Sutton Bridge Experimental Unit

CONTRACT STUDY REPORT

Provision of crops for FSA project CO3037

Exploiting the effects of domestic cooking on acrylamide levels in food

A contract study undertaken for FSA in association with Leatherhead Food International

FINAL REPORT

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1. Introduction

During a meeting of representatives from the Food Standards Agency (FSA), Leatherhead Food International and the BPC (10 October 2005) it was requested that crops for this project be supplied by BPC Sutton Bridge Experimental Unit (SBEU). Carrying out storage at SBEU would aid interpretation of data by collaborators, as samples would be obtained from crops of a known provenance. In previous work, acrylamide determinations were carried out on material purchased in retail outlets.

At the meeting, it was agreed that three cultivars with contrasting characteristics would be obtained and stored conventionally according to typical current practices for the pre-pack industry. The established cultivars Desiree and Maris Piper and the more recently introduced Cabaret were selected.

Three crops of potatoes were stored for a period of approximately 8 months at 3.5 C and 95% RH. Samples were delivered to LFI for frying and subsequent acrylamide evaluation on 3 occasions. Tuber sprouting was controlled by way of treatment with approved sprout suppressants according to industry practices.

2. Materials & methods

Crops of 3 cultivars, Desiree, Maris Piper and Cabaret, were obtained from commercial sources and loaded into store on 26th October 2005. Samples were held in trays of 10kg capacity with five replicates assigned for each variety per sampling occasion. The store was then filled to capacity with identical crop, but which remained unassessed.

Sample trays were held in a fully randomised design, blocked by sampling occasion. Crops were cured at 12°C for 1 week before temperature was reduced to 3.5°C at a rate of 0.5°C/day using refrigeration. Humidity control was enabled, at 95% Relative Humidity, when crop reached holding temperature, by the use of ultrasonic atomisers.

Sprout growth of material became evident during storage, most notably in cv. Desiree. Growth was controlled by use of CIPC sprout suppressant (MSS CIPC 50M at 0.85 litres/20 tonnes rate, Whyte Agrochemicals Ltd., Huddersfield, West Yorks.) applied as a hot-fog to samples assigned to sampling occasions two and three. Application was carried out on 24th November 2005, in a separate gassing chamber.

At store loading, 3 sub-samples were taken of each variety for assessment of disease pathology, dry matter content, fry colour and size grading.

One week before delivery, samples were transferred to a separate store at a temperature of 10 C, prior to washing and delivery to LFI for processing and analysis. The warming of tubers prior to washing is a routine practice and serves to minimise bruising during handling operations.

Washed samples were delivered, by SBEU staff, for same day processing at LFI on the dates shown in table 1.

Table 1. Delivery dates for samples for LFI

sampling occasion	storage term	delivery date	weeks in store
1	Short	7/12/2005	6
2	Medium	15/2/2006	16
3	Long	21/6/2006	34

3. Results

3.1 Pathology

All crops showed evidence of common scab *(Streptomyces scabies),* though this was at a low severity (table 2).

Desiree and Cabaret samples had a high incidence of Silver Scurf *(Helminthosporium solani)* though the severity of infection was low. Black scurf *(Rhizoctonia solani)* occurred in samples of Maris Piper and Cabaret.

Cabaret also had a high incidence of Black Dot *(Colletotrichum coccodes),* and the severity of this (skin blemishing) disease was significant.

Samples of all cultivars were of a suitable quality for the pre-pack market, though with cv. Cabaret this was not of a premium grade.

Table 2. Incidence (% tubers infected) and severity (% surface area affected) of diseases at store loading.

Incidence (%)	Black dot	Black scurf	Common scab	Silver scurf
Desiree	13.33	0.00	29.33	68.00
Maris Piper	13.33	20.00	53.33	4.00
Cabaret	77.33	22.67	30.67	85.33
Severity (% SA)				
Desiree	0.13	0.00	0.29	1.42
Maris Piper	0.29	0.20	0.82	0.04
Cabaret	9.99	0.23	0.31	1.05

4.2 Dry matter

Dry matter content of samples of each variety was assessed (table 3) using the method outlined in appendix 1. For cultivars Desiree and Maris Piper these were within the normal range for pre-packing.

Table 3. Dry matter content (%) of samples at store loading.

cultivar	dry matter (%)
Desiree	22.1
Maris Piper	19.5
Cabaret	19.7

4.3 Fry colour

Fry colour of samples of each cultivar was assessed, after processing into chips, using a standardised frying protocol (appendix 1). At store loading, samples of Maris Piper and Cabaret had light fry colour. Fry colour of cv. Desiree was dark and, although below commercially acceptable thresholds for processing (table 4), was appropriate for crop under `pre-packing' storage conditions. At the time of store loading, recently harvested Desiree material could not be located, and crop was obtained from a commercial store. This material evidently already showed symptoms of low temperature sweetening, resulting in the dark fry colour observed.

Table 4. Fry colour of samples at store loading.

cultivar	SBEU Chip Score	Hunter L value
Desiree	6.20	28.20
Maris Piper	1.80	56.02
Cabaret	1.85	57.67

4.4 Grading

Tuber size distribution for samples is shown in table 5.

Table 5. Size grading

	% by weight in each size band						
cultivar	<30mm	30-40mm	40-50mm	50-60mm	60-70mm	70-80mm	>80mm
Desiree	0.0	0.4	27.9	42.2	29.4	0.0	0.0
Marls Piper	0.0	0.2	12.5	24.9	47.0	13.6	1.8
Cabaret	0.0	0.2	14.3	36.2	38.8	10.5	0.0

Appendix 1: Assessment methods

Dry matter

Dry matter content was estimated using a system[1] operating on the principle of specific gravity (weight in air/weight in water).

[1] *Grav-o-tater:* a computer apparatus for measuring specific gravity. GCC Tai, GC Misener, ES Allaby, LP McMillan - American. Potato Journal, 1985.

BPC SBEU Frying and Colour assessment

From the washed sample to be assessed a 20 tuber sub-sample is obtained, excluding tubers with greening. Using a 3/8th inch hand press, a single central longitudinal strip is cut from each tuber.

The pooled sample of 20 strips is fried for 90 seconds with an oil temperature of 190C at the start of frying, ensuring the fryer is in heating mode (i.e. temperature of oil increasing) when sample immersed. The sample is agitated during frying.

Immediately after frying the colour of the sample is visually assessed in a light cabinet. Fry colour is assessed by comparing individual chips with the USDA standard colour chart. The number of chips of a sample matching the standard colours (scoring between 000 [light] and 4 [dark]) is recorded as appropriate. SBEU chip score is derived using the following conversion.

	Light						Dark
USDA value	000	00	0	1	2	3	4
BPC Chip Score	1	2	3	4	5	6	7

The fry colour of the pooled (20 strips) sample is then assessed using a HunterLab DP-9000 spectrometer.