FARMING AND WATER POLLUTION

Traditional (extensive) farming methods

These farms operate with a minimum of input from outside the farm e.g. not reliant on purchasing fertiliser or pesticides

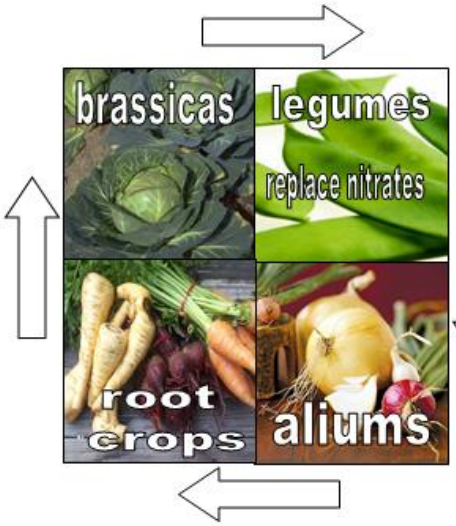
- Produce/yield from the farm is generally used locally
- They use crop rotation
- Organic fertiliser
- Wide crop variety
- Mixed livestock

Use of a wide variety of crops

Maintains biodiversity

- A monoculture with all the same crop reduces biodiversity of plants grown, and of supported animals and habitat
- Also the whole crop could be lost by a single pathogen/disease or pest
- With polyculture (wide crop variety) these problems are reduced – although profit may also be reduced

Use of crop rotation



each crop takes slightly different minerals from the soil and some e.g. legumes return nitrates

Use of crop rotation

- Reduced risk of development of mineral deficient soils
- Reduced risk of problems with pests e.g. potato blight can live in the soil for 5 years

Use of mixed livestock

traditionally
cows ⇨ milk
sheep ⇨ wool
pigs ⇨ meat
chickens ⇨ eggs

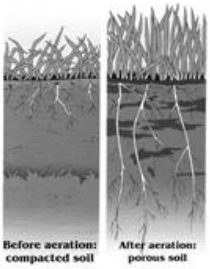
Use of organic fertiliser

Farmyard manure, horse, cattle, chicken

Advantages of organic fertiliser

- Improved soil crumb structure and therefore improved soil aeration and drainage

provides spaces for roots to grow through and oxygen for respiration for Active Transport of minerals



Intensive farming methods

Developed in 1950s to increase yields. This required high outside input and manipulation of the land

- Monocultures were grown as farms specialised in one type of crop
- Many problems were encountered which led to it not being sustainable

Sustainable farming Methods!

There is a need to produce food through farming. This food must also be produced cheaply so that a profit can be made. However, the environment also needs to be protected so that food production can continue into the future i.e. be sustainable

- Polyculture
- Use of organic fertilisers
- Hedgerow planting
- Use biodegradable plastic
- Ploughing across slopes
- IPM

Problems of agricultural pollution in Northern Ireland

Advantages of organic fertiliser

- Reduced risk of eutrophication of water bodies

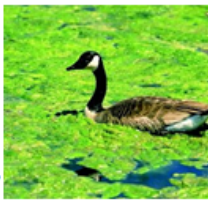
Eutrophication

- Eutrophication is the natural mineral enrichment of water bodies such as Lough Neagh and Lough Erne
- Minerals include nitrates and phosphates and come from rock erosion and run off from the surrounding area
- Lough Neagh and the Erne waterways are naturally eutrophic

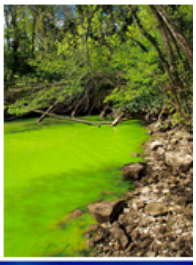
- However, a major source of nitrate input into Lough Neagh and the rivers of the Lough Erne catchment is lowland agriculture fertiliser run off
- **Nitrates and Phosphates** come from artificial fertilisers (NPK) and Phosphates from household waste water and detergents (used in washing powders etc as a brightener), although these can be removed in sewage works
- N and P can **"leach"** (come out) of the soil fertiliser and can **"run off"** (be washed) into waterways
- Products of decomposing organic matter can also be inputted into waterways

Eutrophication sequence…

1. Algae use the excess minerals (**N and P loading**) to grow rapidly producing algal blooms (particularly cyanobacteria/blue-green algae)
2. This reduces the transparency of the water so that **algae** and plants below are unable to obtain sufficient sunlight for photosynthesis and die
3. Algae have a short life span as they quickly use up the available nutrients and die, resulting in large amounts of decomposing plant material which releases unpleasant odours



4. Decomposers such as **bacteria use oxygen** from the water as they **respire** while breaking down the dead algae
5. This **increases the BOD** (biological oxygen demand) of the water
6. As there is less oxygen available for organisms such as invertebrates so they die, **this** impacts on their predators e.g. fish which die and consequently there is a **decrease in biodiversity** in the lake
7. This has resulted in the loss of fisheries and health risks from contamination of drinking water by high N levels and toxic algae, which are costly to remove



Organic pollution:

Can occur through slurry and silage effluent, and from washings from dairies and papermill waste products

- Slurry is a solution of faeces and urine usually collected from animals kept in sheds. It is stored in silos and added to crops as a fertiliser

•Silage is grass that has been preserved to feed ruminants. Unlike hay it is moist and is partly fermented by bacteria, acidic conditions maintain the nutrients in the grass. It is stored in silos but the liquid formed, called silage effluent, may leak into rivers and streams

QUs...

- What effect do you think slurry and silage effluent will have on BOD values in water bodies?
- How will this effect flora, fauna and biodiversity in water bodies?

Figure 36 The discharge of organic matter into a river causes changes in (a) oxygen levels and BOD,

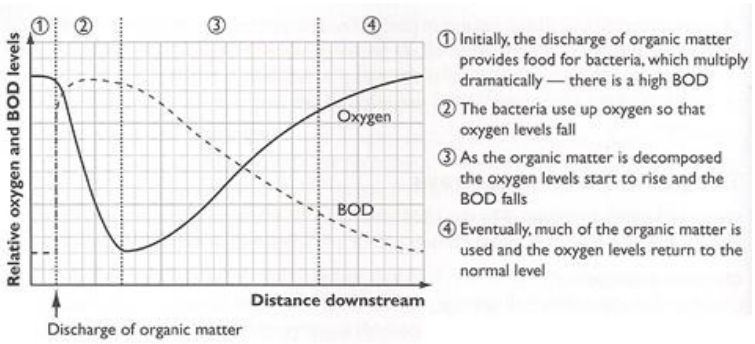
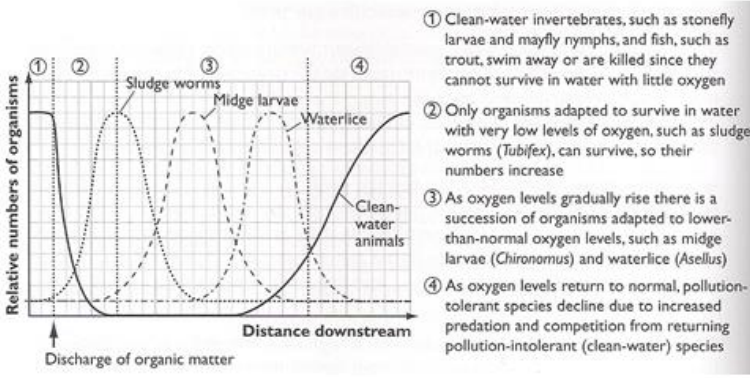


Figure 36 The discharge of organic matter into a river causes changes in (b) the distribution of organisms in the river



Issues with slurry application include:

- Need for optimal soil/weather conditions to minimise the risk of pollution
  - Slurry needs to be broken down in the soil by decomposers to release minerals directly to the roots
  - Soil temperature and pH will affect the rate of decay and slurry can be washed away through the soil

- **Therefore should not be applied**
  - When soil is waterlogged. This is when water appears on the surface of the land when pressure is added
  - When land is flooded or likely to flood
  - When soil has been frozen for 12 hours or longer
  - When land is snow covered
  - If heavy rain is forecast within the next 48 hours
  - Where land is steeply sloping with an average incline of 20% or more and where other factors such as waterways, soil conditions, ground cover and rainfall presents a significant risk of water pollution occurring

Issues with slurry application include:

- The need for 'closed periods' when slurry is not applied
  - It should be applied when growth is optimum
  - No application is allowed from 15 October to 31 January.

- Nitrates and Phosphorus Regulations NI

http://www.dardni.gov.uk/index/fag/nitrates-and-phosphorus-regualtions-2007-questions.htm#closed_period_for_organic_fert

Monitoring of water bodies

- Indicator species are organisms that, by their presence, abundance, lack of abundance, or chemical composition, demonstrate some distinctive aspect of the character or quality of an environment
- In water bodies aquatic invertebrates are commonly surveyed as indicators of water quality and the health of aquatic ecosystems e.g. mayfly larvae are intolerant of pollution

- *Tubifex* or 'sewage/sludge worms' are almost always associated with water quality that has been degraded by inputs of sewage or other oxygen-consuming organic matter such as slurry or silage effluent (usually organic pollution – they are detritus feeders)

- *Tubifex* worms can tolerate severely oxygen deprived water, in contrast with most of the animals of unpolluted environments, such as mayflies (Ephemeroptera) and stoneflies (Plecoptera), which require well-oxygenated conditions

Caddis fly - As nymphs, they need well oxygenated water

Stoneflies

Strategies to reduce the risk of eutrophication in water bodies due to leaching of artificial fertilisers

- Careful application of levels so that 'supply does not exceed demand' in the target crop
- Only apply artificial fertiliser immediately prior to or during periods of vigorous plant growth
- Do not apply artificial fertiliser when heavy rain is forecast
- Do not apply artificial fertiliser adjacent to water bodies

Governmental guidelines exist which must be followed in the application of organic and artificial fertilisers

DARD NI Code of Good Agricultural Practice for the Prevention of Pollution of Water

EC Nitrates Directive Action Programme
(NI is a total territory designation for this EC Nitrates Directive)

Understand that sustainable farming depends on the effective management of the conflict between increased food production and the need for environmental conservation

See cut and stick...