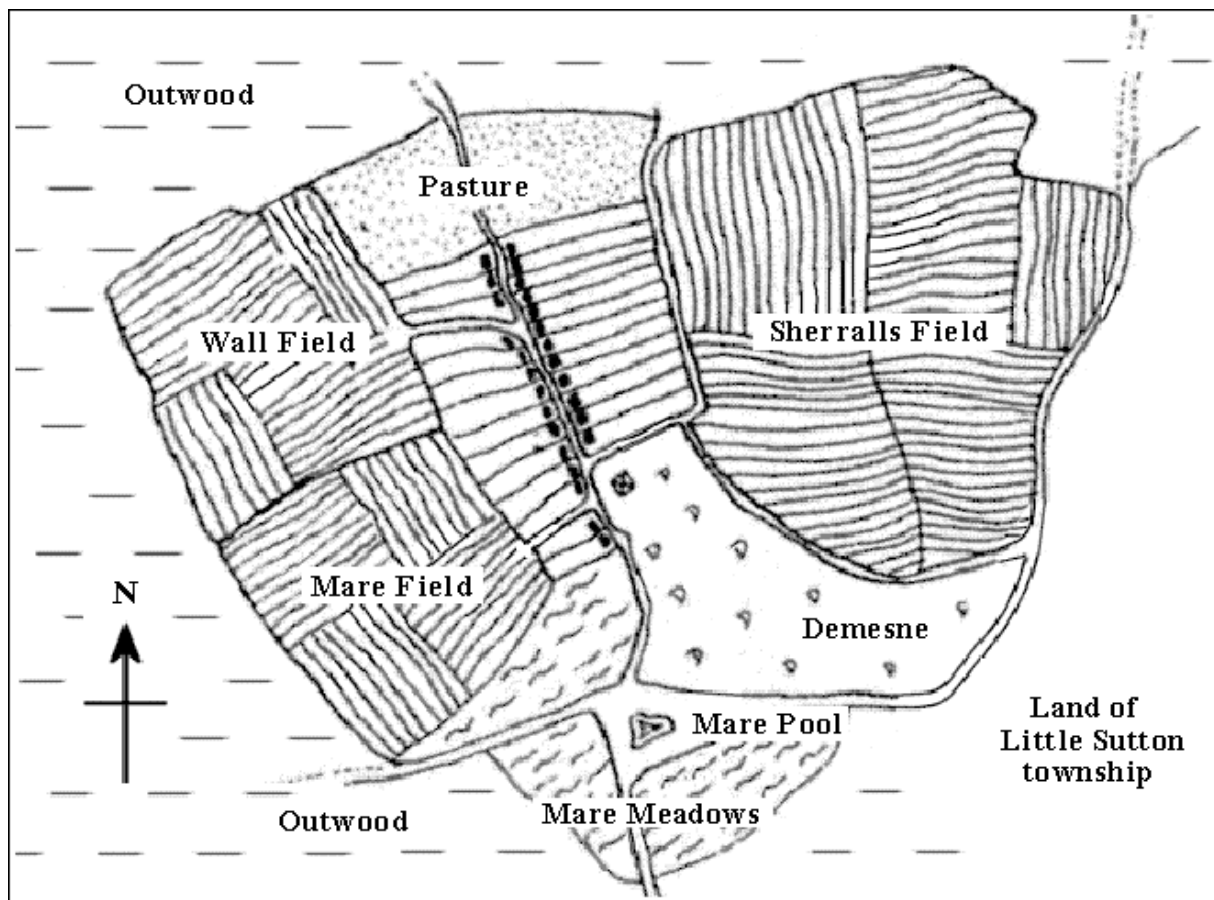


# Crop Rotation

In medieval times, although large areas of the country were owned by the king, the land was commonly granted to a local lord of the manor or other country nobility, often in return for providing men when they were needed for battles. The manorial lord or nobility would often reserve a part of this land, the demesne, for his own use, before the remainder of the cultivated land surrounding the village was divided into three approximately equal areas. These formed the fields of the 'open field system' of land cultivation, an early form of crop rotation. The fields were subdivided into many narrow strips, typically one furlong (220 yards) long (the distance a team of oxen could plough before resting) and 22 yards wide, each strip covering one acre (the amount a team of oxen could plough in one day). Each peasant would be allocated a number of strips distributed around the three open fields, an attempt to ensure that they all had an equal chance of having good or poor soil.



*Schematic map of Hill Village, based on the road and field names of the Corn Map of 1824, to show how the fields may have existed in the eleventh century.  
(based on details in the "Story of Sutton Coldfield" by Roger Lea.)*

## ***The Three Field System***

Although the peasants cultivated the strips, they were not free to decide what to grow. Instead, they would have to comply with a common cultivation system that followed a preset routine. One of the open fields would be sown with winter wheat or rye in the autumn, a second sown with barley or oats in the spring, and the third remaining fallow or uncultivated to recover. Livestock would be restricted to the common land or fallow during the summer but were given access to the open fields to forage after the crops had been harvested. Here their dung provided a small amount of manure to replenish the nutrients, artificial fertilisers being unknown at that date. Unfortunately for the peasants, in some areas the manorial lord would specify that the village livestock were to be penned on the demesne at night, thus gaining the greatest amount of animal dung.

In the autumn, many of the animals that had not been sold to butchers during the spring or summer would have to be slaughtered, there being insufficient fodder to maintain them through the winter. The fallow area would be ploughed and sown with wheat or rye, then in the spring, the second field would be ploughed and barley, oats, beans or lentils would be sown. The remaining area was left fallow. Although the open field system was a very basic crop rotation, only about two thirds of the cultivated land was being used for growing crops.

### *A Surviving Example*

Laxton, a small village approximately four miles east of Ollerton in Nottinghamshire, still cultivates a part of the village land using the medieval open fields system, the last example surviving in Britain. The three fields are cropped in rotation, winter wheat in one field, spring barley, oats, peas or beans in a second field, with the third field originally remaining fallow. However, with a decline in stock numbers, and an amendment to the rules, since 1967 the fallow area has been used to grow a forage crop of grass that is harvested as hay. It has also become necessary to make some compromises to meet the demands of modern agriculture. The old ridge and furrow system, originally created by single furrow ploughs drawn by oxen or horses, also provided channels for field drainage between adjacent strips. The corrugated effect that this produced over the fields has now disappeared, ploughed out by modern tractors pulling multi-furrowed reversible ploughs, with the drainage being provided by underground tile drains or perforated plastic piping. The narrow cultivated strips, often of just one acre, are no longer practical and have been combined into much larger and flatter areas to allow the use of modern agricultural machinery.

### *The Norfolk Four-course Rotation*

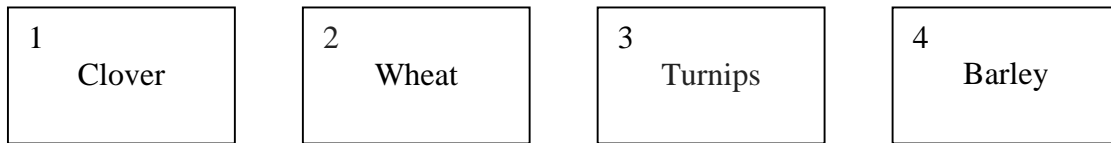
In Europe alternative rotation systems were being used, even in the 16<sup>th</sup> century. A Flemish one was based on a four year cycle, adding turnips and clover to the wheat and barley. Although the Romans were familiar with turnips, and they were being grown in Britain in the reign of Henry VIII, they were usually confined to gardens. This changed when Charles Townsend (1674 – 1738) retired from politics in 1730 and, living at Raynham Hall in Norfolk, devoted his time to improvements in agriculture. He was a keen advocate for growing turnips within a rotational system, so much so that he soon gained the name of ‘Turnip’ Townsend. Many varieties of white or yellow globular rooted turnips were grown, especially on lighter land, but were prone to being damaged by prolonged frosts. Swedes, or Swedish turnips are usually larger but are slower growing and need earlier sowing to produce the harder textured yellow globular root, often purple coloured around the top. They are able to resist colder weather more successfully and in Scotland, in addition to being fed to livestock, they become the ‘neeps’ to accompany the ‘tatties’ and haggis on Burns night.

The rotation that Townsend adopted was the Flemish one, later becoming known as the ‘Norfolk four-course rotation’. This had clover, wheat, turnips and barley as the four crops grown in rotation. The inclusion of clover as a forage crop and turnips as a root crop removed the need to have an area devoted to fallow. The availability of winter forage allowed many more animals to be kept through the winter and permitted the establishment of large flocks or herds of animals.

In Norfolk, where sheep were common, wool was an important source of wealth. Worstead in Norfolk, the origin of the name for worsted cloth, has a large village church that was built from the wealth produced by the local wollen industry. More locally, approximately two miles west of Rocester, Staffordshire, are the impressive ruins of Croxden Abbey, originally founded in 1179 by twelve Cistercian monks from Normandy. With grants of land in Cheshire, Derbyshire, Leicestershire and Staffordshire, the monks became prosperous sheep farmers, and by 1315 were exporting more wool to the continent than any other religious house in the county.

It was not only sheep that benefitted from the availability of winter fodder. Cows could be overwintered to provide a more plentiful supply of milk that could also be used to produce butter and cheese.

If we imagine four fields in the first year of a four year rotation, we will have the following:



1. Clover, a legume, has nitrogen-fixing nodules on the roots. The top growth would be harvested during the summer and dried for winter feed, then sheep allowed to forage on the remainder, their dung providing some additional nutrients.
2. Wheat was grown on the land enriched by the nitrogen from the clover roots and the sheep dung.
3. Turnips would follow the wheat. These could be lifted and stored for winter feed or the livestock were allowed into the field in autumn to feed on the turnips, their dung providing another nutrient source.
4. Barley was grown in the fourth year following the turnips.

Over a four year period, the fields would be cropped as in the table below.

	Field 1	Field 2	Field 3	Field 4
Year 1	Clover	Wheat	Turnips	Barley
Year 2	Wheat	Turnips	Barley	Clover
Year 3	Turnips	Barley	Clover	Wheat
Year 4	Barley	Clover	Wheat	Turnips

Year 5 would then repeat year 1 and the rotation begins again.



*Photograph of demonstration plots of clover, wheat, turnips and barley grown in the display cage in 2014.*

It is now highly unlikely that the original Norfolk four-course rotation is still being used anywhere on a commercial scale, although a demonstration rotation may still be grown at Acton Scott Historic Working Farm in Shropshire. As the economic benefits of growing some crops decrease, and others increase, the crops within the rotation will change. Crops such as potatoes, sugar beet, peas, beans, oilseed rape and maize need to be included, usually as replacements for some or all of the turnips and the clover. An updated version of the Norfolk four-course rotation could begin with peas or field beans, both legumes, to replace the clover, with wheat in the second year. Potatoes or sugar beet could be grown as replacements for the

turnips, with barley, or in some wetter locations, oats, in the fourth year. Alternatively the rotation length can be modified to suit individual requirements. One local dairy farmer uses a simple three year rotation of wheat, barley or oats, and maize, all being grown as feed for the livestock. Permanent or semi-permanent pastures provide grazing during the summer, with the dung and straw bedding from the winter housing being composted before distribution onto the arable fields. Rotations can be extended, even up to six or more years, often including two years of wheat in arable areas. In areas with more livestock, grass and clover may be kept for two or more years before it becomes necessary to revert back to an arable rotation. However, the soil conditions and any special machinery requirements must always be considered. Maize requires different machinery for sowing and harvesting compared to those used for wheat, barley or oats, while other specialised machines are required for potatoes, sugar beet and other root crops.

### ***The Advantages of Crop Rotation***

There are many advantages to using crop rotations for growing crops, whether on a large commercial scale or on a smaller allotment or garden scale.

### ***Improving the Supply of Nutrients in the Soil***

Different types of plants require different nutrients for their growth but by growing different crops in rotation, each is better able to obtain the required nutrients. If the same crop is grown repeatedly in the same location, some nutrients will become diminished and the crop quality will deteriorate. Even using a four year rotation, it was soon discovered that growing turnips on the same piece of land could result in the area developing a 'turnip sickness'. The problem could be avoided by growing alternative root crops, such as potatoes, and restricting the area to growing turnips to only every third rotation, or twelve years. Some plants are shallow rooted, such as barley, turnips, white clover and potatoes, while others, such as wheat, oats, red clover and mangels, have roots extending much deeper into the soil and are therefore capable of obtaining nutrients from deeper soil levels not reached by shallower rooting plants.

### ***Controlling Pest and Diseases***

Many plants have pests or diseases that are specific to that plant or related plants. Without a rotation, these can build up to become a limiting factor in the cultivation of the crop. When a different, non-related crop is grown, the pest or disease will be unable to find the required host plant and will die. Oilseed rape has become a common crop in recent years, as seen by the large areas of yellow flowers in the spring. It is frequently grown as a break crop between years of cereals, the cereal diseases being unable to survive during the years when O.S.R. is grown. In the Shenstone and surrounding areas, parsnips are a common crop, grown on land owned by the grower or rented from farmers requiring a break year within a cereal rotation system. The specialised machinery and facilities required for soil preparation, sowing, lifting, processing and packing are all provided by the grower, with the final product distributed widely to retailers, markets and supermarkets throughout the country. In some other areas, especially in East Anglia, peas are often grown within a rotation. Harvesting is done by travelling contractors with the product quickly transported to central locations for processing and freezing. On the lighter lands of Lincolnshire and the Brecklands of East Anglia, onions and carrots are common crops, although often relying on irrigation systems.

Some crops are grown with the rows of plants widely spaced while others, such as wheat and barley, are grown with the rows close together. Selective herbicides can be used on cereals to control broad leaved weeds but account for the loss of poppies, corn cockle, corn marigold and cornflower, all plants once common in cereal fields. Wider spacing between plants allows weed control by mechanical means, methods that are not possible with closely planted crops. Within an allotment or garden environment, where most of the crops are grown in widely spaced rows, hoeing or hand weeding can be used for weed control.