



BIOX-M

MINT OIL - COMMERCIAL TRIALS 2010

Executive Summary

Biox-M is a highly effective means of controlling sprout development in potatoes in store.

There is some evidence of enhanced efficacy from multiple treatments with Biox-M and from treatment with Biox-M following treatment with CIPC.

Biox-M confers a strong residual smell of mint to the crop. Two independent taste panels found no significant difference between treated and untreated crops when cooked. One taste panel found the residual smell/flavour unacceptable. One consumer panel reported a positive response to a faint residual aroma.

There is evidence to suggest that the initial application rate to crops already stored at less than 5°C should be less than the full individual rate of 90ml/t.

Stores should be managed to remove any risk of condensation forming on the ceiling following treatment.



Branston – King Edward - on removal 10th May 2010

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Introduction

Biox-M is the trade name for naturally occurring spearmint oil, which has recognised efficacy when used to prevent sprout growth in stored potatoes

Spearmint Oil was positively listed in Annexe I to the Plant Products Directive 91/414/EEC in September 2009 for use as a sprout suppressant in potatoes

Biox-M has been granted various approvals by EU Member States following Annexe I listing

Biox-M was granted experimental approval by the Chemicals Regulation Directorate of the HSE on 11th November 2009 for a period of three years (approval number 3093/2009) for the treatment of a maximum of 10,000 tonnes

The experimental approval is for a maximum individual treatment of 90ml/t, and maximum total treatment of 390ml/t

In January 2010 five packers of potatoes for the fresh retail market (QV Foods, Branston, Solanum, Greenvale AP and Manor Fresh) came together to support a series of commercial trials of Biox-M arranged by Juno (Plant Protection) Ltd

A total of 19 varieties were included in the main trial



Treatment of the Hoveton Store

Trial 1 – Hoveton (see also Appendices 2–6)

Site

The store used for the main trial was a former modified atmosphere fruit store at: Preva Produce, Blue 32, Tunstead Road, Hoveton, Norfolk NR12 8QN
OS Ref: TG305187

The stores on site are managed by Preva Produce; all day to day supervision of the store, management of store refrigeration and loading and unloading of crop was undertaken by Preva staff. The store was probably more air tight than many commercial potato stores, but not untypical of the best now in use.

There were no low speed recirculation fans in the store.

Application Equipment

The equipment used to apply Biox-M to the store was a Cedax Electrofog EW 7500, operated by Pierre Galand, an experienced operator of Xeda Electro-fogging equipment.

The application fogger was placed outside the store, with the application tube inserted through a hole in the door (see previous page). Applications were carried out in accordance with the draft label for Biox-M (Appendix 1), and the operating instructions for the Cedax Electrofog EW7500.

Crop Details

Five packers of fresh potatoes supplied a total of 95 one tonne boxes with 19 varieties from a range of soil types to the main trial store on 27th January 2010 (Branston on 29th January).

See Appendix 2 for full details.

Controls, treated either with conventional means (ethylene or CIPC) or untreated, were retained by each supplier.

All were delivered from cold stores holding crop at around 3°C.

11 boxes had received a single treatment with CIPC in November or December.

29 boxes had been in stores treated with ethylene prior to delivery to the trial.

55 boxes had received no previous treatment with a sprout suppressant.

After loading in to store, access for sampling was limited to those boxes at the front of the store or on top of the stacks.



Stacking in the Store

Intake assessment summary:

Each box was assessed for sprout growth on arrival, and scored accordingly:

0	No visible eye movement	46 boxes
1	Eyes open. No measurable sprout growth	28 boxes
2	Eyes open. Sprout growth <2mm	12 boxes
3	Widespread sprout growth <2mm	4 boxes
4	Widespread sprout growth >2mm	1 box
5	Old sprout growth, and some re-growth >5mm	4 boxes

Details of crops scoring 3 to 5

Score

3	Solanum Mozart	4 boxes
4	Manor Fresh Annabelle	1 box
5	Solanum King Edward	4 boxes

Crop delivered into store included a range of sprout development from no eye movement to well established sprout development



Greenvale Vales Sovereign on delivery – 27th January



Manor Fresh Annabelle on delivery – 27th January

Application & Rates

The target store temperature was maintained at 3°C, except when the refrigeration was turned off for 24 hours prior to treatment and 72 hours following treatment. Ambient temperature during most of the storage period was cold, and the store gained less than 1.5°C at the time of each treatment.

Refrigeration and fans were switched off 24 hours prior to each treatment. The fans were turned on for 2 minutes every fifteen minutes during treatment to aid movement of the fog within the store. Refrigeration was re-started around 72 hours after each treatment.

9th February	90ml/t	Biox-M applied as a fog
11th March	45ml/t	Biox-M applied as a fog
27th April	30ml/t	Biox-M applied as a fog
Total applied	165ml/t	

Efficacy

Crops at intake varied widely in sprout development (see previous page). Immediately prior to the second treatment the store was inspected by David Wagstaffe of Superfog, a company specialising in the treatment of commercial potato stores with CIPC for sprout control. His assessment of the control still evident from the first treatment was that, in a commercial situation, the second treatment would have been postponed for at least 10 days, and the crop then reassessed prior to treatment.

Complete control of sprouting was achieved following the first treatment. Six days after treatment, there was little sign of sprout damage; 13 days after treatment, all previously initiated sprouts had blackened and were no longer viable. Samples were removed from the store sequentially during the spring and assessed both at the time of removal, and after washing were stores in refrigerated and ambient conditions (replicating the domestic situation after purchase). See Appendix 6 for full assessment details.

Full control of sprouting was maintained by the combination of temperature and treatment until the crop was removed from store on 10th – 12th May. The only crop that showed any sign of eye movement on removal in May were some tubers of Branston Desiree. In all other cases the sprout control was total, even for those crops (the majority) that had arrived with eyes open through to large and/or established sprouts.





Manors Fresh Annabelle on removal – 10th May 2010



Solanum King Edward on removal – 10th May 2010

This crop was well sprouted on delivery – score 5

Other Issues

Control of sprouting was total.

However, one matter arose following the first treatment at the full recommended rate. When the store was assessed on 24th February (15 days after treatment) it was apparent that some tubers on the top of some of the top boxes (stacked 4 high) had suffered damage from the product condensing on the ceiling of the store and dripping on to the crop underneath (see below). The damage was not uniform; and only affected some tubers at the top of the top layer of boxes. Some varieties appeared to be more susceptible to damage (King Edward, Desiree and Charlotte were the most severely affected, and many varieties were entirely unaffected).

Spearmint oil is phyto-toxic, and the damage would appear to have been the result of small quantities of Biox-M condensing on the ceiling of the store and dripping on to the crop below. The degree of condensation is likely to have been affected by the application rate, the holding temperature in store, the material of the store ceiling, and the absence of internal low speed recirculation fans.

No further damage was seen following the second and third treatments at lower application rates (although there was some damage in another trial – see Trial 2 below).

For Biox-M to gain customer acceptance, it is essential that the risk of damage is minimized. The level of damage to the varieties affected would not be commercially acceptable. It is recommended that the label be modified to reduce the maximum single application rate for crops that are already at holding temperature (i.e. have already been in cold store for some time), and/or are being held below 5°C.



Condensation damage to King Edwards

Trial 2 *(see also Appendix 3 and Associated Reports)*

Site

The store used for the second trial was a converted military building, which had been insulated with spray foam, and is in many ways more typical of potato storage facilities in much of the UK.

Greenvale AP, Tern Hill, Warrant Road, Stoke Heath, Market Drayton, Shropshire, TF9 2JJ
OS Ref: SJ644298.

For full details of this trial see the attached report and photographs:
Mint Oil Trial – Tern Hill March 2010.

Application Equipment

The equipment used to apply the Biox-M to the store was a Cedax Electrofog EW 7500, operated by Pierre Galand, an experienced operator of Xeda Electro-fogging equipment.

The application fogger was placed outside the store, with the application tube inserted through a hole in the door.

Crop Details

See attached report

Application & Rates

This trial was a single treatment at 50ml/t on 11th March 2010.

Efficacy

See attached report.

Other Issues

See attached report.



Trial 3 (see also *Appendix 3*)

Site

The store used for the third trial is another converted building, insulated for use as a potato store Greenvale AP, Floods Ferry, Doddington, March, Cambridgeshire, PE15 0UW.
OS Ref: TL355932.

Application Equipment

The equipment used to apply the Biox-M to the store was a Cedax Electrofog EW 7500, operated by Pierre Galand, an experienced operator of Xeda Electro-fogging equipment.

The application fogger was placed outside the store, with the application tube inserted through a hole in the door.

Crop Details

The majority of the crop in this store was already well sprouted, and in generally poor condition, unlikely to be suitable for the original target market. The trial was aimed at assessing the potential for Biox-M to control severe sprouting and effectively 're-condition' crop, which had begun to fail.

Application & Rates

This trial was a single treatment at 50ml/t on 27th April 2010.

Efficacy

Two blocks of treated crop were packed and delivered to customers. As this stock had been previously written off, this is seen as a successful outcome.

Other Issues

Unaware of any.



Taste and Taint Testing *(see also Associated Reports)*

Summary

Samples from the crop treated at Tern Hill (trial site 2) were sent to Wirral Sensory Services for organoleptic testing.

WSS identified no negative difference between treated and untreated samples (reports attached – p.37 and p.46)

Samples of the Branston crop stored at Hoveton (trial site 1) were sent to Tesco for NPD evaluation on 5th July (56 days after removal from the trial store).

No significant difference was found between treated and untreated samples (report attached p.55)

Samples of the Manor Fresh crop stored at Hoveton (trial site 1) were assessed by Campden on 25th June (46 days after removal from the trial store).

Negative comments were received about mint flavor and taste, and as a result the crop was not packed for retail customers, but some material was sold on to the bag market

Samples of the Solanum crop stored at Hoveton (trial site 1) were assessed on 8th June (29 days after removal from the trial store).

One tester reported no mint taste; a second identified mint.

Conclusions

Biox-M is a highly effective means of preventing sprout growth, and maintaining sprout control of potatoes in store.

Biox-M is effective at controlling existing modest levels of sprouting.

There would appear to be varietal variation in response to treatment with Biox-M, which is to be expected.

A second treatment and/or longer retention in the treated store seems to have conferred additional sprout control in the period following removal from store. Those samples treated once and removed had begun to sprout in less than 10 days (held at ambient temperature subsequently) and around 20 days (refrigerated) following removal from store.

Some samples treated twice and removed over a period from 24th March to 27th April were still completely free of sprouts up to 72 days after treatment and 60 days after removal from store

A minority of samples retained until the end of August still showed no sign of sprouting

There is a suggestion of synergistic efficacy for crops previously treated with CIPC (J026 – King Edward, J030 – King Edward, J039 – Maris Piper).

Biox-M has a strong residual smell following treatment, but there is limited evidence of consumer concern about taint.

It is recommended that the label recommendation be modified to reduce the maximum single application rate for crops that are already at holding temperature (i.e. have already been in cold store for some time), and are being held below 5°C.

It is recommended that further work be undertaken on the relationship between storage temperature and treatment rate, and in relation to the use of Biox-M in sequence with CIPC.

Acknowledgements

Juno PP would like to thank the following for their contributions to and support for the trials – Greenvale AP, Branston, Solanum, QV Foods, Manor Fresh, Preva Produce and Sutton Bridge Crop Storage Research.



Appendix 1 - BioX M – Draft Label

xeda international
technologie pour l'agriculture



BIOX-M MAPP XXXXX

**A liquid sprout inhibitor for use on ware potatoes in store.
Contains 100 % w/w Spearmint Oil as a hot fogging concentrate.**

The (COSHH) Control of Substances Hazardous to Health Regulations may apply to the use of this product at work.

COMPLIANCE WITH THE FOLLOWING CONDITIONS OF USE AND ALL SAFETY PRECAUTIONS MARKED * IS A LEGAL REQUIREMENT

FOR USE ONLY AS AN AGRICULTURAL SPROUT GROWTH INHIBITOR IN FOOD STORAGE

Crops: Potato (post-harvest use).

Maximum total dose: 390 ml of product per tonne of potatoes.

Maximum individual dose: 90 ml of product per tonne of potatoes.

A minimum interval of 21 days must be observed between applications.

Latest time of application: 12 days before removal from store for sale or processing.

READ ALL OTHER SAFETY PRECAUTIONS AND DIRECTIONS BEFORE USE



HARMFUL



**DANGEROUS FOR
THE ENVIRONMENT**

May cause sensitisation by skin contact.

Harmful: may cause lung damage if swallowed.

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Keep out of the reach of children.

Avoid contact with skin.

Wear suitable gloves.

This material and its container must be disposed of as hazardous waste.

Avoid release to the environment. Refer to special instructions/ safety data sheet.

If swallowed do not induce vomiting, seek medical advice and show the label.

To avoid risks to man and the environment, comply with the instructions for use.



SAFETY PRECAUTIONS

Operator protection

Engineering control of operator exposure must be used where reasonably practicable in addition to the following personal protective equipment.

* WEAR SUITABLE PROTECTIVE GLOVES AND FACE PROTECTION (FACESHIELD) when applying the product and when handling the concentrate.

DO NOT BREATHE VAPOUR.

WASH CONCENTRATE from skin or eyes immediately.

WHEN USING DO NOT EAT, DRINK OR SMOKE.

* WEAR SUITABLE PROTECTIVE GLOVES AND SUITABLE RESPIRATORY PROTECTIVE EQUIPMENT when re-entering treated areas within 24hr of treatment.

IF YOU FEEL UNWELL, seek medical advice immediately (show the label where possible).

* KEEP UNPROTECTED PERSONS OUT OF TREATED AREAS for at least 24hr after application.

Approval holder: Xeda International S.A., 2 Z.A. la CRAU, 13670 ST-ANDIOL (France), Tel : + 33 4 90 90 23 23,

Fax: + 33 4 90 90 23 20

Contents: 5 Litres

Consumer protection

DO NOT REMOVE POTATOES FOR SALE OR PROCESSING FOR AT LEAST 12 DAYS AFTER APPLICATION.

Environmental protection

* DO NOT USE OUTDOORS.

* DANGEROUS TO FISH OR OTHER AQUATIC LIFE. Do not contaminate surface waters or ditches with chemical or used container.

Storage and disposal

KEEP AWAY FROM FOOD, DRINK AND ANIMAL FEEDING STUFFS.

KEEP OUT OF REACH OF CHILDREN.

KEEP IN ORIGINAL CONTAINER, tightly closed, in a safe place.

* DO NOT RE-USE CONTAINER for any purpose. (Do not re-use, refill or recharge container).

Marketing company: Juno (Plant Protection) Ltd., Target Farm, Underlyn Lane, Marden, Kent, TN12 9AT, 01622 831376

Batch No:



DIRECTIONS FOR USE

IMPORTANT: This information is approved as part of the Product Label. All instructions within this section must be read carefully for safe and successful use of this product. Read accompanying instructions before use.

PROBLEM CONTROLLED

BIOX-M is a sprout inhibitor for the post-harvest treatment of potatoes.

RESTRICTIONS

Do not remove potatoes for sale or processing for at least 12 days after application.

CROP SPECIFIC INFORMATION

Potatoes should have a set skin and be largely free from soil/debris.

Do not apply to potatoes until they are dry and cured, generally 6-15 days post harvest.

The 1st application should be applied before sprouting is visible. Sprout control efficacy may be reduced if storage temperature is above 10°C

DOSE RATE

Rate of application: The first application should be at a rate of 90 ml/tonne followed by up to 10 repeat applications, at a minimum of 21 day intervals, at 30 ml/tonne.

METHOD OF APPLICATION

BIOX-M is to be used exclusively with Xeda/Cedax Electrofog hot fogging equipment.

Electrofog equipment should be placed outside the store.

IMPORTANT: Follow the Xeda/Cedax Electrofog instructions.

The temperature of the fog exiting the vaporisation pipe should be 185-190°C.

The resistance temperature should be 450-650 °C.

During application all doors and louvres should be tightly closed. Normal ventilation may be resumed 24 hrs after application.

APPLICATION PROCEDURE:

Stop refrigeration and ensure all refrigeration equipment is free from ice and store temperature is even before application

For potatoes in crates or boxes:

Apply the product in the absence of internal circulation, at the end of the application apply low speed internal circulation for a short period, typically 2 to 5 minutes.

Wait a further 2 hours before applying continuous low speed internal circulation for about 22 hours .

For potatoes in bulk:

Apply the product with concomitant low speed internal circulation

Allow internal fans to run continuously at low speed for 24 hours

Normal store control should resume 24 hours after end of application.

MIXING and COMPATIBILITY BIOX-M is applied neat.

COMPANY ADVISORY INFORMATION

This section is not part of the Product Label under the Plant Protection Products Regulations 1995 and serves to provide additional advice or information on the product use at the discretion of the applicant.

CROP CONDITION

For best results apply BIOX-M before the potato eyes open.

GENERAL STORAGE CONSIDERATIONS

Stores should be loaded as quickly as possible to ensure that the curing time is not unnecessarily extended and that the first potatoes loaded have not started to sprout before the last potatoes are cured.

The stacking height for boxes is dictated by the British Standard Mark on the individual boxes and by health and safety legislation. Boxes should be stacked with the pallet slots aligned to aid circulation of the fog. In bulk stores, crop should be stacked to the design height, typically around 4 metres.

After loading the store ensure all surface moisture is removed by use of ventilation. For best results BIOX-M must be applied before the potato eyes open.

STORAGE TEMPERATURE

Potatoes should be held at a temperature suitable for the end-use of the crop.

CONDITIONS OF SUPPLY

All goods supplied are manufactured to our usual standard of quality, but all conditions and warranties, statutory or otherwise, as to the quality or fitness for any purpose of the goods are excluded and no liability (save as to the liability to replace defective goods herein provided) will be accepted by us for any damage, loss or injury whatsoever arising out of or in connection with the goods or drums or other containers thereof, or from the storage, handling, applications or use thereof. In the case of alleged defects in the manufacture of the goods proved by the customer to our satisfaction we will at our expense replace or otherwise remedy the defective goods. In particular, liability in tort arising in or out of the manufacture, distribution, sale or use of the product is hereby expressly excluded. All our goods are sold and supplied on the terms contained in our Standard Conditions of Sale (of which the above is a part) which shall prevail over any other terms and which may be inspected on request.

Storage: BIOX-M can be stored for up to 3 years in original sealed packaging at ambient temperature. Protect from frost.



Appendix 2 – Trial 1 Crop Details

QV Foods

Variety	Boxes	Previous Treatment	Sprouting 27th Jan	Sprouting 10th May
Estima	3	Nil	1	0
Nicola	3	Nil	0	0
Melody	3	Ethylene	0	0
Charlotte	3	Nil	0	0
Maris Piper	3	Ethylene	1	0

Greenvale

Jelly	1	Restrain Jan	2	0	
Sophia	1	Restrain Nov	0	0	
Vales Sov'gn	1	Nil	2	0	
Vales Sov'gn	1	Nil	0	0	
Vales Sov'gn	1	Restrain Jan	0	0	
Vales Sov'gn	1	Nil	1	0	Organic
Tolluca	1	Nil	0	0	Organic
Estima	1	CIPC Nov	1	0	
Maris Peer	1	Nil	0	0	
Tripplo	1	Nil	0	0	Organic

Manor Fresh

King Edward	5	CIPC Dec	2	0	
Chopin	5	Nil	1	0	
Maris Piper	5	CIPC Dec	0-1	0	
Sante	5	Nil	2	0	Organic
Marfona	5	Nil	1	0	
Annabelle	1	Nil	4	0	

Branston

Maris Piper	4	Nil	0	0	
King Edward	5	Nil	1	0	
Desiree	5	Nil	0	0-1	
Saxon	5	Nil	0	0	
Estima	5	Nil	0	0	

Solanum

Estima	4	Ethylene	1	0	
Melody	4	Ethylene	1	0	
Mozart	4	Ethylene	3	0	
King Edward	4	Ethylene	5	0	
Charlotte	4	Nil	0	0	



Appendix 3 – Site and Trial Details

Biox-M Trial

Trial Site Details		Site 1	
Name	Nicholas Tapp		
Address	Juno (Plant Protection) Ltd, 74 North Street, Biddenden, Kent, TN27 8AE		
Trial Site OS Ref	Store 12, Blue 32, Tunstead Road, Hoveton, Norfolk, NR12 8QN TG305187		
Crop Variety Date of delivery to store	Potatoes 19 varieties - see detailed report 27th and 29th January 2010 (from cold stores since harvest autumn 2009)		
Aim of Treatment	Suppress sprouting in stored potatoes		
Application Details			
Name of Product	Biox-M	Spearmint Oil	
Application dates and rates	9th February 11th March 27th April	90ml/t 45ml/t 30ml/t	
Tonnage treated	95 boxes = c.105 tonnes		
Application Machinery	Cedax Electrofog EW 7500		
Crop growth stage at application	Mature, skin set, in store		
Sprouting level at application	From nil to well sprouted at first treatment - see detailed report Nil for subsequent treatments		
Other actions taken to control problem	Maintain refrigeration temperature at 3°C		
Other information	Complete control of sprouting was maintained from 14 days after the first treatment until removal from store on May 10th. Control of sprouting was maintained in many varieties for over 30 days after removal from store		

Biox-M Trial

Trial Site Details Site 2	
Name	James Lee
Address	Greenvale AP, Tern Hill, Warrant Road, Stoke Heath, Market Drayton, Shropshire, TF9 2JJ
Trial Site OS Ref:	Tern Hill, Warrant Road, Stoke Heath, Market Drayton, Shropshire, TF9 2JJ SJ644298
Crop Variety Date of delivery to store	Potatoes 4 varieties - see detailed report In store since harvest autumn 2009
Aim of Treatment	Suppress sprouting in stored potatoes
Application Details	
Name of Product	Biox-M Spearmint Oil
Application date and rate	11th March 50ml/t
Tonnage treated	c. 160 tonnes
Application Machinery	Cedax Electrofog EW 7500
Crop growth stage at application	Mature, skin set, in store
Sprouting level at application	From nil to 2mm sprouts - see detailed report
Other actions taken to control problem	Maintain refrigeration temperature at 3°C
Other information	Treated Cosmos retained in store for 28 days showed no sign of sprouting, against a control of Cosmos held at the same temperature, which were now unusable due to sprout growth

Biox-M Trial

Trial Site Details		Site 3	
Name	James Lee		
Address	Greenvale AP, Floods Ferry, Doddington, March, Cambridgeshire, PE15 0UW		
Trial Site OS Ref:	Floods Ferry, Doddington, March, Cambridgeshire, PE15 0UW TL355932		
Crop Variety	Potatoes 4 varieties		
Date of delivery to store	In store since harvest autumn 2009		
Aim of Treatment	Suppress sprouting in stored potatoes		
Application Details			
Name of Product	Biox-M	Spearmint Oil	
Application date and rate	27th April	50ml/t	
Tonnage treated	c.90 tonnes		
Application Machinery	Cedax Electrofog EW 7500		
Crop growth stage at application	Mature, skin set, in store		
Sprouting level at application	From nil to very large sprouts		
Other actions taken to control problem	Maintain refrigeration temperature at 3°C		
Other information	The trial crop had been written off prior to treatment due to excessive sprout growth. 2 blocks of crop were subsequently washed and packed as treatment had controlled sprouting sufficiently		

Appendix 4 – Trial 1 Diary

Spearmint Oil Commercial Store Trials Records

Diary notes

Preva

Store: Produce 12

Date	Comments
27/01/2010	Greenvale, QV, Manor Fresh and Solanum loaded in. Store set at 3°C
29/01/2010	Branston loaded in.
08/02/2010	Refrigeration turned off 10am
09/02/2010	1115am Treatment with 10lt Biox-M (Spearmint Oil). No visible change in crop condition since loading. Internal fans ran for 3 x 1minute during treatment
12/02/2010	Store now at 4°C. Refrigeration restarted. Set at 3°C
15/02/2010	Store entered. Strong smell of mint in the store. No sign of blackening of sprouts of Annabelle
24/02/2010	Store entered. Noticeable smell of mint in the store. No sign of sprouting on any samples; all previously initiated sprouts now blackened and apparently unviable. Surface damage to some tubers on the top layer of the top boxes in the store. Variety specific with King Edward affected worst, Desiree moderate, and most with almost no sign at all. Suggest the damage is caused by fog condensing on the ceiling and dripping on to top layer of tubers. No damage on any tuber underneath top layer, or apparently in any box lower down the stack. 3 Samples removed for photographing, retention and cooking.
25/02/2010	Samples stored over night in domestic kitchen. Mint aroma still present 24 hours after removal from store. Damaged surface tissue removed in 2 peels. Damaged surface tissue quite soft and a potential source of ingress of soft rots.
25/02/2010	Samples were peeled and sliced, and left to stand for 12 hours in cold water. At the end of the period the water had a noticeable mint aroma. The potatoes were boiled and mashed. The aroma had all but disappeared, but the mash had a faint mint taste - not unpleasant and not detected by all who tasted.
10/03/2010	Adrian Briddon (SBEU) and Simon Faulkner (Solanum) visit store. Strong smell of mint remains in store. AB comments on relatively sealed nature of store (typical fruit MA store, rather than leaky potato store). Damage to tubers confirmed as condensation. AB suggests the SVP of product at store temperature be used to determine max individual dose rate in relation to temperature.
10/03/2010	Refrigeration and ventilation turned off around 10am. Store temp 3°C.
11/03/2010	Store opened at 0800. Inspected by David Wagstaffe (Superfog), Philip Britton (Manor Fresh) and Nick Tapp. DW comment 'If this was a commercial store we would not treat today and look again in a fortnight'. No sprouting observed in any samples in any part of the store. Smell of mint oil remains. Tuber damage in top boxes dry. One pair of boxes of Desiree were swapped, so a new box is now on top. PB took 6 samples before treatment. NT took 3 ' A ' samples before treatment.
11/03/2010	0930 Treatment with 5lt Biox-M (approx 45ml per tonne). Internal fans ran 2 x 1 minute during treatment. Assess in 2 weeks.
12/03/2010	PB reported on Manor Fresh sample cook and taste test.
13/03/2010	NT 'A' samples washed. Faint mint aroma still present. Samples split into 2 lots, both in plastic packs, one to be stored in ambient kitchen, one in fridge. To be assessed for sprout growth weekly.
14/03/2010	Refrigeration restarted in store.
21/03/2010	NT ' A ' samples inspected. Ambient (kitchen) samples broken dormancy - Desiree, Piper, Saxon in order of sprout size. Saxon very small sprouts. All with multiple eyes open and multiple sprouts. Refrigerated samples - no movement visible.

24/03/2010	NT visit to store. Strong smell of mint in store. Boxes inspected in daylight outside store, and investigated to middle of box. Top boxes inspected. No sign of sprout movement at all in any box inspected. No additional condensation damage from second treatment. Removed 7 random ' B ' samples . Samples washed and divided into 2 lots - one lot placed in domestic refrigerator, and one in ambient domestic kitchen.
24/03/2010	B' samples : Branston Desiree; Manor Fresh Organic Sante J043; Manor Fresh King Edward J026; Greenvale Tripplo J009; Branston Estima; Manor Fresh Annabelle J051; Greenvale Vales Sovereign J007
08/04/2010	NT visit to store. Strong smell of mint remains in store. No sign of sprouting or eye movement in any accessible box. 4 random ' C ' samples removed. Samples remain in warm car for 36 hours.
09/04/2010	A' Samples assessed: Ambient - now all fully sprouted. Multiple strong sprouts. Sample disposed of. Refrigerated - eyes now just open and sprouts of <2mm on all. Desiree larger than Piper larger than Saxon. Returned to refrigeration (now 59 days after treatment).
09/04/2010	B' Samples assessed: Ambient Desiree, Sante, Estima, Annabelle and VS all well sprouted with multiple sprouts (samples disposed of). Tripplo and King Edward no eye movement all (sample returned to ambient). King Edward had CIPC treatment previously. Refrigerated - no eye movement at all. Returned to refrigeration.
09/04/2010	C' Samples washed and divided into ambient and refrigerated - no eye movement at all. Solanum Mozart J061, Manor Fresh King Edward J030, Manor Fresh Chopin J032, Manor Fresh Annabelle J051
24/04/2010	A' Samples assessed: Refrigerated samples of Piper, Desiree and Saxon have now broken dormancy (treated once on 9th Feb, removed from store on 11th Mar). Minimal sprout growth.
24/04/2010	B' Samples assessed: Remaining ambient samples (King Edward and Tripplo) still no sprouts. Refrigerated samples - no eye movement.
24/04/2010	C' Samples assessed: Ambient Mozart and King Edward no eye movement; ambient Chopin and Annabelle broken dormancy. Refrigerated samples no eye movement.
26/04/2010	Store refrigeration turned off
27/04/2010	0900 Treatment with 3lt Biox-M (approx 30ml/tonne). No sprouting observed on any crops. 5 x ' D ' Samples removed - Branston Estima; Branston Desiree; Branston King Edward; J039 Manor Fresh Maris Piper; J009 GV Tripplo
30/04/2010	Refrigeration restarted in store.
04/05/2010	D' Samples washed and assessed. No visible eye movement on any sample.
04/05/2010	A' Samples assessed: Refrigerated Desiree, Piper and Saxon all now with 5mm sprouts. Samples disposed of.
04/05/2010	B' Samples assessed: Ambient Tripplo and King Edward - no eye movement. Refrigerated Desiree, Vales S and Sante - eyes just open; Annabelle, King Edward and Tripplo - no movement visible
04/05/2010	C' Samples assessed: Ambient Mozart and King Edward - no eye movement; Refrigerated samples - no eye movement.
10/05/2010	24 Branston bins unloaded from store. All assessed for sprout growth/re-growth - all except Desiree 0; some Desiree with very slight eye movement. Manor Fresh, and Solanum bins unloaded, assessed and sampled. None show any sign of eye movement.
10/05/2010	25 'E' Samples taken, washed and split between refrigerated and ambient
11/05/2010	Greenvale and QV Foods bins collected from store
22/05/2010	E' samples and remaining ' B ' ' C ' and ' D ' samples assessed
03/06/2010	Remaining samples assessed
20/06/2010	Remaining samples assessed
27/08/2010	Remaining samples disposed of. None now suitable for use, due to dehydration, but some still showing no sign of sprout movement

Juno (Plant Protection)

Trial 1 - Post-trial assessments

Manor Fresh

Storage and Treatment at Hoveton						
Variety	Maris Piper	King Edward	Chopin	Sante	Marfona	Annabelle
Delivered to Hoveton	27-Jan	27-Jan	27-Jan	27-Jan	27-Jan	27-Jan
Storage temp	3C	3C	3C	3C	3C	3C
Previous treatment	CIPC - Dec	CIPC - Dec	None	None	None	None
Sprouting assessment	Nil - eyes open	<2mm sprouts	Eyes open	<2mm sprouts	Eyes open	>2mm sprouts
Treatment 1 - 90ml/t	09-Feb	09-Feb	09-Feb	09-Feb	09-Feb	09-Feb
Treatment 2 - 45ml/t	11-Mar	11-Mar	11-Mar	11-Mar	11-Mar	11-Mar
Treatment 3 - 30ml/t	27-Apr	27-Apr	27-Apr	27-Apr	27-Apr	27-Apr
Removed from Hoveton	10-May	10-May	10-May	10-May	10-May	10-May
Sprouting assessment	Nil	Nil	Nil	Nil	Nil	Nil
Post-Storage Records						
Storage temp	2.5C	2.5C	2.5C	2.5C	2.5C	2.5C
Removal for washing & packing (date)	NA	NA	NA	NA	NA	NA
Skin finish comment(s)		81% waste of which 63% was pit rot.	83% total waste, damage and silver scurf / black dot	90% total waste, silver scurf, black dot, rots	33% total waste	
Sprouting assessment(s)					6% waste owing to sprouting	
Shelf life assessments (date and sprouting)			Expt was gassed as part of a larger block - no sprouting seen			
	Crop was not packed owing to mint odour / flavour					
Ultimate destination of packed crop	Crop was not packed, some material in bag market					
Control info (if available)						
Taste tests (blind or aware of product)	Blind test - Campden trained tasters, sample boiled skin on and off.					
Date of test(s)	25/06/2010	25/06/2010	25/06/2010	25/06/2010	25/06/2010	25/06/2010
Comment(s)	4 /10	3.67 /10	6 /10	3.83 /10	4.84 /10	3/10
		Very bitter		Mint	Mint taste	
			Bitter	Quite bitter		
Other Comments						
Initial taste panels showed very minty flavour detectable on all samples and cooking methods (boil, bake, steam and roasted), later samples showed mint detectable on boiled / steamed / baked samples with skin on						

Juno (Plant Protection)

Mint Oil (Biox-M) Trial

Greenvale
AP

Variety	Storage and Treatment at Hoveaton	Sophia	Estima	Tolluca	Maris Peer	Tripplo	VS - Bywater	VS - Allan	VS - GV	
Delivered to Hoveaton	Jelly	27-Jan	27-Jan	27-Jan	27-Jan	27-Jan	27-Jan	27-Jan	27-Jan	VS - Martin
Storage temp	3C	3C	3C	3C	3C	3C	3C	3C	3C	27-Jan
Previous treatment	Restrain - Jan	Restrain - Nov	CIPC - Nov	None	None	None	None	None	Restrain - Jan	None
Sprouting assessment	<2mm sprouts	Nil	Eyes open	Nil	Nil	Nil	<2mm sprouts	Eyes open	Nil	Nil
Treatment 1 - 90ml/t	09-Feb	09-Feb	09-Feb	09-Feb	09-Feb	09-Feb	09-Feb	09-Feb	09-Feb	09-Feb
Treatment 2 - 45ml/t	11-Mar	11-Mar	11-Mar	11-Mar	11-Mar	11-Mar	11-Mar	11-Mar	11-Mar	11-Mar
Treatment 3 - 30ml/t	27-Apr	27-Apr	27-Apr	27-Apr	27-Apr	27-Apr	27-Apr	27-Apr	27-Apr	27-Apr
Removed from Hoveaton	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May
Sprouting assessment	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Storage temp	Post-Storage Records									
Removal from cold store (date)	3C	3C	3C	3C	3C	3C	3C	3C	3C	3C
Skin finish comment(s)	21-May	21-May	21-May	21-May	21-May	21-May	21-May	21-May	21-May	21-May
Sprouting assessment(s)										
Washed and packed (date)	24-May	24-May	24-May	24-May	24-May	24-May	24-May	24-May	24-May	24-May
Shelf life assessments - sprouting	some eyes open	nil	some eyes open	some eyes open	all eyes open	some eyes open	some eyes open	all eyes open	some eyes open	some eyes open
Assessment pack + 2	eyes open - 3mm	some eyes open	some 3mm	some eyes open	some eyes open	all eyes open	<3mm	all eyes open	some eyes open	all eyes open
Assessment pack + 4	>3mm	some 3mm	>3mm	all eyes open	all eyes open	all eyes open	some 3mm	>3mm	all eyes open	all eyes open
Shelf life assessments - in spec for Tesco	Y	Y	Y	N	N	N	Y	Y	Y	Y
Assessment pack + 2	Y	Y/N	N	Y	N	Y/N	Y	Y	N	N
Assessment pack + 4	N	N	N	Y	N	N	N	N	N	N
Ultimate destination of packed crop	The reason for 'out of spec' assessment on many samples was a visual assessment rejection due to the blackened eyes resulting from treatment									
Control info (if available)	Some untreated and therefore too sprouted to consider packing									
Taste tests (blind or aware of product)	Packed control Vales Sovereign and Marfona were similarly out of spec and sprouted									
Date of test(s)	See Wirral Sensory Services Report on Tern Hill treatment									
Comment(s)										
Other Comments	The material treated once at Floods Ferry in April was sent to Tesco for taste evaluation									
	No taint was identified									
	The bulk of this stock had been written off due to excessive sprout growth									
	Some was subsequently 'rescued' and packed after treatment is seen as a positive									

Juno (Plant Protection)

Mint Oil (Biox-M) Trial

Solanum

Storage and Treatment at Hoveton

Variety	King Edward	Mozart	Estima	Melody	Charlotte
Delivered to Hoveton	27-Jan	27-Jan	27-Jan	27-Jan	27-Jan
Storage temp	3C	3C	3C	3C	3C
Previous treatment	Ethylene	Ethylene	Ethylene	Ethylene	untreated
Sprouting assessment	Old sprouts +	2mm sprouts	Eyes open	Eyes open	Nil
Treatment 1 - 90ml/t	09-Feb	09-Feb	09-Feb	09-Feb	09-Feb
Treatment 2 - 45ml/t	11-Mar	11-Mar	11-Mar	11-Mar	11-Mar
Treatment 3 - 30ml/t	27-Apr	27-Apr	27-Apr	27-Apr	27-Apr
Removed from Hoveton	10-May	10-May	10-May	10-May	10-May
Sprouting assessment	Nil	Nil	Nil	Nil	Nil

Post-Storage Records

Storage temp					
Removal for washing & packing (date)			03-Jun	03-Jun	03-Jun
Skin finish comment(s)			slight green		pit rot
Sprouting assessment(s)			Nil	Nil	Nil
Shelf life assessments (date and sprouting)			08-Jun	08-Jun	08-Jun
			Nil to eyes open	Nil to eyes open	Nil to eyes open
			14-Jun	14-Jun	
			Eyes open	Eyes open to >1mm	
Ultimate destination of packed crop					
Control info (if available)			n/a	n/a	n/a
Taste tests (blind or aware of product)			2 tasters	2 tasters	
Date of test(s)			08-Jun	08-Jun	
Comment(s)			Mint tasted by 1	No mint taste	
			Grey appearance	Okay	
			Unpleasant		

Other Comments: 14-Jun Melody and Estima both keeping well. Melody with slightly more sprout growth

Appendix 6 – Trial 1 Sprouting Assessments

A' Samples						
Treatment date	Ref	Previous	Samples	Assessed	Assessed	Assessed
9th February			11th March	21st March	9th April	24th April
			T + 30	T + 40	T + 59	T + 72
Refrigerated	BS	Nil	Desiree	0	2	3
	BS	Nil	Piper	0	2-	2
	BS	Nil	Saxon	0	2-	2
Ambient	BS	Nil	Desiree A	2-	5++	
	BS	Nil	Piper A	3-	5++	
	BS	Nil	Saxon A	3	5++	

B' Samples									
Treatment	Ref	Previous	Samples	Assessed	Assessed	Assessed	Assessed	Assessed	Assessed
9th February			24th March	9th April	24th April	4th May	11th May	22nd May	3rd June
11th March			T + 13	T + 29	T + 44	T + 54	T + 61	T + 72	T + 84
Refrigerated	BS	Nil	Desiree	0	0	1	1+	2	3
	J043	Nil	Sante	0	0	1-	1-	1	1+
	J026	CIPC	King Ed	0	0	0	0	0	0
	J009	Nil	Tripplo	0	0	0	0	0	0
	BS	Nil	Estima	0	0	1	1	1	1
	J051	Nil	Annab	0	0	0	0	0	0
	J007	Nil	Vales S	0	0	1	1	1	1+
Ambient	BS	Nil	Desiree A	3	5	5++			
	J043	Nil	Sante A	5++					
	J026	CIPC	King Ed A	0	0	0	1	1+	1+
	J009	Nil	Tripplo A	0	0	0	0	2	5
	BS	Nil	Estima A	5++					
	J051	Nil	Annab A	5++					
	J007	Nil	Vales S A	5++					

C' Samples								
Treatments	Ref	Previous	Samples	Assessed	Assessed	Assessed	Assessed	Assessed
9th February			8th April	24th April	4th May	11th May	22nd May	3rd June
11th March			T + 28	T + 44	T + 54	T + 61	T + 72	T + 84
Refrigerated	J061	Ethylene	Mozart	0	0	0	0	0
	J030	CIPC	King Ed	0	0	1-	1	1
	J032	Nil	Chopin	0	0	1-	1	1
	J051	Nil	Annab	0	0	0	0	0
Ambient	J061	Ethylene	Mozart A	0	0	0	0	0
	J030	CIPC	King Ed A	0	0	0	1	1
	J032	Nil	Chopin A	1	5++			
	J051	Nil	Annab A	1	5++			



D' Samples

Treatments			Samples	Assessed	Assessed	Assessed	Assessed	Assessed
9th February			27th April	4th May	11th May	22nd May	3rd June	20th June
11th March	Ref	Previous	T + 47	T + 54	T + 61	T + 72	T + 84	T + 101
Refrigerated	BS	Nil	Desiree	0	0	1+	3	4
	J039	CIPC	M Piper	0	0	0	0	0
	BS	Nil	King Ed	0	0	0	1	2
	BS 171	Nil	Estima	0	0	0	2	2
	J009	Nil	Tripplo	0	0	0	0	0
Ambient	BS	Nil	Desiree A	0	2+	5+		
	J039	CIPC	M Piper A	0	0	1	1	2
	BS	Nil	King Ed A	0	0	1+	1+	3
	BS 171	Nil	Estima A	0	1	5+		
	J009	Nil	Tripplo A	0	0	2	5	

E' Samples

Treatments			Samples		Assessed	Assessed	Assessed
9th February			10th May	10th May	22nd May	3rd June	20th June
11th March	Ref	Previous	T + 13	T + 13	T + 25	T + 37	T + 54
27th April	117	Nil	Piper	0	0	2	3
	526	Nil	King Ed	0	0	1	2
	854	Nil	Saxon	0	0	1	2
	170	Nil	Estima	0	1	2+	3+
	1155	Nil	Desiree	0	1	4	5+
	J058	Ethylene	Melody	0	0	0	1
	J052	Ethylene	Estima	0	0	1	1
	J062	Ethylene	Mozart	0	0	1	1
	J065	Ethylene	King Ed	0	0	2	3
	J071	Nil	Charlotte	0	1	4	5+
	J035	Nil	Chopin	0	0	2	4
	J036	CIPC	Piper	0	0	0	1
	J045	Nil	Sante	0	1	2	5
	J050	Nil	Marfona	0	0	1	4+
	J051	Nil	Annabelle	0	0	1-	1-
	J016	Nil	Estima	0	0	0	1
	J014	Nil	Nicola	0	0	1+	4
	J015	Ethylene	Melody	0	0	1	2
	J019	Nil	Charlotte	0	1	3	5
	J001	Restrain	Jelli	0	0	2	4
	J002	Restrain	Sophia	0	0	1+	2
Refrigerated	J003	Nil	Vales S	0	0	1	2
	J005	Nil	M Peer	0	0	0	0
	J009	Nil	Tripplo	0	0	0	0
	J006	Nil	Tolluca	0	0	2	2

E⁺ Samples			Samples		Assessed	Assessed	Assessed
Treatments			10th May	10th May	22nd May	3rd June	20th June
9th February	Ref	Previous	T + 13	T + 13	T + 25	T + 37	T + 54
11th March	117	Nil	Piper A	0	4		
27th April	526	Nil	King Ed A	0	1	2	3
Ambient	854	Nil	Saxon A	0	5		
	170	Nil	Estima A	0	4	5+	
	1155	Nil	Desiree A	0	5+		
	J058	Ethylene	Melody A	0	4		
	J052	Ethylene	Estima A	0	0	1	1
	J062	Ethylene	Mozart A	0	0	3	5
	J065	Ethylene	King Ed A	0	2	5	
	J071	Nil	Charlotte A	0	3	5+	
	J035	Nil	Chopin A	0	2	5	
	J036	CIPC	Piper A	0	0	1	2
	J045	Nil	Sante A	0	5	5+	
	J050	Nil	Marfona A	0	3	5+	
	J051	Nil	Annabelle A	0	0	5	
	J016	Nil	Estima A	0	1-	1	4
	J014	Nil	Nicola A	0	2+	5	
	J015	Ethylene	Melody A	0	2-	3	4
	J019	Nil	Charlotte A	0	2	5+	
	J001	Restrain	Jelli A	0	5+		
	J002	Restrain	Sophie A	0	2	5	
	J003	Nil	Vales S A	0	2+	5	
	J005	Nil	M Peer A	0	0	4	5
	J009	Nil	Tripplo A	0	0	2	2
	J006	Nil	Tolluca A	0	1	5	
Note:			Samples disposed of				
Note:			Highlighted samples remained un-sprouted or virtually unchanged from the June assessment until the end of August				

Associated Reports

Greenvale Mint Oil Trial Report	29
Wirral Sensory Services – Lady Balfour	37
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Tesco NPD Assessment	55

Mint Oil Trial – Tern Hill March 2010



Summary

- A small organic store was treated with 45ml/t Biox-M spearmint oil formulation. This is half the full recommended rate
- The store contained 160t of Cosmos and Marfona but had a capacity of 220t. A box of Lady Balfour was put into the store pre-treatment and two boxes of Marfona and Cosmos were removed to provide untreated comparisons.
- The eyes of the Cosmos had opened and a small degree of sprouting (1-2mm) was evident in some tubers. There was no sprouting evident in Lady Balfour or Marfona.
- Two trays of sprouted Marfona and Estima were placed on the floor of the store to examine the effect of mint oil on emerged sprouts.
- Samples were examined and removed 6 days post treatment for organoleptic testing.
- Samples were examined and removed 12 days (the label harvest interval) post treatment for organoleptic testing.
- Samples of treated and untreated Cosmos and Lady Balfour were sent to Wirral Sensory Services for independent taste trials – samples were removed from the store 12 days post-treatment, washed, and tested 14 days post treatment.

Results

- Mint oil smells strongly! The smell is still present in the store three weeks after treatment.
- It has a dramatic effect on existing sprouts burning and blackening them after only 3 days and resulting in them withering away after 12 days.
- The effect on the Cosmos sprouts was delayed in some of the boxes. After 6 days it was thought that the mint oil had not affected some of the boxes as the sprouts were still white. After 12 days these sprouts had also blackened and withered.
- Untreated Cosmos in a store held at a similar temperature (2.5-3C) showed sprouting up to 5mm. Treated and untreated Lady Balfour showed no sprouting after 12 days.
- Damage occurred to the top layer of Cosmos tubers in the boxes at the top of the columns. This was thought to be associated with the presence of condensation. This damage was not seen on the single box of Lady Balfour where there was no condensation present, nor was it seen in the trays of Marfona and Estima on the floor.
- Treated and untreated samples of Cosmos and Lady Balfour were packed into standard perforated polyethylene film 14 days after treatment and stored at 20C. After 6 days there was a difference between the levels of sprouting in the Cosmos in that the sprouting had continued slightly in the untreated but the burnt off sprouts in the treated had not developed further. There was no sprouting evident in the Lady Balfour six days after packing. 11 days after packing saw no difference between treated and untreated samples in either Cosmos or Lady Balfour – all had significant levels of sprouting.
- Taint – 6 days after treatment all the treated samples tasted strongly of mint after boiling. Lady balfour noticeably more than Cosmos or Marfona. 12 days after treatment, on the day that harvest interval expired, there was still a noticeable taint in Lady Balfour but less so in Marfona and Cosmos (but still detectable).
- Taint – Four samples were sent to Wirral Sensory Services for consumer acceptance testing. Treated and untreated Cosmos and Lady Balfour. 50 consumers on the panel were asked to comment on the boiled potatoes (14 days post treatment). Of the 100 respondents for the treated samples only four commented on a mint flavour (all Lady Balfour) and this was viewed as a positive attribute.
- Cosmos tubers remaining in the treated store 28 days after treatment are still showing no signs of further sprouting. Untreated Cosmos is sprouting and now at a stage where it would be unusable.

“Conclusions”

- It's too early to draw too many conclusions from such a limited trial
- Independent testing suggests that taint is not an issue after 14 days post treatment at half rate.
- Biox M can be very “hot” particularly when condensation is present in the store.
- Biox M appears to be very good at burning and removing existing sprouts from tubers – could be a useful tool in “reconditioning” sprouted stock?
- The results from the Cosmos which showed some sprouts unaffected after 6 days, with some completely black, suggests that there is a degree of variability in the speed of effect. The boxes that reacted the quickest were closest to the initial entry point of the fog.
- Recirculation of the gas through the store post-treatment should improve the distribution and could have evened up the initial effect of the Biox-M.

- The shelf life trial was inconclusive in identifying whether there is residual activity of the mint oil which can be utilised in extending shelf life. It did appear to give a positive effect on treated Cosmos after 6 days however this could be due to the physical effect of damaging existing sprouts rather than preventing new sprout growth. It did not appear to extend the effective shelf-life of Lady Balfour which hadn't broken dormancy when it was packed.
- The effect of the Biox M in preventing further growth of sprouts in the treated tubers 28 days post treatment suggests that there could be an element of residual control.

Raw Material Store Trial

7C – Organic Cosmos and Lady Balfour with two trays of sprouting Marfona and Estima



Estima tubers – pre treatment
Showing a level of sprouting up to 15mm.



Estima tubers – 6 days after treatment
Sprouts have been burnt



Marfona tubers – pre treatment
Sprouting present up to 7mm



Marfona tubers – 6 days after treatment
Sprouts have been burnt



Marfona tubers – 12 days after treatment
Sprouts have been burnt

Cosmos



Cosmos tubers 12 days after treatment – it appeared that the level of control had been variable with some tubers showing sprouts that looked unaffected by the mint oil



Cosmos tubers – 12 days after treatment – sprouts appear untouched – subsequently these sprouts also turned back and withered.



Cosmos tubers – 12 days after treatment

Sprouts have been burnt



Cosmos tubers – 12 days after treatment

The potatoes on the top layer of the top most boxes suffered a scorch like damage. This was put down to the presence of condensation – it was not seen in the absence of condensation (single stacked boxes)

Lady Balfour



Treated Lady Balfour tubers – 12 days after treatment

Potatoes haven't yet broken dormancy



Untreated Lady Balfour tubers (12 days after treatment)

Potatoes haven't yet broken dormancy

There is no difference between treated and untreated.

Shelf – life trial

Cosmos and Lady Balfour – treated and untreated packed in standard perforated polyethylene film and stored at 20C in shelf-life room.

Cosmos



Treated Cosmos – Packing + 6 days
21 days after treatment
Slight sprout growth in some tubers



Untreated Cosmos – Packing +6 days
21 days after treatment
There is more sprout growth evident. It appears that where initial sprout growth has been burnt off with mint oil then subsequent sprout growth takes longer to redevelop.

Lady Balfour

There was no sprouting evident in either treated or untreated Lady Balfour after 6 days – no photos were taken. Photos were taken after 11 days (below) and similar levels of sprouting were seen in both treated and untreated.



Treated Lady Balfour – Packing + 11 days

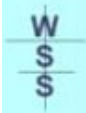
Sprout growth up to 10mm



Untreated Lady Balfour – Packing + 11 days

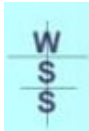
Sprout growth up to 10mm

There appears to be no difference between treated and untreated tubers after 11 days



WSS Product Testing Report
Lady Balfour Mint Potato Research
Date tested: 26th March 2010





Test Objective

To assess consumer acceptance of a Lady Balfour Mint Potato Untreated product against the equivalent Treated product via a Central Location Preference Test.

Sample

The panel consisted of 50 respondents, category purchasers, primary Sainsbury's shoppers, with a cross section of age and gender.

Products Tested

1. Lady Balfour Mint Potato Untreated
2. Lady Balfour Mint Potato Treated

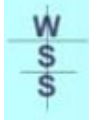
Methodology

A Central Location Test of 50 typical consumers was carried out in the Wirral area, with respondents being recruited according to the above mentioned criteria.

Respondents were presented with the products in a randomised order to prevent any bias; the products were also debranded before assessment.

Respondents were asked to taste the products and score them on an 11-point hedonic scale for a number of key parameters, they were also asked to note down any particular likes or dislikes.

Finally, the respondents were asked to say which of the products they preferred.



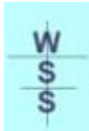
Attribute Results

RESULTS (Mean score where 0 = Extremely Unacceptable, 10 = Extremely Acceptable)

*** = Significant difference and 95% Confidence**

Scores out of 10	Untreated	Treated
Overall Acceptance	6.18	5.98

Scores out of 10	Untreated	Treated
Appearance	6.82	6.86
Aroma	6.36	6.18
Flavour	6.10	5.90
Texture	6.18	6.06

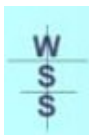


Preference Question

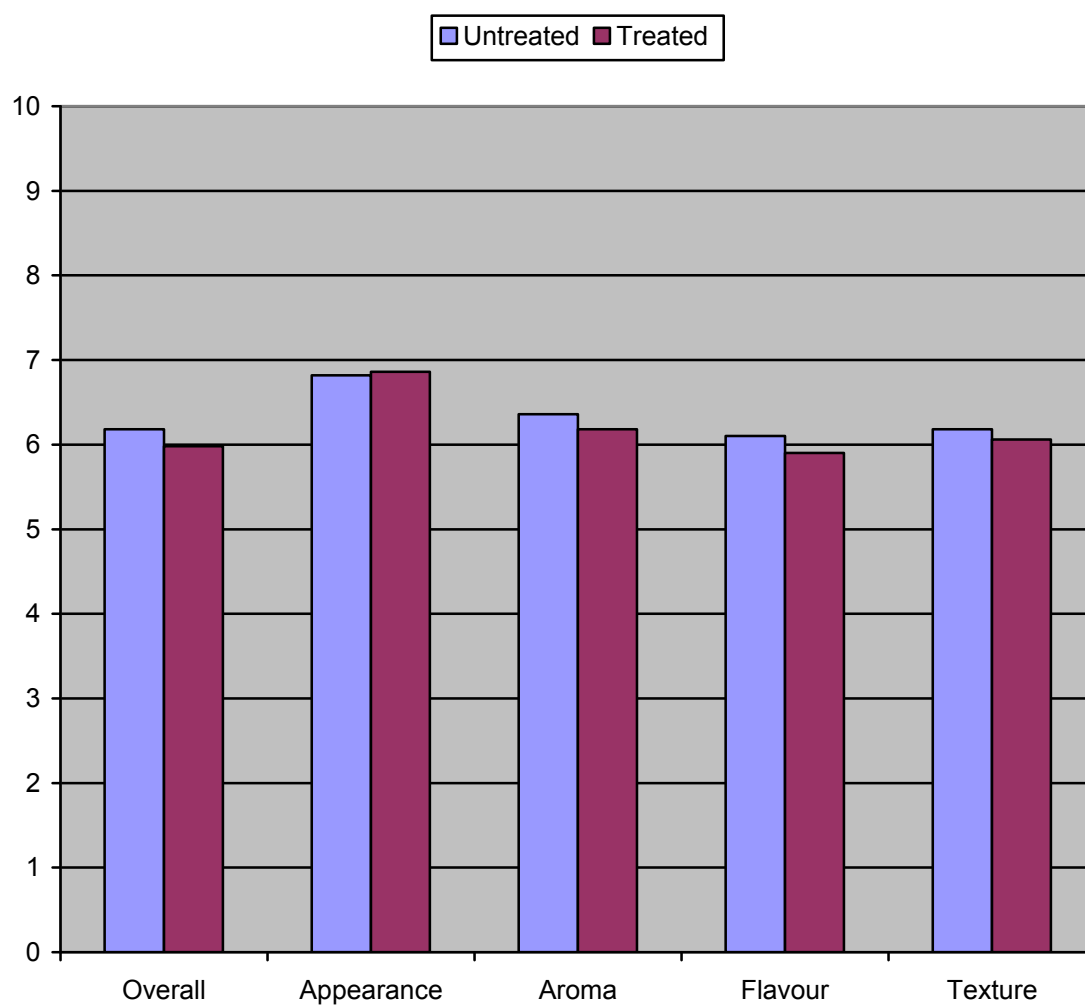
	Untreated	Treated	No Preference
Number of responses (n=50)	22	24	4

Significant differences at 95% confidence

There were no significant differences for overall preference between the products at 95% confidence

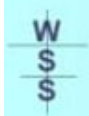


Summary Table of Attribute Results



Wirral Sensory Services Ltd, 37 Allport Lane, Bromborough, Wirral, CH62 7HH
Tel: 0151 346 2999

<http://www.wssintl.com>



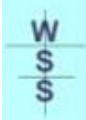
Verbatim Comments

Lady Balfour Untreated

Likes	Dislikes
nice cream colour, nice fluffy potato ideal for mashing, roasting and chipping	no real flavour to the potatoes
looks alright	very watery- not a lot of flavour
good texture	did not like flavour
nice firm texture, very pleasant aftertaste	
good colour	
	not particularly nice flavour
	flavour and texture
a lightly creamy flavour, good texture	
good potato	
nice taste, floury good colour	
large chunk	no flavour
holds its shape but breaks up easily	
softness	colour, weak flavour
	flavour could be better
not watery like some potatoes	
flavour quite good	
a good colour	a little too crumbly
a nice fluffy texture and taste	
	difficult to judge
big sized potato, good colour	not enough flavour, texture quite wet
good colour and texture	
nice potato	needed something to go with it, it was a bit bland
fluffy texture of centre of potato	colour slightly too yellowy
	bit watery and tasteless
good flavour and texture	
	bland flavour, coarse texture
	no taste
	it does not have a lot of flavour
lovely colour and aroma, good size potato	
not too floury, could be a good baking potato or useful for boiling	leaves a slight aftertaste in the mouth
look good, flavour not bad	
	tasteless
looked good and tasted good	
	unsalted
	tasteless, no real taste and a bit watery
	the texture and appearance
very large, light fluffy texture on outside, contrast soft outside but hard inside	

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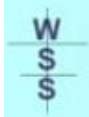
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smooth flavour, good texture, firmness, slices as a boiled potato, does not fall apart or mush	
good size and aroma	
	not much flavour or aroma, not very appealing appearance
smelt nice	tasted funny
taste	too tough
	rather dry and floury, would more suit being mashed than boiled
quite flavoursome and not crumbly	
	very little taste, and poor texture
	very yellow colour
texture better for roast potatoes	not much flavour, texture floury
nice colour and texture	

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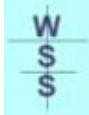
Lady Balfour Treated

Likes	Dislikes
nice colour after being boiled	no flavour, I detected a lemony hint, very dry in texture
firm and full of flavour, not watery like the first	
more flavour to the potato - hint of mint?	
Unusual taste of lemon, pleasant texture	
nice and fluffy, should think it would mash very well	
	horrible taste, watery texture, slightly medicinal flavour
appearance, texture, aroma	flavour was weak
	flavour was a little off, no aroma
nice and fluffy, should think it would mash very well	
nice and floury, good taste and colour	
good size, had a soft sweetness	
slightly minty flavour detected, holds shape but breaks up easily	
fluffy, nice colour	
	again, did not like the flavour
	too watery and tasteless
	very little flavour
a nice creamy flavour	
	not as much flavour
	didn't like first taste and aftertaste
big potato, good colour	not enough flavour, texture too wet
colour was good	did not like the taste very much
	nothing, just needed something else to try with it
nice potato	
quite a firm potato	not much flavour to potato
nice colour and firm texture	
	lacking in flavour
	very bland flavour, no potato aroma
very soft	not much taste
I like the texture of the product as it is very soft and smooth	
nice colour of potato, slight taste of mint	quite bland
nicer flavour, nice texture for baking boiling or mashing, good overall potato	
looked good	not to my taste, earthy
fairly nice taste	
	aroma
flavour of mint	unsalted
the hint of mint flavour	
the flavour, appearance, texture	

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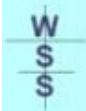


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	too much of a yellow saffron colour, horrid almost septic taste
very soft texture, make excellent mash, flavour	
	not much flavour or aroma, quite hard
tastes nice	
creamy, good texture, nice and soft	
it had a slight minty taste, often potatoes are bland but this had flavour	
	the aroma was off-putting
	very little taste
mashed well	
golden colour	slightly odd flavour like lemons, texture grainy and hard, strange smell, lemony
good colour	seemed a bit watery

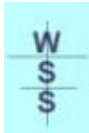
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WSS Product Testing Report
Cosmos Mint Potato Research
Date tested: 26th March 2010





Test Objective

To assess consumer acceptance of an Untreated Cosmos Mint Potato against the equivalent Treated product via a Central Location Preference Test.

Sample

The panel consisted of 50 respondents, category purchasers, primary Sainsbury's shoppers, with a cross section of age and gender.

Products Tested

1. Cosmos Mint Potato Untreated
2. Cosmos Mint Potato Treated

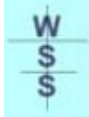
Methodology

A Central Location Test of 50 typical consumers was carried out in the Wirral area, with respondents being recruited according to the above mentioned criteria.

Respondents were presented with the products in a randomised order to prevent any bias; the products were also debranded before assessment.

Respondents were asked to taste the products and score them on an 11-point hedonic scale for a number of key parameters, they were also asked to note down any particular likes or dislikes.

Finally, the respondents were asked to say which of the products they preferred.



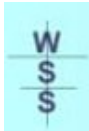
Attribute Results

RESULTS (Mean score where 0 = Extremely Unacceptable, 10 = Extremely Acceptable)

*** = Significant difference and 95% Confidence**

Scores out of 10	Untreated	Treated
Overall Acceptance	6.84	6.84

Scores out of 10	Untreated	Treated
Appearance	7.00	6.72
Aroma	6.48	6.28
Flavour	6.68	6.94
Texture	6.76	7.22

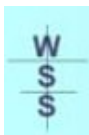


Preference Question

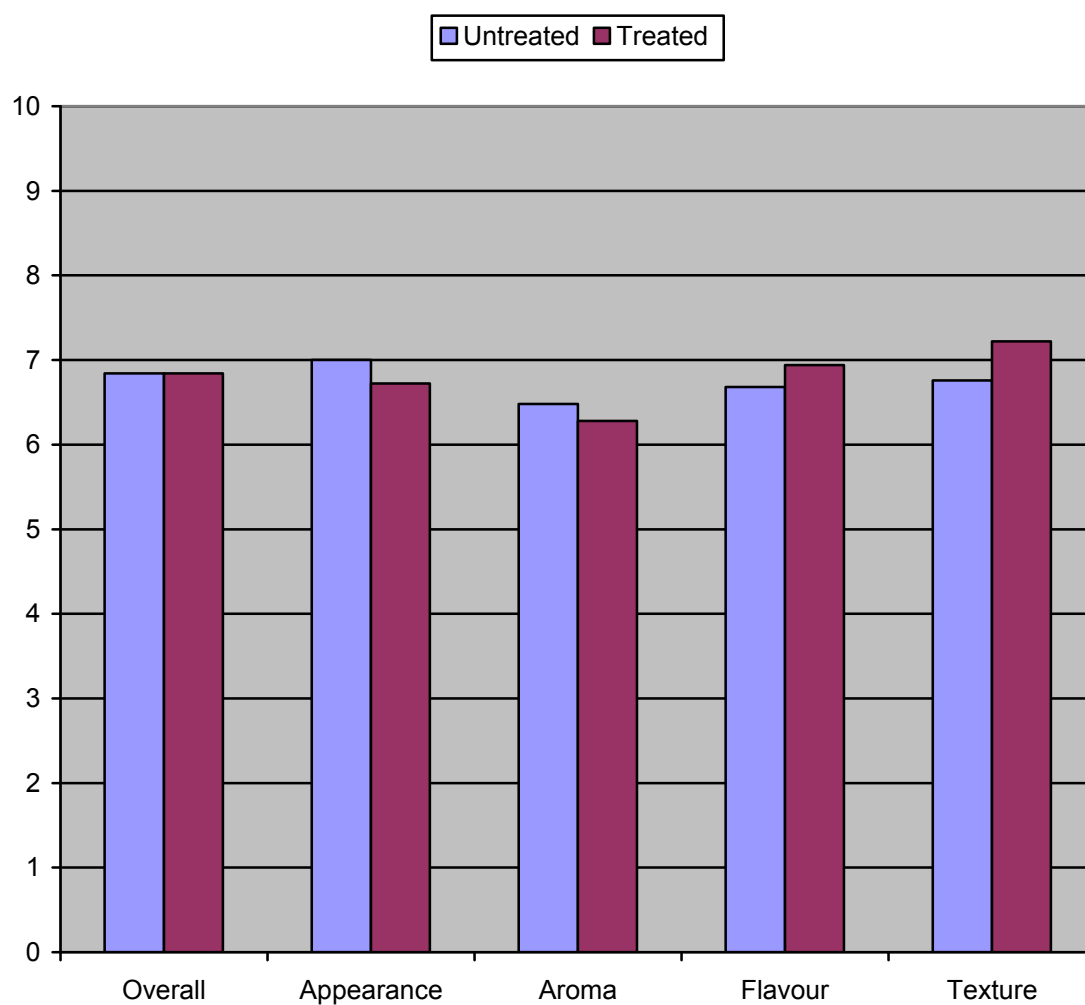
	Untreated	Treated	No Preference
Number of responses (n=50)	25	24	1

Significant differences at 95% confidence

There were no significant differences for overall preference between the products at 95% confidence

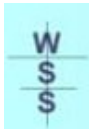


Summary Table of Attribute Results



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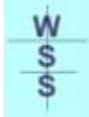
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Verbatim Comments

Untreated Cosmos Mint Potato

Likes	Dislikes
quite a firm potato, nice buttery colour	earthy taste
a good all rounder	
nice texture and taste, very pleasant on the palate, all round pleasing veg	
good colour	
not too bad in flavour	looks a bit yellow
flavour, texture and aroma	
just ok	
flavour ok, and looked ok too	
nice earthy flavour and smell, would make a good mash or roast	slightly wet texture
quite a strong flavour, slightly buttery	
nice taste, not too watery	
	hardly any flavour at all
	too stodgy and colour too strong, and very hard
a very good flavour	
a smooth taste	
nice taste and aftertaste	
dense texture, some flavour	far too yellow
more flavour, and texture was good	
nice potato, nice flavour and texture	nothing to taste with it so it was a bit bland
	very little flavour to the potato, and texture not very good
good flavour colour and texture	
very good flavour and texture, good to look at	
	bland, cannot taste potato flavour
I like it, has a smooth texture and flavour	
nice appearance, potato cooked just right, fluffy flavour which was nice	not much of an aroma, potato was quite small
pleasant flavour and texture, a good all round potato	
good texture, nice colour	
	slightly bitter aftertaste
just like the real thing	unsalted
	flavour was weak and watery

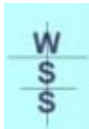


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the texture	
	doesn't taste like potato
	slightly soft texture
the texture of the potato	not very nice
	too tough, no flavour, disgusting!
best potato, good colour, texture and appearance, tastes just right - not too bland , not too rubbery	
firmness of potato, did not crumble when broken into	
quite a good taste	
	too floury
creamy taste, you wouldn't need much butter on it, texture nice and smooth	
texture just right, nice buttery taste	

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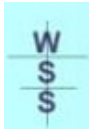


Treated Cosmos Mint Potato

Likes	Dislikes
nice buttery colour, fluffy potato, nice taste, would make a nice baking potato	
	a bit watery
very agreeable flavour, slightly sweet but a good all round veg	
nutty flavour	
nice soft texture, flavour not bad	
texture, flavour, aroma and appearance	
a sweet flavour, but not to my liking	
good	
good taste, looked nice too, floury	
nice colour	left a metallic aftertaste, not nice
nice texture which breaks up easily	
colour, fluffy	lacks taste
texture, flavour much better	
	bland
a nice flavour and quite fluffy	a little too yellow
	a good potato but slightly dry
	a bit hard
	no aftertaste
dense texture, some flavour	
	texture not as good
liked this one	nothing to taste with it
good firm potato, ideal for roasting, and pleasant flavour	
nice colour texture and flavour	
good texture	slightly lacking in flavour
creamy, easier to swallow	flavour nice, but still a bit bland, rubbery
good taste	
softness of the product	there is no flavour in this product
lovely, creamy and soft taste, nice texture, cooked just right	not much of an aroma
	very soapy texture, not pleasant, very little flavour
looks good	
good earthy wholesome taste	appearance
	flavour and texture
	unsalted, too soft, no substance, artificial texture
the texture, soft and smooth	
texture, flavour, appearance	
smooth soft texture, sweet flavour,	vivid yellow colour
	appearance

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flavour quite smooth	bit too yellow in appearance, and two black eyes remained, slightly too soft texture
good size and texture, floury texture	
nice appearance and texture	
	it had a funny taste
flavour	texture and appearance
nice buttery taste, slightly yellowy colour which means you think of butter, good crumbly texture, melts in mouth	
	very little taste
good firm texture, versatile	
texture very smooth, think it would be good mashed	slight smell
	watery flavour and texture, unappetising

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NPD – Investigative



Maris Piper Bakers

Test Product 1: Treated Maris Piper Baker

Test Product 2: Untreated Maris Piper Baker

Result: For Information

Test Attributes	Acceptability Rating Treated Vs Untreated
Appearance (Uncooked)	No significant difference in acceptability
Appearance (Cooked)	No Significant difference in acceptability
Aroma	No significant difference in acceptability
Flavour	No significant difference in acceptability
Texture	No significant difference in acceptability
Overall opinion	No significant difference in acceptability

Next Steps

- The report is for information only.
- In order to gain approval for the Tesco range the NPD samples will need to be tested against a suitable competitor benchmark i.e. JS Maris Piper Potatoes.
- Statistically, there was no significant difference in acceptability on all attributes between the Treated and Untreated Maris Piper Baker potatoes.
- The comments noted were those that 5 or more panellists agreed with.

Reason for Test:
Supplier & Site Code:
Report code:
Test date:

Investigation
Branston BS1
035289
05/07/10

Sub-group
Period:
Category:
Issued by:

FI 5SG
5
Produce
Natalie Arpino / ML

NPD – Investigative



Test Product 1: Treated Maris Piper Baker

Test Attributes	Positive/Observation	Negative
Appearance (Uncooked)	The sample looked large, earthy, round, dirty, dry and firm in appearance.	
Appearance (Cooked)	The sample had thick skin, had a fluffy inner, crisp skin and had a cream coloured inner in appearance when cooked.	
Aroma	The sample had potato, earthy, potato skin and baked aromas.	
Flavour	The sample had potato, skin, earthy, baked and slight sweet flavours.	
Texture	The sample had a fluffy inner, chewy skin, a soft inner, thick skin, was easy to break down and had crisp skin in texture.	
Overall opinion		

Test Product 2: Untreated Maris Piper Baker

Test Attributes	Positive/Observation	Negative
Appearance (Uncooked)	The sample looked large, earthy, brown, firm and unwashed in appearance.	
Appearance (Cooked)	The sample had thick skin, yellow flesh, a floury inner and had crisp skin in appearance when cooked.	
Aroma	The sample had potato, earthy, potato skin and baked aromas.	
Flavour	The sample had potato, baked, slight sweet, earthy and skin flavours.	
Texture	The sample had a fluffy inner, crisp skin, was easy to break down, had floury potato and thick skin textures.	
Overall opinion		

Reason for Test:
Supplier & Site Code:
Report code:
Test date:

Investigation
Branston BS1
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Period:
Category:
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Produce
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