

# Cropping Programmes and Rotations



*Winter wheat crop.*

## Developments in Cropping Systems and Rotations

Historically, it was essential to grow different crops in a sequence. This was mainly in order to maintain soil fertility but also to restrict problems caused by the build-up of:

- Weeds;
- Pests;
- Diseases.



*Weeds in spring barley crop.*



*Diseases.*



*Pests in spring beans.*

As a result, farmers adopted a cropping sequence or rotation (or several different rotations on different parts of a farm) determined by:

- Soil type;
- Climate;
- Weed, pest and disease problems;
- Crop markets.



*Forage maize on a dairy farm before reseeding.*

Most farms carried a mixture of livestock and crops resulting in reliance on a fairly wide range of both saleable crops and livestock feed, and providing both grazed and housed livestock to supply/cycle nutrients in the form of manure.

Gradually, farms became more specialised with livestock often disappearing from crop growing farms because of lower profitability, lack of specialist labour and a tendency to want to specialise in one form of agriculture.



*Forage maize silage fed to livestock.*



*Large arable farm in Pembrokeshire.*

High cereal prices in the 1970s and early 1980s encouraged farmers to move towards growing cereals year after year on the same land – these were often high input systems since crop nutrients largely came from bought-in fertilizers and weed, pest and disease control were carried out chemically. Reduced cereal prices from the mid 1980s forced some farmers to diversify to a certain extent in order to reduce growing costs and to try to capitalise on better prices for non-cereal crops. Generally, ‘new’ (often very simple) rotations were introduced.

The future is very difficult to predict and will be influenced by a large number of different factors:

- Crop prices e.g. increased national wheat acreage following high 2007 prices – this may see farmers constantly changing their cropping practice in response to market volatility;
- Input costs – the high costs of fertilizer, crop protection chemicals and fuel may shape cropping practice;
- Particular farming systems or practices e.g. Agri-environment schemes, low input and/or organic systems and adoption of integrated crop management all favour or even rely on the adoption of crop rotations to a greater or lesser degree.

### Break crops



*Plantain and clover.*

These are crops grown in between consecutive ‘main’ crops (usually wheat or barley) in order to:

- Break the cycle of weeds, diseases and pests associated with the main crop/s – pests, diseases and even weeds are closely associated with specific crops;
- Allow cultural/cheaper chemical control of weeds;
- Improve soil conditions
  - Soil structure – due to crop root growth, cultivation systems and season of sowing and harvesting;
  - Soil organic matter – due to the return of crop residues or animal manures if the crops are grazed or fed to livestock;
  - Soil nutrients – especially nitrogen following nitrogen fixing crops;

- Spread workloads (different sowing and harvesting dates) and pressure on machinery and crop handling and storage facilities;
- Spread risk
  - The impact of crop failure would be huge if only one or two crops were grown;
  - Marketing – more than one crop allows the risk of poor prices in any one year to be reduced;
- Increase returns/profitability
  - Direct – better returns from another crop;
  - Indirect – residual benefits e.g. soil nutrients and structure leading to better yields and fewer weeds, diseases and pests leading to reduced growing costs for subsequent crops.

### **Advantages of crop rotations**

- Increased profitability – a wider range of crops to sell, higher yields, lower inputs;
- More variety/interest – different crops have different management requirements;
- Environmental advantages – greater habitat diversity etc.



## Disadvantages of crop rotations

- Over-complication leading to poor husbandry – workload clashes, poor understanding of a wide range of crops;
- Weaker marketing position when selling small quantities of a wider range of crops;
- Failure to justify machinery etc – e.g. potato and sugar beet harvesters.



## Typical break crops (for cereals)

### Traditional

- Grass/fodder – grass 'leys', especially those that were kept for 2 or more years, have always been viewed as the best break crop because of the weed, pest and disease break provided and the improved soil fertility, soil structure and soil organic matter levels left behind;
- Potatoes;
- Sugar beet;
- Vegetables;
  - Roots e.g. turnips, swedes,
  - Alliums e.g. onions, leeks,
  - Brassicas e.g. cabbage, cauliflower, broccoli, sprouts.



## “Combinable”

- Another cereal – other cereals e.g. oats, rye or triticale can provide a break for the main cereal;
- Oilseed rape;
- Peas;
- Beans;
- Linseed.



## How crops may or may not fulfil their role as a break

### Oilseed rape (advantages)

- Breaks the cycle of common cereal pests, diseases and weeds;
- Leaves the soil in good condition – good rooting system, early harvest;
- Is drilled and harvested at different times from cereals and spreads the workload;
- Effective herbicides are available for the control of problem weeds.

### Linseed (disadvantages)

- Often leaves a legacy of weeds (few herbicides available);
- Often harvested late – limited opportunity to sow the following crop early enough to get good establishment and a worthwhile yield.

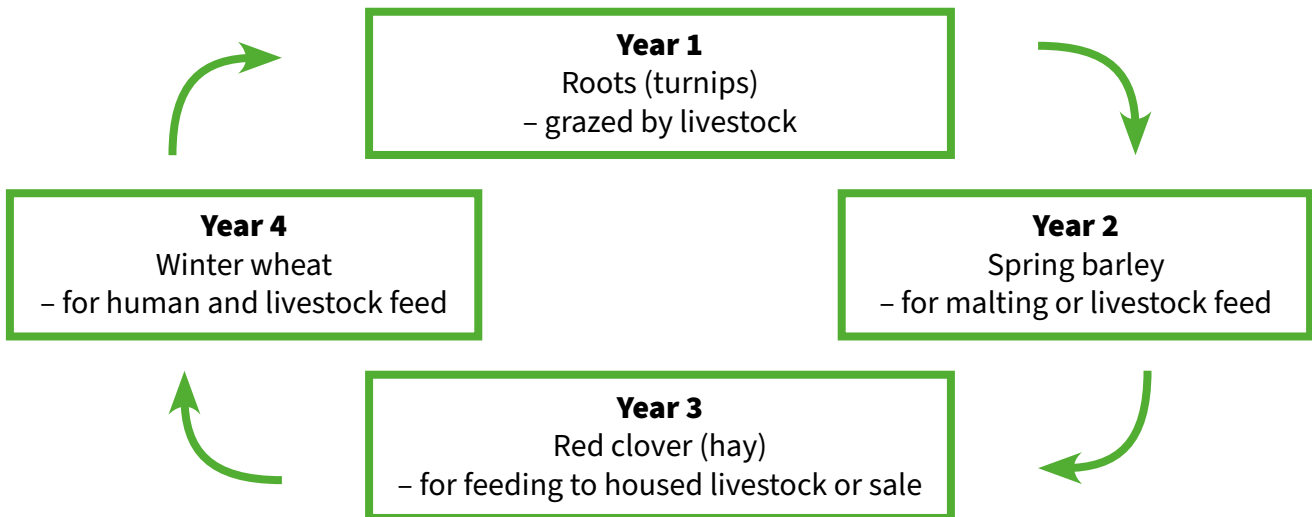
## Designing crop rotations

Crops need to be complementary

- Agronomically “sound” – “break”, exhaustive/restorative;
- Not problematic from a management perspective – timeliness, clashes, storage, sale.

## The Norfolk Four Course Rotation

This was first documented in 1730 by “Turnip” Viscount Townshend of Raynham. Up to this time a ‘fallow’ year, when no crop was grown, was one of the few options available in order to reduce the incidence of pests, weeds and diseases and replenish soil fertility.



The two cereals were the exhaustive crops while roots (due to the return of manure from grazing animals) and red clover (due to nitrogen fixation) would be restorative.

The four year rotation allowed for three clear years between growing the same crop on the same field and provided sufficient break in the life cycle of most pests and diseases. Red clover would smother weeds while weeds could be controlled easily by manual or mechanical hoeing in the root crops since they would be grown in well spaced rows.

Over the years rotations developed to suit different growing conditions, crops and farming systems.

### A ‘traditional root crop’ rotation

<b>Year 1</b>	<b>Potatoes</b>
<b>Year 2</b>	<b>Winter wheat</b>
<b>Year 3</b>	<b>Winter wheat (“second wheat”)</b>
<b>Year 4</b>	<b>Sugar Beet</b>
<b>Year 5</b>	<b>Winter wheat</b>

**A more modern ‘combinable’ crop rotation** – harvested (and often cultivated and sown) with the same machinery

<b>Year 1</b>	<b>Oilseed rape</b>
<b>Year 2</b>	<b>Winter Wheat (“first wheat”)</b>
<b>Year 3</b>	<b>Winter beans</b>
<b>Year 4</b>	<b>Winter Wheat</b>
<b>Year 5</b>	<b>Peas</b>
<b>Year 6</b>	<b>Winter Wheat</b>
<b>Year 7</b>	<b>Winter Barley</b>

## Example rotation 1 (5 years – heavy soil)

**Winter beans → Winter Wheat (2) → Winter Oilseed Rape → Winter Wheat**

- Two break crops, two first wheats (higher yielding and likely to be of better quality) and a second wheat crop (slightly lower yielding and of poorer quality but still usually highly viable);
- Two high yielding (low input) wheat crops without build up of take-all disease;
- Break crops are affected by different sclerotinia stem rots, therefore 5 year break;
- Winter beans fix nitrogen.

## Example rotation 2 (5 years – mixed farm)

**Grass ley (2) → Winter Wheat (2) → Oats**

- Two years of grass build up fertility and improve soil structure;
- No take-all build up since oats are affected by a different species;
- Pest problems could arise where wheat follows grass.

## The role of Set-aside (non-cropped areas)

The EU has set a default level of 10% of arable land which has to be taken out of arable production on a ‘permanent’ or ‘rotational’ basis (although the level adopted has been lower than this in recent years and was set at zero in 2008). Rotational set-aside allows:

- A ‘fallow’ year to be built into the farm’s rotation i.e. a year when no crop is grown;
- For the least profitable crop to be replaced with set-aside;
- For certain field margins/headlands to remain un-cropped.

## Cropping rotations/programmes

### Continued importance:

- Integrated crop management – the principles of minimising chemical inputs and capitalising on natural processes place heavy reliance on crop rotations;
- Organic farming – rotations are an essential component of what are often viewed as ‘balanced’ systems.

Huw Jones from Fferm y Bryn farm discusses the importance of drop rotation.

