



Laboratory trial in Postharvest

## Postharvest Unit at Writtle College

The East of England is a significant region for the agriculture, food and drink sector, accounting for more than £2.9bn of the region's contribution to the UK's GDP and with over 90,000 people employed in food processing and research and development.

The region is home to many household brands such as Perrier, Ferrero and So Good, as well as key players in food processing including Allied Bakeries, Bernard Matthews, Campbells, Premier Foods, Nestle and Del Monte . There are also a number of internationally renowned centres of excellence, providing leading-edge research into different aspects of the food and drink industry, including the dedicated Postharvest Unit at Writtle College.

Writtle College is a partner institution of the University of Essex and based at Chelmsford in Essex. It is one of the foremost colleges in the UK serving the land-based, amenity, leisure and rural industries, with 2,500 full-time equivalent students. The College is a Higher Education Institution, with around 65% of its students on HND, foundation degree, undergraduate and postgraduate courses. It is an independent institution and has worked in partnership with the University of Essex since 1998.

### Research and development

The Postharvest Unit uses modern analytical equipment to carry out research and development into many different produce types – fruit, vegetables, salads and ornamentals (flowers and pot plants).

Dr Chris Bishop is a Reader in Postharvest Technology at Writtle College. He says: 'Our unit focuses exclusively on produce from the moment of harvest to reaching the consumer, with an emphasis on cold storage and international transport. This part of the supply chain is crucial to preserving quality, as currently one third of produce is lost between harvest and sale. We work in conjunction with leading national and international companies including retail suppliers, packaging companies, government bodies, non-governmental industry bodies and other educational establishments.

### The East of England offers:

- **An established network of agricultural suppliers and food processors;**
- **Convenient access to supermarkets and retailers;**
- **Proximity to the markets of London and the South-East, as well as mainland Europe;**
- **A skilled labour pool;**
- **A network of road haulage and logistics providers.**



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# Postharvest Unit

## at Writtle College



Commercial trials of banana packaging

'There is no doubt that the East of England's importance in terms of the food and drink sector is down to its location. Much of the supply chain comes into the region through the ports and airports, giving us a significant geographical advantage.'

Recent trials and research have centred on packaging of fresh produce, energy usage, surface coatings, anti-oxidants, PPO browning, store and packhouse design, ripening procedures, transportation, HACCP and food safety. Examples of recent projects include:

- **Minimal processing of Snap Beans** – investigating the effect of knife sharpness on enzymatic browning at the cut surface of trimmed beans, the interaction between temperature and knife sharpness on enzymatic browning and the behaviour of Snap Beans under modified atmosphere packaging, maximising storage life and enabling alternative transport to be assessed;
- **Postharvest behaviour of grapes** – investigating the effect of packaging and storage conditions, use of postharvest treatments on dehydration and other postharvest aspects;
- **Airfreight transport of perishable products** – Writtle College has been involved with airfreight of perishables in terms of design, refurbishment and management of facilities at five airports in Africa, alongside the monitoring of consignments and training. Work has been funded by USAID, the EU and commercial companies. Writtle staff have written training manuals, conference and

research papers and co-authored a University of California Davis manual.

Simon Hanney, one of the Postharvest Researchers adds: 'During the past year, the Postharvest Unit has provided facilities to test a new biodegradable packaging material for food products. This material, called Starpol 2000®, is biodegradable according to EN 13432 and can be converted into film, bags or food trays. The Unit's facilities were able to test this new material to ensure that it meets the demands of the food sector and our staff expertise was used to contribute to the development of the products.'

'Writtle College Postharvest Unit provided the use of its facilities to Aquasol and its parent company Stanelco plc for the testing of Starpol biodegradable materials through a KEEP collaborative work scheme. Tests undertaken on packaging include tensile tests (BS EN 527-3:1995) and puncture tests (BS EN 14477) conducted with UKAS calibrated and certified Lloyd Instruments, water vapour transmission (BS EN ISO 2556:2001), heat sealing, gas permeability tests and simulating the various conditions within the food supply chain. Starpol 2000® has excellent properties for food usage, as well as for a number of other applications, and the Unit looks forward to seeing products packed in Starpol materials on supermarket shelves in the next few months.'

Some commercial projects require rigorous analysis and evaluation prior to end client acceptance and another member of the Unit Dr Alan Gash is often involved with statistical validation.

Commercial trial – supply chain simulation & ripening of avocados





Vase life trial undertaken with controlled lighting and temperature

## Facilities

The Unit has a comprehensive range of advanced facilities and conditions which can be used as part of analytical scientific testing.

These include:

### Storage conditions

- Cold store (0-15°C) and laboratory fridges (5-15°C)
- Dedicated ambient room for shelf and vase life testing (20°C, controlled humidity, 1000/1500 lux lighting to different time durations)
- Hotbox and Consumer abuse (20-35°C), hot water baths and dry matter ovens

### Controlled atmospheres

- Managed CA conditions via David Bishop Oxstat in sealed vessels: CO<sub>2</sub> atmospheres (0-100%) and O<sub>2</sub> atmospheres via pre-mixed cylinder (0-35%)
- C<sub>2</sub>H<sub>4</sub> (ethylene) free environments (via ventilation or additional scrubbers)

### Measurements

- Acidity – pH by digital measurement facilities
- Colour – Minolta colorimeter measurements (CIE system measuring L, b\* and a\* values)
- Damage – ‘Electronic Potato’ for damage assessments, including such issues as grading and handling systems
- Emotional quality – experienced staff in various disciplines, looking at visual and ‘texture/quality’
- Flesh – destructive and non-destructive methods including Penetrometers (0-13 kg/cm<sup>2</sup>), Shoremeter and an Instron unit
- Packaging testing (including cold storage and shelf life simulations)
  - Modified Atmosphere packaging: measuring C<sub>2</sub>H<sub>4</sub> (ethylene), CO<sub>2</sub> and O<sub>2</sub> via small sample electronic measurement methods and gas permeability
  - Material testing: tensile tests (BS EN 527-3:1995) and puncture tests (BS EN 14477) conducted with UKAS calibrated and certified Lloyd Instruments, computer linked equipment for comprehensive analysis
  - Water vapour transmission (BS EN ISO 2556:2001)
- Relative humidity – monitored during storage period with remote automatic recording probes

- Respiration rate and calculation of weight losses due to respiration
- Temperature – monitored with remote automatic recording probes
- Visual – digital photographs taken to show appearance both individually and for treatment comparisons
- Weight – via electronic balances

## International links

The Postharvest Unit works alone or in collaboration with various international institutions such as UC Davis Postharvest Centre in California or Dem Bosch in the Netherlands on a wide range of projects.

Currently there is a commercial fresh produce packaging company which uses Writtle College for its European trial work and UC Davis for its North American work. This is an excellent example of international cooperation between specialist institutions in the area of packaging of fresh produce. Examples of recent projects include:

**Zambia** – involved the postharvest handling and cold storage of export crops. The EU-supported project involved the Unit working with 19 separate exporters of flowers and high value vegetable crops. Each farm’s postharvest practices were reviewed, followed by the delivery of a short training course and list of recommendations.

**Kenya** – the Unit conducted postharvest training with residential courses for government, NGO and private companies providing some of the background and then demonstrating hands-on practical postharvest procedures.

**Uganda** – the project included postharvest handling and cold chain for cut flowers, with temperature monitoring and postharvest practices evaluation with exporters, focusing on handling procedures and training.

**Egypt** – this EU-supported project involved cold storage and cold chain, with the provision of specific postharvest advice and designs for producers and exporters. The Unit also provided data on existing practices and training seminars.

“ There is no doubt that the East of England’s importance in terms of the food and drink sector is down to its location. ”

Since 2000, staff from the Unit have worked in the countries mentioned above, in addition to Belarus, Ghana, India, Jordan, Mauritius, Nepal, Rwanda, Russia, Sri Lanka, South Africa, Turkey and Ukraine as well as on various projects in the EU.

International students – Writtle College has an excellent reputation with a network of international students which encourages links and joint projects with a variety of countries. Projects have also been undertaken by Commonwealth Supported Scholarships.

Writtle College is a member of i10, a regional collaboration of ten higher education institutions in the East of England. Objectives are to help businesses and other organisations to gain access to, and support for, innovation services required to enhance their growth and development, to promote the capabilities of the region’s universities and to contribute to the economic, social and environmental progress of the East of England.

UKAS calibrated equipment used for measuring mechanical strength of packaging



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Examples of portable Postharvest equipment

#### KEY FACTS

- The Postharvest Unit at Writtle College is an internationally renowned centre of excellence providing leading edge research into different aspects of the food and drink industry.
- The dedicated unit uses modern analytical equipment to carry out research and development into many different produce types – fruit, vegetables, salads and ornamentals (flowers and pot plants).
- An extensive range of facilities are on offer, which can be used as part of analytical scientific testing including storage conditions, controlled atmospheres and measurement criteria.
- The Postharvest Unit benefits from established international links, as well as conducting collaborative commercial work with other similar units. A commercial fresh produce packaging company is currently using Writtle College for European trial work and UC Davis for its North American work – an excellent example of international cooperation.



Writtle College maintains a dedicated Postharvest Unit ([www.writtle.ac.uk/research/postharvest](http://www.writtle.ac.uk/research/postharvest)) with modern analytical equipment to research and develop knowledge into many different produce types. The unit has carried out work in conjunction with many leading national and international companies, including retail suppliers, packaging companies, government bodies, non-governmental industry bodies (e.g. British Potato Council) and other educational establishments.

## Trials Work

The Unit undertakes PhD, MSc, BSc and commercial trials on the evaluation of postharvest techniques, packaging and chemicals, including involvement with major retailers and their suppliers. Trials in conjunction with commercial companies are conducted on a near continuous basis and recent topics include: energy usage, surface coatings, anti-oxidants, PPO browning, store and packhouse design, ripening procedures, transport of cut flowers, HACCP and Food Safety.

## Research Topics & Publications since 2000 have included the following:

- I-MCP (Smartfresh)
  - Tully, Hanney & Bishop (2004); The effect of I-MCP on UK cultivar plum, *Acta Hort* **682** 1579-1584
  - The use of I-MCP in UK Horticultural products (KEEP project)
- Airfreight
  - Thompson, Bishop & Brecht (2004) Air Transport of Perishable Products, UC Davis Postharvest Centre
  - Bishop & Morpeth (2000) Perishable airfreight - out of Africa, some observations. *Outlook in Agriculture* **29** 3 221-224
  - Bishop (2000). Transport aerien de fleurs coupees d'Afrique. *Revue General du Froid*. **1004** 53-56
- Cold Store and "Cool chain" evaluations
  - Hanney & Bishop (2004); Energy usage in onion storage, *Acta Hort* **682** 1617-1624
  - Bishop, Wainwright, & Pailes (2002) Cool-chain - an integrated temperature management system for Fresh produce. *Crop Management and Postharvest Handling of Horticultural Products Vol II*
- Temperature treatments
  - Johnson, Grout, Bishop & Perera (2002) The use of radiant heat to reduce the inoculum level of silver scurf on potato tubers before storage, *Acta Hort* **619**
  - Nyanjage, Wainwright & Bishop (2001) Effects of hot water treatments and storage temperatures on quality and impedance of mango fruits and the use of impedance as an index of assessing fruit quality. *Annals of Applied Biology* **139** p21-29
  - Bishop, C.F.H., Thorogood, A.J., Duran T. & Devres, Y.O (2000) Reduction of potato damage during grading by radiant heating. *Potato Research* **43** p413-426.
- Minimal Processing / Fresh Cut Products
  - Bishop, Grout, Akriovousi & Makwabera (2002) Interactions between knife sharpness and storage temperature on browning at the cut surface of hand trimmed bobby beans (*Phaseolus Vulgaris*), *Acta Hort* **599** pp129-132
  - Various commercial research and reports on a wide variety of minimally processed vegetable and fruit products
- Packaging
  - Bishop & Hanney (2005) Issues relating to fresh produce packaging and disposal (In Press; *Aspects of Applied Biology*)
  - Packaging development and trials work, including modified atmosphere packaging, abuse conditions, returnable packaging, and biodegradable (KEEP Project)
  - Reducing food waste through innovative packaging design, WRAP funded research contract

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