GCSE geography • Know more

WIDE WORLD

April 2016 Volume 27 Number 4

Plan before you write

Managing your exam answers minute by minute

Plus all-new case studies:

- Rio Olympics 2016
- Eco-friendly tomato growing in Norfolk
- Potash mining in a National Park

The UK North–South divide

Can government schemes narrow the gap?

eMagazine now available
(see inside for details)

PHILIP ALLAN FOR HODDER EDUCATION

case study

Sustainable horticulture

Cornerways Tomato Nursery, Norfolk

Why is British Sugar growing tomatoes? This case study of a tomato nursery shows how by-products of one process can be reused for environmental and economic sustainability

Sugar beet is a major crop in eastern England and the British Sugar beet factory at Wissington is the largest in Europe (Figure 1). Apart from producing sugar the refining process also converts much of the waste into other products. For example, as the sugar beet (a root vegetable) is cleaned, the stones and soil that are washed off are recycled for use in building materials and landscaping. The beet pulp left after extraction of the sugar is converted into animal feed. Electricity is also generated by a **combined heat and power (CHP)** plant.

You must be thinking by now 'what has this to do with tomatoes?' Cornerways Nursery, also owned by British Sugar, is connected to the Wissington sugar refinery by nearly 400 km of water and gas pipes. It grows around 140 million 'eco-friendly' tomatoes a year using some of the waste products from the factory.

Inputs, processes and outputs

Economic systems have inputs, processes and outputs. A sustainable system will reuse or recycle waste outputs back as inputs. Figure 2 shows a systems diagram for growing tomatoes at the nursery.

Looking at Figure 3 you can see how the **inputs** are used to grow tomatoes. For example, carbon dioxide (CO_2), heat and water are inputs which help the tomatoes photosynthesise and

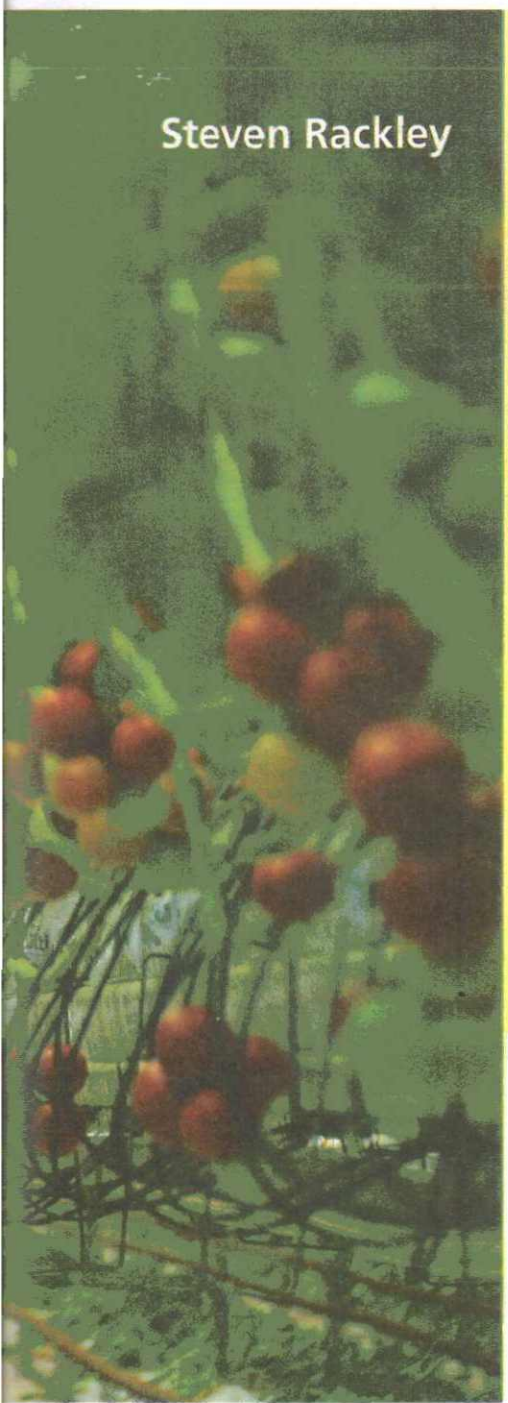


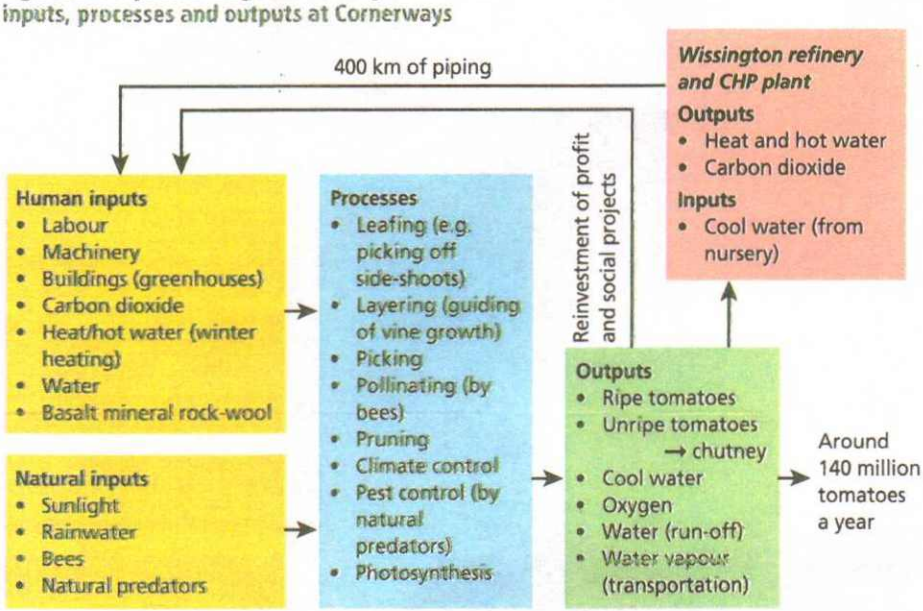
Figure 1 Map showing the location of Wissington sugar beet refinery and Cornerways Nursery

Environmental sustainability

So where does the Wissington sugar beet refinery come into all this? The refinery uses a CHP plant to generate electricity for its needs. Carbon dioxide (a greenhouse gas) produced by such plants usually passes straight into the atmosphere. At Wissington the gas is captured and piped to Cornerways glasshouses as an input to increase the levels of carbon dioxide in the glasshouses and boost the growth of the tomato plants. Another by-product of the CHP plant is hot water, which is also piped to the greenhouses, instead of being cooled in cooling towers. The hot water is used to keep the temperature in the greenhouses at the optimum level, no matter what the time of year.

Perhaps the most impressive aspect of environmental sustainability at the nursery is the use of natural resources. The tomato plants are watered using rainwater collected from the greenhouse roofs, and pollinated by over 8,500 bees housed in 170 'hive boxes' spread throughout the nursery. Natural

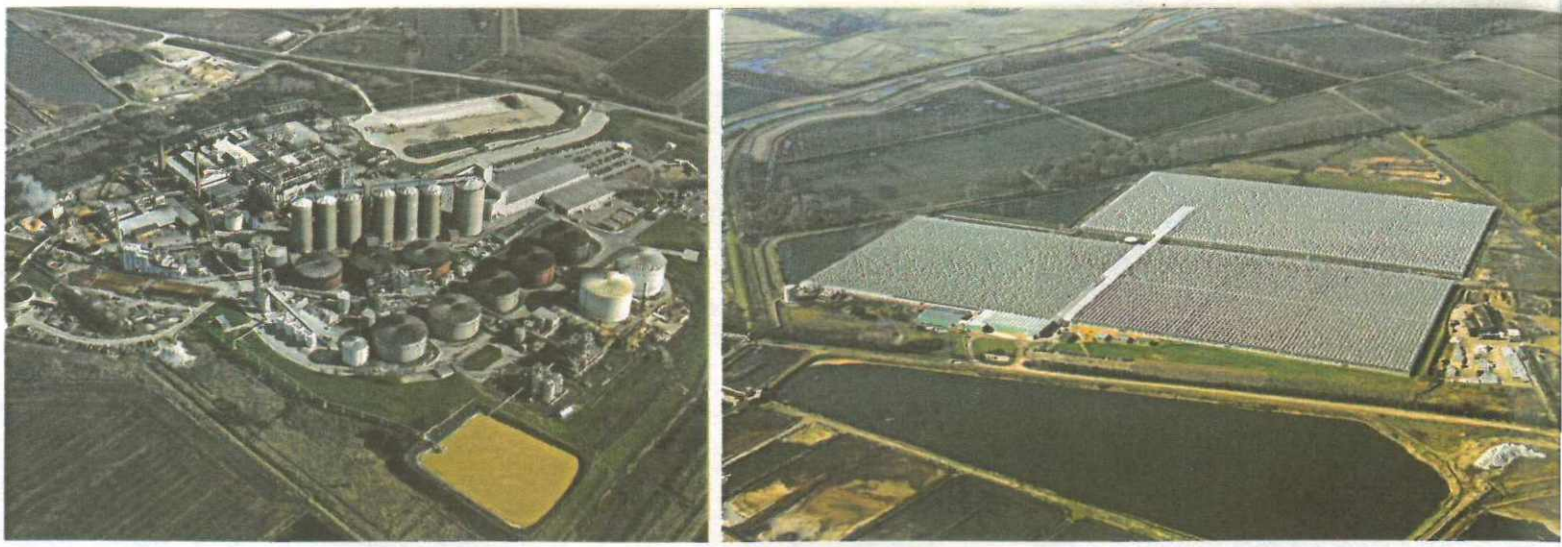
Figure 2 A systems diagram showing some of the inputs, processes and outputs at Cornerways



grow. Tomatoes thrive in a carbon-dioxide concentration of 1,000 **ppm** (normal atmospheric concentration is around 400 ppm) and at a temperature of 18–21°C. These inputs are computer-controlled.

Many of the horticultural **processes** are done by hand. Cornerways employs around 100 staff in winter and 400 in summer when more of the pruning, leafing, layering and picking is done. By November the plants can be up to 13 metres long.

Ripened tomatoes are the main **output**, although Cornerways also makes chutney out of unripened tomatoes.



(Above left) British Sugar's Wissington factory in Norfolk. (Above right) British Sugar's award-winning horticulture business, Cornerways Nursery in Norfolk, produces around 140 million 'eco-friendly' tomatoes each year

predators such as *Encarsia* (a type of wasp) and *Macrolophus* (a bug) control pests such as whitefly. This does away with the need for harmful pesticides.

Economic sustainability

A staggering 12.5 litres of water is needed to grow just one tomato. Using rainwater rather than paying for piped water is therefore economically as well as environmentally sustainable. Excess rainwater is stored for use in periods of low precipitation. Using bees as pollinators and natural predators instead of pesticides also saves money. The combined result of these savings is that since opening in 2001 Cornerways has been able to expand the nursery from one to three greenhouses.

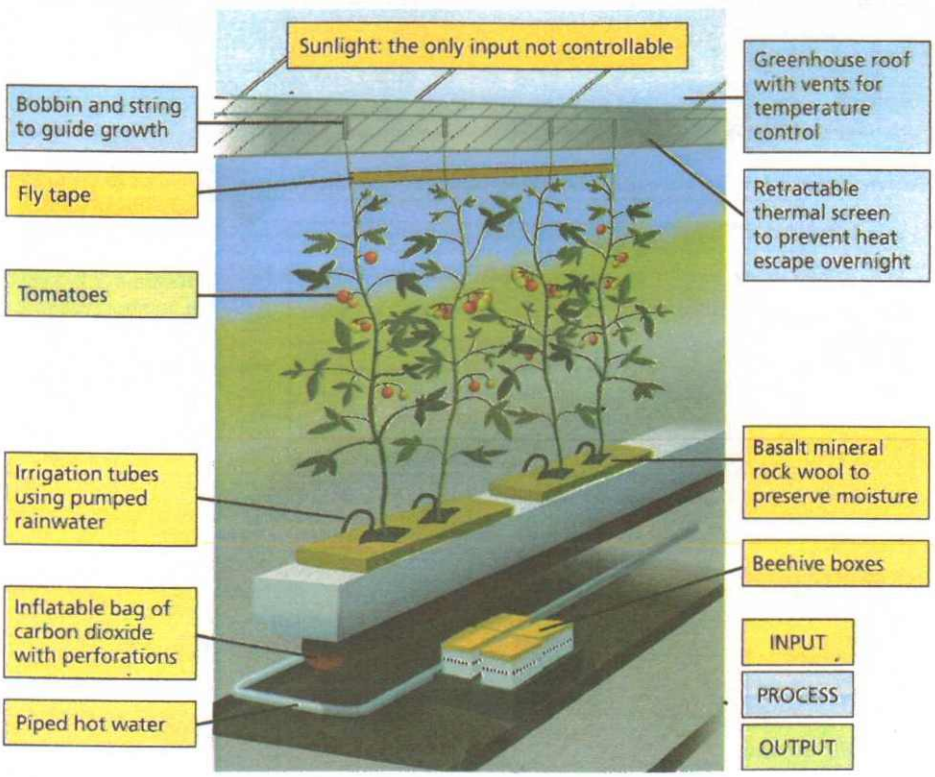
Social sustainability

New ideas do not just come from the managers at Cornerways. Workers on all levels are considered stakeholders in the business and are invited to put forward their ideas. Staff are organised into teams to brainstorm and implement ideas on improving health and safety, engaging consumers and working with the local community. One idea put forward by a member of staff is to farm tilapia fish under the rows of tomato vines. The biological waste from the fish would supply the tomatoes with nutrients.

At the moment only one test tank has been installed to see how this experiment works out.

Cornerways was recognised for its sustainable practices when it was awarded East of England Co-ops Producer of the Year, 2015.

Figure 3 A diagram showing the inputs and outputs to one line of tomato vines



Glossary

CHP (combined heat and power) A way of generating electric power and thermal energy from a single fuel source.

Horticulture The process of growing fruits, vegetables and flowers.

ppm (parts per million) A measure of the level of a particular molecule in the atmosphere out of a million in total.

Further reading

You can follow Cornerways Nursery on Facebook and Twitter. Social networking is one of the ways it connects with its consumers and the community. This would be a great way for you ask your own questions directly.

You can read about Cornerways here: www.britishsugar.co.uk/tomatoes.aspx and access learning resources from British Sugar at: www.britishsugar.co.uk/learning-zone.aspx