

(page 1/8)

## Introduction

This resource has been developed by the Soil Association to provide information for teachers and pupils on the key elements of both organic and intensive farming. We hope to provide as balanced a view as possible, but acknowledge that our principal aim as an organisation is to promote the benefits of organic farming.

Organic and intensive farming can be said to be on either ends of a wide spectrum. At one of end of the spectrum, intensive farms produce high yields, which can be sold to consumers at a low cost. In contrast, organic farmers aim to produce food of high nutritional quality whilst taking into consideration animal welfare and the environmental impact of farming activities. In between these two approaches there are many farmers that use a mixture of traditional methods of **animal husbandry** and crop protection as well as some intensive methods.

Farmers are principally involved in growing crops and/or raising livestock. Historically, farms were mixed systems involving both activities. Modern methods of farming have led to intensive systems with farmers tending to specialise for example, farming one species or just growing arable crops. This means that they can take advantage of economies of scale. Organic farms are in the main, still mixed systems where crops and animals are part of an integrated system.

The definitions of words that are *highlighted* can be found in the glossary on page 7.





# **Growing Crops: Intensive farming**

Intensive farmers aim to increase *crop yield*. They do this by artificially maximising plant growth and by using *synthetic* chemicals to provide fertility and control pests and diseases that threaten crops.

#### **Maximising plant growth**

• Use of artificial fertilisers

In order to *photosynthesize*, plants need the following essential elements from the soil: nitrogen, phosphorus and potassium. Nitrogen is necessary for healthy growth of leaves and stems, phosphorus for root and seed development, and potassium for growth of flowers and fruits.

By adding these chemicals to the soil for uptake by plant roots, or by spraying, for uptake through leaves, intensive farmers can artificially stimulate plant growth. Artificial fertilisers are made from fossil fuels. The production of nitrogen fertiliser releases nitrous oxide which is a major *greenhouse gas*.





• Growth regulators

These are used to reduce the length of the plant stem meaning that farmers can use more nitrogen. If these weren't used, too much nitrogen could cause the crop to grow too tall, fall over and then be hard to harvest and spoil the crop.

• Crops

High-yielding crop varieties are used, and farmers use a practice called mono-cropping which means they grow the same crop in the same field year after year. This can be profitable in the short term up to 5 years.

• Large field sizes

Where there are small fields, crops alongside the hedges are sometimes weedier. Rows in the shade of the hedge may be later to ripen than the rest of the field causing the farmer problems when it comes to harvest. Removal of hedgerows has the added benefit of making it easier to use large machinery.



#### Chemical control of pests and diseases

Pesticides

The term *pesticide* refers to substances used to control pests and diseases that can destroy crops. Insecticides are used to kill pests such as aphids or weevils. If the number of insects is reduced more plants survive, therefore increasing plant yield. Herbicides kill weeds. Some are used to clear a field before a crop is planted others work by selectively killing a plant that competes with a crop. Fungicides are used to kill fungi such as mildew which attack crops.

**Pesticides** are most commonly sprayed as a liquid, and can be contact (kill what they touch) or systemic (absorbed by the plant and then the pest/pathogen takes up the chemical from the plant).

Seed treatment

Chemicals are applied to seeds to help to reduce the possibility of infection by disease or by being eaten by pests before germination.

## **Growing Crops: Organic farming**

The aim of organic farming is to create a self-sustaining system. Organic farmers encourage naturally occurring biological cycles and avoid the use of external inputs such as *synthetic* fertilisers or pesticides wherever possible. They work to increase long term *soil fertility* and conserve natural resources such as water.

#### Maximising healthy plant growth

• Adding organic matter to the soil

Organic farmers build soil fertility by encouraging the natural production of the elements essential for plant growth. They do this by adding matter such as composted animal manure to the soil, which is then broken down by *microbes* in order to provide a balanced diet for plants.

• Natural nitrogen

Plants crops such as clover and beans (both from the family of plants called legumes) are "nitrogen fixers". These plants absorb nitrogen from the air and have special **nodules** on their roots that add the nitrogen to the soil. Clover and beans are used as part of **crop rotations** on organic farms.





By rotating plants that add nitrogen to the soil with those that use up large amounts of it, organic farmers are able to maintain soil fertility naturally. An example crop rotation might include grass and clover (two years), wheat (withdraws soil nutrients), beans (give soil chance to recover), oats (withdraws soil nutrients) and finally turnips (less demanding than oats and wheat).

## **Control of pests and diseases**

• Crop rotation

This helps prevent the build up of diseases and pests in a crop by providing a break in the life cycles of the pest by removing 'host' crops for a period of time. **Crop rotations** also help in supporting a more diverse and stable agri-ecosystem which helps in building populations of natural pest-predators. It is key in balancing the fertility building phase with the cropping phase.

• Biological control



- Rather than using **pesticides** to destroy pests, organic farmers encourage natural pest predators. Examples would be ladybirds to eat aphids and birds such as to thrushes eat slugs and snails. In order to encourage these species, organic farmers maintain hedgerows, ponds and field margins, sown flower strips and construct **beetle banks**.
- Use of resistant crop varieties

This reduces the likelihood of diseases occurring. For example, certain varieties of potato are more resistant to one of the main potato diseases called potato blight.

Mechanical control

Selective weeding such as removing weeds in between rows of vegetables is used to maintain healthy plant growth. Special blankets are used to cover crops to prevent, for example, cabbage white butterflies on cabbages

• Pesticide use

There are four *pesticides* which organic farmers are allowed to use as a very last resort to save their crop. These are copper, derris, sulphur and soft soap. They have been selected for their natural origins and the fact that they break down quickly in the environment. For most of them, farmers must get permission from the certification body before they can be used.



# **Rearing Livestock: Intensive farming**

## Increasing productivity



• Stocking rates

Animals are often kept in high numbers in large industrial units. This means that the farm can rear many more animals in less space with less labour. There is limited space per animal and little opportunity for animals to exercise or go outside. As animals use less energy exercising, they have reduced feed requirements.

• Feeding methods

Animals are fed plant or animal protein that leads to quick weight gain ready for sale. High protein feeds are likely to contain *genetically modified* ingredients, for example, soya.



Growth promoters

These are *antibiotics* to make animals grow

faster. Intensively reared chickens now take half as long to reach their slaughter weight as those reared 30 years ago.

• Breeds

Animals are bred selectively to put on weight quickly or yield higher quanities. High performance breeds are preferred as they produce large quantities of meat or milk. 90% of dairy cows are the black and white Holstein breed. These cows can produce up to ten times as much milk as a calf would naturally suckle. Meat chickens have been selectively bred to grow twice as fast as egg-layers.

## **Avoidance of disease**

• Routine use of antibiotics

Hundreds of tonnes of *antibiotic* drugs are used each year on UK farms. Three-quarters of theses are the same as, or very similar, to those used in human medicine. Many farm animals still get daily doses of *antibiotics* in their feed or water in order to prevent possible illness.



# **Rearing Livestock: Organic farming**

• Smaller herd sizes

Lower stocking rates improve animal welfare and help avoid the problems of disease and stress. In smaller herds animals are able to recognise each other and there is less occurrence of bullying – eg tail biting in pigs.

• Feed

Animals are given 100% organic feed where possible. Cows and sheep, known as ruminants are only fed plant based feedstuffs, never food containing meat or other animal products. Animals such as pigs and poultry are permitted a percentage of fish oil and fish meal in their diets. All organic animals must have a predominantly **forage**-based diet – ie grass, hay or silage. Genetically modified ingredients are banned under organic standards.



• Animal welfare

Animals are given access to fields and comfortable bedding. They are allowed to express their natural patterns of behaviour, for example, interacting in family groups. This helps to reduce stress and maintain health.

• Optimising animal health

An emphasis is placed on the continued care and management of animals. Many farmers use *homeopathy* and herbal remedies. Conventional drugs like *antibiotics* are used when required but only to alleviate suffering, not routinely.

• Rotating species

Animals pests and diseases are generally species specific. Organic farms therefore rotate their livestock as well as their crops to prevent the build-up of stomach worms etc in cattle and sheep. Land that has reared chickens may be left for 5 years before the next batch of chickens is grazed on it.



(page 7/8)

# Glossary

Animal husbandry	The branch of agriculture concerned with the management, care and breeding of animals.
Antibiotic	A drug given to animals (including humans) to kill microorganisms such as bacteria.
Arable	Land that is used to grow crops.
Beetle banks	These are grass strips, about two metres wide, that run the length of large arable fields.
Crop rotations	A system in which two or more crops are grown alternately in a field in a set sequence.
Crop yield	The amount of plant crop produced per square metre of land.
Economies of scale	A fall in the average cost of something due to an increase in the amount produced.
Forage	Grasses and other plant material used as feed for livestock.
Genetically modified	When the cellular structure of plants or animals is altered. For example, modifying a plant so that it is resistant to weeds.
Greenhouse gas	A gas that contributes to climate change, because it traps heat in the earth's atmosphere.
Greenhouse gas Homeopathy	A gas that contributes to climate change, because it traps heat in the earth's atmosphere. A type of alternative medicine that uses a tiny amount of naturally occurring substances to treat illnesses.
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Greenhouse gas Homeopathy Microbes Nodules	A gas that contributes to climate change, because it traps heat in the earth's atmosphere. A type of alternative medicine that uses a tiny amount of naturally occurring substances to treat illnesses. A living organism that can be seen only with a microscope. Soil microbes help dead plants and animals to decompose. Lumps that grow on the roots of certain plants such as clover.
Greenhouse gas Homeopathy Microbes Nodules Pesticides	A gas that contributes to climate change, because it traps heat in the earth's atmosphere. A type of alternative medicine that uses a tiny amount of naturally occurring substances to treat illnesses. A living organism that can be seen only with a microscope. Soil microbes help dead plants and animals to decompose. Lumps that grow on the roots of certain plants such as clover. Various categories of poisonous chemicals used to kill pests. Pesticides include fungicides, herbicides, and insecticides.
Greenhouse gas Homeopathy Microbes Nodules Pesticides Photosynthesis	A gas that contributes to climate change, because it traps heat in the earth's atmosphere. A type of alternative medicine that uses a tiny amount of naturally occurring substances to treat illnesses. A living organism that can be seen only with a microscope. Soil microbes help dead plants and animals to decompose. Lumps that grow on the roots of certain plants such as clover. Various categories of poisonous chemicals used to kill pests. Pesticides include fungicides, herbicides, and insecticides. The process by which plants use sunlight, water and carbon dioxide to grow.
Greenhouse gas Homeopathy Microbes Nodules Pesticides Photosynthesis Soil fertility	A gas that contributes to climate change, because it traps heat in the earth's atmosphere. A type of alternative medicine that uses a tiny amount of naturally occurring substances to treat illnesses. A living organism that can be seen only with a microscope. Soil microbes help dead plants and animals to decompose. Lumps that grow on the roots of certain plants such as clover. Various categories of poisonous chemicals used to kill pests. Pesticides include fungicides, herbicides, and insecticides. The process by which plants use sunlight, water and carbon dioxide to grow. The amount of organic matter in soil and how this affects plant growth.



# **Further information**

#### **Other Soil Association briefing sheets:**

Available free from www.soilassociation.org/library

- Organic food and farming: some common questions answered
- Key elements of organic farming
- Inputs in organic farming
- The principal aims of organic agriculture and processing
- How does organic farming benefit wildlife?
- Animal welfare: some common questions answered
- Evidence in support of organic farming
- Soil the importance and protection of a living soil

#### Other organisations and websites:

Agricultural Industries Organisation: www.agindustries.org.uk British Farm Standard: www.thelittleredtractor.org.uk Compassion in World Farming: www.ciwf.org.uk Crop Protection Association: www.cropprotection.org.uk Dairy Council: www.nationaldairycouncil.org Farming and Countryside Education: www.face-online.org.uk Home Grown Cereals Authority: www.flourandgrain.com National Farmers Union: www.nfu.org.uk Linking Farming and Education: www.leafuk.org Meat and Livestock Commission: www.bmesonline.org.uk The Organic Milk Suppliers Cooperative: www.omsco.co.uk

An animated film about factory farming and sustainability issues www.themeatrix.com