZ
			Process yield on macronutriments, fibers	
		sensory characteristics (sensory panel tests)	Flavor	
			Palatability	
			Taste Texture Bakingvolume	

Tab. 6 Wheat sprout salad

Processing step	**Process device**	**Control parameters (and tools)**	**Criteria to be measured**	**Remarks**
sprouting	Plant growth chamber, Weiss VB VB 0714	- temperature (Pt-100 thermometer) 21°C - humidity (hygrometer) 50-60% - light (spectrum, intensity) (lumi-/spectrometer) daylight - sprouting time (stopwatch) 48h	Energy consumption Gas exchanges balance? Water consumption	simplified alternative sprouting under daylight conditions
drying	Heraeus drying chamber Funcion Line UT6, (heat power 1.27 kW)	drying temperature (Pt 100 thermometer) 45°C drying air velocity (hotwire anemometer) 1-2 m/s drying air humidity (Li-hygrometer) < 50% RH Sensory characteristics (sens. panel tests)	Energy consumption	(evtl. also cutting – see Frekeeh)
End product Wheat sprout salad		Chemical food analysis (AOAC methods) (macro-/micronutrients, fibers)	micronutrients, macronutrients /fibers	majn part done at Univ. Bern (U. Feller) ETHZ
			Process yield on macronutriments, fibers	Other ingredients to be added in salad : oil,

				vinegar, spice mix
		sensory characteristics (sensory panel tests)	Flavor	
			Palatability	
			Taste Texture	

Tab. 7 Freekeh burger

Processing step	Process device	Control parameters and tools	Criteria to be measured	Additional Aspects
Raw product		Chemical food analysis (macronutrients, fibers, cations)		
Roasting	Coffee Drum a.) electric roaster Swissmar Alpenröst; 1020 Watts – or b.) direct gas fired RK drum (ca. 1.5 kW)	-roasting temp.: 200-470°C (thermocouples and IR-based contactless temperature sensors) -roasting time: 1- 20 min. (stopwatch) -cooling conditions-air cooler (Pt 100 thermometer) < 25°C	Energy consumption , Power peaks Yield	Process to be adjusted for green wheat (frekeeh) – (only well defined roasting profiles available for coffee)
thrashing (evtl.)	Lab-scale thrashing device: WINTERSTEIGER LD 180 el. Motor 0,75 kW; thrash drum 560-1400rpm fan 1720 rpm	-rotational speed of thrasher (rpm-strobe meter) -rotational speed of fan (inbuilt potentiometer) -grain mass flow rate / residence time (electronic balance / stop watch)	Energy consumption Power peaks Yield	Process to be adjusted for green wheat frekeeh (no industrial data yet available)
cutting	El. Cutter: Krups G VA2 Speedy Pro Plus (power 400 W Container volume: 400 ml)	rotational speed (stepwise prefixed) residence time (stopwatch)	Energy consumption Power peaks	Different particle size distributions to be decided / fixed
Processing step	**Process device**	**Control parameters (and tools)**	**Criteria to be measured**	**Additional Aspects**
	Heraeus drying chamber Funcion	drying temperature (Pt 100 thermometer) 50°C	Energy consumption	

drying	Line UT6, (heat power 1.27 kW)	drying air velocity (hotwire anemom) 1-2 m/s drying air humidity (Li-hygrometer)	Yield	
cooking	SAMSUNG Mikrowave CE 1185 UB Power: 900 W	cooking time (stopwatch): 10-15 min. cracked-, 30-35 min. whole grain swelling time (stopwatch): 5 min.	Energy consumption Yield	process optimization based on sensory testing results
End product		chemical food analysis (AOAC methods, macro-/micronutrients, fibers)	micronutrients, macronutrients, fibers	main part done at Univ. Bern (U. Feller)
			Global Processing yield on macronutriments and fibers	ETHZ
		Sensory characteristics (sensory panel tests)	Flavor Palatability Taste Texture	

Conclusions concerning qualitative or quantitative aspects of the different studied processes for bread wheat will be summarized answering the following questions:

Macronutrients preservation
Micronutrients preservation
Sensory analysis
Energy consumption evaluation per Kcal obtained end product
Necessary room and laboratory equipment weight
Risks to human
Critical processing aspects: Power peaks, vibration, waste/dust generation

3.4 **Soya based products:**

Tests will be realized on the following cultivars : Atlantic, Cresir, PR91M10 and Regir (market samples for all four cultivars)

Note:
A certain number of processing steps include a mechanical treatment (e.g. cutting, milling, kneading, thrashing, grinding,…), which may have as a side effect an increase in temperature of the product. However, for soymilk/okara production, the temperature rise during wet grinding is negligible compared to paste boiling and soymilk sanitization.

Tab. 8 Soy milk test plan

Processing step	**Process device**	**Control parameters (and tools)**	**Criteria to be measured**	**Remarks**
Raw product (soybean seeds)		Chemical food analysis (macronutrients, fibers, phytic acid, isoflavones)		
Soaking	Thermostat bath (Buchi Heating Bath B-490 – Power: 1300 W)	Thermometer: Soaking temp.: 20-25°C Stopwatch: soaking time: 24 h Seeds:water = 1:10	Energy and water consumption	
Wet grinding	Blender (Braun Minipimper 400 – Power: 300W)	rpm-strobe meter: rotational speed of blades Stopwatch: grinding time	Energy and water consumption	
Paste boiling	Cooker (Bimby Vorwerk TM31 – Power: 1000W)	Stpowatch: cooking time= 30 mim		
Filtration	Filter 70 mesh			
Soymilk sanitization	Cooker (Bimby Vorwerk TM31 – Power: 1000W)	Stpowatch: cooking time= 15 mim	Energy consumption	
End product Soya milk		Chemical food analysis (AOAC methods) (macro-/micronutrients, fibers)	macro-/micronutrients, Phytic acid content	
			Process yield on protein content Fat content Isoflavones	
		sensory characteristics	Flavor	

		(sensory panel tests)	Palatability	
			Taste	

Tab. 9 Okara test plan

Processing step	**Process device**	**Control parameters (and tools)**	**Criteria to be measured**	**Remarks**
Raw product (soybean seeds**)**		Chemical food analysis (macronutrients, fibers)		
Soaking	Thermostat bath (Buchi Heating Bath B-490 – Power: 1300 W)	Soaking temp.: 20-25°C Soaking time: 24 h Seeds:water = 1:10		
Wet grinding	Blender (Braun Minipimper 400 – Power: 300W)	Rotational speed of blades Grinding time	Energy consumption	
Paste boiling	Cooker (Bimby Vorwerk TM31 – Power: 1000W)	Cooking time: 30 min	Energy consumption	
Filtration	Filter 70 mesh			
End product Okara (pulpe residue from soya juice extraction)		Chemical food analysis (AOAC methods) (macro-/micronutrients, fibers)	macro-/micronutrients, fibers Phytic acid content	
			Process yield on protein content Fat content Isoflavones	Other possible ingredients for «domestic" recipes (Recipes adding different products, will be not evaluated)
		sensory characteristics (sensory panel tests)	Flavor	
			Palatability	
			Taste Texture	

Tab. 10 Soya sprouts

Processing step	Process device	Control parameters (and tools)	Criteria to be measured	Remarks
sprouting	Climate cabinet (Thermaks 6000 – Power: 1200 Watt) Soybeans are germinated in darkness	Thermometer		
Drying*	Heto LYOPRO 6000 Powereddry PL6000	Thermometer,	energy consumption	
End product Soya sprout		(macro-/micronutrients, fibers)	macro-/micronutrients, fibers	
			Process yield on protein content Fat content Isoflavones Phytic acid content	Other ingredients to be added to salad ? Oil and salt.
		sensory characteristics (sensory panel tests)	Flavor	
			Palatability	
			Taste Texture	

***Sprouts water content is 10-15%. Freeze-drying completely removes the water.

Conclusions concerning qualitative or quantitative aspects of the different studied processes for soya will be summarized answering the following questions:

Macronutrients preservation
Micronutrients preservation
Sensory analysis
Energy consumption evaluation per Kcal obtained end product
Necessary room and laboratory equipment weight
Risks to human

4 Realization and timing

- The three teams will homogenize the definition of their criteria (yield, nutrient preservation, energy…).
- The process yield (mass loss), energy consumption, should be gathered in a separate table
  The product nutritional analysis results will be presented in the same table format.
- A common simple sensory test plan will be done by the three teams. It will be a simple hedonic quotation, including each time this is possible, a comparison to a reference market product (boiled potato, sprout or soy juice…). The hedonic quotation would include aspect, texture, taste and global evaluation notes (from 1 –awful- to 10 –excellent-). Tests will be performed by 8 to 10 (non expert) consumers. The questionnaire proposed to the non expert consumers who tasted the potatoes is included in the annex of this document. As it was only used by people from the IPL network, the document is in French. It will be translated when proposed to European citizens in general.

The experimental results are expected on June, 30th 2010. The report will be issued on 30th September 2010.

5 Annexes

5.1 Annex 1: Questionnaire for sensorial evaluation on potato

Fiche d'évaluation sensorielle – Pommes de terre – Projet MELiSSA

Date : …../…../ 2010 Numéro de lot : ……

0 : Nullement Satisfait pour ce critère 5 : Entièrement Satisfait pour ce critère

Descripteurs	Notation					
Évaluation Visuelle						
Couleur de la peau	0	1	2	3	4	5
Couleur de la chair	0	1	2	3	4	5
Aspect extérieur de la peau (points noirs, réseaux,…)	0	1	2	3	4	5
Évaluation Olfactive						
Intensité (sentir au moins trois fois)	0	1	2	3	4	5
Évaluation Gustative						
Saveur (Note globale)	0	1	2	3	4	5
Sucré	0	1	2	3	4	5
Salé	0	1	2	3	4	5
amer	0	1	2	3	4	5
Arômes (Note globale)	0	1	2	3	4	5
Fruits secs (noisette)	0	1	2	3	4	5
Végétal (légume vert cru ou cuit, herbacé)	0	1	2	3	4	5
Fumé, grillé, brûlé	0	1	2	3	4	5
Terreux (terre fraiche)	0	1	2	3	4	5
Autre n°1 (précisez):	0	1	2	3	4	5
Texture (Note globale)	0	1	2	3	4	5
Texture de la peau	0	1	2	3	4	5
Friable (se casse, se désagrège en morceaux)	0	1	2	3	4	5
Dureté	0	1	2	3	4	5
Farinosité (poudreuse, étouffante)	0	1	2	3	4	5
Granulosité (présence de grains)	0	1	2	3	4	5
Fondant (passe vite de l'état solide à liquide)	0	1	2	3	4	5
Humidité (sensation d'eau en bouche)	0	1	2	3	4	5
Persistance en bouche	0	1	2	3	4	5
Autre n°1 (précisez):						
Cuisson (Note globale)	0	1	2	3	4	5
Justesse de cuisson	0	1	2	3	4	5

Note Globale	0	1	2	3	4	5

Donnez votre avis sur la pomme de terre analysée :

……
……
……
……
……..

Achèteriez-vous cette pomme de terre ? OUI – NON
Pourquoi ?

……
……..

Consommeriez-vous cette pomme de terre ? OUI – NON
Pourquoi ?

……
……..

Adapted from Desgrousilliers J., Etieve C. http://www.yopdf.eu/analyse-sensorielle-du-pomme-pdf.html#a3. (May 2010)

6 Table to reply to remaining ESTEC comments

General comments issue 1 review 0		General comments issue 1 review 1		UGent answer
1	The TN aims at describing the food processing test plan proposed in relationship with the final products preliminary selected in TN 3.31. Although the test plan is rather clear, the procedures were expected to be defined more accurately: i.e. control parameters setpoints defined, duration of processing steps defined, which is not the case for all processes. It is understood that few procedures may have been partially elaborated during the testing work. If it is the case, then it	1	Few unclarities remain wrt setpoints expected to be reached in the procedure (cooking time in tab.3; drying temperature, drying air velocity, drying air humidity, cutting residence time in tab4; fermentation temperature, fermentation humidity, fermentation time, baking temperature, baking humidity and baking time in tab5.;sprouting temperature, sprouting humidtity, sprouting light, sprouting time, drying temperature, drying air velocity and drying air humidity in tab6.; etc...). If those setpoints cannot be provided in the Technical	For potato, details were added to table 1-2. For wheat, details wrt setpoint were added to table 5-7. For soybean, all setpoints were defined for soymilk and okara production process. Several studies suggest the following soybean germination conditions: 20°C; 99% relative humidity; darkness; 4-7 days.

	should be clearly mentioned. Please clarify the document everywhere it is applicable..		note because they are unknown and they have consequently to be established by test, please indicate in the present worksheet.	
2	A certain number of processes include a "drying" step. It is regretted that the water loss have not been considered as a criteria to be measured. Same comment applies for "soaking", "boiled potatoe cooking" and anywher water is used in the processing steps. Please clarify the reason of not considering this criteria.	2	this comment has been answered in the text of the Technical Note	
3	A certain number of processing steps include a mechanical treatment (e.g. cutting, milling, kneading, thrashing, grinding,…), which may have as a side effect an increase in temperature of the product. Is it relevant to consider this aspect in the future establishment of energy balance (heat transfer)?	3	this comment has been answered in the text of the Technical Note	
4	A simple sensory test plan is proposed, based on a hedonic quotation. The questionnaire proposed to the non experts consumers should be included in this TN	4	the questionnaire proposed has been added in the annexes	
		5	remaining detailed comment can be answered directly in the present worksheet	
Detailed comments				
Section	**Comment**	**Section**	**Comment**	
3.1	the Saline cultivar is reported as being a field grown cultivar, for which samples were provided for			

	analyses. The reasons for including this cultivar in the test plan should be clarified.			
3.1	In addition, it is mentioned that the cultivar will be analysed, but the processed analyses are proposed on a list of cultivar which does not include the Saline. Please clarify			
3.1 tab 2	delivered power is mentioned as a control parameter. Is it proposed to be measured during the test and used as a controller of the process?	3.1 tab 2	delivered power is mentioned as a control parameter. Is it proposed to be measured during the test and used as a controller of the process?	YES, both the potato and wheat processing experts confirm that it is proposed to measure the power consumption during the test and use it as a control parameter of the process. *For soybean, the delivered power was not directly measured in the tests so far.*
3.1 tab 2	the energy consumption is proposed as a "criteria to be measured". Will it be measured or assessed? This point should be clarified			
3.4 tab 9	the filtration step needs to be documented in more details.			