Photosynthesis and crop production

To maximise crop production it is important that photosynthesis takes place at its optimum rate. The availability of the raw materials can be increased, if necessary, to ensure that they do not limit the rate of photosynthesis and hence production. It is much easier to control the environmental factors that affect photosynthesis in a glasshouse than in an open field.

Examples of increasing or enhancing environmental factors include:

- increasing temperature
- increasing carbon dioxide levels
- increasing light intensity
- increasing fertiliser applications
- increasing water availability

Figure 6

Increasing any of these environmental factors will increase the rate of photosynthesis if that factor is limiting. Paraffin heaters can be used to increase both temperature and carbon dioxide levels. It is also possible to pipe carbon dioxide into the glasshouse. Water sprinklers and artificial lighting are also frequently used to create ideal conditions. The use of sensors allows the environment to be controlled to within very strict limits. However, enhancing environmental factors has cost implications and maximum profit will be achieved when there is a balance between increasing essential raw materials and increased productivity.

The leaf – the centre of photosynthesis

In most plants the process of photosynthesis takes place in the leaves. Leaves come in many shapes and sizes but to allow photosynthesis to take place efficiently they are usually highly adapted for:

- light absorption
- gas exchange

The way in which leaves are arranged on a plant ensures that each leaf can absorb as much light as possible and that as far as possible each leaf is not in the shade of other leaves. The section through a leaf shown in Figure 7 shows many other ways in which a leaf is designed to aid light absorption and encourage gas exchange.

Light absorption in a leaf is maximised by:

- The short distance from top to bottom which allows all the cells to receive light.
- The large surface area.
- The thin transparent **cuticle** that reduces water loss by evaporation, but does not prevent light entering the leaf.
- The presence of chloroplasts rich in the pigment chlorophyll that absorbs light.
- The regular structure of the **palisade layer**, which ensures that many cells rich in chloroplasts are packed together near the upper surface of the leaf.

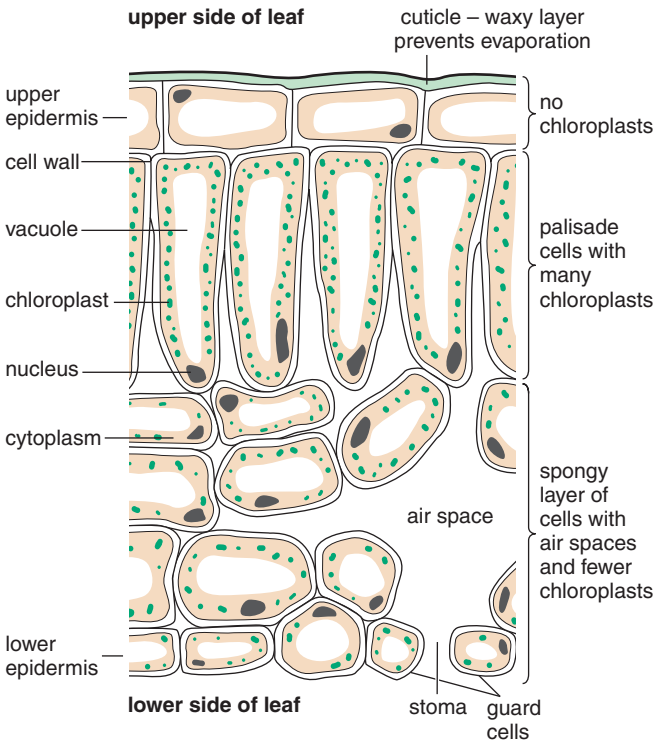

Figure 7 Cross section of a leaf