

# **FUTURE DEVELOPMENTS IN THE AUTHENTICITY PROGRAMME**



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**Food Standards Agency**

# FSA - Policy Rationale of Authenticity Programme

- Contributes to Agency objectives
  - to promote honest and informative labelling to help consumers make informed choices
  - Protect consumers from food fraud and illegal practices
- Assists in the improvement of enforcement of food standards
- Supports food labelling policy

# DRIVERS OF THE PROGRAMME

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**Policy  
Legislation  
Standards**

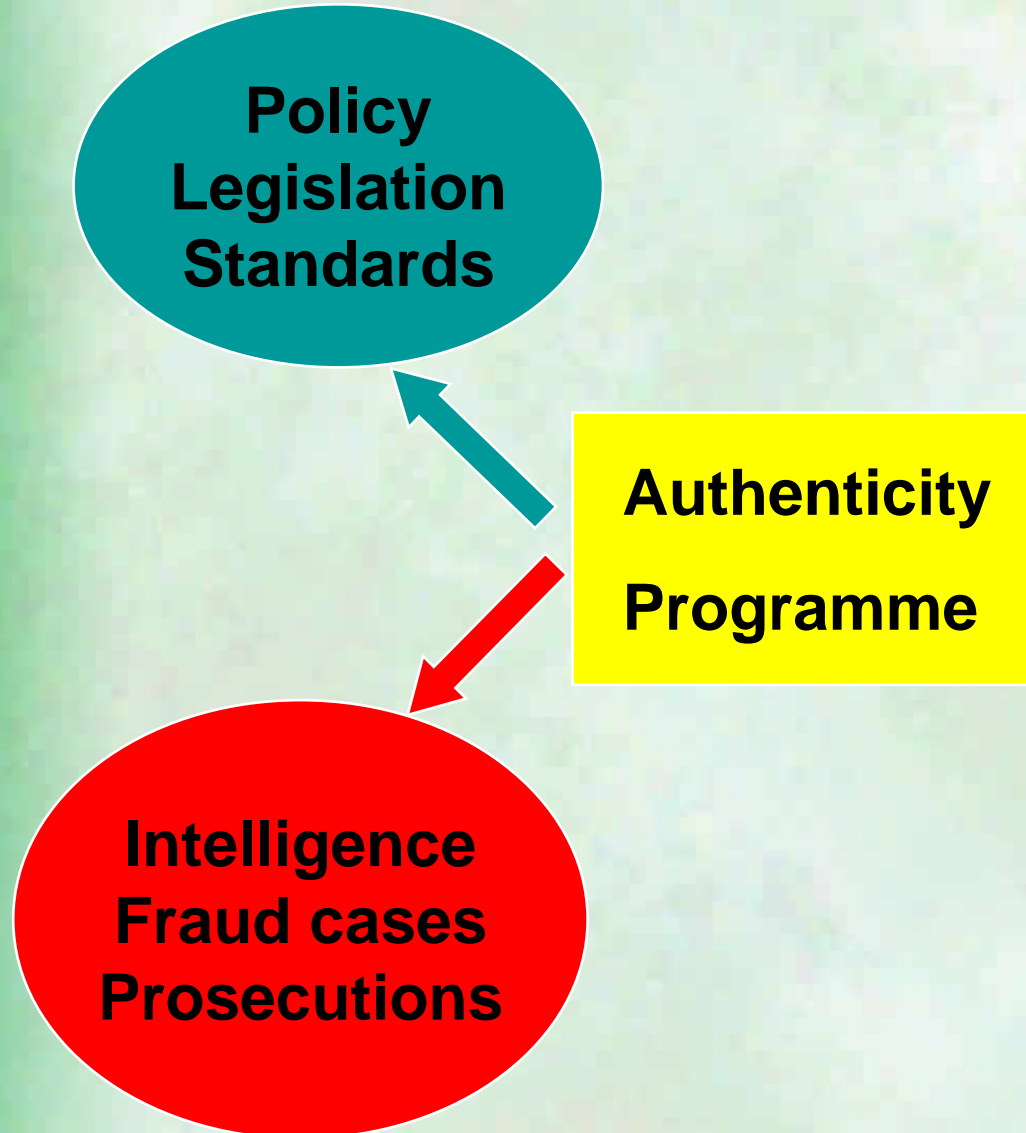
**Authenticity  
Programme**

# POLICY

- Review and draft of the EC Food Labelling Regulation – general prohibition on misleading descriptions, compulsory origin labelling for meat and nutritional labelling.
- Implementation of action plan on food fraud.
- Strengthening of food standards

# DRIVERS OF THE PROGRAMME

[www.food.gov.uk](http://www.food.gov.uk)

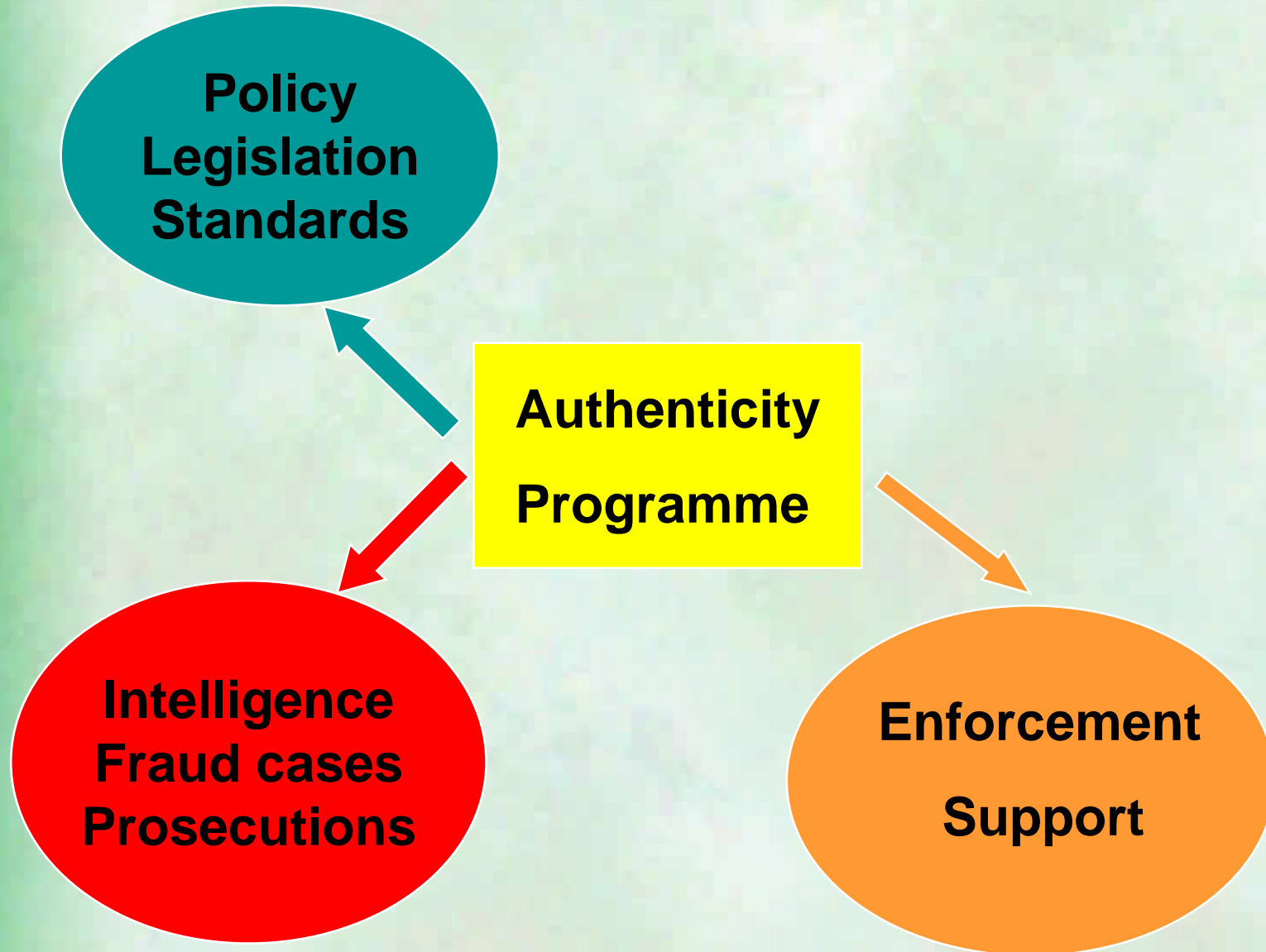


# INTELLIGENCE

- Whistleblower website
- Trained enforcement officers for fraud
- Memex database - prosecutions
- LA investigations, surveys
- Industry complaints of unfair competition
- Notifications from other countries – Fraud network

# DRIVERS OF THE PROGRAMME

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# ENFORCEMENT SUPPORT

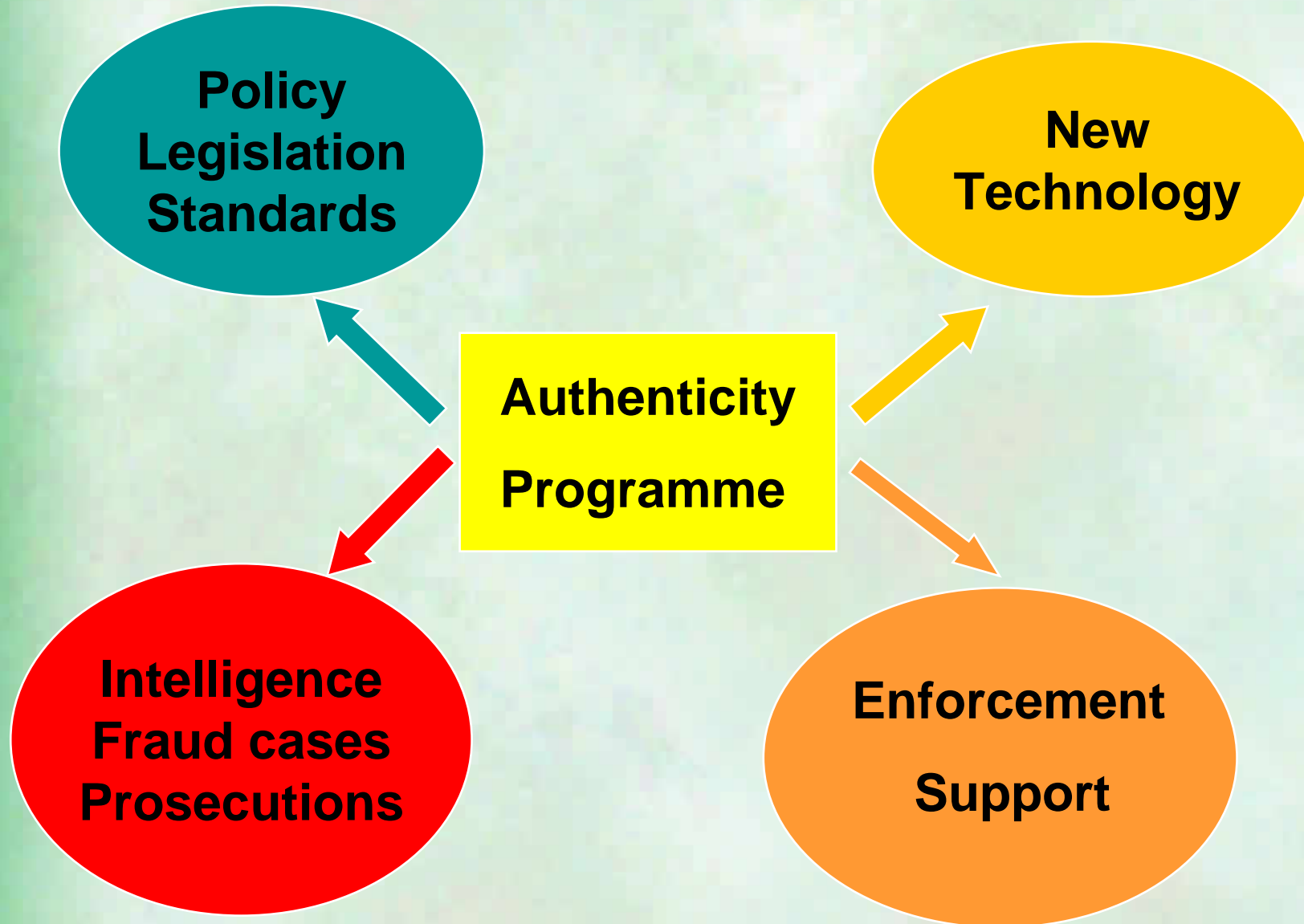
- **Technology transfer of methods to public analysts – where possible**
  - good example: DNA lab on a chip technology
- **Informal and formal authenticity surveys – agreed sampling protocols and using robust methods – coordinate with LA surveys**
- **Closer cooperation with LACORS Sampling Programme and Imported Food Sampling Programme**
- **Ad hoc support in preliminary investigations**

# R&D Programme

## Technology Transfer to Public Analysts

<b>Issue</b>	<b>Technique</b>
<b>Meat species- commercial, exotic bushmeat</b>	<b>DNA- specific probes, RFLP</b>
<b>Durum wheat pasta</b>	<b>DNA-specific probes</b>
<b>Basmati rice</b>	<b>DNA- microsatellites, Indels</b>
<b>Fruit juices:Orange juice adulteration – other fruit juices</b>	<b>DNA- heteroduplex DNA -RFLP</b>
<b>Fish species</b>	<b>DNA- RFLP</b>

# DRIVERS OF THE PROGRAMME



# **NEW TECHNOLOGY**

**So far AN06 Programme around 120 projects  
and its successor Q01 120 projects.**

**Early projects based on spectroscopic  
techniques NIR, FTIR, and protein gel  
electrophoresis- move to DNA techniques  
plus further development of isotopic  
techniques.**

**Unexploited opportunities.**

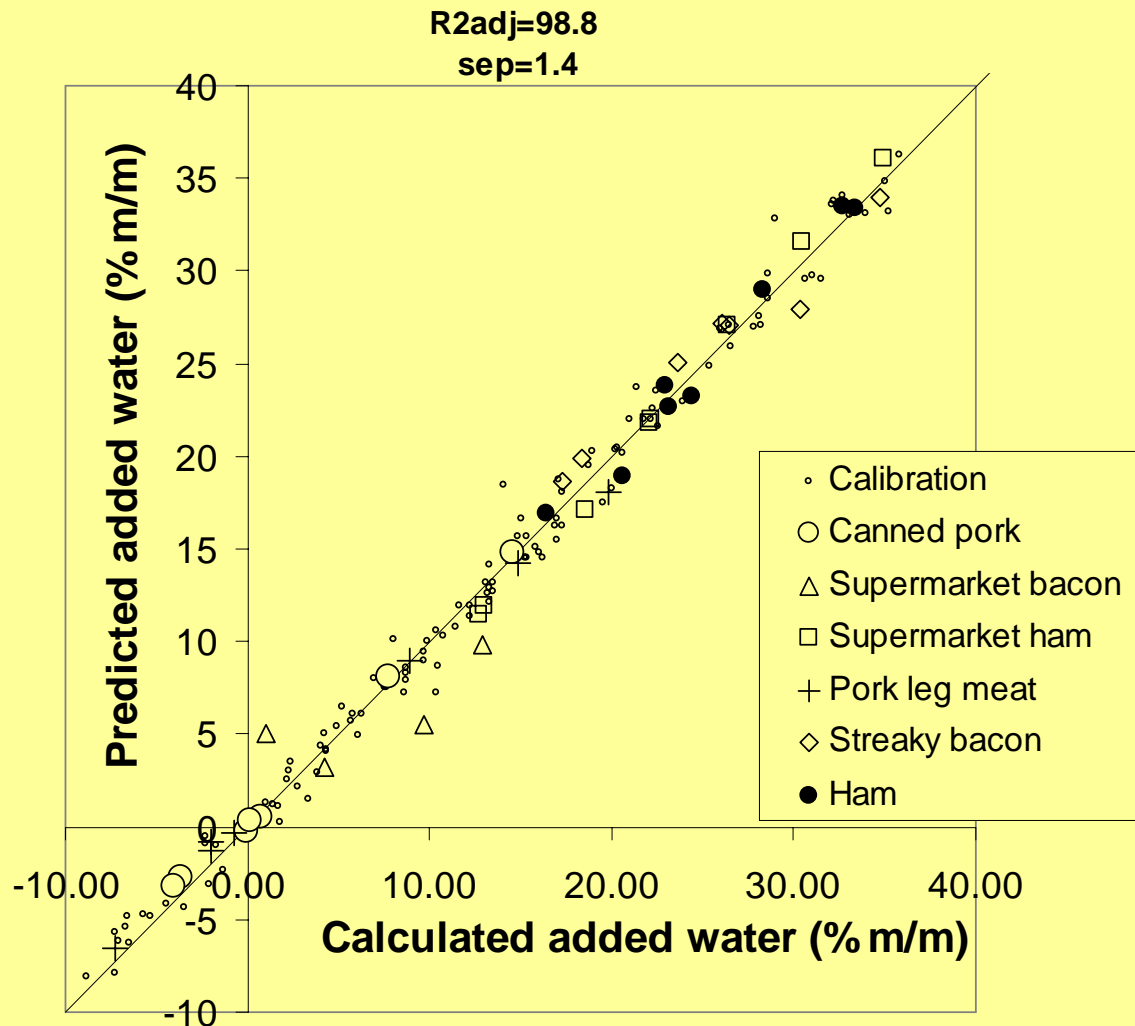
**Emerging techniques**

# UNEXPLOITED OPPORTUNITIES

## 1. Added Water by Dielectric Spectroscopy

- Rapid calibrated method to measure added water in cured meat.
- Could apply to chicken breast as well
- Could easily detect if falsifying added water in cured meat or chicken by increasing nitrogen content.
- Routine screen test followed by chemical analysis

# UNEXPLOITED OPPORTUNITIES



Calibration complex – uses 9 different frequencies of dielectric measurements and 10 principal components of chemical analyses.

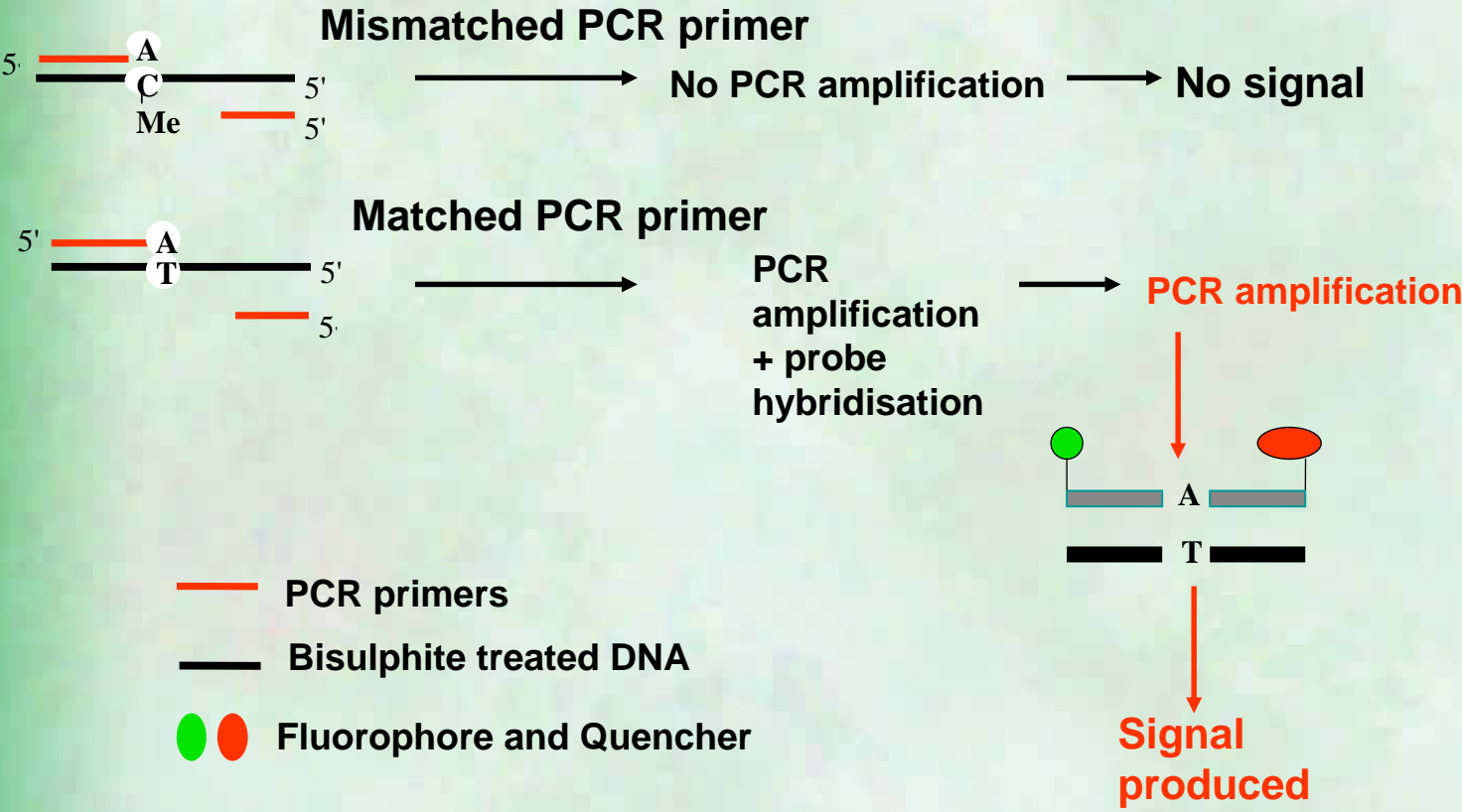
# UNEXPLOITED OPPORTUNITIES

## 2. Promoter Methylation for Tissue Discrimination

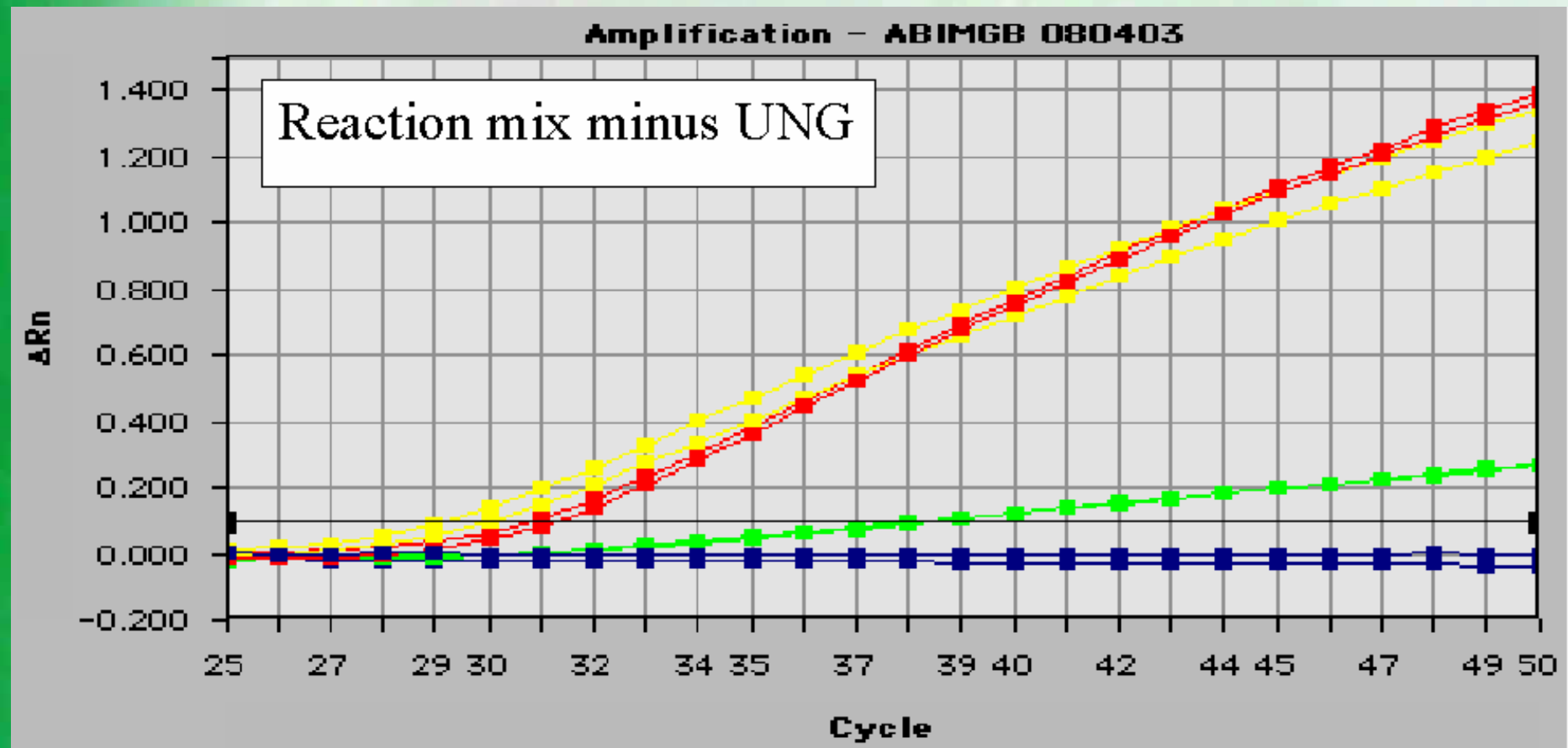
- All tissues contain the same DNA
- Different cell types will express different genes at different stages of their growth
- Those genes that do not need to be expressed can be inactivated by methylation of specific C residues within the promoter
- Detection of a gene in the unmethylated state in a tissue that does not express it (should contain the methylated state) indicates that this DNA must come from another source
- Sheep CNS, Cow CNS, liver, heart, kidney and pork liver differentiation with respective muscle.

# USING TAQMAN PROBES FOR METHYLATION DETECTION

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# OPTIMISATION OF TAQMAN ASSAY



- Non Template Controls -UNG
- Bis treated brain DNA, -UNG
- Bis treated Spinal Cord DNA, -UNG
- Bis treated Muscle DNA, -UNG

# UNEXPLOITED OPPORTUNITIES

## Promoter Methylation for Tissue Discrimination

- When earlier work applied to capillary electrophoresis system (Agilent) sensitivity very low (less sensitive than commercial immunoassay).
- Considerable cross reactivity between muscle and tissue
- Method was abandoned, however still potential using methods which can differentiate 1 bp difference.

# UNEXPLOITED OPPORTUNITIES

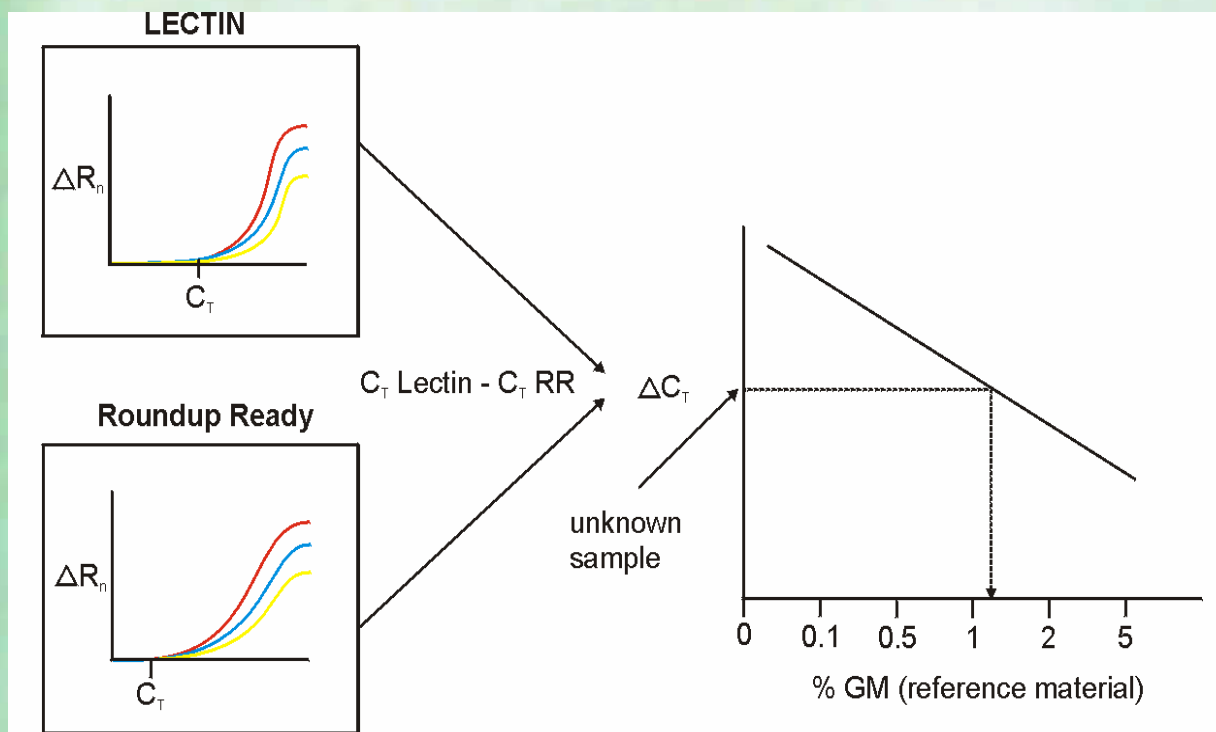
## 3. Quantitative DNA Measurement

- PCR conditions optimised, best extraction methods evaluated etc.
- Tested with GMOs, durum pasta, Basmati rice, meat and fish species
- All use real-time PCR except Basmati/non-Basmati rice quantification.

# UNEXPLOITED OPPORTUNITIES

## 2. Measurement of DNA without using PCR

- Standard real-time PCR for GMO applied to meat species using nuclear GAPDH target

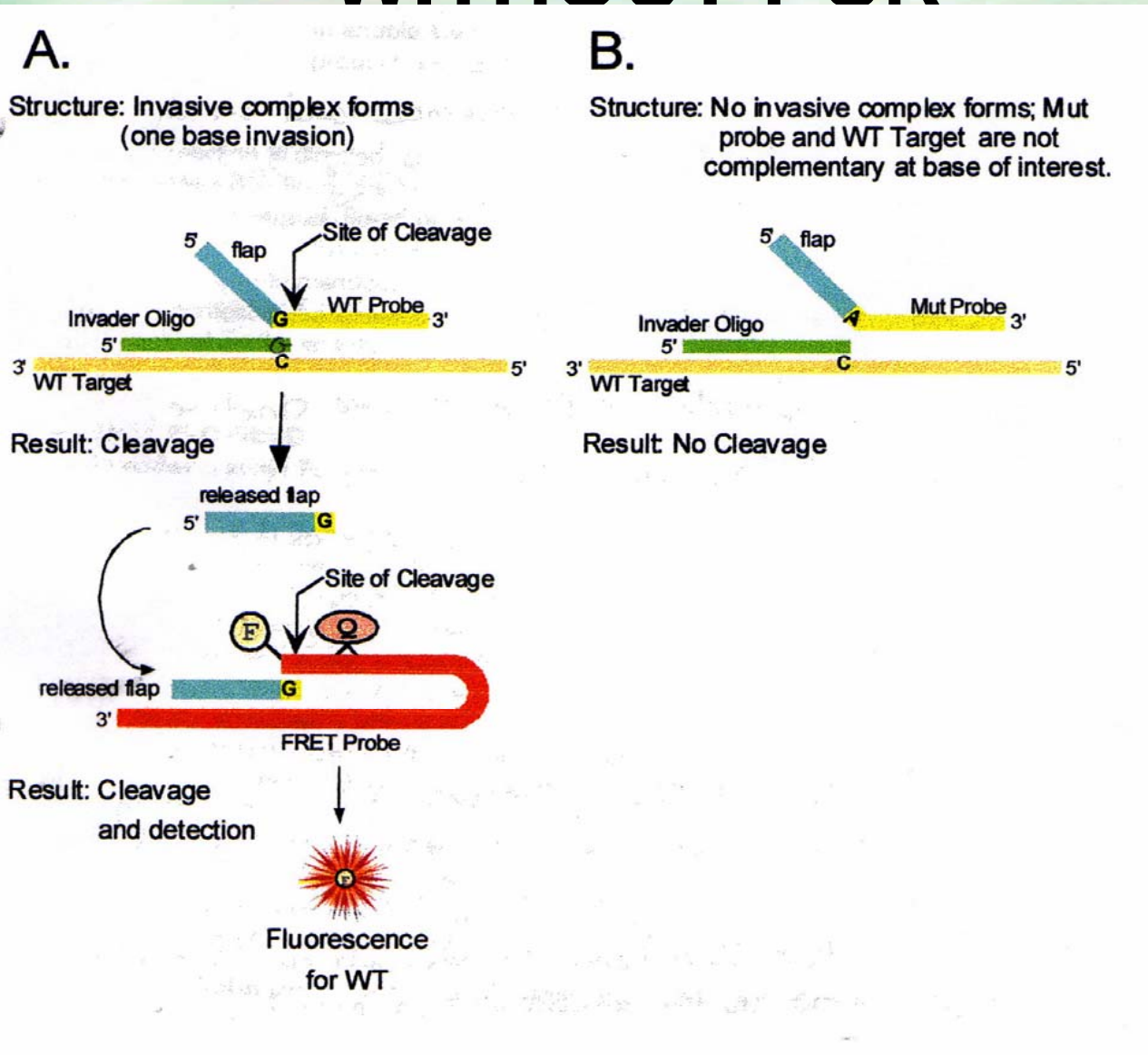


**Table – Comparison of 3 different calibrations to determine the % turkey by real-time PCR in a turkey/lamb sausage**

<b>Actual amount of turkey in turkey/lamb sausage % (w/w)</b>	<b>Determined % (w/w) Turkey – <u>Meat admixture</u></b>	<b>Determined % (w/w) Turkey – <u>DNA admixture</u></b>	<b>Determined % (w/w) Turkey – <u>DNA dilution calib. curve</u></b>
50	16.6 ± 2.2 (2)	-----	14.0 ± 3.5 (2)
10	4.6 ± 1.0 (6)	3.6 ± 1.3 (3)	2.3 ± 1.2 (6)
1	0.5 ± 0.1 (2)	0.6 ± 0.2 (3)	0.2 ± 0.0 (2)

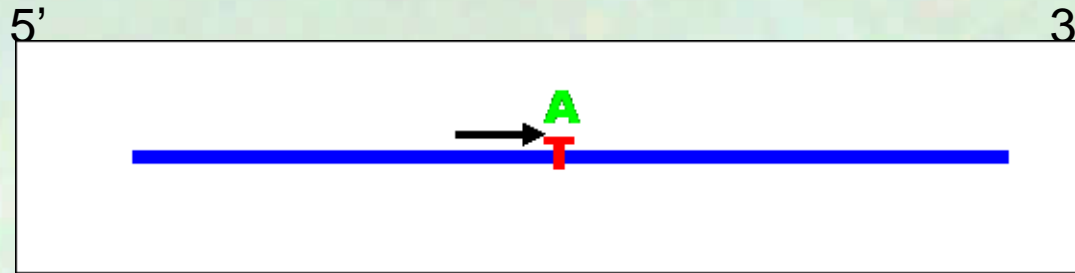
( ) Number of replicate determinations.

# INVADER ASSAY- QUANTITATION WITHOUT PCR



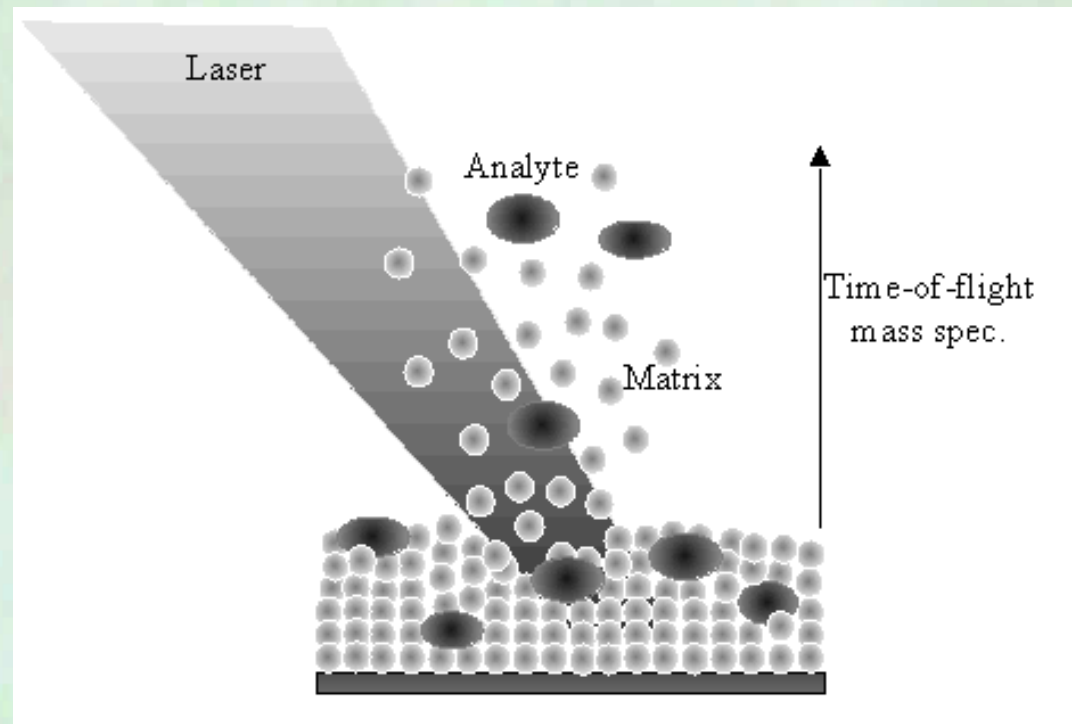
# SNP MARKERS

RICE VARIETY	BASMATI?	ory-122-1	ory-58-2	ory-262	ory-S0186	ory-S0157	ory-S0153	Genotype
Derhadun	Pure Bred	GG	AA	GG	TT	GG	GG	1
Kernal	Pure Bred	AA	AA	GG	TT	GG	GG	2
Super Basmati	Hybrid	GG	AA	GG	TT	GG	GG	1
Pusa Basmati	Hybrid	AA	AA	GG	CC	CG	GG	3
Pak 385	Hybrid	GG	TT	GG	TT	GG	GG	4
Basmati 370	Pure Bred	GA	AA	GG	TT	GG	GG	5
Sherbati	Non-Basmati	GG	TT	CC	CC	CC	CC	6
Taraori (HBC 19)	Pure Bred	GA	AA	GG	TT	GG	GG	7

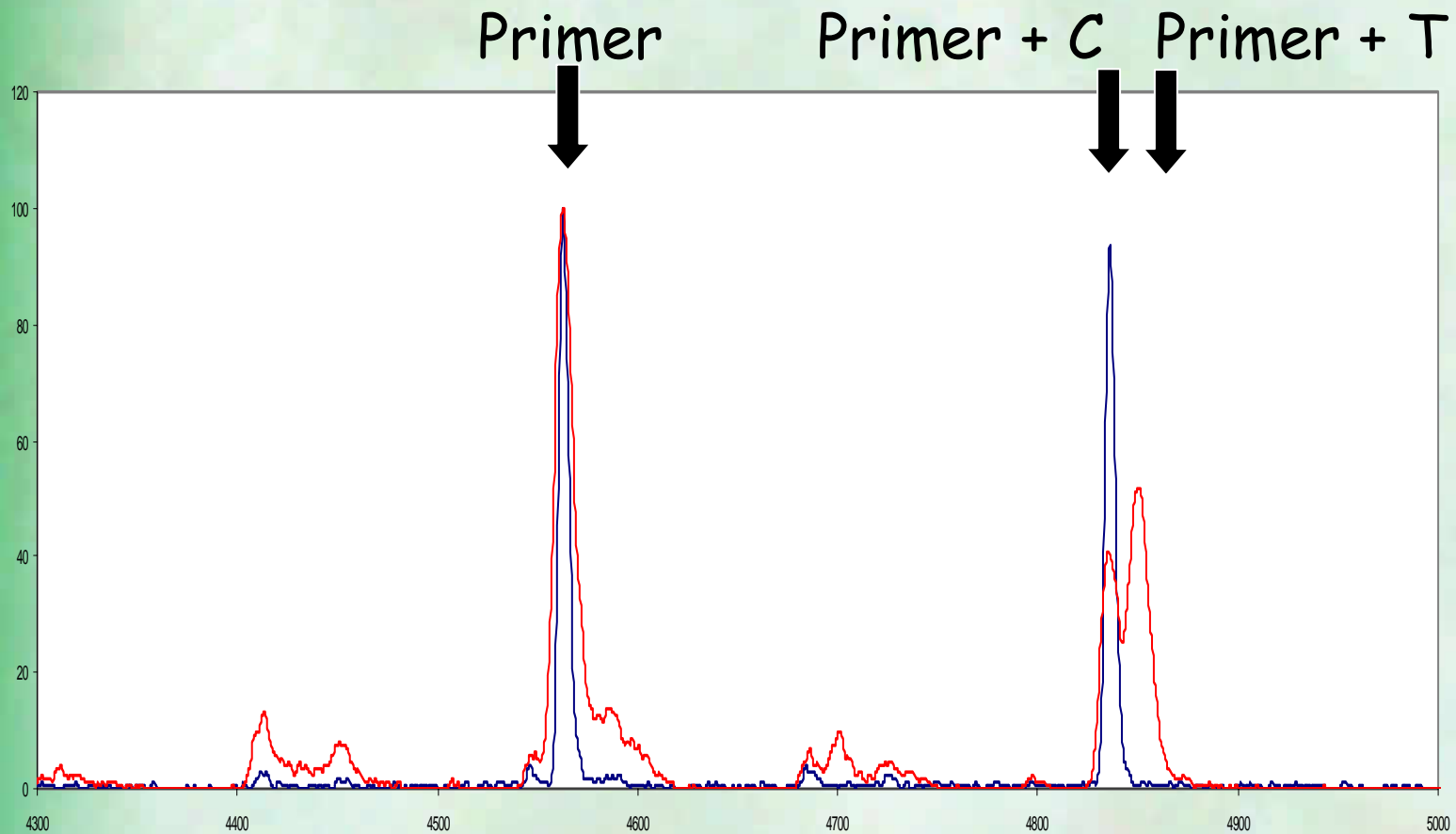


Two stage amplification – PCR around SNP to amplify fragment containing the SNP, followed by clean up. Second stage is linear extension of 3' primer to stop at SNP base. Further clean up and mixed with matrix.

Matrix assisted laser desorption ionisation time of flight MS



# MALDI-TOF MS-Based SNP Genotyping of Basmati Rice



# EMERGING TECHNOLOGY

## 4. Bioinformatics

- Using computers to interpret biological data.

Main use has been to manipulate huge amounts of data from DNA and protein sequence data.

- Barrier to wider use in food authenticity has been lack of genome data for many plants and animals (number of sequences more than doubled between 04 and 06)

# FUTURE NEW TECHNOLOGY

## 4. Bioinformatics

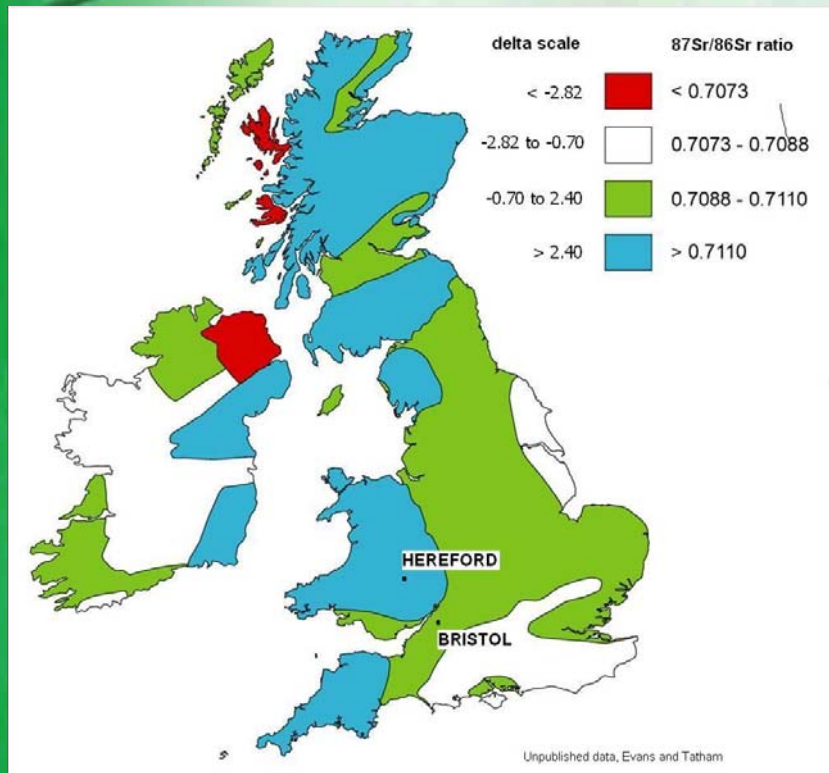
- Identification of markers characteristic of genetic variation between species, or varieties, which may also be linked to geographic origin.

- Analysis of genomic and proteomic data to identify differences in gene types or proteins when comparing similar biomaterials.

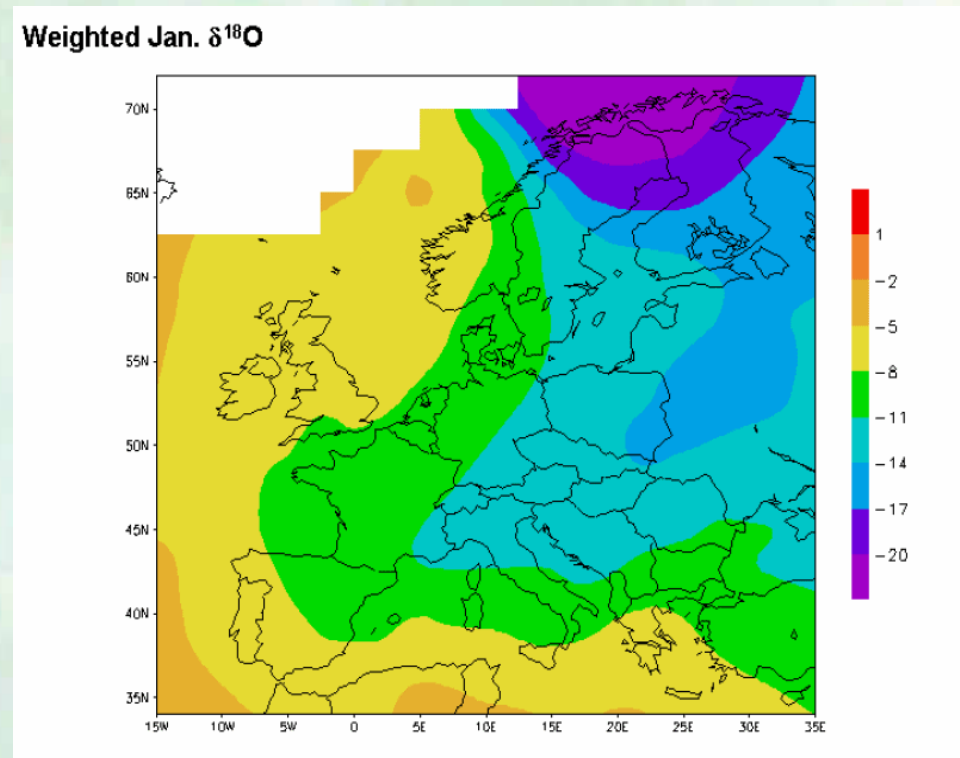
- Provision of software for researchers to analyse own data.

# EMERGING TECHNOLOGY

## 5. Food Mapping



Distribution of Strontium in UK



Weighted mean O isotopes in precipitation, Source IAEA, 2001

# EMERGING TECHNOLOGY

## 5. Food Mapping

- Prediction of isotopic ratios of Sr, light isotopes, trace elements from geographic location, geoclimatic and geological maps

- Use modelling based on data derived from analysis.

- Has worked well for natural mineral waters.

- Will work best where food has closest association location and environment – cereals, lamb, wine?

# THANK YOU



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