

Biomathematics & Statistics Scotland

BioSS



research, consultancy and training

in statistics and mathematics

applied to

agriculture, the environment, food and health

<http://www.bioss.ac.uk/>

Biomathematics & Statistics Scotland

BioSS



Measuring Sheep Muscle Volumes with a CT Scanner

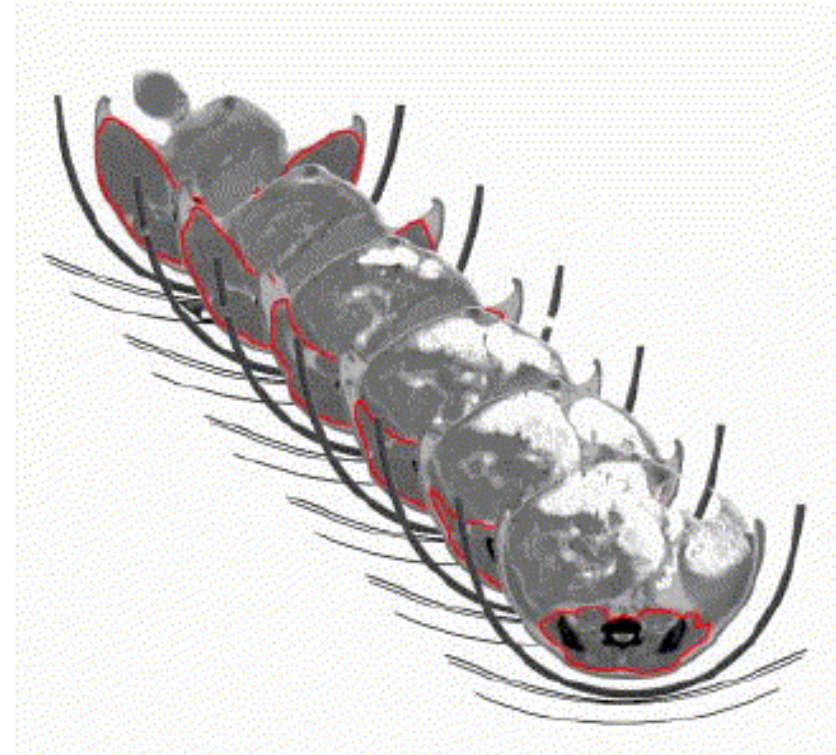


Image analysis: Medical scanners

3-D X-ray computed tomography (CT)

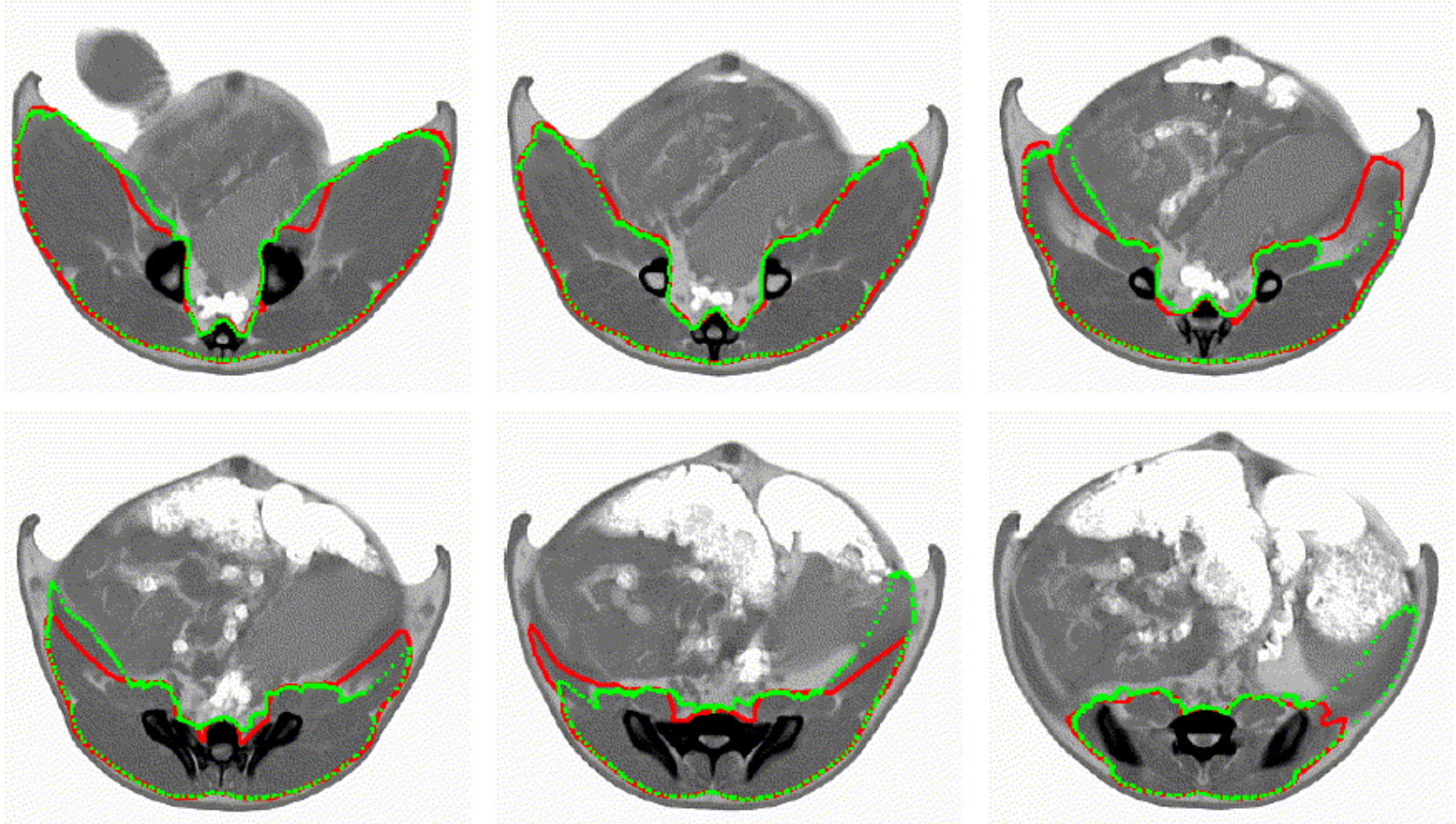


sheep skeleton



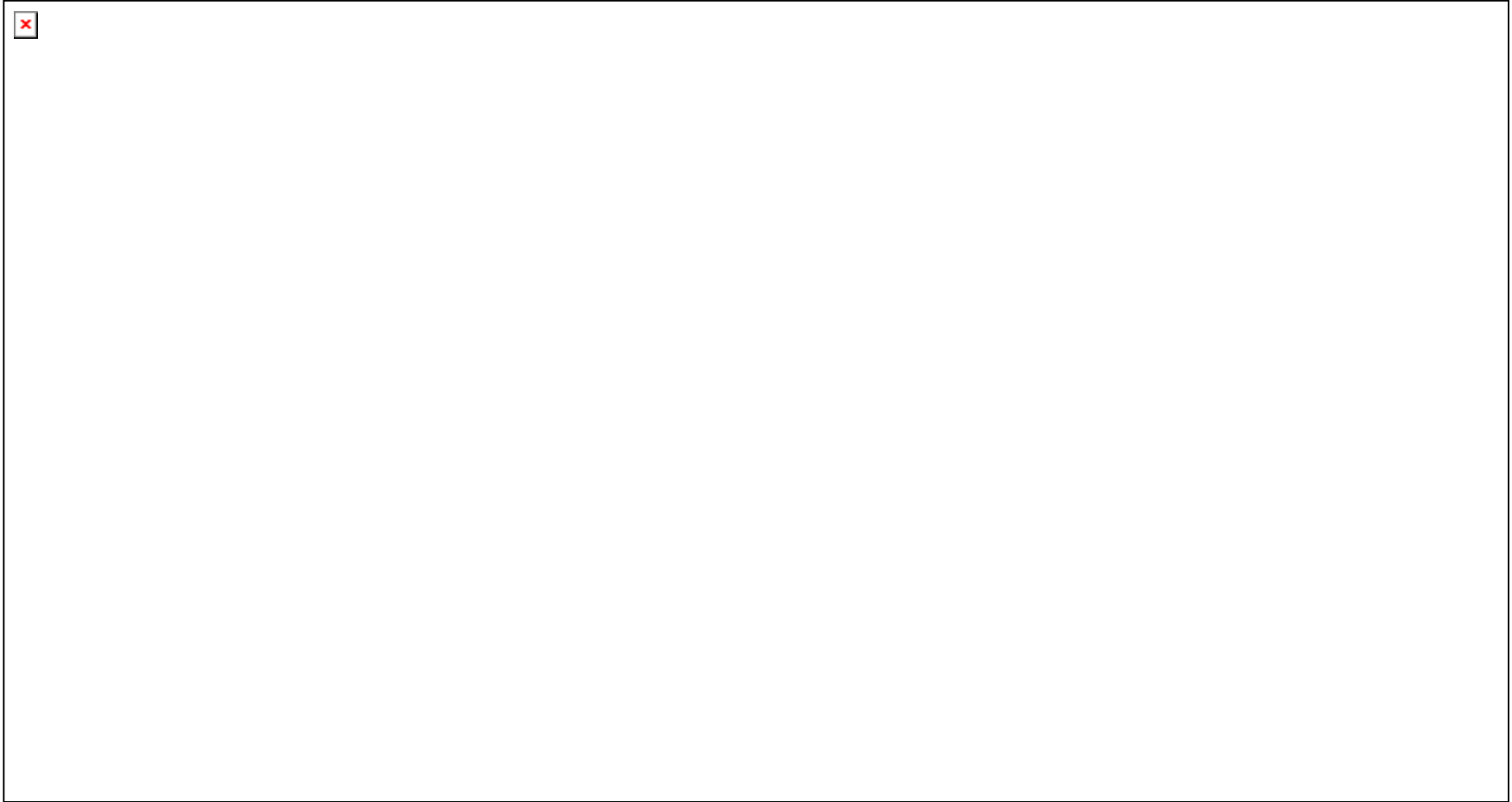
leg muscles in pelvic region

Result if every image segmented separately



automatic and hand-drawn boundaries

Result of 3-D segmentation



automatic and hand-drawn boundaries

STAR (Sheep tomogram analysis routines):

The screenshot displays the STAR 3.7 software interface. The main window shows a CT scan of a sheep's head with a yellow outline. The interface includes a menu bar with options like Open, Save, Crop, Shape, Gut, Batch..., Adjust, and Thresholds. A 'Save' dialog box is open, showing options for saving as Screen, Cutouts, Bitmap, Scanner, or Ascii. The 'Magnification x' is set to 1, and the 'Section' is LV5 (X). A 'Histogram' window shows the distribution of Hounsfield units, with a peak around 150. The histogram axes are 'No. of Pixels' (0 to 650) and 'Grey Level' (0 to 250). The histogram data is: Black: 240344 pixels, White: 1372. A 'CT Details' window shows the following information: ID: 1059,T14,SU; Live Weight: (blank); Seq No: 5; Time: 09:54:28; Date: 23-MAY-02; Operator: KAM; Left of Image: Right of animal; Top of Image: Ventral surface; Table Posn: -412; Diameter: 450 mm; Magnification: 1.1378; Scan Time: 1500 ms; Thickness: 8 mm; kV: 8; mA: 67; Scanner: Esprit. An 'Accept' dialog box is also visible, asking 'Accept changes?' with 'Yes' and 'No' buttons.

STAR 3.7

Open Save

Crop Shape

Gut Batch...

Adjust Thresholds

Save

Screen Bitmap

Cutouts Scanner

Ascii

Confirm overwrite

Default filenames

Magnification x 1

Draw None

Section LV5 (X)

About Quit

1059_003.DIC

Histogram

Hounsfield units

No. of Pixels

Grey Level

Black: 240344 pixels White: 1372

CT Details

ID: 1059,T14,SU

Live Weight:

Seq No: 5

Time: 09:54:28

Date: 23-MAY-02

Operator: KAM

Left of Image: Right of animal

Top of Image: Ventral surface

Table Posn: -412

Diameter: 450 mm

Magnification: 1.1378

Scan Time: 1500 ms

Thickness: 8 mm

kV: 8

mA: 67

Scanner: Esprit

Accept

Accept changes?

Toggle

Line

Cutout

Accept Yes No

28/01/2005



SENSORY PROFILING



WHAT IS SENSORY PROFILING?

A method to characterize food and drinks by their
Texture, flavour and odour

A range of attributes within category:

e.g. intensity, persistence, fruity, creamy for
flavour in fruit yoghurt.

SENSORY PROFILING

- Sensory Scotland (Ayr) has an experienced panel of assessors
- Sensory laboratory with screened booths
- Evaluate dairy products, fruit and drinks.

SAMPLE PRESENTATION ORDER

Samples A-D

Order of sample presentation

Assessor	1	2	3	4
1	A	D	B	C
2	B	A	C	D
3	C	B	D	A
4	D	C	A	B

Sensory profiling

General principles

- Sensory Scotland panel of approx 12 assessors
- Sessions, replicate runs (repetitions) – same day
- Within sessions scoring 4 or 5 samples

Attributes

Appearance – white, yellow, grainy, shiny

Odour – intensity, creamy, earthy

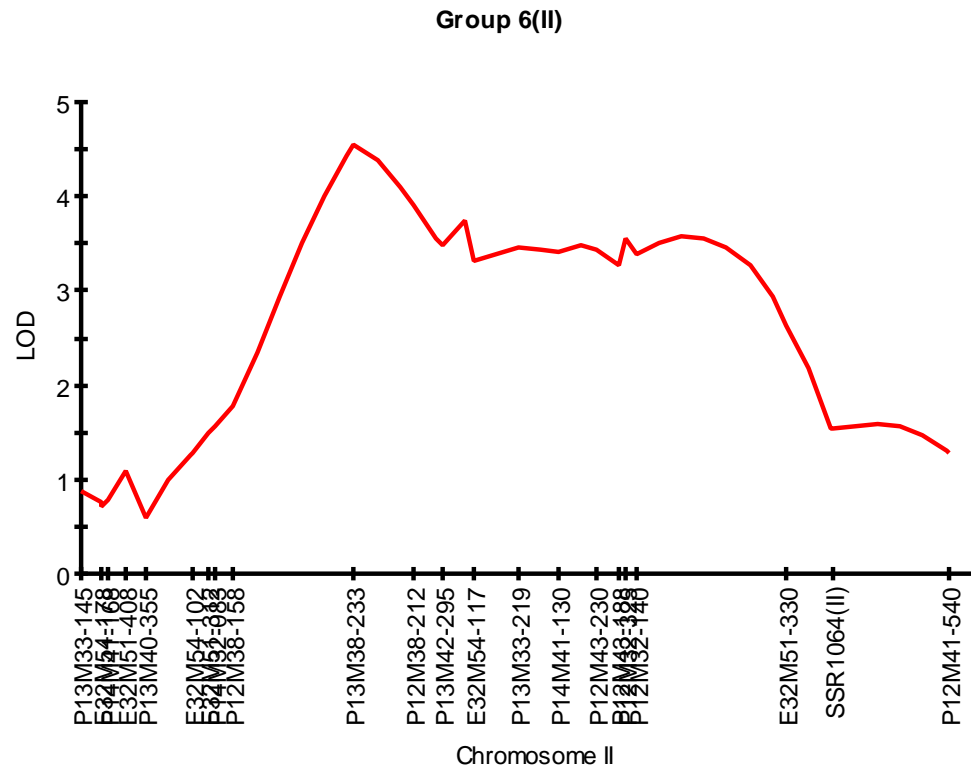
Flavour – intensity, creamy, earthy,
salty, metallic, sweet

After-taste – intensity, after-taste, bitter

Texture – floury, sticky, moist/dry,
smooth/grainy, chalky

Acceptability – acceptability

Floury Texture in Potato



Metabolic Profiling



Tuber Life Cycle

GCMS Polar

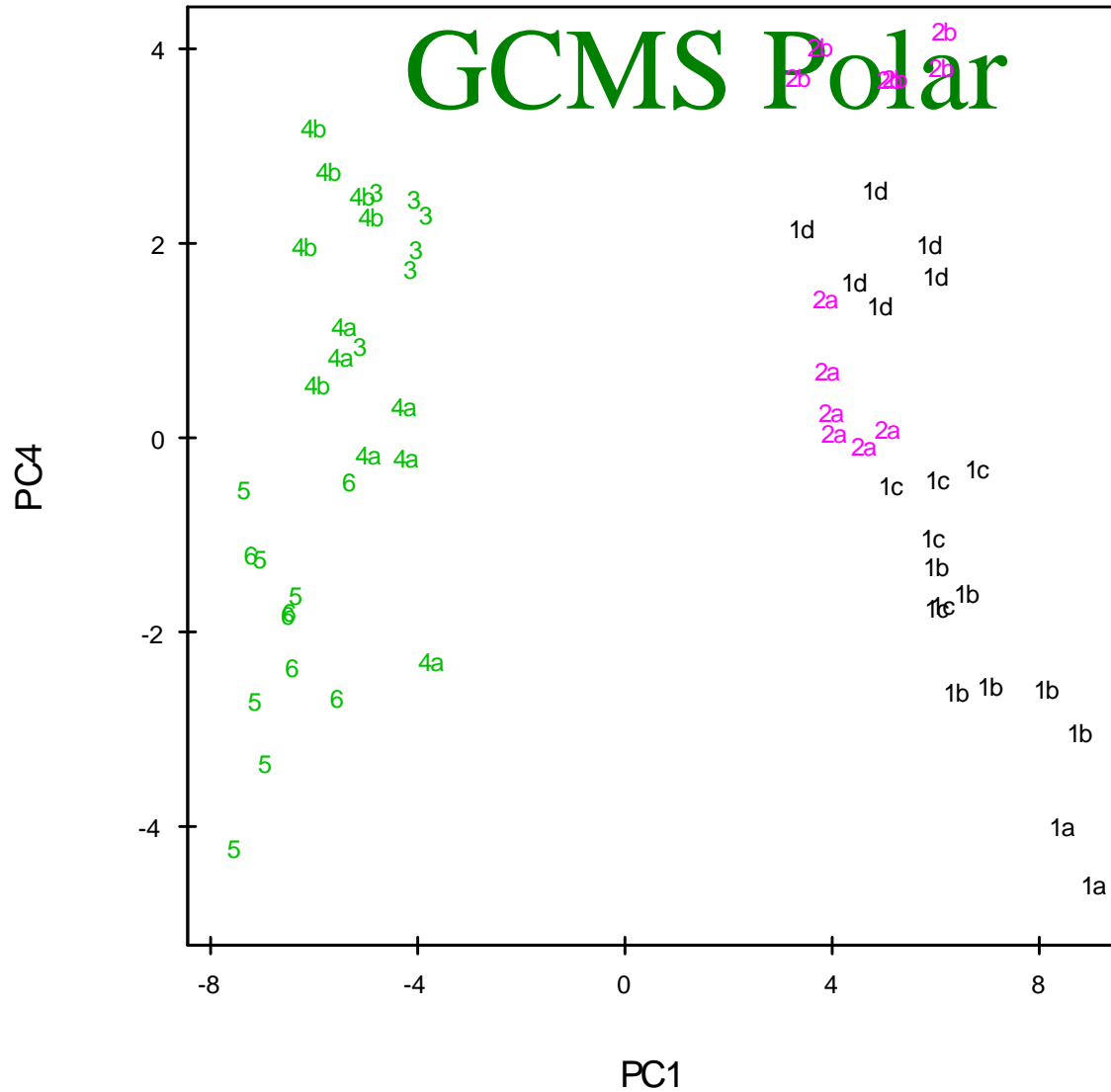
- GCMS Polar detected 85 compounds
- Selected 63 metabolites showing significant differences among tuber growth stages for cluster analysis

Tuber Life Cycle

GCMS Polar

- Experimental samples
 - 11 potato tuber developmental stages - cv. Desiree
 - Stage 1 - Small developing tubers
 - 1a <1cm Ø ; 1b <2cm Ø ; 1c >2cm Ø ; 1d >2.5cm Ø
 - Stage 2 - Large developing tubers (5-6cm Ø)
 - 2a harvest / store 3 days - 10°C/dark
 - 2b leave on plant 3 days / harvest
 - Stage 3 - Tubers (~135g) from senesced plant
 - harvest / no storage
 - Stage 4 - Tubers (~135g) from senesced plant
 - 4a harvest / store 4 weeks - 5°C/dark/bag
 - 4b harvest / store 4 weeks - RT/dark/soil
 - Stage 5 - Tubers (~135g) from senesced plant
 - harvest / store until eyes open - 5°C/dark
 - / store until sprouting appears (~2 weeks) - RT
 - Stage 6 - Tubers (~135g) from senesced plant
 - harvest / store until eyes open - 5°C/dark
 - / store until sprouting appears (~2 weeks) – RT
 - / plant tubers until shoots appear – RT?/dark
- 3 glasshouse reps per stage except for stages 1,2 & 3 (one rep only)
- 2 technical rep per experimental sample (= 2 x GC-MS sampling)

Tuber Life Cycle



Tuber Life Cycle

GCMS Polar

Examining each compound separately,

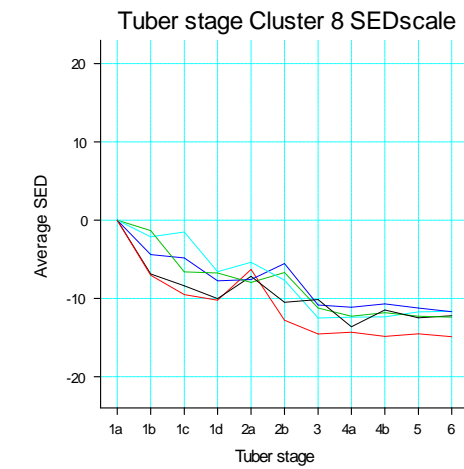
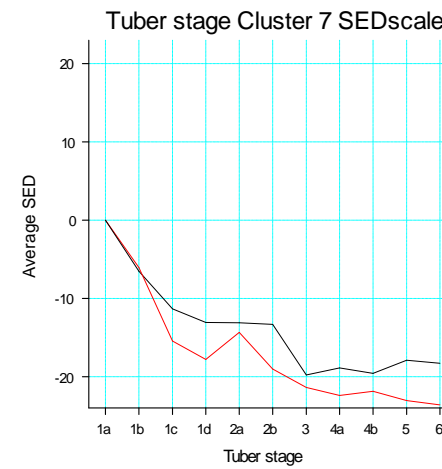
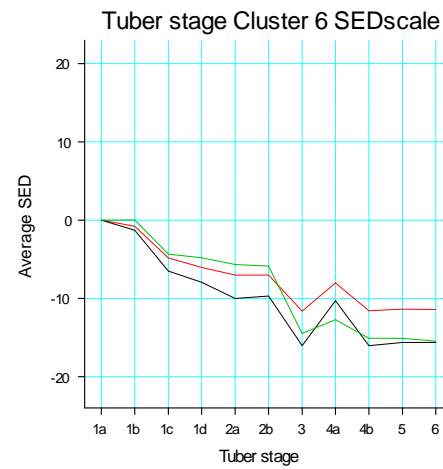
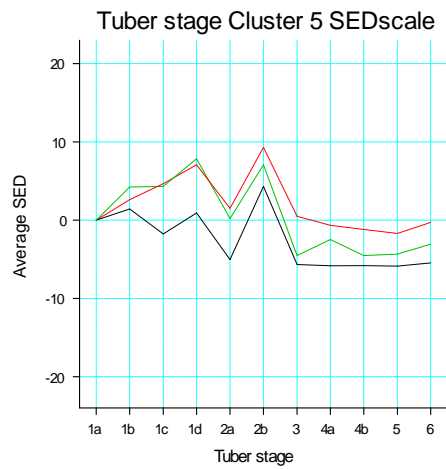
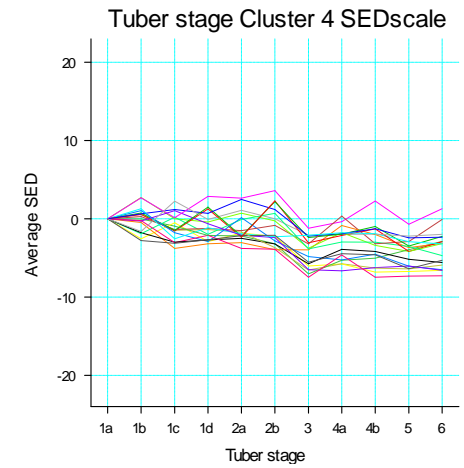
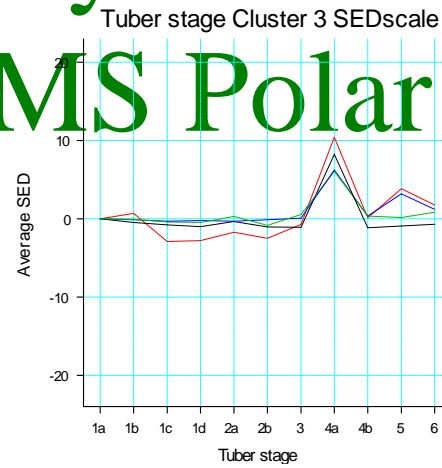
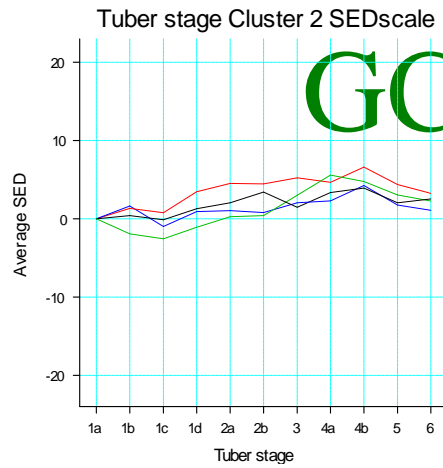
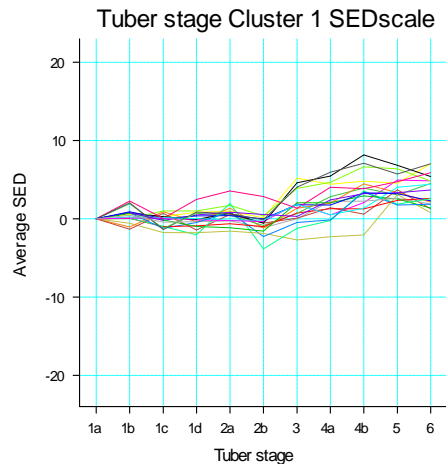
By

Analysis of Variance

To detect those compounds which
behave differently at the various Life
Cycle stages

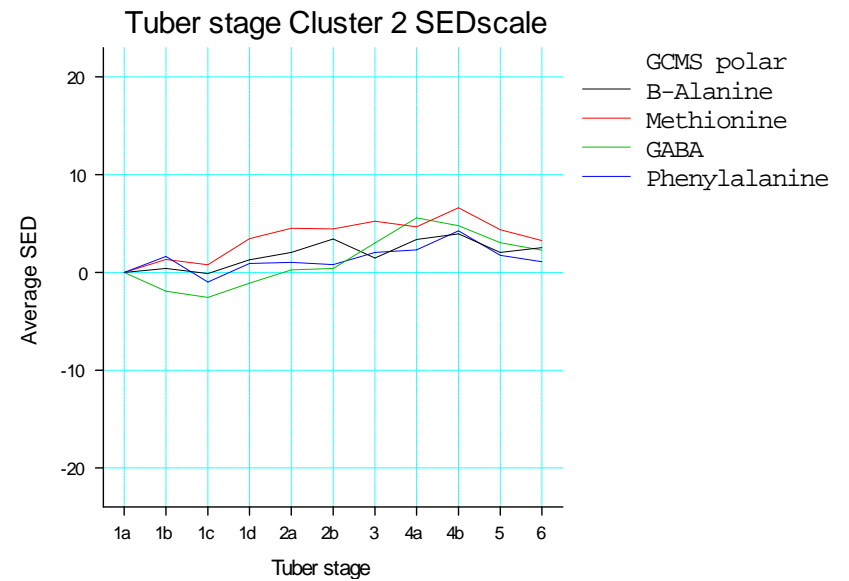
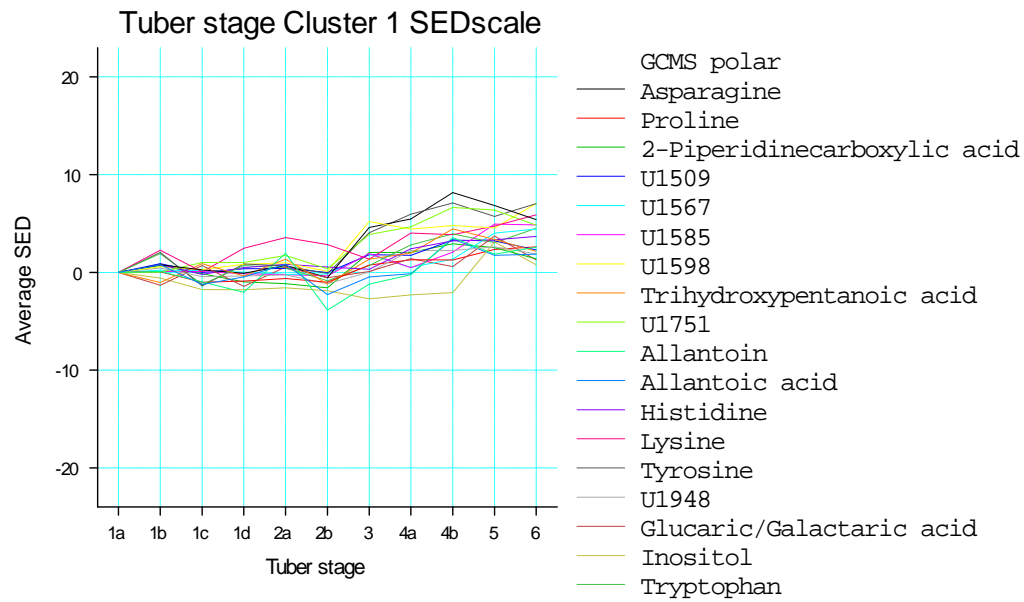
Tuber Life Cycle

GCMS Polar



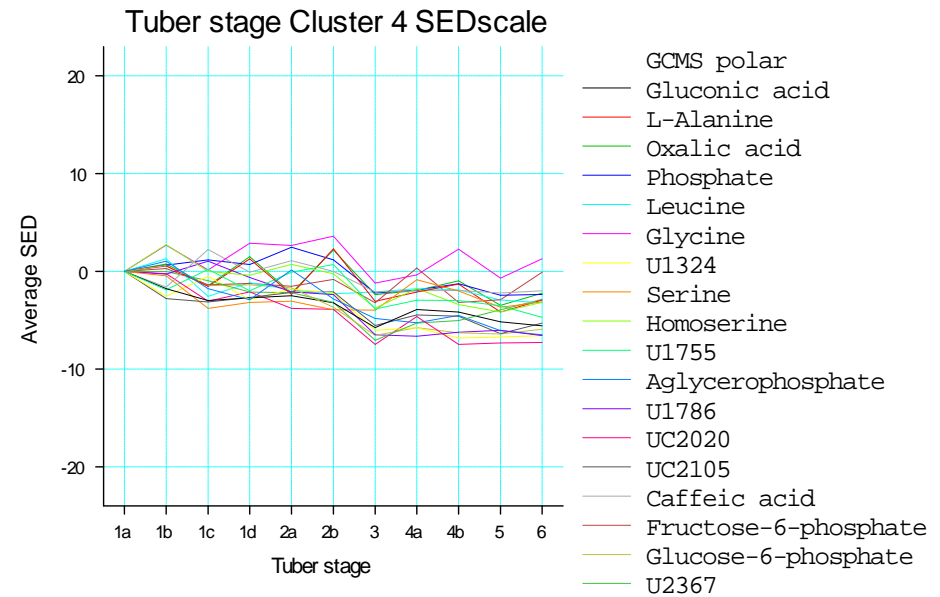
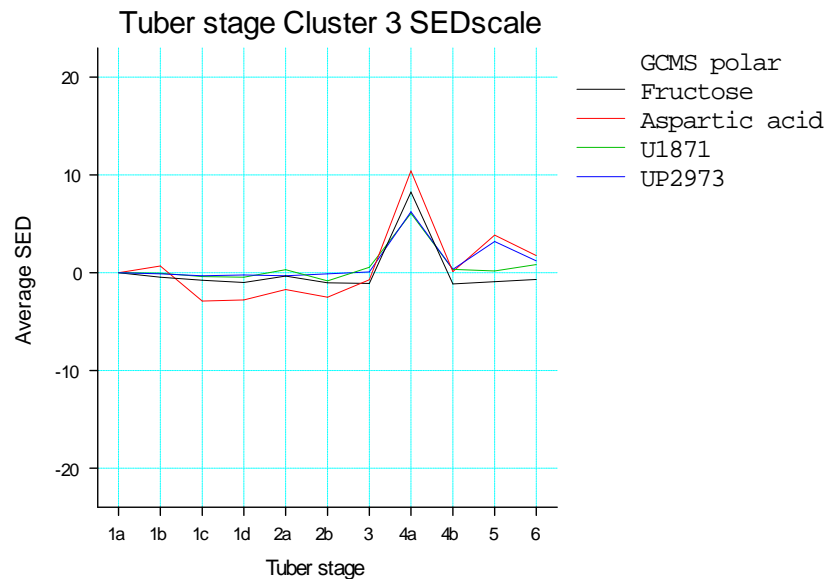
Tuber Life Cycle

GCMS Polar



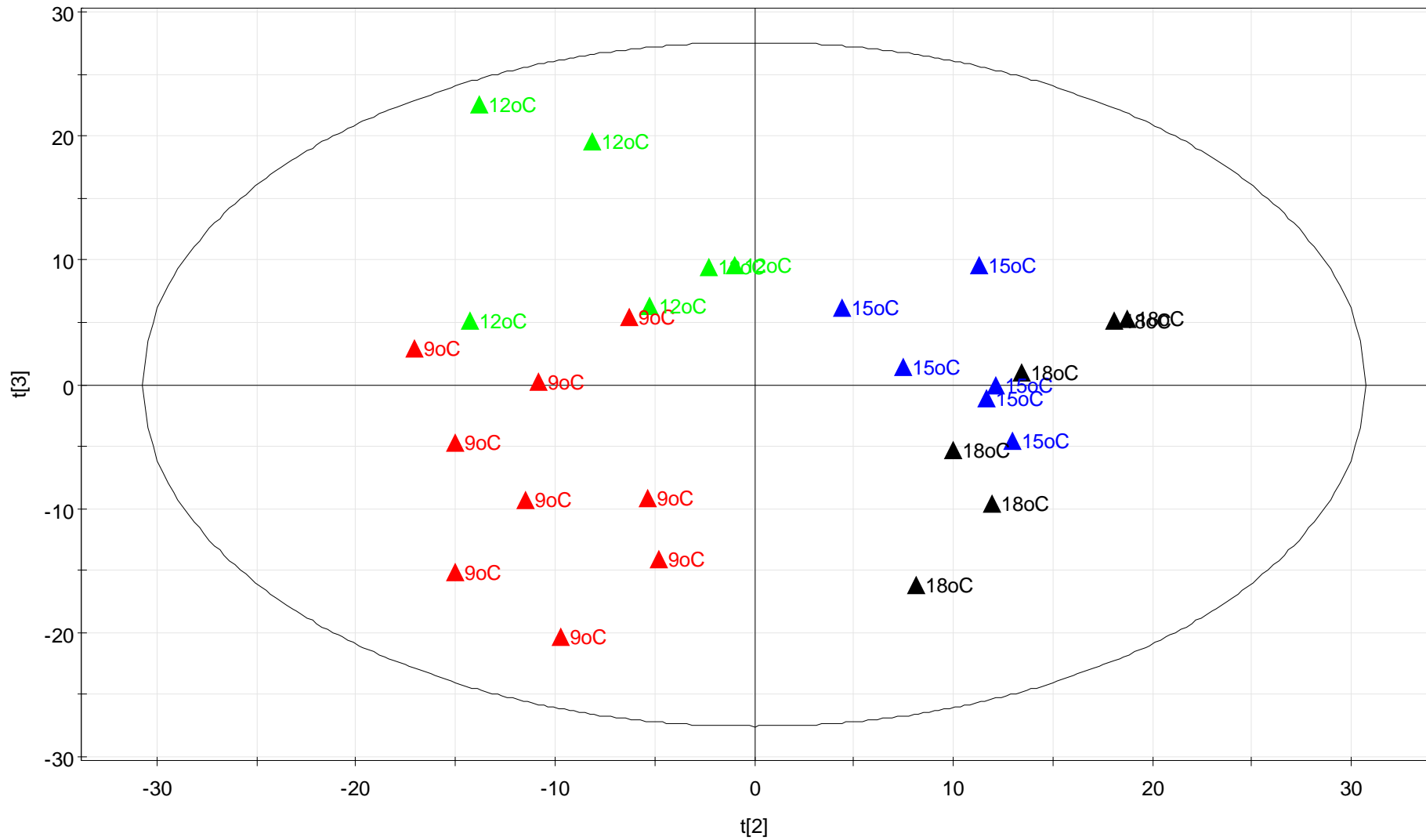
Tuber Life Cycle

GCMS Polar



Climate change modelling on Rubus fruit quality
Phytotron experiment with Inger Martinussen (Bioforsk)
PCA based on soluble metabolites analyse by short column LC-MS

- ▲ 9oC
- ▲ 12oC
- ▲ 15oC
- ▲ 18oC



R2X[2] = 0.0700279

R2X[3] = 0.0563862

Ellipse: Hotelling T2 (0.95)