



Final Report Annex

R458

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Annex A1. Tuber Pathology and physiology quality assessments

Table A1.a.1. Effect of storage temperature and storage duration on skin bloom, visual assessment, 2011/12

Storage duration (months)	Storage treatment	Skin bloom visual assessment (scale1-5)							
		Desiree		King Edward		Marfona		Maris Piper	
		Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
Intake		1.47	0.17	1.83	0.40	2.36	0.14	1.99	0.22
2	2.5°C	2.20	0.11	2.19	0.32	3.55	0.39	2.64	0.29
	4	2.16	0.12	2.43	0.20	3.23	0.08	2.87	0.17
	5.5	2.25	0.04	2.51	0.21	3.40	0.23	2.85	0.04
4	2.5	2.16	0.04	2.29	0.16	3.75	0.23	2.48	0.18
	4	2.09	0.13	2.29	0.15	3.99	0.12	2.51	0.33
	5.5	2.24	0.28	2.17	0.25	3.61	0.23	2.87	0.16
6	2.5	2.16	0.17	2.80	0.17	4.01	0.08	3.40	0.22
	4	2.39	0.24	2.92	0.02	3.89	0.32	3.63	0.20
	5.5	2.19	0.02	2.81	0.18	3.76	0.28	3.79	0.51
	2.5-5.5	2.15	0.15	2.60	0.30	3.63	0.09	3.53	0.18

Table A1.b.1. Skin bloom values for all four varieties over the trial duration, 2012/13.

Storage duration (months)	Treatment	Skin Bloom (1-5)							
		Desiree		King Edward		Marfona		Maris Piper	
		mean	sd	mean	sd	mean	sd	mean	sd
Intake		2.0	0.02	2.9	0.12	2.3	0.13	2.1	0.08
2	2.5 °C	2.7	0.10	3.6	0.11	3.0	0.20	2.6	0.42
	2.5 °C + CIPC	2.8	0.36	4.0	0.22	3.1	0.05	2.8	0.06
	4 °C	2.8	0.17	3.9	0.08	2.9	0.18	2.6	0.06
	4 °C + CIPC	2.7	0.14	3.7	0.29	3.1	0.09	2.9	0.15
	5.5 °C + CIPC	2.9	0.06	3.9	0.16	2.9	0.02	2.9	0.35
4	2.5 °C	2.6	0.11	3.9	0.12	3.1	0.17	2.9	0.17
	2.5 °C + CIPC	2.7	0.04	4.1	0.06	3.2	0.07	2.8	0.08
	4 °C	2.6	0.02	4.0	0.14	3.1	0.18	2.8	0.07
	4 °C + CIPC	2.7	0.12	4.2	0.13	2.8	0.30	2.8	0.05
	5.5 °C + CIPC	2.7	0.10	4.1	0.11	3.0	0.08	2.8	0.19
6	2.5 °C	2.9	0.08	3.7	0.10	2.8	0.12	2.8	0.18
	2.5 °C + CIPC	2.8	0.16	4.0	0.11	3.1	0.08	2.7	0.12
	4 °C	2.8	0.06	4.2	0.18	3.1	0.58	2.9	0.08
	4 °C + CIPC	2.8	0.04	4.0	0.12	2.7	0.08	2.9	0.15
	5.5 °C + CIPC	2.8	0.06	4.0	0.06	2.8	0.10	2.7	0.15
	2.5-5.5 °C + CIPC	2.8	0.06	4.0	0.08	2.9	0.11	2.8	0.05

Table A1.a.2. Effect of storage temperature and duration on incidence of silver scurf, 2011/12

	Sampling Occasion	% silver scurf incidence							
		Desiree		King Edward		Marfona		Maris Piper	
Storage treatment °C		Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
2.5	SO1	9.3	2.3	4.0	4.0	4.0	4.0	14.7	8.3
4		12.0	8.0	1.3	2.3	5.3	2.3	22.7	12.9
5.5		14.7	2.3	2.7	2.3	18.7	12.9	30.7	16.2
2.5	SO2	9.3	4.6	0.0	0.0	9.3	2.3	13.3	6.1
4		8.0	4.0	0.0	0.0	4.0	6.9	26.7	10.1
5.5		10.7	4.6	1.3	2.3	6.7	8.3	38.7	16.2
2.5	SO3	6.7	2.3	4.0	4.0	1.3	2.3	17.3	12.9
4		9.3	9.2	0.0	0.0	4.0	6.9	36.0	4.0
5.5		12.0	4.0	4.0	6.9	10.7	10.1	32.0	12.0
2.5-5.5		16.0	10.6	2.7	2.3	10.7	10.1	33.3	16.2

Table A1.b.2. Silver scurf incidence on all varieties during the storage trial, 2012/13.

	Storage Treatment	Silver Scurf Incidence (%)							
		Desiree		King Edward		Marfona		Maris Piper	
Storage duration (months)		mean	sd	mean	sd	mean	sd	mean	sd
Intake		1.3	2.31	8.0	4.00	72.0	4.00	2.7	4.62
2	2.5 °C	22.7	10.07	9.3	2.31	77.3	8.33	0.0	0.00
	2.5 °C + CIPC	9.3	4.62	6.7	6.11	61.3	8.33	1.3	2.31
	4 °C	12.0	6.93	6.7	2.31	82.7	8.33	6.7	6.11
	4 °C + CIPC	6.7	6.11	13.3	11.55	62.7	22.03	6.7	8.33
	5.5 °C + CIPC	20.0	10.58	4.0	0.00	81.3	12.22	4.0	4.00
4	2.5 °C	18.7	6.11	13.3	8.33	90.7	8.33	9.3	4.62
	2.5 °C + CIPC	12.0	4.00	1.3	2.31	77.3	12.22	9.3	2.31
	4 °C	25.3	4.62	9.3	6.11	89.3	8.33	24.0	0.00
	4 °C + CIPC	25.3	2.31	6.7	6.11	86.7	9.24	17.3	10.07
	5.5 °C + CIPC	26.7	12.86	10.7	9.24	88.0	6.93	17.3	6.11
6	2.5 °C	26.7	4.62	16.0	8.00	82.7	2.31	14.7	10.07
	2.5 °C + CIPC	4.0	0.00	18.7	4.62	80.0	10.58	13.3	8.33
	4 °C	26.7	6.11	13.3	9.24	85.3	10.07	12.0	4.00
	4 °C + CIPC	22.7	4.62	10.7	4.62	74.7	11.55	8.0	4.00
	5.5 °C + CIPC	38.7	8.33	22.7	9.24	89.3	4.62	16.0	12.00
	2.5-5.5 °C + CIPC	22.7	10.07	4.0	6.93	81.3	12.22	24.0	17.44

Table A1.c.2. Silver scurf severity on all varieties during the storage trial, 2013/14.

Silver scurf Severity (%)									
		Desiree		King Edward		Marfona		Maris Piper	
Storage duration (months)	Treatment	mean	sd	mean	sd	mean	sd	mean	sd
2	2.5 °C	1.65	0.72	3.43	1.51	0.39	0.18	1.65	0.72
	2.5 °C + CIPC	1.76	0.53	5.32	1.88	0.70	0.44	1.76	0.53
	4 °C + CIPC	1.51	0.62	6.50	3.16	0.84	0.28	1.51	0.62
	5.5 °C + CIPC	2.23	0.58	4.27	3.64	0.65	0.26	2.23	0.58
4	2.5 °C	2.43	1.39	5.64	1.70	0.61	0.10	2.43	1.39
	2.5 °C + CIPC	2.38	0.95	4.83	1.28	0.62	0.15	2.38	0.95
	4 °C + CIPC	2.07	0.96	6.03	1.56	1.08	0.88	2.07	0.96
	5.5 °C + CIPC	1.49	0.23	8.42	4.04	0.87	0.43	1.49	0.23
6	2.5 °C	2.50	1.79	5.51	0.69	0.60	0.44	2.50	1.79
	2.5 °C + CIPC	2.77	1.53	4.17	3.08	1.22	1.02	2.77	1.53
	4 °C + CIPC	3.00	1.16	4.56	3.90	1.49	1.49	3.00	1.16
	5.5 °C + CIPC	2.37	0.77	3.33	0.79	1.16	0.49	2.37	0.77

Table A1.a.3. Effect of storage temperature and duration on incidence of black dot, 2011/12

	Sampling Occasion	% Black dot incidence							
		Desiree		King Edward		Marfona		Maris Piper	
Storage treatment °C		Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
2.5	SO1	36.0	10.6	40.0	8.0	82.7	2.3	5.3	4.6
4		22.7	2.3	29.3	10.1	70.7	12.9	0.0	0.0
5.5		22.7	8.3	38.7	16.7	64.0	14.4	4.0	6.9
2.5	SO2	33.3	8.3	37.3	2.3	69.3	2.3	1.3	2.3
4		28.0	10.6	33.3	2.3	68.0	14.4	4.0	6.9
5.5		38.7	9.2	41.3	4.6	68.0	4.0	0.0	0.0
2.5	SO3	22.7	4.6	46.7	12.9	69.3	2.3	10.7	4.6
4		32.0	12.0	32.0	6.9	70.7	9.2	2.7	2.3
5.5		18.7	10.1	32.0	4.0	72.0	6.9	2.7	4.6
2.5-5.5		21.3	6.1	28.0	4.0	69.3	2.3	2.7	4.6

Table A1.b.3. Black dot incidence on all varieties during the storage trial, 2012/13.

Storage duration (months)	Treatment	Black Dot Incidence (%)							
		Desiree		King Edward		Marfona		Maris Piper	
		mean	sd	mean	sd	mean	sd	mean	sd
Intake		96.0	4.00	29.3	6.11	1.3	2.31	100.0	0.00
2	2.5 °C	97.3	2.31	26.7	20.53	0.0	0.00	93.3	8.33
	2.5 °C + CIPC	96.0	4.00	40.0	10.58	0.0	0.00	97.3	2.31
	4 °C	94.7	2.31	46.7	4.62	0.0	0.00	92.0	0.00
	4 °C + CIPC	97.3	4.62	28.0	18.33	0.0	0.00	93.3	6.11
	5.5 °C + CIPC	94.7	2.31	30.7	10.07	0.0	0.00	96.0	4.00
4	2.5 °C	98.7	2.31	42.7	2.31	1.3	2.31	96.0	4.00
	2.5 °C + CIPC	94.7	2.31	40.0	4.00	0.0	0.00	100.0	0.00
	4 °C	96.0	4.00	33.3	4.62	0.0	0.00	98.7	2.31
	4 °C + CIPC	96.0	4.00	34.7	8.33	0.0	0.00	100.0	0.00
	5.5 °C + CIPC	93.3	4.62	30.7	12.22	0.0	0.00	94.7	9.24
6	2.5 °C	100.0	0.00	30.7	14.05	0.0	0.00	100.0	0.00
	2.5 °C + CIPC	97.3	4.62	30.7	2.31	0.0	0.00	96.0	4.00
	4 °C	93.3	8.33	32.0	6.93	0.0	0.00	94.7	4.62
	4 °C + CIPC	90.7	6.11	33.3	2.31	0.0	0.00	100.0	0.00
	5.5 °C + CIPC	96.0	4.00	34.7	4.62	0.0	0.00	97.3	2.31
	2.5-5.5 °C + CIPC	98.7	2.31	34.7	10.07	1.3	2.31	96.0	4.00

Table A1.c.3. Black dot severity on all varieties during the storage trial, 2013/14.

Black Dot Severity (%)									
		Desiree		King Edward		Marfona		Maris Piper	
Storage duration (months)	Treatment	mean	sd	mean	sd	mean	sd	mean	sd
Intake									
2	2.5 °C	0.43	0.61	3.43	1.51	0.01	0.02	0.17	0.02
	2.5 °C + CIPC	0.29	0.21	5.32	1.88	0.00	0.00	0.20	0.15
	4 °C + CIPC	1.09	0.15	6.50	3.16	0.00	0.00	0.21	0.13
	5.5 °C + CIPC	0.34	0.13	4.27	3.64	0.00	0.00	0.21	0.13
4	2.5 °C	0.24	0.13	5.64	1.70	0.00	0.00	0.16	0.03
	2.5 °C + CIPC	1.20	0.78	4.83	1.28	0.00	0.00	0.15	0.10
	4 °C + CIPC	0.87	0.91	6.03	1.56	0.02	0.02	0.17	0.15
	5.5 °C + CIPC	0.86	0.75	8.42	4.04	0.00	0.00	0.22	0.15
6	2.5 °C	0.41	0.34	5.51	0.69	0.00	0.00	0.11	0.11
	2.5 °C + CIPC	0.35	0.11	4.17	3.08	0.00	0.00	0.21	0.18
	4 °C + CIPC	0.69	0.82	4.56	3.90	0.01	0.02	0.16	0.08
	5.5 °C + CIPC	0.80	0.70	3.33	0.79	0.00	0.00	0.33	0.20

Table A1.a.4. Respiration rates for all varieties during the storage trial, 2011/12.

	Sampling Occasion	Respiration rate mg CO ₂ /kg/hr							
		Desiree		King Edward		Marfona		Maris Piper	
		Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
Storage treatment °C	Intake	3.24	0.15	3.21	0.24	4.01	0.28	3.75	0.17
2.5	SO1	1.95	0.13	1.30	0.10	1.29	0.14	1.62	0.25
4		1.78	0.17	1.34	0.36	1.80	0.41	1.75	0.20
5.5		1.95	0.27	1.73	0.67	1.36	0.14	1.73	0.35
2.5	SO2	2.42	0.19	2.05	0.05	1.58	0.03	2.22	0.12
4		2.56	0.32	2.77	0.31	1.92	0.52	2.05	0.07
5.5		2.24	0.29	1.75	0.35	1.70	0.15	3.93	0.35
2.5	SO3	3.36	0.16	2.69	0.10	2.46	0.17	3.04	0.11
4		2.81	0.23	2.06	0.22	2.03	0.14	2.15	0.17
5.5		2.42	0.10	1.92	0.09	1.92	0.16	1.90	0.16
2.5-5.5		2.56	0.24	1.88	0.05	1.89	0.21	2.19	0.24

Table A1.b.4. Respiration rates for all varieties during the storage trial, 2012/13.

		Respiration rate (mg CO ₂ /kg/hr.)							
		Desiree		King Edward		Marfona		Maris Piper	
Storage duration (months)	Treatment	mean	sd	mean	sd	mean	sd	mean	sd
Intake		2.94	0.06	3.91	0.64	2.29	0.35	3.52	0.50
2	2.5 °C	1.70	0.18	1.62	0.14	1.37	0.06	1.14	0.08
	2.5 °C + CIPC	1.47	0.04	1.61	0.17	1.12	0.12	0.99	0.13
	4 °C	1.37	0.03	1.41	0.10	0.73	0.63	1.08	0.13
	4 °C + CIPC	1.30	0.06	1.37	0.17	1.08	0.13	0.92	0.13
	5.5 °C + CIPC	1.40	0.06	1.57	0.11	1.12	0.08	0.92	0.05
4	2.5 °C	1.17	0.03	1.66	0.13	1.67	0.11	1.56	0.24
	2.5 °C + CIPC	1.23	0.19	1.58	0.13	1.44	0.48	1.34	0.38
	4 °C	1.15	0.15	1.11	0.31	1.41	0.30	1.46	0.52
	4 °C + CIPC	1.29	0.14	2.29	0.18	1.41	0.23	1.30	0.36
	5.5 °C + CIPC	1.46	0.38	1.41	0.10	1.16	0.34	1.09	0.13
6	2.5 °C	1.32	0.20	1.49	0.04	1.44	0.28	1.58	0.18
	2.5 °C + CIPC	2.02	0.06	2.70	0.32	1.59	0.13	1.56	0.08
	4 °C	1.43	0.12	1.55	0.17	1.45	0.05	1.11	0.07
	4 °C + CIPC	1.60	0.08	1.99	0.13	1.46	0.09	2.11	1.30
	5.5 °C + CIPC	2.08	0.08	2.29	0.14	2.15	0.04	1.65	0.20
	2.5-5.5 °C + CIPC	2.01	0.14	2.35	0.18	1.49	0.13	1.25	0.02

Table A1.c.4. Respiration rates for all varieties during the storage trial, 2013/14.

Respiration rate (mg CO ₂ /kg/hr.)									
		Desiree		King Edward		Marfona		Maris Piper	
Storage duration (months)	Treatment	mean	sd	mean	sd	mean	sd	mean	sd
Intake		5.00	0.35	3.48	0.68	3.68	0.23	2.61	0.52
2	2.5 °C	2.40	0.51	2.77	0.91	1.95	0.12	2.53	0.76
	2.5 °C + CIPC	2.18	0.26	2.09	0.30	1.68	0.28	2.01	0.26
	4 °C + CIPC	4.32	0.45	2.85	0.24	1.87	0.25	2.53	0.49
	5.5 °C + CIPC	2.24	0.46	2.13	0.70	1.71	0.51	1.76	0.11
4	2.5 °C	1.95	0.17	1.85	0.23	0.99	0.11	1.52	0.13
	2.5 °C + CIPC	2.33	0.32	2.15	0.43	1.35	0.25	1.89	0.45
	4 °C + CIPC	2.12	0.05	1.87	0.22	1.54	0.13	1.78	0.22
	5.5 °C + CIPC	1.78	0.06	1.47	0.12	1.37	0.22	1.45	0.11
6	2.5 °C	2.11	0.12	2.04	0.29	1.50	0.25	1.82	0.19
	2.5 °C + CIPC	2.22	0.26	1.84	0.19	1.35	0.11	1.68	0.10
	4 °C + CIPC	2.41	0.23	1.81	0.08	1.76	0.73	1.80	0.14
	5.5 °C + CIPC	1.74	0.08	1.66	0.17	1.24	0.05	1.58	0.09

Table A1.a.5. Sprout length for all four varieties over the trial duration, 2011/12.

		Sprout Length (mm)							
		Desiree		King Edward		Marfona		Maris Piper	
Storage duration (months)	Storage Treatment	mean	sd	mean	sd	mean	sd	mean	sd
Intake									
2	2.5 °C	0.01	0.12	0.9	1.9	0.0	0.0	0.0	0.0
	4 °C	0.13	0.37	2.1	3.7	0.0	0.2	0.0	0.0
	5.5 °C	0.13	0.40	3.0	4.4	0.0	0.1	0.0	0.1
4	2.5 °C	0.08	0.27	1.0	1.9	0.0	0.0	0.1	0.4
	4 °C	0.35	0.56	2.1	3.3	0.5	0.6	0.6	1.0
	5.5 °C	2.42	3.49	3.8	7.0	1.4	1.6	3.0	3.9
6	2.5 °C	0.93	0.27	1.6	1.8	0.7	0.5	0.8	0.4
	4 °C	1.08	0.35	3.2	3.1	0.9	0.5	1.2	0.9
	5.5 °C	3.14	2.84	4.0	3.9	5.5	4.9	5.9	5.8
	2.5-5.5 °C	1.29	0.56	2.7	2.7	1.4	1.0	1.3	0.7

Table A1.b.5. Sprout length for all four varieties over the trial duration, 2012/13.

		Sprout Length (mm)							
		Desiree		King Edward		Marfona		Maris Piper	
Storage duration (months)	Storage Treatment	mean	sd	mean	sd	mean	sd	mean	sd
Intake									
2	2.5 °C	0.1	0.1	0.2	0.20	0.0	0.00	0.0	0.00
	2.5 °C + CIPC	0.0	0.02	0.0	0.00	0.0	0.00	0.0	0.02
	4 °C	0.0	0.05	0.1	0.09	0.0	0.00	0.0	0.07
	4 °C + CIPC	0.0	0.00	0.1	0.07	0.0	0.00	0.0	0.00
	5.5 °C + CIPC	0.1	0.14	0.1	0.19	0.0	0.00	0.0	0.05
4	2.5 °C	0.1	0.10	0.2	0.16	0.0	0.02	0.2	0.20
	2.5 °C + CIPC	0.1	0.08	0.1	0.08	0.0	0.00	0.0	0.07
	4 °C	0.3	0.22	0.5	0.58	0.0	0.07	0.3	0.04
	4 °C + CIPC	0.3	0.28	0.3	0.17	0.0	0.05	0.2	0.06
	5.5 °C + CIPC	0.3	0.19	0.8	0.26	0.2	0.12	0.3	0.37
6	2.5 °C	0.1	0.13	0.5	0.27	0.0	0.00	0.2	0.04
	2.5 °C + CIPC	0.1	0.15	0.2	0.04	0.0	0.02	0.2	0.04
	4 °C	0.6	0.05	0.8	0.21	0.4	0.37	0.7	0.17
	4 °C + CIPC	0.2	0.10	0.7	0.13	0.1	0.04	0.5	0.37
	5.5 °C + CIPC	0.6	0.11	1.1	0.20	0.4	0.24	0.4	0.13
	2.5-5.5 °C + CIPC	0.7	0.18	1.0	0.26	0.3	0.06	0.9	0.32

Table A1.c.5. Sprout length for all four varieties over the trial duration, 2013/14.

Sprout length (mm)									
		Desiree		King Edward		Marfona		Maris Piper	
Storage duration (months)	Treatment	mean	sd	mean	sd	mean	sd	mean	sd
2	2.5 °C	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.8
	2.5 °C + CIPC	0.0	0.0	0.0	0.2	0.0	0.0	1.4	0.6
	4 °C + CIPC	0.0	0.0	0.6	0.1	0.0	0.0	1.5	0.9
	5.5 °C + CIPC	0.0	0.0	0.8	0.0	0.0	0.0	1.2	0.7
4	2.5 °C	0.5	0.2	0.6	0.4	0.2	0.0	0.6	1.1
	2.5 °C + CIPC	0.5	0.2	1.2	0.5	0.0	0.1	1.2	1.9
	4 °C + CIPC	0.6	0.3	0.6	0.6	0.0	0.1	0.9	1.7
	5.5 °C + CIPC	0.6	0.7	2.2	1.2	0.3	0.5	0.9	1.5
6	2.5 °C	0.0	0.0	0.0	0.2	0.0	0.0	2.5	1.4
	2.5 °C + CIPC	0.0	0.1	0.6	0.4	0.0	0.0	2.4	1.6
	4 °C + CIPC	0.5	0.3	0.7	0.8	0.2	0.1	1.0	1.6
	5.5 °C + CIPC	0.5	0.9	0.6	1.2	0.6	0.6	1.3	1.7

Table A1.a.6. Effect of storage temperature and duration on weight loss of tubers, 2011/12

	Sampling Occasion	Sprout length (mm)							
		Desiree		King Edward		Marfona		Maris Piper	
Storage treatment °C		Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
2.5	SO1	1.2	0.1	1.3	0.2	2.3	0.3	3.5	0.3
4		1.3	0.1	1.5	0.1	2.6	0.1	3.9	0.1
5.5		1.6	0.0	1.5	0.1	3.0	0.1	4.9	0.7
2.5	SO2	2.0	0.2	2.0	0.1	3.7	0.3	4.7	0.1
4		2.2	0.1	2.3	0.2	4.6	0.2	5.5	0.4
5.5		2.3	0.1	2.7	0.2	4.3	0.1	5.7	0.1
2.5	SO3	2.2	0.2	2.8	0.2	4.3	0.6	5.5	0.1
4		2.6	0.0	3.4	0.5	5.2	0.7	7.0	0.2
5.5		3.0	0.2	3.5	0.3	5.5	0.2	7.2	0.4
2.5-5.5		2.5	0.2	3.2	0.3	5.2	0.2	6.8	0.3

Table A1.b.6. Weight loss for all varieties during the trial duration, 2012/13.

Storage duration (months)	Treatment	Weight loss %							
		Desiree		King Edward		Marfona		Maris Piper	
		mean	sd	mean	sd	mean	sd	mean	sd
Intake									
2	2.5 °C	2.4	0.27	3.3	0.48	1.0	0.13	3.1	0.47
	2.5 °C + CIPC	2.4	0.14	4.1	0.26	1.5	0.35	3.5	0.29
	4 °C	2.3	0.04	3.7	0.44	1.2	0.08	2.9	0.26
	4 °C + CIPC	2.2	0.11	3.5	0.27	1.2	0.16	3.8	0.27
	5.5 °C + CIPC	1.9	0.14	3.1	0.29	1.0	0.09	2.7	0.47
4	2.5 °C	3.2	0.20	5.0	0.43	1.6	0.11	3.9	0.09
	2.5 °C + CIPC	3.3	0.65	6.4	0.74	2.0	0.21	4.3	0.49
	4 °C	3.0	0.17	5.0	0.31	1.8	0.36	4.4	0.33
	4 °C + CIPC	2.9	0.33	5.4	0.29	1.6	0.32	4.2	0.41
	5.5 °C + CIPC	2.7	0.19	3.9	0.24	1.4	0.10	3.5	0.26
6	2.5 °C	3.7	0.35	5.6	0.35	2.1	0.28	4.6	0.22
	2.5 °C + CIPC	3.6	0.49	7.3	1.55	2.7	0.41	5.2	0.18
	4 °C	3.9	0.41	6.2	0.54	2.2	0.28	4.8	0.43
	4 °C + CIPC	3.7	0.40	6.6	0.76	2.0	0.23	4.3	0.45
	5.5 °C + CIPC	3.2	0.36	5.0	0.47	1.8	0.26	4.4	0.02
	2.5-5.5 °C + CIPC	3.4	0.35	6.2	0.96	2.3	0.33	5.0	0.69

Figure A1.b.2. Average weight loss across all storage treatments over the trial duration, 2012/13

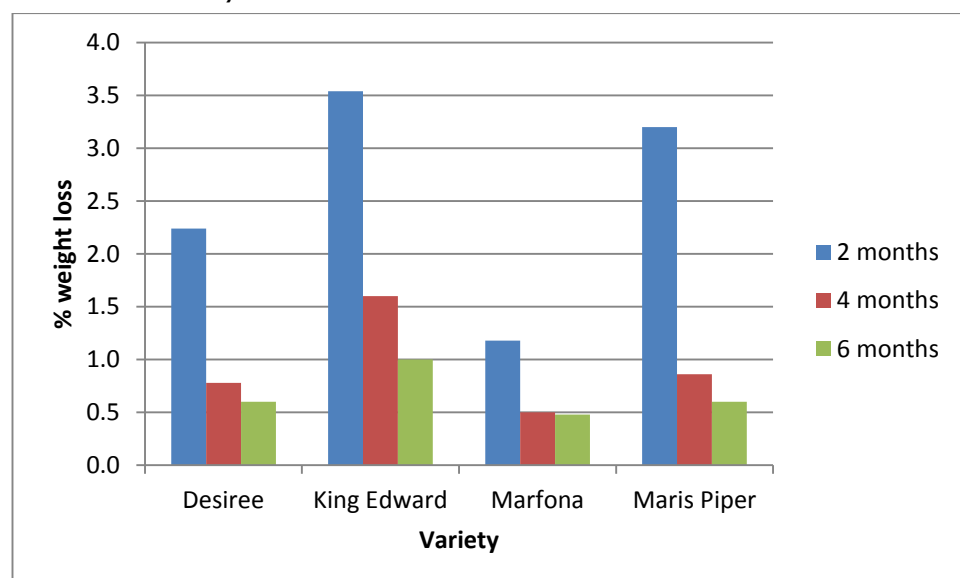
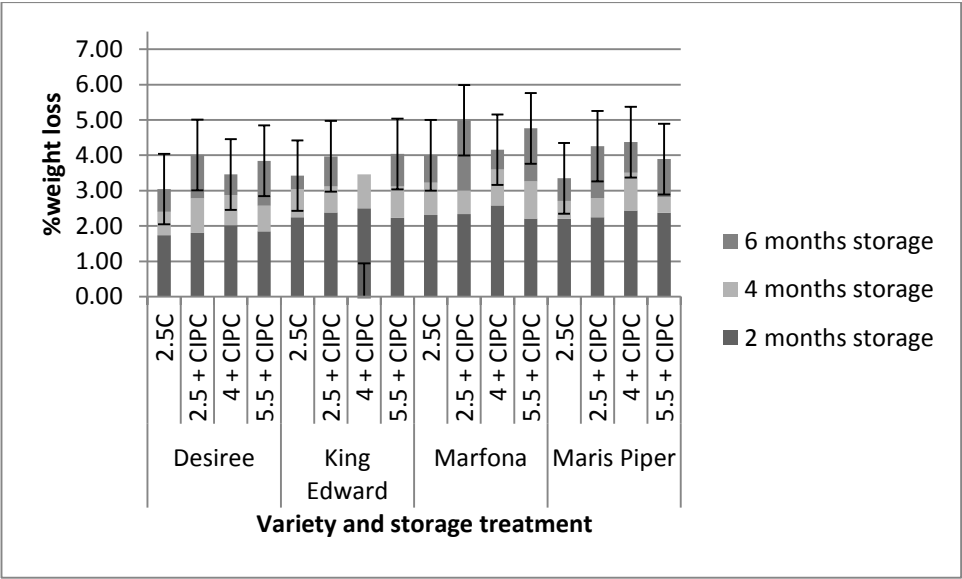


Table A1.c.6. Weight loss for all varieties during the trial duration, 2013/14.

% Weight Loss									
		Desiree		King Edward		Marfona		Maris Piper	
Storage duration (months)	Treatment	mean	sd	mean	sd	mean	sd	mean	sd
2	2.5 °C	1.74	0.18	2.25	0.08	2.31	0.28	2.20	0.23
	2.5 °C + CIPC	1.80	0.03	2.38	0.03	2.34	0.16	2.25	0.14
	4 °C + CIPC	2.02	0.13	2.50	0.14	2.59	0.25	2.43	0.15
	5.5 °C + CIPC	1.85	0.08	2.23	0.11	2.21	0.12	2.37	0.20
4	2.5 °C	2.40	0.18	3.05	0.14	3.23	0.31	2.71	0.25
	2.5 °C + CIPC	2.78	0.20	3.11	0.12	3.01	0.10	2.79	0.11
	4 °C + CIPC	2.87	0.20	3.46	0.19	3.60	0.27	3.51	0.60
	5.5 °C + CIPC	2.57	0.07	3.12	0.14	3.26	0.30	2.82	0.06
6	2.5 °C	3.04	0.33	3.42	0.12	4.00	0.19	3.35	0.15
	2.5 °C + CIPC	4.01	0.29	3.97	0.18	4.99	0.33	4.26	0.18
	4 °C + CIPC	3.46	0.17	3.41	0.31	4.16	0.28	4.37	0.80
	5.5 °C + CIPC	3.84	0.14	4.04	0.09	4.76	0.35	3.89	0.31

Figure A1.c.1. Cumulative weight loss of varieties during six month storage, 2013/14



error bars, standard deviation for final assessment

Table A1.a.7. Effect of storage temperature and duration on French fry colour, 2011/12

Storage duration (months)	Storage Treatment	SBCSR fry colour score							
		Desiree		King Edward		Marfona		Maris Piper	
		mean		mean		mean		mean	
6	2.5 °C	7.0		7.0		7.0		7.0	
	4 °C	7.0		6.3		6.7		7.0	
	5.5 °C	6.2		4.3		5.6		7.0	
	2.5-5.5 °C	6.9		6.8		6.7		7.0	

French fry colour correspondence of USDA and SBCSR units

SBCSR score	1	2	3	4	5	6	7
USDA score	000	00	0	1	2	3	4

Table A1.b.7. French fry colour scores for all four varieties after 6 months storage, 2012/13.

Storage duration (months)	Storage Treatment	SBCSR fry colour score							
		Desiree		King Edward		Marfona		Maris Piper	
		mean		mean		mean		mean	
6	2.5 °C	5.0		5.1		4.8		5.0	
	2.5 °C + CIPC	5.0		5.2		4.8		5.0	
	4 °C	5.0		5.2		5.0		3.9	
	4 °C + CIPC	3.7		4.3		4.2		3.0	
	5.5 °C + CIPC	4.0		3.9		3.9		2.6	
	2.5-5.5 °C + CIPC	4.6		5.1		4.6		4.2	

SBCSR score	1	2	3	4	5	6	7
USDA score	000	00	0	1	2	3	4

Figure A1.b.3 Relationship between storage temperature and French fry colour, 2012/13

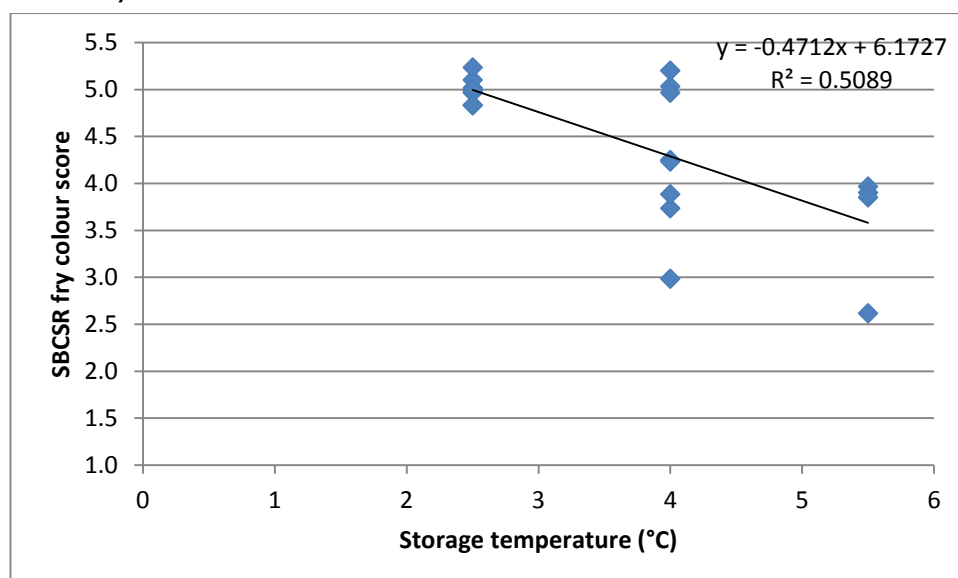


Table A1.c.7. French fry colour scores (SBCSR values) for all four varieties after 6 months storage, 2013/14.

		Desiree	King Edward	Marfona	Maris Piper
Storage duration (months)	Treatment °C	mean	mean	mean	mean
6	2.5	5.75	4.9	5.25	3.9
	2.5 + CIPC	5.6	4.65	5.1	4.3
	4 + CIPC	4.6	3.35	5.15	3.35
	5.5 + CIPC	4	3	4	3

French fry colour correspondence of USDA and SBCSR units

SBCSR score	1	2	3	4	5	6	7
USDA score	000	00	0	1	2	3	4

Figure A1.c.2. Relationship between storage temperature and French fry colour, 2013/14

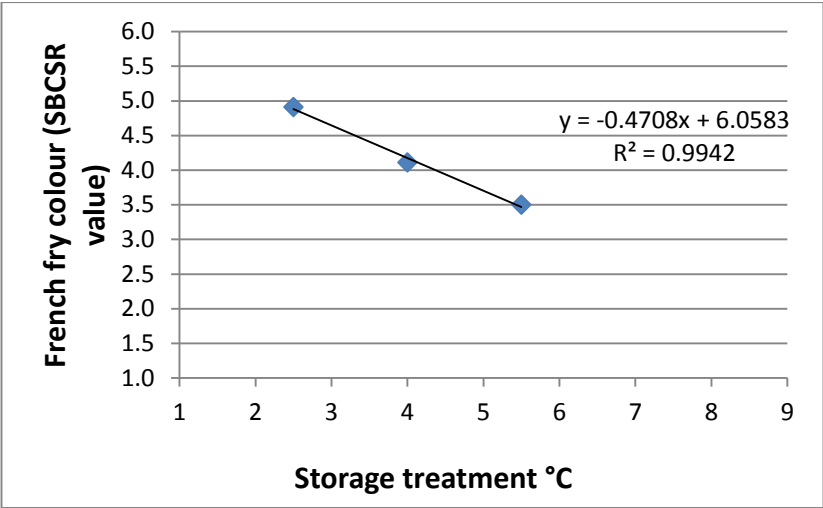


Table A1.a.8. Effect of storage temperature and duration on acrylamide content of French fry samples, 2011/12.

Storage duration (months)	Storage Treatment	Acrylamide (µg/kg)							
		Desiree		King Edward		Marfona		Maris Piper	
		mean	sd	mean	sd	mean	sd	mean	sd
6	2.5 °C	2155	164	1259	89	724	37	1154	22
	4 °C	2210	158	975	39	863	62	1071	70
	5.5 °C	2069	199	460	78	993	48	840	87
	2.5-5.5 °C	2446	22	1080	85	863	47	1079	59

Table A1.a.8a. Effect of storage temperature and duration on acrylamide content of French fry samples. post-hoc Bonferroni significance tests, 2011/12.

Temp.	Desiree			King Edward			Maris Piper			Marfona		
	2.5°-5.5 °C	4 °C	5.5	2.5°-5.5 °C	4 °C	5.5	2.5°-5.5 °C	4 °C	5.5	2.5°-5.5 °C	4 °C	5.5
2.5 °C	NS	NS	NS	NS	*	***	NS	NS	***	NS	NS	**
2.5-5.5 °C	n/a	NS	NS	n/a	NS	***	n/a	NS	**	n/a	NS	NS
4 °C	n/a	n/a	NS	n/a	n/a	***	n/a	n/a	*	n/a	n/a	NS

*** P < 0.001, ** P < 0.01, * P<0.05, NS Non-significant result at the 5% level. n/a Not applicable.

Figure A1.a.1. 2011/12. Relationship of fry colour with acrylamide content for all varieties and treatments, maximum fry colour (7) values excluded

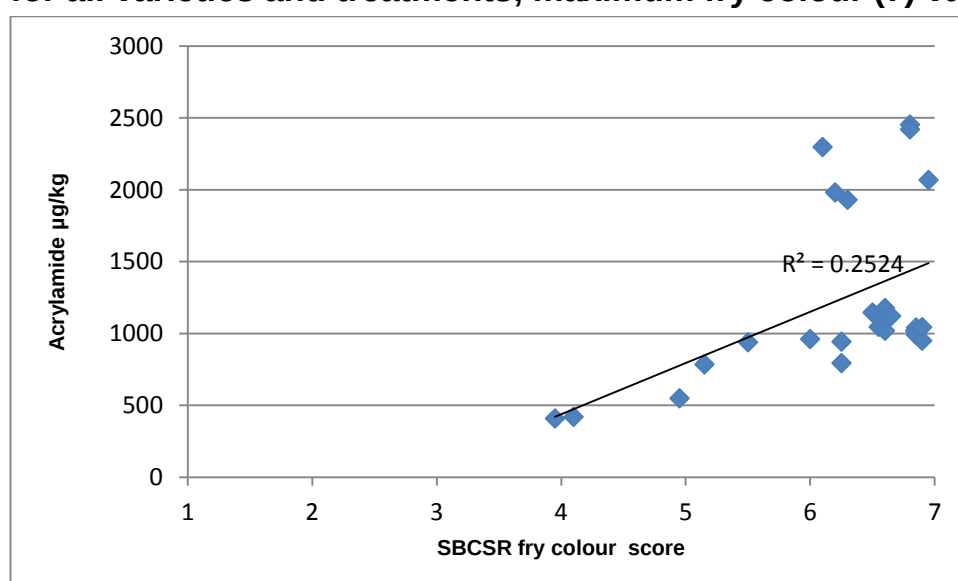
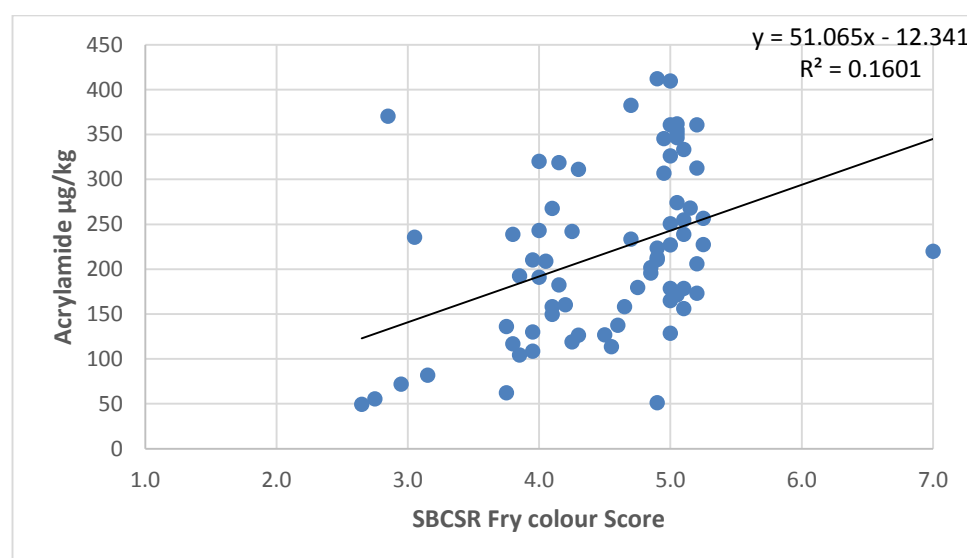


Table A1.b.8. Acrylamide content of French fries prepared from all varieties after 6 months storage, 2012/13

Storage duration (months)	Storage Treatment	Acrylamide (µg/kg)							
		Desiree		King Edward		Marfona		Maris Piper	
		mean	sd	mean	sd	mean	sd	mean	sd
6	2.5 °C	361.5	45.0	344.8	11.2	234.8	29.4	244.9	25.5
	2.5 °C + CIPC	361.2	9.6	344.7	27.8	195.5	14.7	166.7	28.4
	4 °C	328.1	73.3	240.9	14.7	193.1	18.8	157.8	26.2
	4 °C + CIPC	202.2	137.5	290.6	42.3	154.0	32.3	93.6	29.1
	5.5 °C + CIPC	203.4	10.8	175.8	56.6	109.9	6.4	55.7	6.5
	2.5-5.5 °C + CIPC	281.9	88.0	228.0	42.9	142.6	25.2	138.0	11.5

Figure A1.b.4. Relationship of fry colour with acrylamide content for all varieties and treatments, 2012/13.



Annex A2. Taste and Texture results

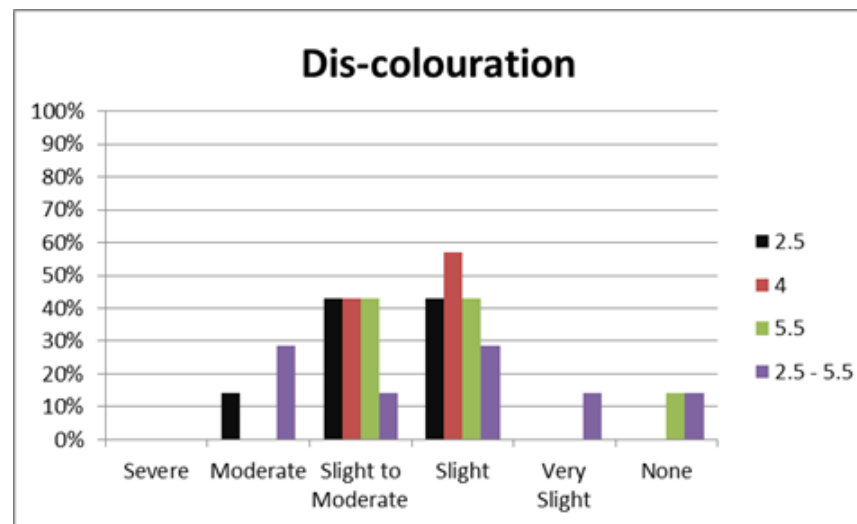
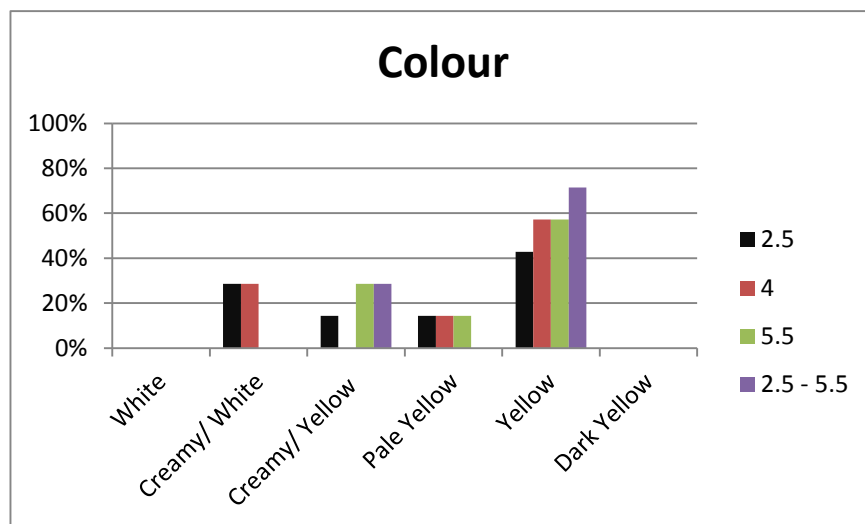
2012-13 Tasting panel – FPSA committee members

2013-14 Tasting panel – FPSA member representatives with experience of taste and texture assessment

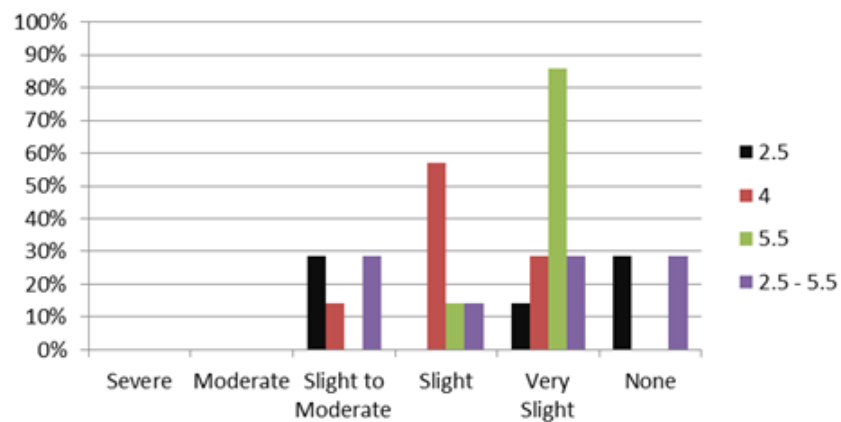
Taste and texture 2012-13

Individual taste or texture attributes are identified in graph title and descriptors in X-axis.

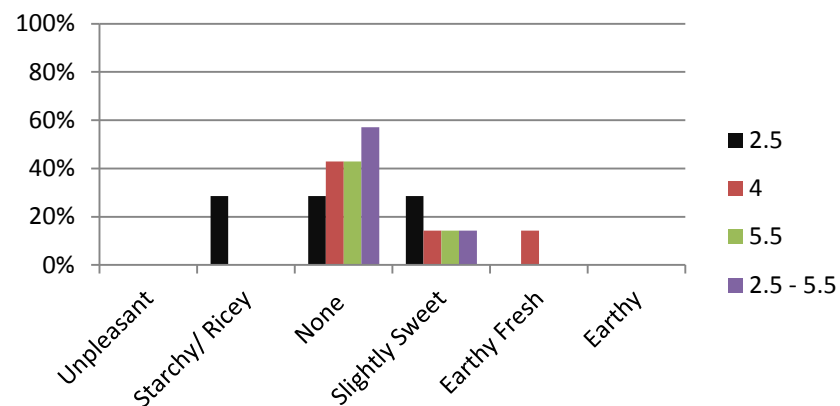
Annex A2.b.1 Taste and texture attributes Desiree 2012/13



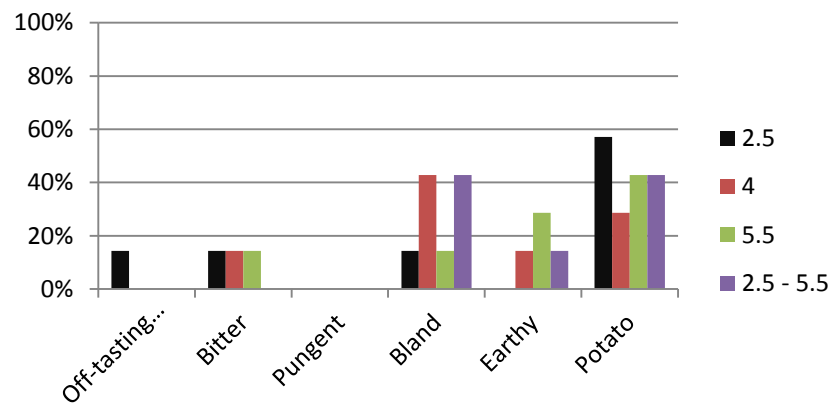
Dis-integration



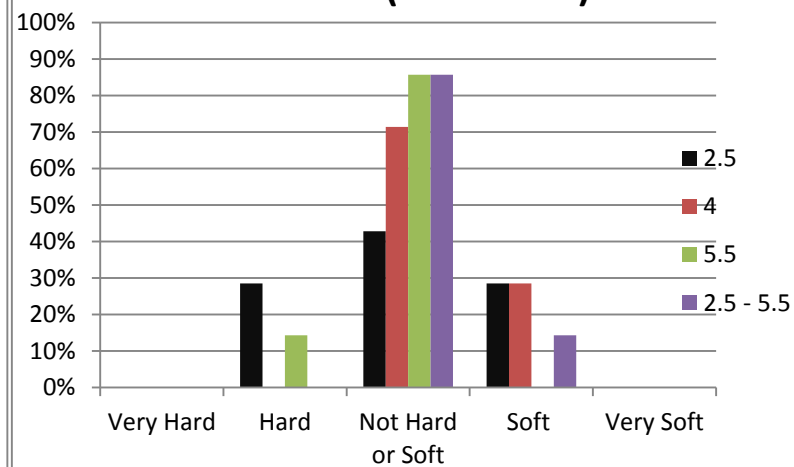
Aroma

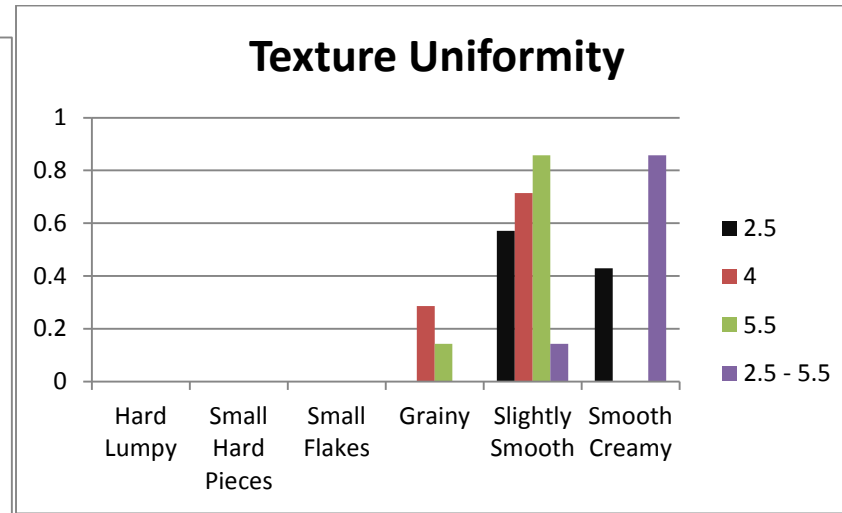
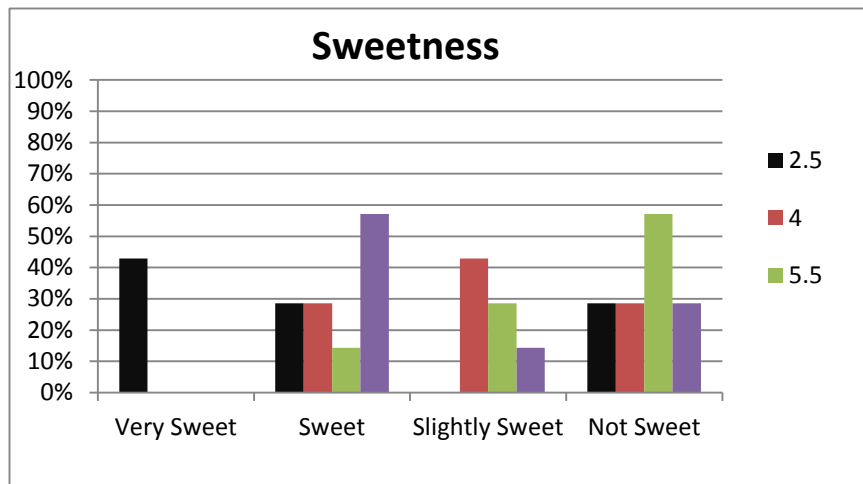


Flavour

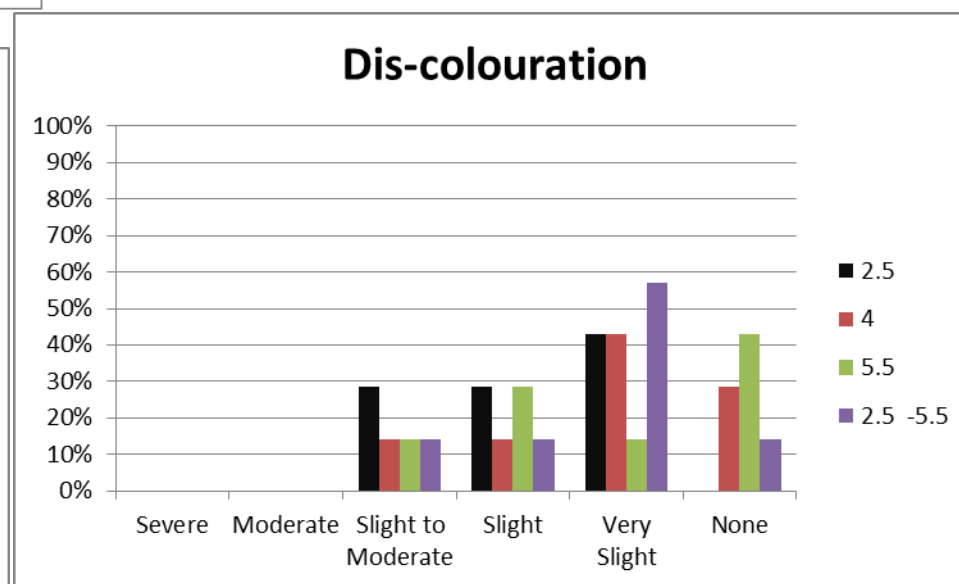
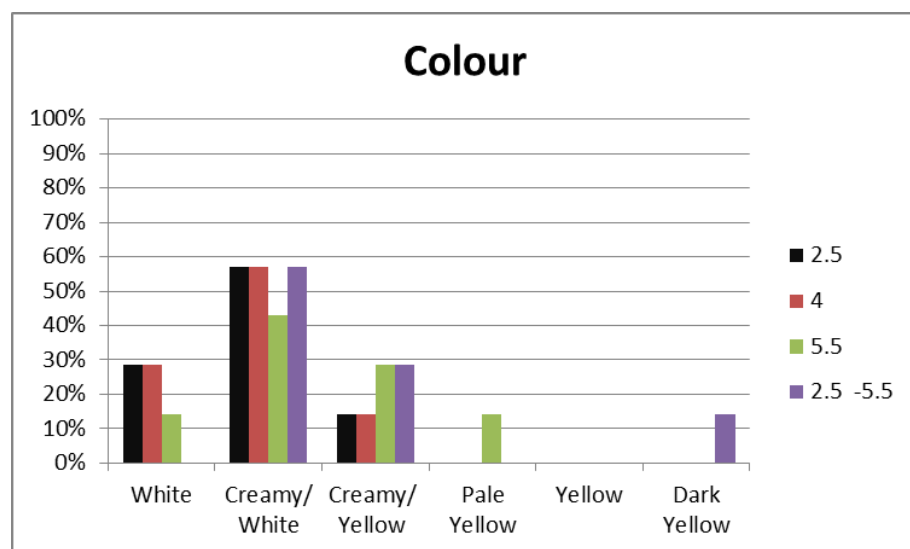
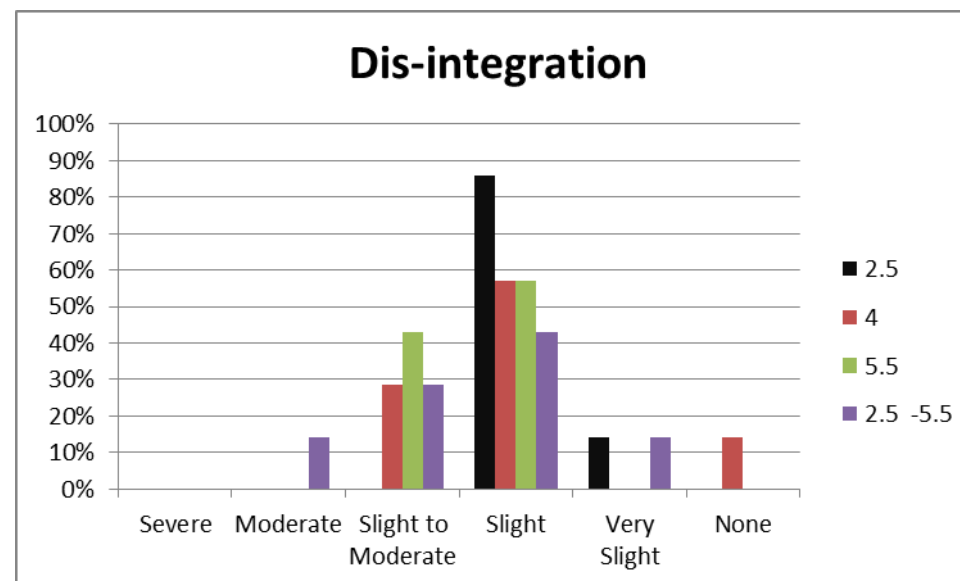
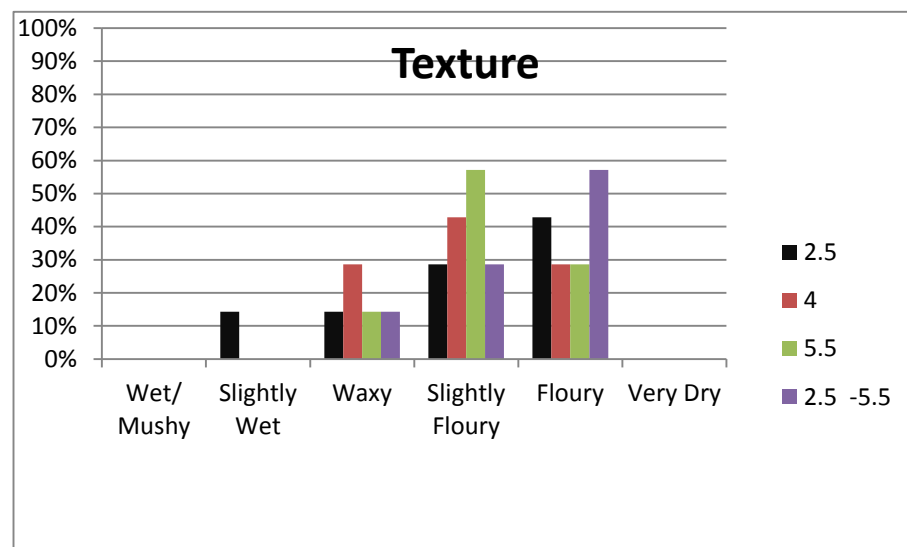


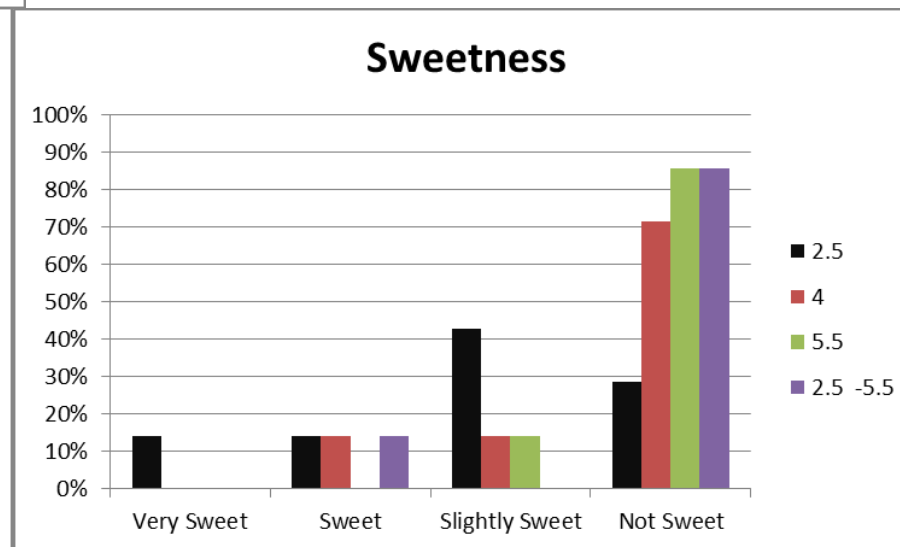
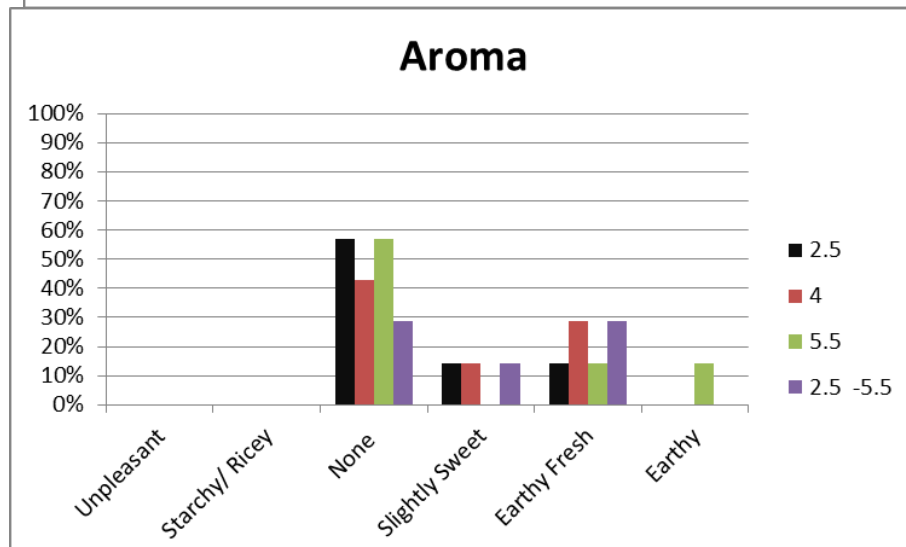
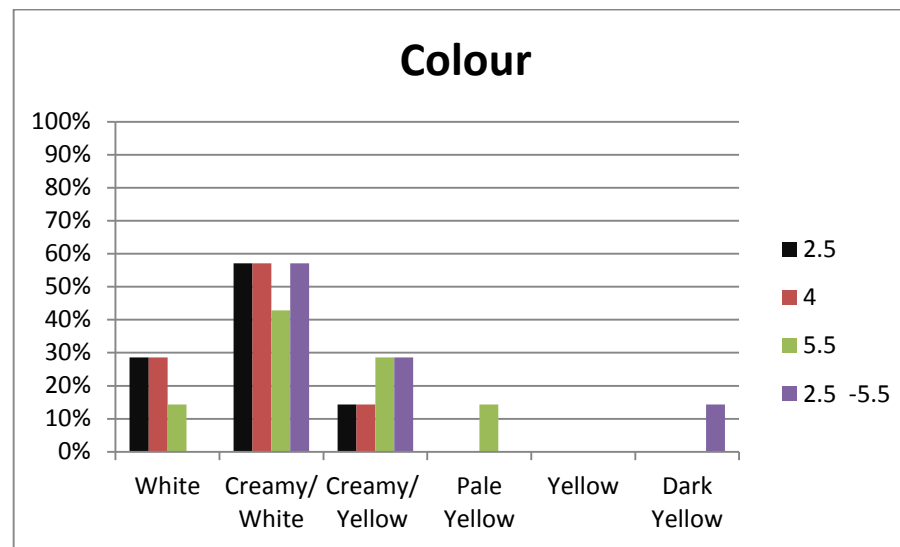
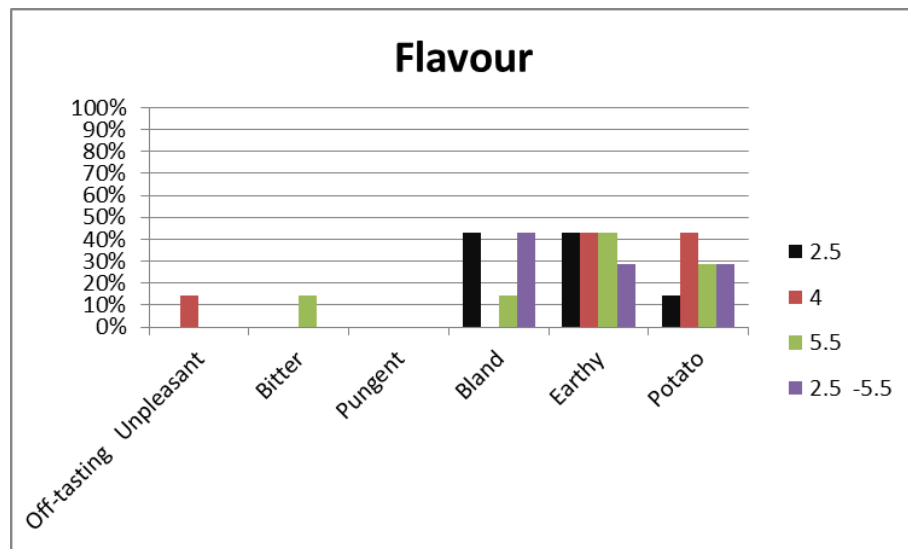
Hardness (initial bite)



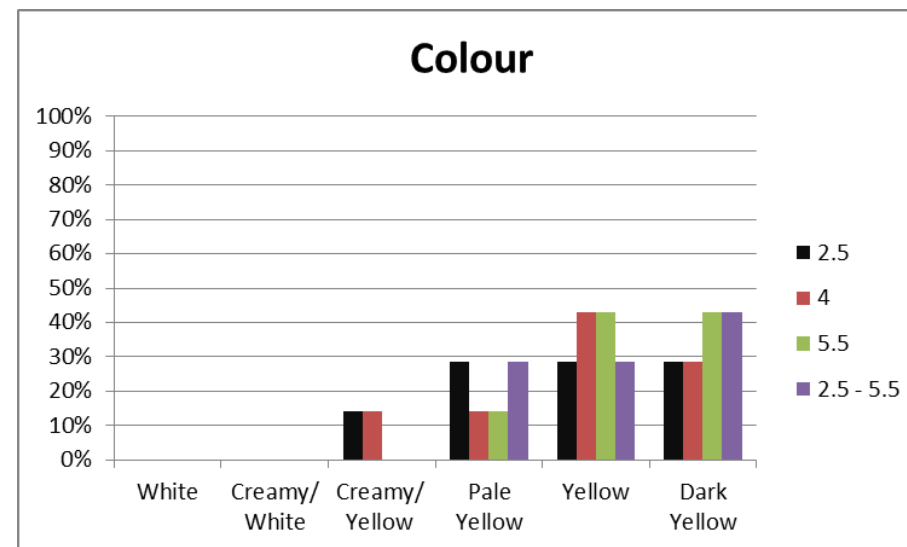
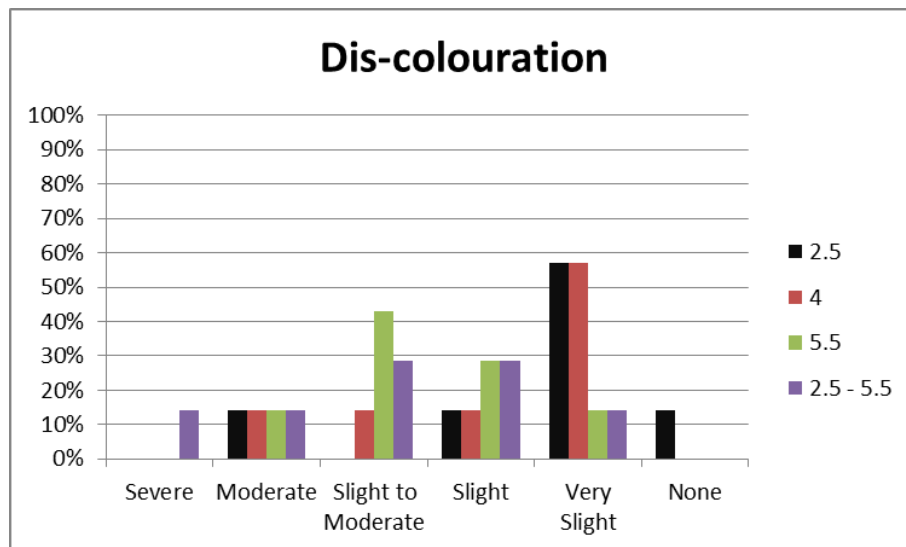


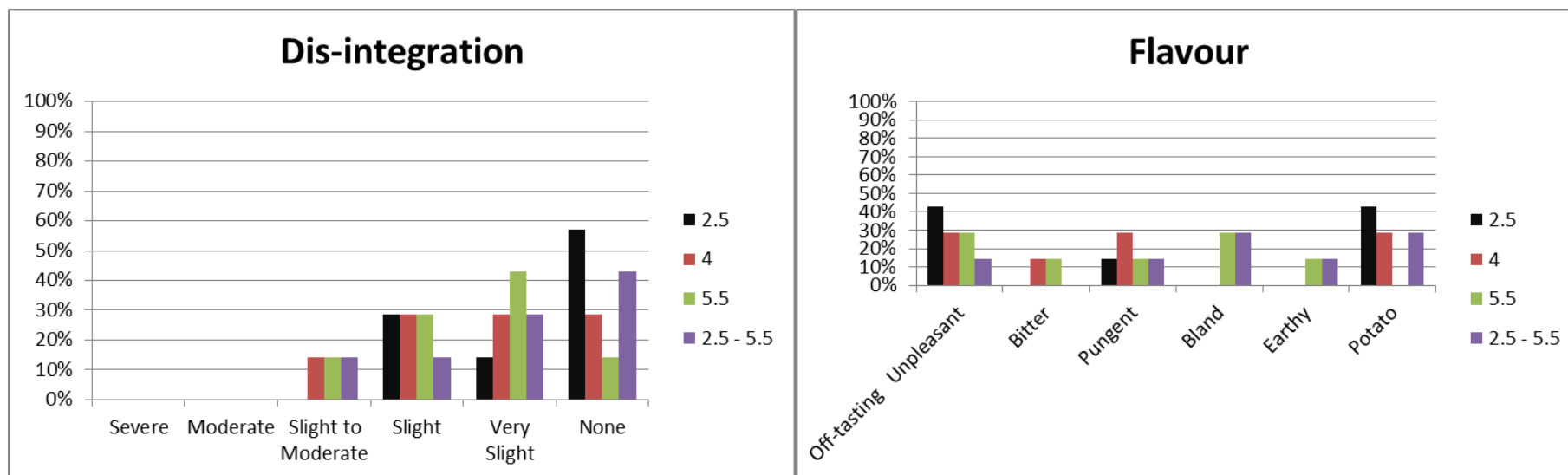
Annex A2.b.1 Taste and texture attributes King Edward 2012/13



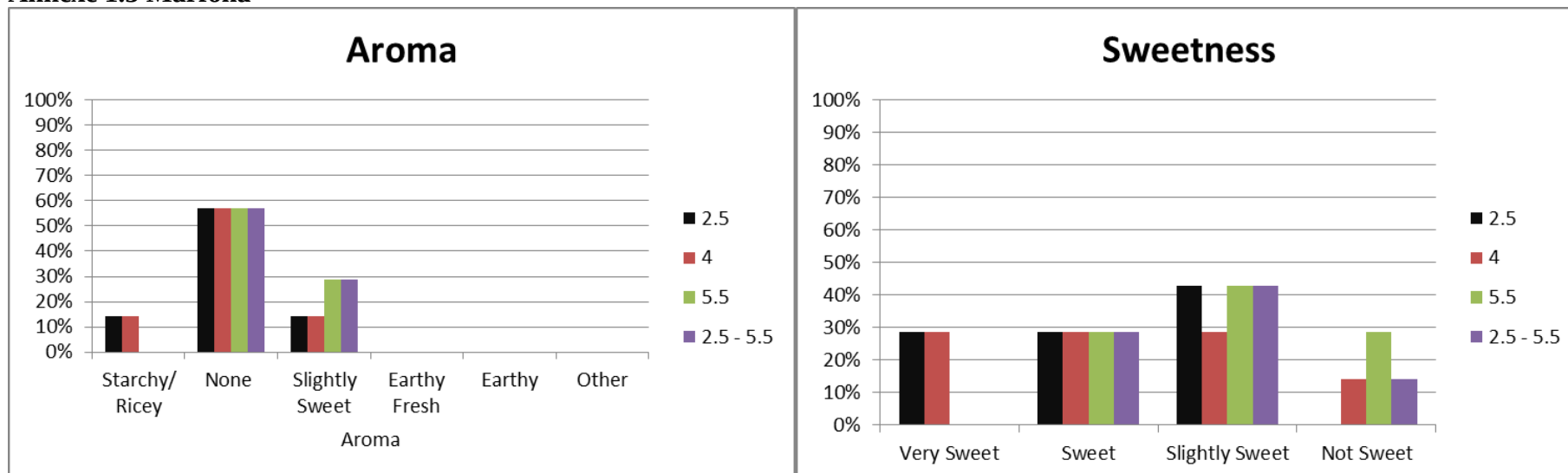


Annex A2.b.1 Taste and texture attributes Marfona 2012/13



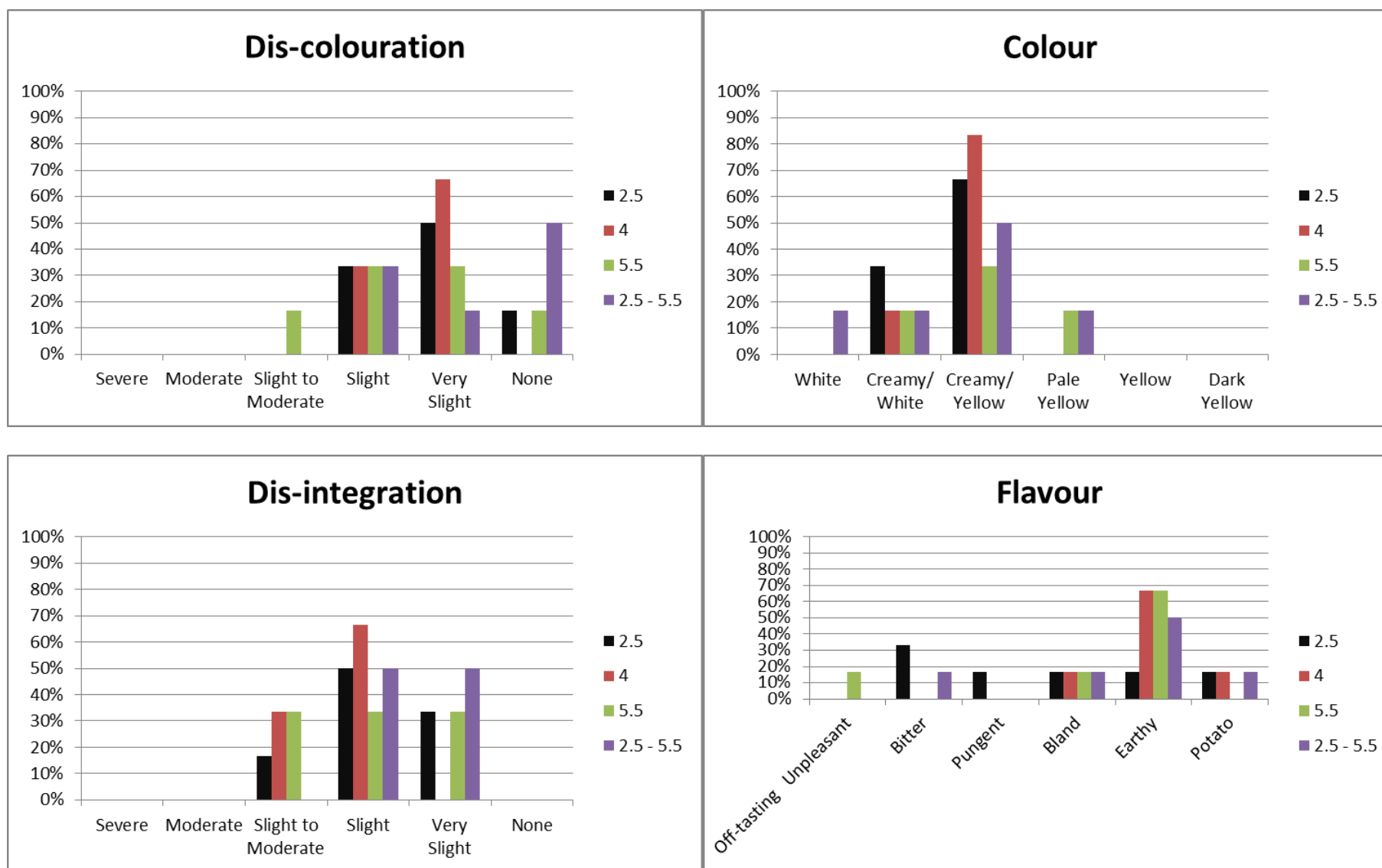


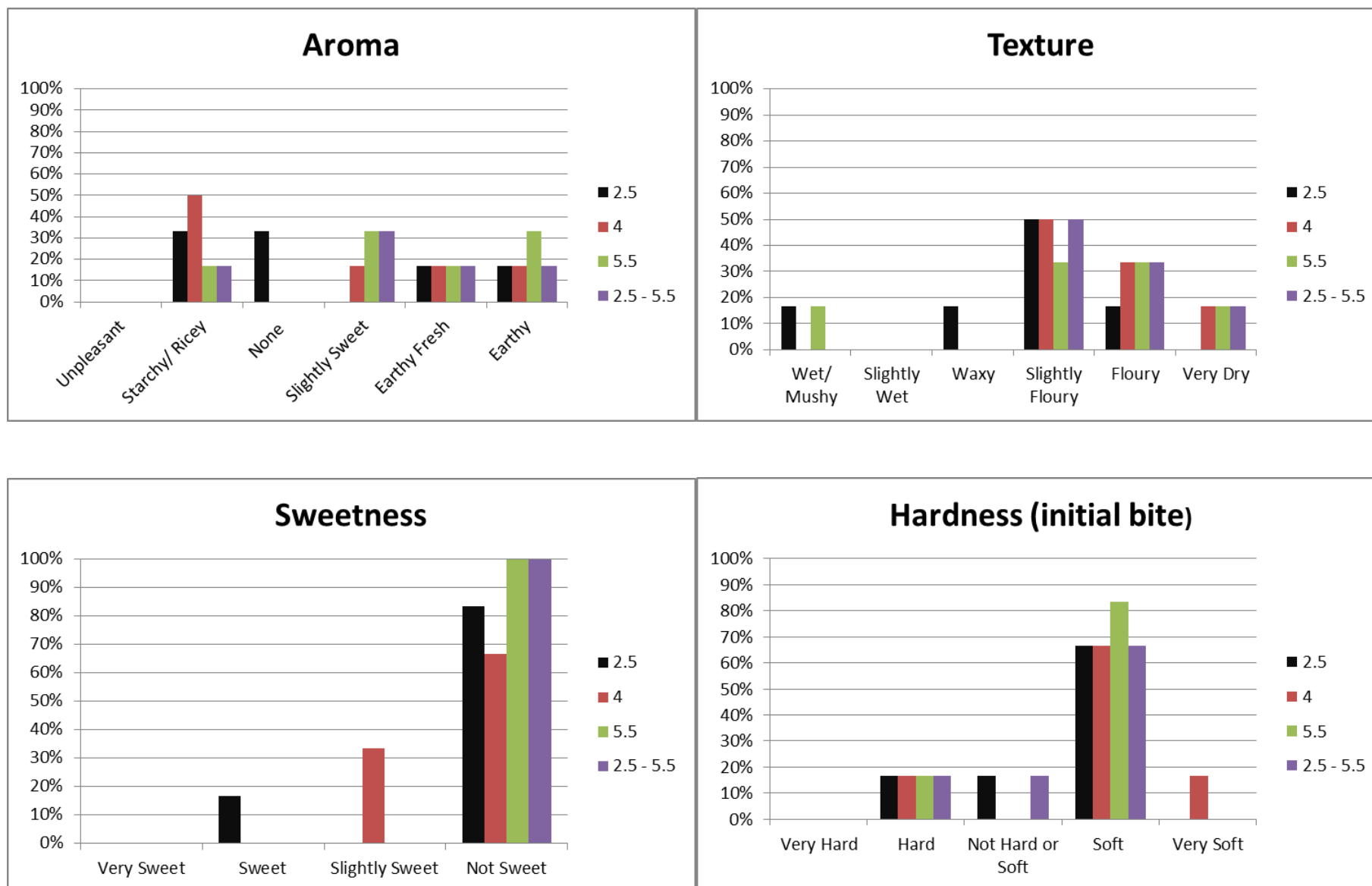
Annexe 1.3 Marfona





Annex A2.b.1 Taste and texture attributes Maris Piper 2012/13





Annex A2.b.2. Taste and texture, Taste Panel Procedure 2012/13

The following guidelines should be followed when rating attributes of a potato sample:

The emphasis is on the specific attributes identified in the evaluation form rather than personal preferences.

Space is provided for additional comments on taste and texture attributes that are not specifically mentioned but warrant further comment.

Please do not talk with other panellists during evaluations.

Please refrain from smoking, eating, or drinking for 45 minutes prior to tasting.

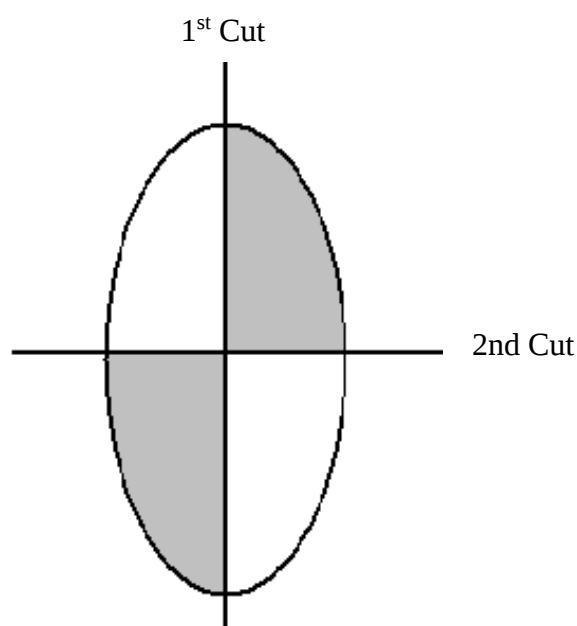
Water is provided to clear the palate between samples, if necessary.

If you have a question regarding the Taste Panel, ask the person conducting the panel.

Annex A2.b.3. Taste and texture, Procedure for the preparation of cooked potatoes Study 2012/13

Procedure for the preparation of cooked potatoes

1. Avoiding damaged, rotting and greens, select 12 tubers from each replicate tray, pool into one new tray.
2. Peel tubers in the rumbler until >95% of peel is removed
3. Cut in half longitudinally, then cut each half transversely, then cut vertically (total 3 cuts)
4. From each tuber select two diagonally opposite eighths for cooking (see diagram below)
5. Peel any remaining skin from surface of quarters with a hand peeler and rinse in fresh water (from SBCSR kitchen only).
6. For each sample cook 20 quarters per sample in steamer (check with skewer until cooked)



Annex A2.b.3. Taste and texture, Procedure for the preparation of cooked potatoes Study 2012/13

Taste and texture 2013-14

Annex A2.c.1 Taste and texture attributes Descriptive statistics, Desiree 2012/13

Scores Attribute Colour

Line	2.5	4	5.5
Line 1	7.90	7.10	7.20
Line 2	8.60	8.10	9.00
Line 3	9.30	10.00	8.70
Line 4	9.20	10.00	10.00
Line 5	9.10	7.70	8.50
Line 6	7.90	8.40	8.90

Statistics Attribute Colour

	2.5	4	5.5
Scores	6	6	6
Min	7.90	7.10	7.20
Max	9.30	10.00	10.00
Range	1.40	2.90	2.80
Mean	8.67	8.55	8.72
Std. Dev.(n)	0.58	1.10	0.83
Std. Dev.(n-1)	0.64	1.20	0.91
Var. Coeff. (%)	7.39	14.09	10.40
Conf. Int. 5% ±	0.67	1.26	0.95
Conf. Int. 1% ±	1.05	1.98	1.49

Scores Attribute Shape Retention

Line	2.5	4	5.5
Line 1	8.90	8.50	8.30
Line 2	7.70	8.70	6.50
Line 3	9.80	9.90	9.50
Line 4	10.00	10.00	10.00
Line 5	10.00	9.90	7.20
Line 6	8.00	9.70	9.10

Statistics Attribute Shape Retention

	2.5	4	5.5
Scores	6	6	6
Min	7.70	8.50	6.50
Max	10.00	10.00	10.00
Range	2.30	1.50	3.50
Mean	9.07	9.45	8.43
Std. Dev.(n)	0.94	0.61	1.25
Std. Dev.(n-1)	1.03	0.67	1.36
Var. Coeff. (%)	11.37	7.07	16.18
Conf. Int. 5% ±	1.08	0.70	1.43
Conf. Int. 1% ±	1.70	1.10	2.25

Scores Attribute Sweetness

Line	2.5	4	5.5
Line 1	8.00	2.60	0.90
Line 2	9.80	3.60	8.40
Line 3	1.60	2.80	0.10
Line 4	1.50	7.90	1.20
Line 5	7.80	6.20	6.40
Line 6	7.60	2.30	1.40

Statistics Attribute Sweetness

	2.5	4	5.5
Scores	6	6	6
Min	1.50	2.30	0.10
Max	9.80	7.90	8.40
Range	8.30	5.60	8.30
Mean	6.05	4.23	3.07
Std. Dev.(n)	3.26	2.09	3.14
Std. Dev.(n-1)	3.57	2.29	3.44
Var. Coeff. (%)	59.06	54.05	112.31
Conf. Int. 5% $\pm$	3.75	2.40	3.62
Conf. Int. 1% $\pm$	5.88	3.77	5.67

Scores Attribute Bitterness

Line	2.5	4	5.5
Line 1	1.80	2.60	2.40
Line 2	1.40	3.40	3.00
Line 3	8.80	4.90	9.90
Line 4	8.00	0.80	8.50
Line 5	4.10	3.00	3.90
Line 6	0.50	0.70	0.50

Statistics Attribute Bitterness

	2.5	4	5.5
Scores	6	6	6
Min	0.50	0.70	0.50
Max	8.80	4.90	9.90
Range	8.30	4.20	9.40
Mean	4.10	2.57	4.70
Std. Dev.(n)	3.24	1.47	3.37
Std. Dev.(n-1)	3.55	1.61	3.69
Var. Coeff. (%)	86.47	62.66	78.43
Conf. Int. 5% $\pm$	3.72	1.69	3.87
Conf. Int. 1% $\pm$	5.84	2.65	6.07

Scores Attribute Earthy Flavour

Line	2.5	4	5.5
Line 1	2.50	7.40	8.10
Line 2	0.30	7.80	8.00
Line 3	9.60	3.10	9.90
Line 4	2.20	2.20	5.00
Line 5	6.90	3.00	7.20
Line 6	1.60	2.40	2.20

Statistics Attribute Earthy Flavour

	2.5	4	5.5
Scores	6	6	6
Min	0.30	2.20	2.20
Max	9.60	7.80	9.90
Range	9.30	5.60	7.70
Mean	3.85	4.32	6.73
Std. Dev.(n)	3.28	2.35	2.49
Std. Dev.(n-1)	3.59	2.57	2.73
Var. Coeff. (%)	93.34	59.52	40.55
Conf. Int. 5% $\pm$	3.77	2.70	2.87
Conf. Int. 1% $\pm$	5.92	4.23	4.49

Scores Attribute Wetness

Line	2.5	4	5.5
Line 1	6.00	2.60	2.50
Line 2	2.30	3.80	3.40
Line 3	0.60	5.40	0.20
Line 4	3.10	6.20	3.20
Line 5	4.20	3.20	2.80
Line 6	5.90	6.90	3.50

Statistics Attribute Wetness

	2.5	4	5.5
Scores	6	6	6
Min	0.60	2.60	0.20
Max	6.00	6.90	3.50
Range	5.40	4.30	3.30
Mean	3.68	4.68	2.60
Std. Dev.(n)	1.93	1.58	1.13
Std. Dev.(n-1)	2.11	1.73	1.23
Var. Coeff. (%)	57.35	37.04	47.48
Conf. Int. 5% $\pm$	2.22	1.82	1.30
Conf. Int. 1% $\pm$	3.48	2.86	2.03

Scores Attribute Floury Texture

Line	2.5	4	5.5
Line 1	5.40	8.00	8.10
Line 2	7.20	7.10	7.30
Line 3	9.30	9.90	1.10
Line 4	7.60	2.90	3.20
Line 5	6.60	7.40	7.50
Line 6	3.30	3.00	7.40

Statistics Attribute Floury Texture

	2.5	4	5.5
Scores	6	6	6
Min	3.30	2.90	1.10
Max	9.30	9.90	8.10
Range	6.00	7.00	7.00
Mean	6.57	6.38	5.77
Std. Dev.(n)	1.87	2.59	2.64
Std. Dev.(n-1)	2.05	2.83	2.89
Var. Coeff. (%)	31.19	44.37	50.16
Conf. Int. 5% $\pm$	2.15	2.97	3.04
Conf. Int. 1% $\pm$	3.37	4.66	4.76

Scores Attribute Smoothness

Line	2.5	4	5.5
Line 1	3.80	6.80	4.20
Line 2	8.30	9.10	3.90
Line 3	3.30	9.70	3.40
Line 4	2.20	7.20	7.70
Line 5	2.70	3.10	3.70
Line 6	6.90	4.40	2.30

Statistics Attribute Smoothness

	2.5	4	5.5
Scores	6	6	6
Min	2.20	3.10	2.30
Max	8.30	9.70	7.70
Range	6.10	6.60	5.40
Mean	4.53	6.72	4.20
Std. Dev.(n)	2.26	2.35	1.68
Std. Dev.(n-1)	2.48	2.58	1.84
Var. Coeff. (%)	54.62	38.40	43.70
Conf. Int. 5% $\pm$	2.60	2.71	1.93
Conf. Int. 1% $\pm$	4.08	4.25	3.02

Comparison table of means

Attribute	2.5	4	5.5
Colour	8.67	8.55	8.72
Shape Retention	9.07	9.45	8.43
Sweetness	6.05	4.23	3.07
Bitterness	4.10	2.57	4.70
Earthy Flavour	3.85	4.32	6.73
Wetness	3.68	4.68	2.60
Floury Texture	6.57	6.38	5.77
Smoothness	4.53	6.72	4.20

Annex A2.c.2 Taste and texture attributes ANOVA, Desiree 2012/13

Analysis: Attribute Colour

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	8.67	0.64
2	4	6	8.55	1.20
3	5.5	6	8.72	0.91

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	7.40	0.44
2	2	3	8.57	0.45
3	3	3	9.33	0.65
4	4	3	9.73	0.46
5	5	3	8.43	0.70
6	6	3	8.40	0.50

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	0.09	0.04	0.13	0.8822
Judge	5	9.96	1.99	5.76	0.0093 **
Residuals	10	3.46	0.35		
Total	17	13.50			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Shape Retention

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	9.07	1.03
2	4	6	9.45	0.67
3	5.5	6	8.43	1.36

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	8.57	0.31
2	2	3	7.63	1.10
3	3	3	9.73	0.21
4	4	3	10.00	0.00
5	5	3	9.03	1.59
6	6	3	8.93	0.86

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	3.16	1.58	2.61	0.1228
Judge	5	10.79	2.16	3.56	0.0416 *
Residuals	10	6.07	0.61		
Total	17	20.02			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Sweetness

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	6.05	3.57
2	4	6	4.23	2.29
3	5.5	6	3.07	3.44

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	3.83	3.71
2	2	3	7.27	3.25
3	3	3	1.50	1.35
4	4	3	3.53	3.78
5	5	3	6.80	0.87
6	6	3	3.77	3.35

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	27.12	13.56	1.74	0.2241
Judge	5	71.54	14.31	1.84	0.1927
Residuals	10	77.78	7.78		
Total	17	176.45			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Bitterness

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	4.10	3.55
2	4	6	2.57	1.61
3	5.5	6	4.70	3.69

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	2.27	0.42
2	2	3	2.60	1.06
3	3	3	7.87	2.63
4	4	3	5.77	4.31
5	5	3	3.67	0.59
6	6	3	0.57	0.12

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	14.52	7.26	1.83	0.2104
Judge	5	104.00	20.80	5.24	0.0128 *
Residuals	10	39.71	3.97		
Total	17	158.24			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Earthy Flavour

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	3.85	3.59
2	4	6	4.32	2.57
3	5.5	6	6.73	2.73

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	6.00	3.05
2	2	3	5.37	4.39
3	3	3	7.53	3.84
4	4	3	3.13	1.62
5	5	3	5.70	2.34
6	6	3	2.07	0.42

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	28.74	14.37	1.93	0.1956
Judge	5	60.37	12.07	1.62	0.2409
Residuals	10	74.48	7.45		
Total	17	163.60			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Wetness

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	3.68	2.11
2	4	6	4.68	1.73
3	5.5	6	2.60	1.23

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	3.70	1.99
2	2	3	3.17	0.78
3	3	3	2.07	2.89
4	4	3	4.17	1.76
5	5	3	3.40	0.72
6	6	3	5.43	1.75

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	13.03	6.51	2.48	0.1331
Judge	5	18.76	3.75	1.43	0.2939
Residuals	10	26.22	2.62		
Total	17	58.00			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Floury Texture

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	6.57	2.05
2	4	6	6.38	2.83
3	5.5	6	5.77	2.89

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	7.17	1.53
2	2	3	7.20	0.10
3	3	3	6.77	4.92
4	4	3	4.57	2.63
5	5	3	7.17	0.49
6	6	3	4.57	2.46

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	2.11	1.05	0.14	0.8742
Judge	5	25.55	5.11	0.66	0.6616
Residuals	10	77.37	7.74		
Total	17	105.02			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Smoothness

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	4.53	2.48
2	4	6	6.72	2.58
3	5.5	6	4.20	1.84

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	4.93	1.63
2	2	3	7.10	2.80
3	3	3	5.47	3.67
4	4	3	5.70	3.04
5	5	3	3.17	0.50
6	6	3	4.53	2.30

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	22.42	11.21	2.04	0.1812
Judge	5	25.70	5.14	0.93	0.4992
Residuals	10	55.06	5.51		
Total	17	103.19			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Annex A2.c.1 Taste and texture attributes Descriptive statistics, King Edward 2012/13

Scores Attribute Colour

Line	2.5	4	5.5
Line 1	7.10	6.10	7.40
Line 2	6.50	6.60	5.10
Line 3	6.00	2.80	4.30
Line 4	2.40	8.30	5.90
Line 5	2.30	3.10	7.10
Line 6	6.80	6.70	7.80

Statistics Attribute Colour

	2.5	4	5.5
Scores	6	6	6
Min	2.30	2.80	4.30
Max	7.10	8.30	7.80
Range	4.80	5.50	3.50
Mean	5.18	5.60	6.27
Std. Dev.(n)	2.03	1.99	1.27
Std. Dev.(n-1)	2.22	2.18	1.39
Var. Coeff. (%)	42.92	38.99	22.22
Conf. Int. 5% $\pm$	2.34	2.29	1.46
Conf. Int. 1% $\pm$	3.66	3.59	2.29

Scores Attribute Shape Retention

Line	2.5	4	5.5
Line 1	9.60	8.80	9.30
Line 2	8.80	7.80	3.40
Line 3	10.00	1.60	2.00
Line 4	10.00	10.00	8.20
Line 5	9.60	9.00	8.40
Line 6	8.20	6.70	3.20

Statistics Attribute Shape Retention

	2.5	4	5.5
Scores	6	6	6
Min	8.20	1.60	2.00
Max	10.00	10.00	9.30
Range	1.80	8.40	7.30
Mean	9.37	7.32	5.75
Std. Dev.(n)	0.66	2.75	2.94
Std. Dev.(n-1)	0.72	3.02	3.22
Var. Coeff. (%)	7.69	41.24	55.93
Conf. Int. 5% $\pm$	0.76	3.17	3.38
Conf. Int. 1% $\pm$	1.19	4.97	5.29

Scores Attribute Sweetness

Line	2.5	4	5.5
Line 1	8.10	1.60	0.50
Line 2	5.40	3.20	0.90
Line 3	2.70	5.80	3.00
Line 4	8.30	8.40	6.90
Line 5	8.20	7.60	2.70
Line 6	3.90	0.90	0.70

Statistics Attribute Sweetness

	2.5	4	5.5
Scores	6	6	6
Min	2.70	0.90	0.50
Max	8.30	8.40	6.90
Range	5.60	7.50	6.40
Mean	6.10	4.58	2.45
Std. Dev.(n)	2.24	2.87	2.21
Std. Dev.(n-1)	2.46	3.15	2.43
Var. Coeff. (%)	40.25	68.67	99.03
Conf. Int. 5% $\pm$	2.58	3.30	2.55
Conf. Int. 1% $\pm$	4.04	5.18	3.99

Scores Attribute Bitterness

Line	2.5	4	5.5
Line 1	0.20	0.60	0.70
Line 2	0.60	1.20	7.90
Line 3	9.00	0.00	4.20
Line 4	0.80	0.00	2.40
Line 5	0.00	0.00	4.50
Line 6	0.20	0.90	0.90

Statistics Attribute Bitterness

	2.5	4	5.5
Scores	6	6	6
Min	0.00	0.00	0.70
Max	9.00	1.20	7.90
Range	9.00	1.20	7.20
Mean	1.80	0.45	3.43
Std. Dev.(n)	3.23	0.48	2.47
Std. Dev.(n-1)	3.54	0.53	2.71
Var. Coeff. (%)	196.64	117.38	78.84
Conf. Int. 5% $\pm$	3.72	0.55	2.84
Conf. Int. 1% $\pm$	5.83	0.87	4.46

Scores Attribute Earthy Flavour

Line	2.5	4	5.5
Line 1	1.50	6.40	4.50
Line 2	8.10	7.00	1.50
Line 3	4.00	1.30	1.50
Line 4	1.90	1.40	3.60
Line 5	2.00	6.80	6.10
Line 6	3.20	2.20	0.30

Statistics Attribute Earthy Flavour

	2.5	4	5.5
Scores	6	6	6
Min	1.50	1.30	0.30
Max	8.10	7.00	6.10
Range	6.60	5.70	5.80
Mean	3.45	4.18	2.92
Std. Dev.(n)	2.25	2.57	2.00
Std. Dev.(n-1)	2.46	2.82	2.19
Var. Coeff. (%)	71.35	67.35	75.07
Conf. Int. 5% $\pm$	2.58	2.96	2.30
Conf. Int. 1% $\pm$	4.05	4.64	3.60

Scores Attribute Wetness

Line	2.5	4	5.5
Line 1	2.60	2.50	1.10
Line 2	3.90	3.00	2.30
Line 3	3.70	3.30	0.60
Line 4	2.70	2.50	3.00
Line 5	8.20	1.20	1.90
Line 6	2.20	0.80	0.70

Statistics Attribute Wetness

	2.5	4	5.5
Scores	6	6	6
Min	2.20	0.80	0.60
Max	8.20	3.30	3.00
Range	6.00	2.50	2.40
Mean	3.88	2.22	1.60
Std. Dev.(n)	2.02	0.91	0.88
Std. Dev.(n-1)	2.22	1.00	0.96
Var. Coeff. (%)	57.06	45.06	59.95
Conf. Int. 5% $\pm$	2.33	1.05	1.01
Conf. Int. 1% $\pm$	3.65	1.64	1.58

Scores Attribute Floury Texture

Line	2.5	4	5.5
Line 1	3.90	5.80	8.40
Line 2	7.20	7.10	9.00
Line 3	8.10	1.10	0.60
Line 4	2.20	2.20	6.80
Line 5	2.20	4.30	6.50
Line 6	6.40	8.90	8.60

Statistics Attribute Floury Texture

	2.5	4	5.5
Scores	6	6	6
Min	2.20	1.10	0.60
Max	8.10	8.90	9.00
Range	5.90	7.80	8.40
Mean	5.00	4.90	6.65
Std. Dev.(n)	2.36	2.70	2.86
Std. Dev.(n-1)	2.58	2.96	3.13
Var. Coeff. (%)	51.61	60.36	47.09
Conf. Int. 5% $\pm$	2.71	3.10	3.29
Conf. Int. 1% $\pm$	4.25	4.87	5.15

Scores Attribute Smoothness

Line	2.5	4	5.5
Line 1	3.00	1.60	0.70
Line 2	7.80	5.50	1.40
Line 3	7.10	1.50	1.70
Line 4	8.90	8.40	7.10
Line 5	8.80	7.80	3.70
Line 6	3.30	1.60	2.20

Statistics Attribute Smoothness

	2.5	4	5.5
Scores	6	6	6
Min	3.00	1.50	0.70
Max	8.90	8.40	7.10
Range	5.90	6.90	6.40
Mean	6.48	4.40	2.80
Std. Dev.(n)	2.44	2.97	2.13
Std. Dev.(n-1)	2.67	3.25	2.33
Var. Coeff. (%)	41.15	73.90	83.36
Conf. Int. 5% $\pm$	2.80	3.41	2.45
Conf. Int. 1% $\pm$	4.39	5.35	3.84

Comparison table of means

Attribute	2.5	4	5.5
Colour	5.18	5.60	6.27
Shape Retention	9.37	7.32	5.75
Sweetness	6.10	4.58	2.45
Bitterness	1.80	0.45	3.43
Earthy Flavour	3.45	4.18	2.92
Wetness	3.88	2.22	1.60
Floury Texture	5.00	4.90	6.65
Smoothness	6.48	4.40	2.80

Annex A2.c.2 Taste and texture attributes ANOVA, King Edward 2012/13

Analysis: Attribute Colour

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	5.18	2.22
2	4	6	5.60	2.18
3	5.5	6	6.27	1.39

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	6.87	0.68
2	2	3	6.07	0.84
3	3	3	4.37	1.60
4	4	3	5.53	2.97
5	5	3	4.17	2.57
6	6	3	7.10	0.61

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	3.58	1.79	0.51	0.6179
Judge	5	22.83	4.57	1.29	0.3419
Residuals	10	35.45	3.54		
Total	17	61.87			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Shape Retention

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	9.37	0.72
2	4	6	7.32	3.02
3	5.5	6	5.75	3.22

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	9.23	0.40
2	2	3	6.67	2.87
3	3	3	4.53	4.74
4	4	3	9.40	1.04
5	5	3	9.00	0.60
6	6	3	6.03	2.57

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	39.47	19.74	5.15	0.0290 *
Judge	5	61.52	12.30	3.21	0.0549
Residuals	10	38.31	3.83		
Total	17	139.31			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Sweetness

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	6.10	2.46
2	4	6	4.58	3.15
3	5.5	6	2.45	2.43

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	3.40	4.11
2	2	3	3.17	2.25
3	3	3	3.83	1.71
4	4	3	7.87	0.84
5	5	3	6.17	3.02
6	6	3	1.83	1.79

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	40.35	20.17	5.70	0.0223 *
Judge	5	73.70	14.74	4.16	0.0263 *
Residuals	10	35.41	3.54		
Total	17	149.45			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Bitterness

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	1.80	3.54
2	4	6	0.45	0.53
3	5.5	6	3.43	2.71

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	0.50	0.26
2	2	3	3.23	4.05
3	3	3	4.40	4.50
4	4	3	1.07	1.22
5	5	3	1.50	2.60
6	6	3	0.67	0.40

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	26.78	13.39	2.11	0.1725
Judge	5	37.09	7.42	1.17	0.3892
Residuals	10	63.58	6.36		
Total	17	127.45			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Earthy Flavour

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	3.45	2.46
2	4	6	4.18	2.82
3	5.5	6	2.92	2.19

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	4.13	2.47
2	2	3	5.53	3.54
3	3	3	2.27	1.50
4	4	3	2.30	1.15
5	5	3	4.97	2.59
6	6	3	1.90	1.47

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	4.85	2.43	0.42	0.6661
Judge	5	36.62	7.32	1.28	0.3458
Residuals	10	57.33	5.73		
Total	17	98.80			

- * significant at 5 %
- ** significant at 1 %
- *** significant at 0,1 %

Analysis: Attribute Wetness

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	3.88	2.22
2	4	6	2.22	1.00
3	5.5	6	1.60	0.96

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	2.07	0.84
2	2	3	3.07	0.80
3	3	3	2.53	1.69
4	4	3	2.73	0.25
5	5	3	3.77	3.86
6	6	3	1.23	0.84

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	16.74	8.37	3.66	0.0643
Judge	5	11.24	2.25	0.98	0.4742
Residuals	10	22.90	2.29		
Total	17	50.88			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Floury Texture

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	5.00	2.58
2	4	6	4.90	2.96
3	5.5	6	6.65	3.13

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	6.03	2.26
2	2	3	7.77	1.07
3	3	3	3.27	4.19
4	4	3	3.73	2.66
5	5	3	4.33	2.15
6	6	3	7.97	1.37

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	11.59	5.80	0.92	0.4306
Judge	5	62.93	12.59	1.99	0.1654
Residuals	10	63.15	6.31		
Total	17	137.67			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Smoothness

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	6.48	2.67
2	4	6	4.40	3.25
3	5.5	6	2.80	2.33

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	1.77	1.16
2	2	3	4.90	3.24
3	3	3	3.43	3.18
4	4	3	8.13	0.93
5	5	3	6.77	2.70
6	6	3	2.37	0.86

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	40.93	20.47	9.85	0.0043 **
Judge	5	94.91	18.98	9.14	0.0017 **
Residuals	10	20.78	2.08		
Total	17	156.62			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Annex A2.c.1 Taste and texture attributes Descriptive statistics, Marfona 2012/13

Scores Attribute Colour

Line	2.5	4	5.5
Line 1	8.40	8.10	7.00
Line 2	6.80	8.50	7.20
Line 3	5.80	3.80	2.50
Line 4	8.30	8.50	8.30
Line 5	6.30	6.60	5.40
Line 6	7.20	6.30	7.80

Statistics Attribute Colour

	2.5	4	5.5
Scores	6	6	6
Min	5.80	3.80	2.50
Max	8.40	8.50	8.30
Range	2.60	4.70	5.80
Mean	7.13	6.97	6.37
Std. Dev.(n)	0.96	1.66	1.95
Std. Dev.(n-1)	1.05	1.82	2.13
Var. Coeff. (%)	14.77	26.15	33.52
Conf. Int. 5% ±	1.11	1.91	2.24
Conf. Int. 1% ±	1.73	3.00	3.51

Scores Attribute Shape Retention

Line	2.5	4	5.5
Line 1	8.50	9.20	9.70
Line 2	7.10	9.00	6.80
Line 3	9.90	9.90	0.20
Line 4	9.40	10.00	10.00
Line 5	9.50	9.70	9.50
Line 6	8.20	9.90	9.90

Statistics Attribute Shape Retention

	2.5	4	5.5
Scores	6	6	6
Min	7.10	9.00	0.20
Max	9.90	10.00	10.00
Range	2.80	1.00	9.80
Mean	8.77	9.62	7.68
Std. Dev.(n)	0.95	0.38	3.52
Std. Dev.(n-1)	1.04	0.42	3.86
Var. Coeff. (%)	11.85	4.33	50.22
Conf. Int. 5% ±	1.09	0.44	4.05
Conf. Int. 1% ±	1.71	0.69	6.35

Scores Attribute Sweetness

Line	2.5	4	5.5
Line 1	6.20	5.90	0.20
Line 2	2.10	6.80	2.20
Line 3	9.30	7.90	3.40
Line 4	7.60	0.70	2.40
Line 5	2.40	2.10	7.20
Line 6	4.20	1.30	1.10

Statistics Attribute Sweetness

	2.5	4	5.5
Scores	6	6	6
Min	2.10	0.70	0.20
Max	9.30	7.90	7.20
Range	7.20	7.20	7.00
Mean	5.30	4.12	2.75
Std. Dev.(n)	2.64	2.84	2.23
Std. Dev.(n-1)	2.90	3.11	2.44
Var. Coeff. (%)	54.66	75.55	88.89
Conf. Int. 5% $\pm$	3.04	3.26	2.57
Conf. Int. 1% $\pm$	4.77	5.12	4.02

Scores Attribute Bitterness

Line	2.5	4	5.5
Line 1	0.50	0.60	0.20
Line 2	1.80	1.50	2.50
Line 3	0.00	0.10	5.30
Line 4	2.80	5.70	2.50
Line 5	6.50	7.20	1.80
Line 6	0.80	0.30	0.20

Statistics Attribute Bitterness

	2.5	4	5.5
Scores	6	6	6
Min	0.00	0.10	0.20
Max	6.50	7.20	5.30
Range	6.50	7.10	5.10
Mean	2.07	2.57	2.08
Std. Dev.(n)	2.18	2.81	1.73
Std. Dev.(n-1)	2.39	3.08	1.89
Var. Coeff. (%)	115.71	120.10	90.74
Conf. Int. 5% $\pm$	2.51	3.24	1.98
Conf. Int. 1% $\pm$	3.94	5.07	3.11

Scores Attribute Earthy Flavour

Line	2.5	4	5.5
Line 1	1.70	0.70	8.60
Line 2	7.90	7.20	7.00
Line 3	9.40	0.00	0.40
Line 4	3.00	7.20	6.20
Line 5	5.90	7.70	3.30
Line 6	2.30	3.80	6.40

Statistics Attribute Earthy Flavour

	2.5	4	5.5
Scores	6	6	6
Min	1.70	0.00	0.40
Max	9.40	7.70	8.60
Range	7.70	7.70	8.20
Mean	5.03	4.43	5.32
Std. Dev.(n)	2.91	3.16	2.70
Std. Dev.(n-1)	3.19	3.46	2.96
Var. Coeff. (%)	63.30	78.12	55.67
Conf. Int. 5% $\pm$	3.34	3.64	3.11
Conf. Int. 1% $\pm$	5.24	5.70	4.87

Scores Attribute Wetness

Line	2.5	4	5.5
Line 1	7.10	6.20	5.00
Line 2	3.80	4.40	4.40
Line 3	4.90	0.10	0.40
Line 4	7.50	1.60	6.40
Line 5	3.00	1.40	6.80
Line 6	8.00	6.40	6.50

Statistics Attribute Wetness

	2.5	4	5.5
Scores	6	6	6
Min	3.00	0.10	0.40
Max	8.00	6.40	6.80
Range	5.00	6.30	6.40
Mean	5.72	3.35	4.92
Std. Dev.(n)	1.92	2.45	2.20
Std. Dev.(n-1)	2.10	2.68	2.41
Var. Coeff. (%)	36.72	80.05	48.92
Conf. Int. 5% $\pm$	2.20	2.81	2.52
Conf. Int. 1% $\pm$	3.46	4.41	3.96

Scores Attribute Floury Texture

Line	2.5	4	5.5
Line 1	4.90	4.90	5.10
Line 2	2.30	4.30	4.90
Line 3	6.50	2.50	1.00
Line 4	7.00	3.30	7.70
Line 5	2.40	0.70	8.10
Line 6	1.60	3.50	3.40

Statistics Attribute Floury Texture

	2.5	4	5.5
Scores	6	6	6
Min	1.60	0.70	1.00
Max	7.00	4.90	8.10
Range	5.40	4.20	7.10
Mean	4.12	3.20	5.03
Std. Dev.(n)	2.13	1.35	2.43
Std. Dev.(n-1)	2.33	1.48	2.66
Var. Coeff. (%)	56.64	46.22	52.92
Conf. Int. 5% $\pm$	2.45	1.55	2.80
Conf. Int. 1% $\pm$	3.84	2.43	4.38

Scores Attribute Smoothness

Line	2.5	4	5.5
Line 1	3.70	5.00	7.70
Line 2	8.00	8.10	7.50
Line 3	8.40	8.00	8.20
Line 4	7.30	2.60	1.70
Line 5	1.80	0.80	8.90
Line 6	8.50	4.30	2.50

Statistics Attribute Smoothness

	2.5	4	5.5
Scores	6	6	6
Min	1.80	0.80	1.70
Max	8.50	8.10	8.90
Range	6.70	7.30	7.20
Mean	6.28	4.80	6.08
Std. Dev.(n)	2.59	2.65	2.86
Std. Dev.(n-1)	2.83	2.91	3.13
Var. Coeff. (%)	45.10	60.57	51.51
Conf. Int. 5% $\pm$	2.97	3.05	3.29
Conf. Int. 1% $\pm$	4.66	4.79	5.16

Comparison table of means

Attribute	2.5	4	5.5
Colour	7.13	6.97	6.37
Shape Retention	8.77	9.62	7.68
Sweetness	5.30	4.12	2.75
Bitterness	2.07	2.57	2.08
Earthy Flavour	5.03	4.43	5.32
Wetness	5.72	3.35	4.92
Floury Texture	4.12	3.20	5.03
Smoothness	6.28	4.80	6.08

Annex A2.c.2 Taste and texture attributes ANOVA, Marfona 2012/13

Analysis: Attribute Colour

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	7.13	1.05
2	4	6	6.97	1.82
3	5.5	6	6.37	2.13

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	7.83	0.74
2	2	3	7.50	0.89
3	3	3	4.03	1.66
4	4	3	8.37	0.12
5	5	3	6.10	0.62
6	6	3	7.10	0.75

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	1.95	0.98	1.19	0.3435
Judge	5	36.73	7.35	8.97	0.0018 **
Residuals	10	8.19	0.82		
Total	17	46.87			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Shape Retention

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	8.77	1.04
2	4	6	9.62	0.42
3	5.5	6	7.68	3.86

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	9.13	0.60
2	2	3	7.63	1.19
3	3	3	6.67	5.60
4	4	3	9.80	0.35
5	5	3	9.57	0.12
6	6	3	9.33	0.98

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	11.27	5.63	0.98	0.4071
Judge	5	23.46	4.69	0.82	0.5624
Residuals	10	57.23	5.72		
Total	17	91.96			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Sweetness

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	5.30	2.90
2	4	6	4.12	3.11
3	5.5	6	2.75	2.44

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	4.10	3.38
2	2	3	3.70	2.69
3	3	3	6.87	3.08
4	4	3	3.57	3.59
5	5	3	3.90	2.86
6	6	3	2.20	1.73

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	19.54	9.77	1.15	0.3553
Judge	5	35.21	7.04	0.83	0.5574
Residuals	10	84.99	8.50		
Total	17	139.74			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Bitterness

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	2.07	2.39
2	4	6	2.57	3.08
3	5.5	6	2.08	1.89

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	0.43	0.21
2	2	3	1.93	0.51
3	3	3	1.80	3.03
4	4	3	3.67	1.77
5	5	3	5.17	2.94
6	6	3	0.43	0.32

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	0.97	0.48	0.12	0.8917
Judge	5	52.25	10.45	2.50	0.1016
Residuals	10	41.73	4.17		
Total	17	94.94			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Earthy Flavour

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	5.03	3.19
2	4	6	4.43	3.46
3	5.5	6	5.32	2.96

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	3.67	4.30
2	2	3	7.37	0.47
3	3	3	3.27	5.32
4	4	3	5.47	2.19
5	5	3	5.63	2.21
6	6	3	4.17	2.07

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	2.44	1.22	0.10	0.9039
Judge	5	35.00	7.00	0.59	0.7115
Residuals	10	119.54	11.95		
Total	17	156.98			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Wetness

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	5.72	2.10
2	4	6	3.35	2.68
3	5.5	6	4.92	2.41

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	6.10	1.05
2	2	3	4.20	0.35
3	3	3	1.80	2.69
4	4	3	5.17	3.14
5	5	3	3.73	2.77
6	6	3	6.97	0.90

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	17.39	8.70	2.40	0.1407
Judge	5	50.70	10.14	2.80	0.0779
Residuals	10	36.21	3.62		
Total	17	104.30			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Floury Texture

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	4.12	2.33
2	4	6	3.20	1.48
3	5.5	6	5.03	2.66

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	4.97	0.12
2	2	3	3.83	1.36
3	3	3	3.33	2.84
4	4	3	6.00	2.36
5	5	3	3.73	3.88
6	6	3	2.83	1.07

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	10.08	5.04	0.95	0.4207
Judge	5	20.27	4.05	0.76	0.5982
Residuals	10	53.33	5.33		
Total	17	83.69			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Smoothness

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	6.28	2.83
2	4	6	4.80	2.91
3	5.5	6	6.08	3.13

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	5.47	2.04
2	2	3	7.87	0.32
3	3	3	8.20	0.20
4	4	3	3.87	3.01
5	5	3	3.83	4.42
6	6	3	5.10	3.08

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	7.77	3.89	0.51	0.6178
Judge	5	54.60	10.92	1.42	0.2972
Residuals	10	76.89	7.69		
Total	17	139.27			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Annex A2.c.1 Taste and texture attributes Descriptive statistics, Maris Piper 2012/13

Scores Attribute Colour

Line	2.5	4	5.5
Line 1	3.90	5.00	3.80
Line 2	3.60	4.30	3.40
Line 3	0.90	2.50	4.20
Line 4	2.40	6.40	2.70
Line 5	2.20	7.10	7.70
Line 6	6.10	6.00	6.80

Statistics Attribute Colour

	2.5	4	5.5
Scores	6	6	6
Min	0.90	2.50	2.70
Max	6.10	7.10	7.70
Range	5.20	4.60	5.00
Mean	3.18	5.22	4.77
Std. Dev.(n)	1.63	1.52	1.83
Std. Dev.(n-1)	1.79	1.66	2.01
Var. Coeff. (%)	56.17	31.88	42.10
Conf. Int. 5% ±	1.88	1.75	2.11
Conf. Int. 1% ±	2.94	2.74	3.30

Scores Attribute Shape Retention

Line	2.5	4	5.5
Line 1	7.60	6.90	7.20
Line 2	6.40	8.20	2.90
Line 3	8.00	7.00	3.60
Line 4	9.90	10.00	7.60
Line 5	9.50	8.20	5.80
Line 6	7.30	8.30	2.70

Statistics Attribute Shape Retention

	2.5	4	5.5
Scores	6	6	6
Min	6.40	6.90	2.70
Max	9.90	10.00	7.60
Range	3.50	3.10	4.90
Mean	8.12	8.10	4.97
Std. Dev.(n)	1.22	1.03	2.00
Std. Dev.(n-1)	1.34	1.12	2.19
Var. Coeff. (%)	16.52	13.88	44.01
Conf. Int. 5% ±	1.41	1.18	2.29
Conf. Int. 1% ±	2.21	1.85	3.60

Scores Attribute Sweetness

Line	2.5	4	5.5
Line 1	4.80	3.00	0.80
Line 2	7.10	1.50	1.10
Line 3	0.00	5.60	7.10
Line 4	0.80	1.20	1.50
Line 5	5.90	1.80	3.50
Line 6	0.30	0.60	0.30

Statistics Attribute Sweetness

	2.5	4	5.5
Scores	6	6	6
Min	0.00	0.60	0.30
Max	7.10	5.60	7.10
Range	7.10	5.00	6.80
Mean	3.15	2.28	2.38
Std. Dev.(n)	2.87	1.65	2.34
Std. Dev.(n-1)	3.14	1.81	2.56
Var. Coeff. (%)	99.84	79.24	107.41
Conf. Int. 5% $\pm$	3.30	1.90	2.69
Conf. Int. 1% $\pm$	5.18	2.98	4.21

Scores Attribute Bitterness

Line	2.5	4	5.5
Line 1	1.50	0.60	4.10
Line 2	1.30	1.90	4.20
Line 3	6.00	0.10	1.10
Line 4	5.60	7.80	3.20
Line 5	2.50	3.60	6.40
Line 6	0.40	0.40	0.40

Statistics Attribute Bitterness

	2.5	4	5.5
Scores	6	6	6
Min	0.40	0.10	0.40
Max	6.00	7.80	6.40
Range	5.60	7.70	6.00
Mean	2.88	2.40	3.23
Std. Dev.(n)	2.15	2.69	2.01
Std. Dev.(n-1)	2.36	2.95	2.20
Var. Coeff. (%)	81.82	122.73	68.17
Conf. Int. 5% $\pm$	2.48	3.09	2.31
Conf. Int. 1% $\pm$	3.88	4.85	3.63

Scores Attribute Earthy Flavour

Line	2.5	4	5.5
Line 1	3.30	3.40	7.70
Line 2	3.00	2.80	2.00
Line 3	9.70	0.10	6.60
Line 4	2.00	8.00	6.30
Line 5	7.80	5.70	6.70
Line 6	4.10	7.00	4.60

Statistics Attribute Earthy Flavour

	2.5	4	5.5
Scores	6	6	6
Min	2.00	0.10	2.00
Max	9.70	8.00	7.70
Range	7.70	7.90	5.70
Mean	4.98	4.50	5.65
Std. Dev.(n)	2.79	2.69	1.87
Std. Dev.(n-1)	3.05	2.95	2.05
Var. Coeff. (%)	61.28	65.47	36.32
Conf. Int. 5% $\pm$	3.21	3.09	2.15
Conf. Int. 1% $\pm$	5.03	4.85	3.38

Scores Attribute Wetness

Line	2.5	4	5.5
Line 1	2.10	0.90	1.30
Line 2	2.30	1.30	0.90
Line 3	0.30	2.30	0.60
Line 4	6.20	7.60	2.70
Line 5	1.30	6.30	1.90
Line 6	1.10	1.30	2.80

Statistics Attribute Wetness

	2.5	4	5.5
Scores	6	6	6
Min	0.30	0.90	0.60
Max	6.20	7.60	2.80
Range	5.90	6.70	2.20
Mean	2.22	3.28	1.70
Std. Dev.(n)	1.90	2.65	0.84
Std. Dev.(n-1)	2.08	2.91	0.92
Var. Coeff. (%)	93.87	88.53	54.30
Conf. Int. 5% $\pm$	2.18	3.05	0.97
Conf. Int. 1% $\pm$	3.43	4.78	1.52

Scores Attribute Floury Texture

Line	2.5	4	5.5
Line 1	8.50	8.50	9.60
Line 2	8.10	8.50	9.00
Line 3	9.40	2.70	8.70
Line 4	6.40	6.80	7.40
Line 5	1.20	7.20	8.10
Line 6	9.00	8.70	7.60

Statistics Attribute Floury Texture

	2.5	4	5.5
Scores	6	6	6
Min	1.20	2.70	7.40
Max	9.40	8.70	9.60
Range	8.20	6.00	2.20
Mean	7.10	7.07	8.40
Std. Dev.(n)	2.80	2.08	0.78
Std. Dev.(n-1)	3.07	2.28	0.85
Var. Coeff. (%)	43.26	32.23	10.13
Conf. Int. 5% $\pm$	3.22	2.39	0.89
Conf. Int. 1% $\pm$	5.06	3.75	1.40

Scores Attribute Smoothness

Line	2.5	4	5.5
Line 1	3.40	1.00	6.40
Line 2	1.30	2.10	1.60
Line 3	0.40	4.10	8.80
Line 4	6.20	6.70	7.50
Line 5	1.30	8.00	3.90
Line 6	2.70	1.80	2.40

Statistics Attribute Smoothness

	2.5	4	5.5
Scores	6	6	6
Min	0.40	1.00	1.60
Max	6.20	8.00	8.80
Range	5.80	7.00	7.20
Mean	2.55	3.95	5.10
Std. Dev.(n)	1.91	2.61	2.65
Std. Dev.(n-1)	2.09	2.85	2.90
Var. Coeff. (%)	81.91	72.26	56.91
Conf. Int. 5% $\pm$	2.19	3.00	3.05
Conf. Int. 1% $\pm$	3.44	4.70	4.78

Comparison table of means

Attribute	2.5	4	5.5
Colour	3.18	5.22	4.77
Shape Retention	8.12	8.10	4.97
Sweetness	3.15	2.28	2.38
Bitterness	2.88	2.40	3.23
Earthy Flavour	4.98	4.50	5.65
Wetness	2.22	3.28	1.70
Floury Texture	7.10	7.07	8.40
Smoothness	2.55	3.95	5.10

Annex A2.c.2 Taste and texture attributes ANOVA, Maris Piper 2012/13

Analysis: Attribute Colour

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	3.18	1.79
2	4	6	5.22	1.66
3	5.5	6	4.77	2.01

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	4.23	0.67
2	2	3	3.77	0.47
3	3	3	2.53	1.65
4	4	3	3.83	2.23
5	5	3	5.67	3.02
6	6	3	6.30	0.44

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	13.69	6.84	3.17	0.0860
Judge	5	28.34	5.67	2.62	0.0911
Residuals	10	21.61	2.16		
Total	17	63.64			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Shape Retention

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	8.12	1.34
2	4	6	8.10	1.12
3	5.5	6	4.97	2.19

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	7.23	0.35
2	2	3	5.83	2.70
3	3	3	6.20	2.31
4	4	3	9.17	1.36
5	5	3	7.83	1.88
6	6	3	6.10	2.99

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	39.48	19.74	13.61	0.0014 **
Judge	5	24.70	4.94	3.41	0.0469 *
Residuals	10	14.51	1.45		
Total	17	78.68			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Sweetness

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	3.15	3.14
2	4	6	2.28	1.81
3	5.5	6	2.38	2.56

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	2.87	2.00
2	2	3	3.23	3.35
3	3	3	4.23	3.74
4	4	3	1.17	0.35
5	5	3	3.73	2.06
6	6	3	0.40	0.17

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	2.70	1.35	0.21	0.8151
Judge	5	33.96	6.79	1.05	0.4406
Residuals	10	64.64	6.46		
Total	17	101.29			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Bitterness

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	2.88	2.36
2	4	6	2.40	2.95
3	5.5	6	3.23	2.20

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	2.07	1.82
2	2	3	2.47	1.53
3	3	3	2.40	3.16
4	4	3	5.53	2.30
5	5	3	4.17	2.01
6	6	3	0.40	0.00

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	2.10	1.05	0.22	0.8065
Judge	5	47.70	9.54	2.00	0.1649
Residuals	10	47.81	4.78		
Total	17	97.60			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Earthy Flavour

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	4.98	3.05
2	4	6	4.50	2.95
3	5.5	6	5.65	2.05

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	4.80	2.51
2	2	3	2.60	0.53
3	3	3	5.47	4.90
4	4	3	5.43	3.09
5	5	3	6.73	1.05
6	6	3	5.23	1.55

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	4.00	2.00	0.24	0.7910
Judge	5	27.76	5.55	0.67	0.6578
Residuals	10	83.33	8.33		
Total	17	115.08			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Wetness

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	2.22	2.08
2	4	6	3.28	2.91
3	5.5	6	1.70	0.92

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	1.43	0.61
2	2	3	1.50	0.72
3	3	3	1.07	1.08
4	4	3	5.50	2.52
5	5	3	3.17	2.73
6	6	3	1.73	0.93

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	7.82	3.91	1.52	0.2644
Judge	5	42.49	8.50	3.31	0.0506
Residuals	10	25.66	2.57		
Total	17	75.98			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Floury Texture

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	7.10	3.07
2	4	6	7.07	2.28
3	5.5	6	8.40	0.85

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	8.87	0.64
2	2	3	8.53	0.45
3	3	3	6.93	3.68
4	4	3	6.87	0.50
5	5	3	5.50	3.75
6	6	3	8.43	0.74

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	6.94	3.47	0.68	0.5293
Judge	5	25.58	5.12	1.00	0.4649
Residuals	10	51.14	5.11		
Total	17	83.65			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Analysis: Attribute Smoothness

Factor Product

Level	Name	Size	Mean	Std. Dev.
1	2.5	6	2.55	2.09
2	4	6	3.95	2.85
3	5.5	6	5.10	2.90

Factor Judge

Level	Name	Size	Mean	Std. Dev.
1	1	3	3.60	2.71
2	2	3	1.67	0.40
3	3	3	4.43	4.21
4	4	3	6.80	0.66
5	5	3	4.40	3.38
6	6	3	2.30	0.46

Analysis of variance

Sources of variation	D.F.	S.S.	M.S.	Comp. F	Proba.
Product	2	19.57	9.79	1.78	0.2180
Judge	5	49.73	9.95	1.81	0.1985
Residuals	10	54.94	5.49		
Total	17	124.24			

* significant at 5 %

** significant at 1 %

*** significant at 0,1 %

Annex A3. Costs of storage, Warmer Storage Modelling

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Introduction

Quantification of the effects of warmer storage on energy consumption can be done both experimentally and theoretically. Experimental work in the field can give confusing and unreliable results as control of factors such as harvest date and conditions, market pressures, disease in store etc. can impact on energy use to such an extent that the change in energy consumptions are indeterminable.

Theoretical modelling provides an alternative which gives the user control over the external influences to better determine the energy changes. It is therefore this approach which was agreed as the best way to analyse warmer storage effect on energy consumption.

Materials and Methods

Software

An MS Excel model was constructed as the analysis package. The model analysed the impact of changing conditions, both internally and externally, on an hourly basis for the duration of a set storage season. The model was as close as possible to a real world store and was based on a particular design and construction that is widely used in practice. Previous projects – R401 and R439, supplied information to populate the model's parameters and to verify that the resulting energy consumption predictions were realistic.

Model parameters

The table below describes the information used in the model, whether it is a variable or fixed value and how it was obtained.

Item	Type	Values (where applicable)	Source
Building dimensions	Fixed values	Length Width Height to eaves Height to ridge	Real world store
Insulation levels	Fixed values	Thickness on roof Roof U value Thickness on walls Wall U value	Real world store
Air leakage	Fixed value	Permeability	Results of R439
Type of cooling and fan size	Fixed for the building size	Refrigeration and typical fan size	Results of R439
Crop data	Respiration rate – fixed	1.75 mgCO ₂ /kg/hr (5.18 W/tonne)	Measured values
	Target store temp – variable	2.5, 4 and 5.5 °C	Project variable
	Start crop temp – fixed	20 °C	Ambient temp
	Max cooling/day - fixed	0.5 °C /day	Store managers guide
Harvesting times and storage duration	Fixed	September harvest – end June store empty	Project spec
Location	Variable	5 locations	Project spec
External temperatures	Variable	3 year average of hourly values	Based on location

Table3.1 Input Parameters

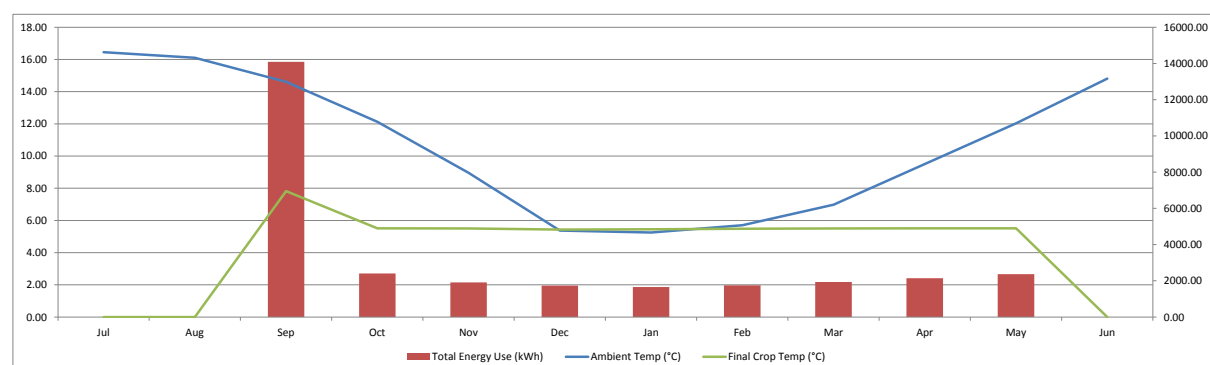
Building Characteristics		Refrigeration Equipment	
Width (m)	26	Compressor Size (kW)	18
Length (m)	26	COP	4
Height To Eaves (m)	10	Fan Size (kW)	12
Height To Ridge (m)	7		
Ambient cooling	No	Crop Data	
Temp diff at which ambient is available	3	Respiration Rate (W/tonne)	5.18
		Tonnage	1000
Insulation Levels		Target Temperature (°C)	5.5
Type	Composite Panel	Starting Crop Temperature (°C)	20
Thickness on Roof (mm)	70	Maximum Cooling (°C per day)	0.5
Thickness on Walls (mm)	50		
		Month	
Air Leakage Rate		Crop lifted from	September
Permeability (m3/m2h)	12	Crop removed from store by	June
(Air Changes per Hour ACH-1)	0.235		
Fan Capacity (m3/h)	100000	Location	
		Crop Season	Average

Figure 3.1 Model screenshot

The model provides a table and graphical representation of the results, as seen in Figure 2 below:

		Average Temp (oC)	Total Use (kWh)	Fan Use (kWh)	Compressor Use (kWh)
Jul	31	16.45	0	0	0
Aug	31	16.10	0	0	0
Sep	30	14.61	14088	8640	5448
Oct	31	12.13	2402	69	2333
Nov	30	8.96	1910	230	1680
Dec	31	5.37	1736	634	1103
Jan	31	5.25	1652	581	1071
Feb	28	5.70	1748	662	1072
Mar	31	6.98	1933	536	1398
Apr	30	9.50	2144	337	1807
May	31	12.03	2363	56	2307
Jun	30	14.81	0	0	0
Total		10.66	29,977	11,745	18,219

Figure 3.2: Results table and graph



Results

The model was run for each of three different target crop temperatures at every location, the locations were:

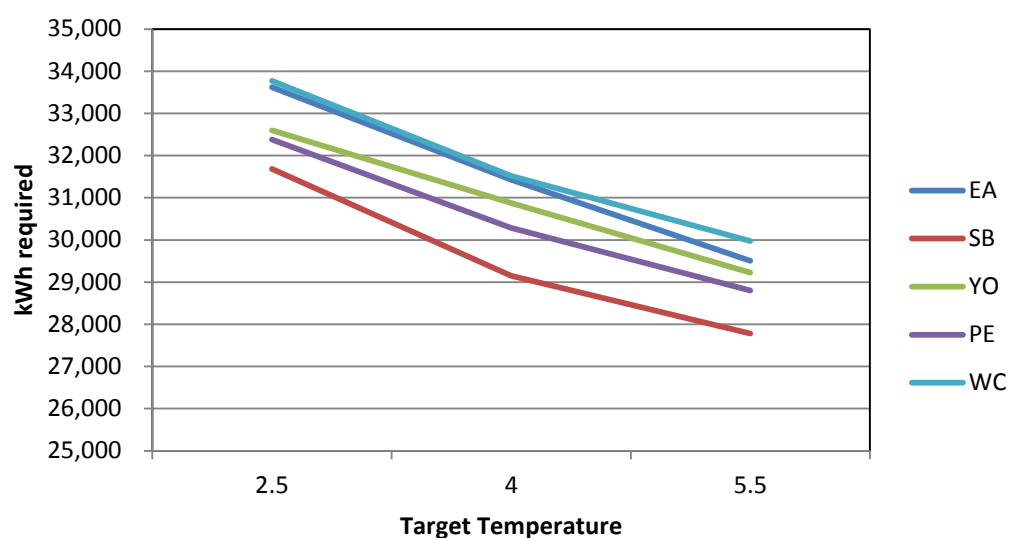
- East Anglia (EA)
- Scottish Borders (SB)
- Yorkshire (YO)
- Pembrokeshire (PE)
- West Country (WC)

The table and graph below show the energy consumption required at each temperature point, all the results are for a 1,000 tonne store.

	EA	SB	YO	PE	WC	Average
2.5	33,621	31,681	32,598	32,380	33,773	32,810
4	31,422	29,147	30,877	30,284	31,517	30,649
5.5	29,505	27,779	29,226	28,805	29,977	29,133

Table 3.2: Energy requirement (kWh) per location at each of the three target temperatures

Figure 3.3 Energy requirement (kWh) per location at each of the three target temperatures



Conclusion and discussion

As is obvious from the results, a greater target temperature causes reduced energy consumption and this has the biggest effect. An increase in target temperature from 2.5°C to 4°C exhibits an

energy saving of 7% on average, and increasing to 5.5°C gives an 11% saving in energy consumption.

The financial saving is an important point to consider because the trade-off between warmer storage and energy savings is increased input, and potentially greater sprouting or break down in store. Figure 4 demonstrates the effect that warmer storage has on the cost of energy required for storing potatoes.

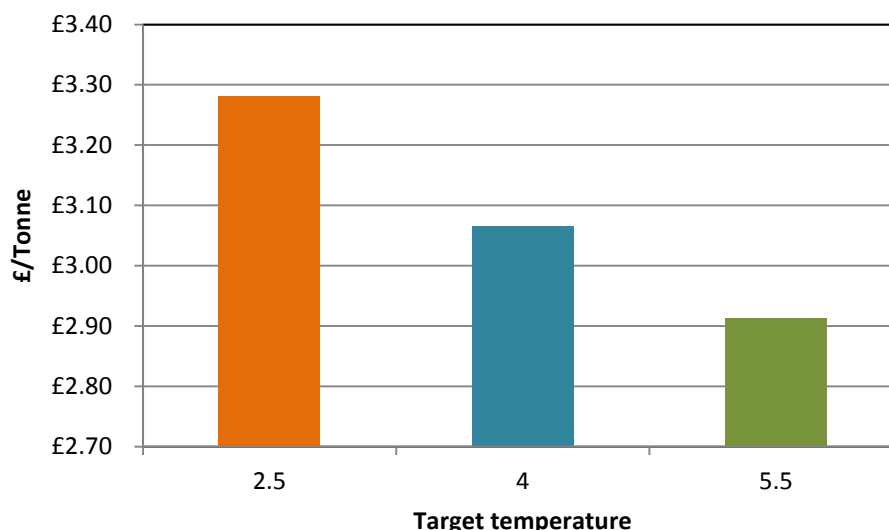


Figure 3.4 Effect of warmer storage on energy costs

The graph demonstrates that a reduction in costs of £0.22 and £0.38 per tonne is achievable from the reduced energy consumption at the two warmer storage temperatures. Reduction in energy consumption also has an effect on the carbon footprint; the carbon emissions associated with the energy consumed will be reduced by 0.96KgCO₂e/tonne¹ and 1.67KgCO₂e/tonne for each of the warmer target temperatures respectively (compared with 2.5°C)

¹ Using 0.44548KgCO₂e/kWh as given by the Carbon Trust 2013 update on carbon emission factors (June 2013)
http://www.carbontrust.com/media/18223/ctl153_conversion_factors.pdf