



Barley

CROP PRODUCTION

Around 60% of the Scottish cereal crop is spring barley. Spring barley is sown from mid-March and harvest starts at the end of August – a growing season of 5 months. Winter barley is sown in September and harvested in August the next year – a growing season of 11 months.

Once the grain is harvested, the straw (dried stems) can be baled and used for animal bedding/feeding.

Where the straw is not baled, it is chopped up into small pieces and ploughed back into the soil.

PRODUCTS and USES

Barley is the most common arable crop grown in Scotland used for malting (making whisky) and making animal feed.



CROP PRODUCTION

Winter wheat has a growing season of up to 11 months. It is sown in September/October and harvested in September the following year. Spring wheat is sown from March onwards and harvested in September – a growing season of 7 months.

Once the grain is harvested, the straw (dried stems) can be baled and used for animal bedding.

Where the straw is not baled, it is chopped up into small pieces and ploughed back into the soil.

PRODUCTS and USES

There are two planting times for wheat in Scotland – winter and spring.

Winter wheats produce soft grains and spring wheats produce harder grains. The type of grain produced determines what it is used for.

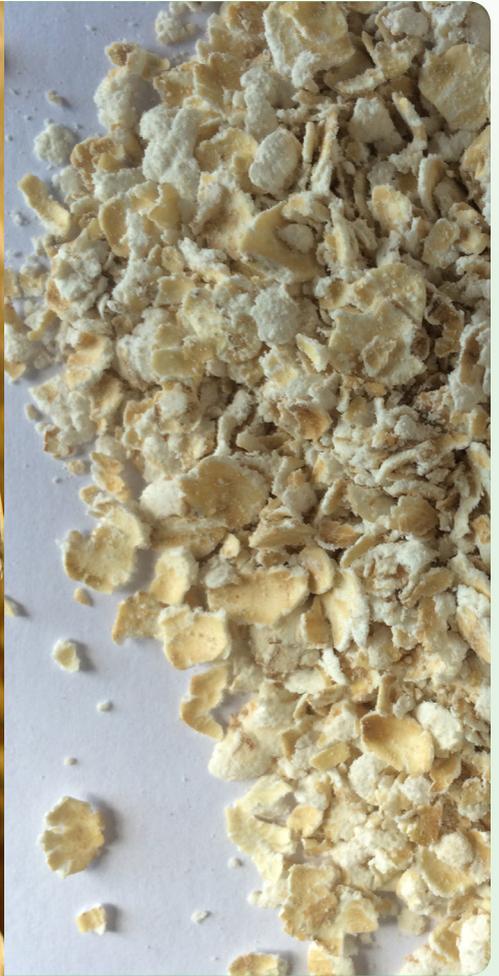
Hard wheats have a higher protein content than soft wheats and so produce more gluten; soft wheat has a larger percentage of carbohydrates and less gluten-forming protein.

The wheat grown in Scotland has three main uses:

1. The majority of the wheat crop goes to distilleries where it is malted and made into beers and spirit. Farmers growing wheat for the distilling market grow winter wheat varieties as soft grains are required.
2. 20% of the wheat is used in animal feeds. This tends to be the poorer quality grain. This helps farmers fatten beef cows and pigs, feed chickens so they lay eggs and provide energy for dairy cows to produce milk.
3. The remaining 5% is milled in Scotland where it is bulked up with imported grain. These hard grains from spring wheats provide the flour we use to make bread, cakes and cereals.

The weather and the markets in Scotland determine the varieties which are grown in Scotland. There is ongoing research to breed new hard milling varieties.

When you buy a loaf from the supermarket the majority of the wheat used to produce the flour will have been imported. The wheat comes from Canada, United States, Russia and Germany.



Oats

CROP PRODUCTION

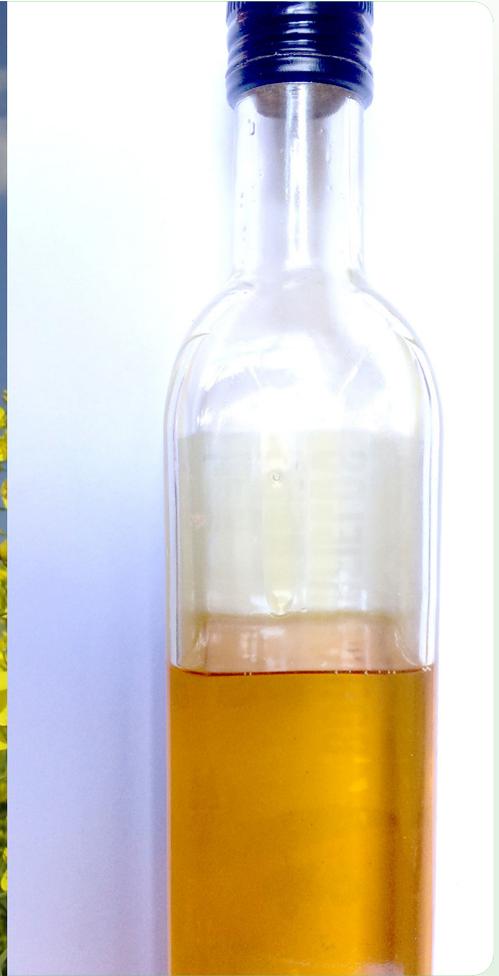
Winter oats are sown in September and harvested in August – a growing season of 11 months. Spring oats are sown in March and harvested in September – a growing season of 6 months.

Once the grain is harvested, the straw (dried stems) can be baled and used for animal bedding.

Where the straw is not baled, it is chopped up into small pieces and ploughed back into the soil.

PRODUCTS and USES

Once milled, oats are steamed, heated and cooled in a kiln. The oats are then rolled, cut or ground to produce flakes, oatmeal or flour. These oats are used in porridge, breakfast cereals, breads, flours and beauty products. Oats can also be used as animal feed.



Oilseed Rape

CROP PRODUCTION

Oilseed rape, which creates the fields of yellow flowers seen over spring and summer, is a member of the brassica family.

Farmers often grow oilseed rape as a break crop to help manage disease and break up the soil with its deeper root system.

Winter oilseed rape is sown in August and harvested the following August – a growing season of 12 months.

The crop grows to around 1m in height and, after the flowers have bloomed and died, the plant produces pods. These look like long thin pea pods and they contain the seeds the farmer wants. The pods need to ripen before the crop can be harvested. The rape stalks are quite tough and do not make good straw, so are usually chopped up and returned to the soil.

PRODUCTS and USES

The small black seeds are crushed to produce oil for cooking or biofuel. Oilseed rape oil is one of the healthiest oils used in cooking because it is low in saturated fat.

Oilseed rape is high in polyunsaturated fat, which can help promote good heart health and lower the risk of heart disease and obesity.



Potatoes

CROP PRODUCTION

Scotland produces both seed potatoes and ware potatoes. Seed potatoes are potatoes which are harvested and then used to grow more potatoes. The Certifying Authority for seed potatoes in Scotland is the Science and Advice for Scottish Agriculture (SASA) and farmers work hard to keep disease free potato status. Ware potatoes are those grown for human consumption.

Main crop potatoes are planted in April for harvesting in September/October. Early varieties are planted slightly earlier in February. Potatoes are significantly impacted by the weather. They also need to be regularly checked for blight (a disease which kills the leaves), aphids, nematodes (small worms which eat the potato tuber) and treated or sprayed accordingly.

PRODUCTS and USES

Potatoes are sold as they are harvested, after washing, as new potatoes. However, the majority of the potatoes harvested go into storage and are kept in cool conditions in large warehouses and released for sale throughout the year to ensure a year round supply.

They are also used in a wide range of products like pre-packed foods and dried to provide a powder which can be used in a range of food manufacturing processes. Potatoes are also used to produce vodka, which is a more expensive method than using grains where the majority of vodka comes from.

SEASONALITY

Scottish potatoes are available throughout the year, as they are stored in large warehouses in the dark, where the temperature is kept cool to prevent sprouting. They are released onto the market on demand. The new potato season begins in May/June.



Field Vegetables

CROP PRODUCTION

A range of vegetables are grown in Scotland including carrots, beetroot, parsnips, turnips, swede, Brussels sprouts, cabbages, cauliflower, kale, peas, beans, leeks, maize and onions. These are generally grown on a contract as they are high value crops for human consumption. They are rotated round the farm and are planted in different fields each year to stop disease building up. Some of these crops are grown specifically to feed livestock over the winter for example turnips and swede may be planted to feed sheep, they might eat the turnip in the field or have it brought to them indoors. Legumes (peas and beans) are good at increasing the fertility of the soil as they can fix nitrogen.

Vegetables may also require irrigation (watering) and care needs to be taken when cultivating the soil to avoid soil blowing away.

Harvesting vegetables requires either human labour or specialist harvesting machinery which involves significant investment. As the vegetables are produced on a very large scale, precision farming helps ensure efficiency. Precision farming focuses on using satellites, yield maps and a range of other technology to minimise input of seed and fertilisers whilst maximising vegetable output.

PRODUCTS and USES

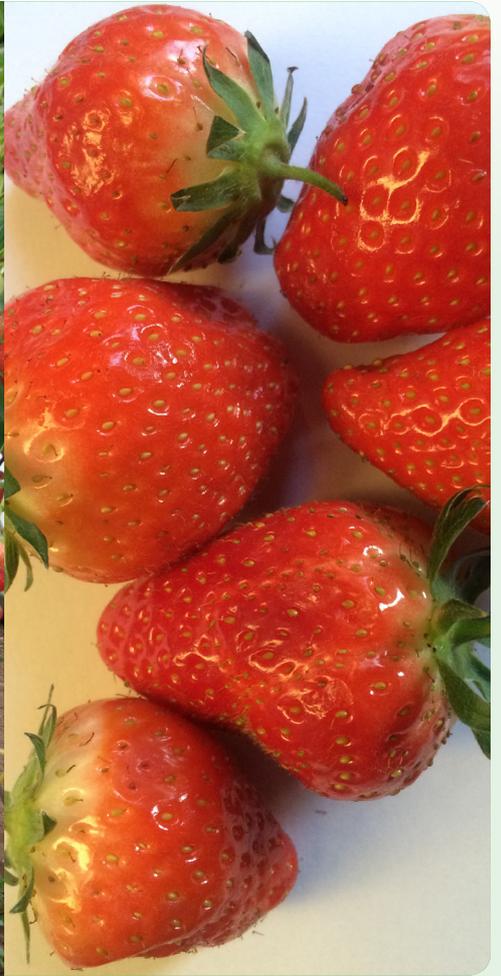
Mis-shapen vegetables are quite a common occurrence and are regularly rejected by supermarkets and often go into animal feed. As well as being found in the fruit and vegetable section of the supermarket, vegetables are frozen and used in processed foods and smoothies. Some vegetables are juiced and available to drink like beetroot and carrot juice. Vegetables are also used as natural colouring for foods (e.g. beetroot gives a red colour) and as sweeteners (e.g. carrot juice in breakfast cereals).

SEASONALITY

British carrots are available in the shops for around 11 months of the year, from early to mid June when the new British season starts right through to May.

Out of season, carrots may come from China (the world's largest producer), Russia, US, France, Poland or Ukraine.

(see the Food and Farming Calendar for more information on the seasonality of field vegetables in Scotland)



Soft Fruit

CROP PRODUCTION

A range of soft fruit is grown in Scotland with the key soft fruits being raspberries and strawberries. The majority of fruit growing is concentrated in the East of Scotland due to the climate. Fife, Angus and Perthshire are the production hotspots for strawberries in Scotland. The soft fruits are grown in poly-tunnels which help maintain a constant temperature throughout the growing season (March – September). During the winter months the plastic from the polytunnels is rolled back. This is done for 2 key reasons – it stops the winter weather damaging the plastic and it lets the frost build up, which helps minimise disease.

Blueberries are also grown in Scotland. The climate in Scotland means that the fresh blueberries are ripening during a blueberry gap – this is when the rest of the northern hemisphere has finished production before the southern hemisphere starts production. This provides a premium price for the berries.

PRODUCTS and USES

Strawberries and raspberries are sold in punnets. Strawberries and raspberries are also frozen as berries, canned, freeze dried and used in smoothies, cereals and products like cheesecake and ice-cream.

SEASONALITY

Scottish strawberries are available from May through to October. If you buy strawberries out of season they come from Spain, Holland, Jordan, Morocco and Egypt.



Tomatoes & Herbs

CROP PRODUCTION

Tomatoes are grown in Scotland undercover in glasshouses. The glasshouses are heated as the weather is often not sunny enough to ripen the tomatoes. The Clyde Valley area used to be the hub of tomato growing in Scotland, but tomato growing in Scotland has scaled back significantly due to the costs involved in production and the large volumes of tomatoes which are imported from countries like Spain.

There are pros and cons with importing tomatoes. On the positive side tomatoes grown abroad do not need extra heating as the sunshine does the ripening. However, they still need to be exported to Scotland. Home grown products do not have to be transported, but they do need extra heating.

Tomatoes grown in Scotland are being grown traditionally in soil as well as hydroponically. Hydroponic growing involves growing without soil. The seedlings grow in perlite or coconut coir which is free draining. A nutrient solution is dripped through the material the tomato grows in and the plant absorbs what it requires and the rest flows away.

PRODUCTS and USES

Tomatoes grown in Scotland are available as they are picked either on the vine, or in punnets. Imported tomatoes are also available as loose products but are also preserved through tinning and drying. Tomatoes can be juiced and are used in a wide variety of packaged meals for example lasagne.

SEASONALITY

Scottish tomatoes are available from April/May till October/November. Out of season, tomatoes are imported from Spain where the climate remains warmer. Here they are grown in poly-tunnels. The imported tomatoes have a journey of approximately 1,000 miles. They are picked before they are ripe to ensure they are not damaged prior to shipping.



Forestry

PRODUCTION

There are trees, woods and forests distributed across Scotland. They provide places for recreation, for habitats for other plants and animals and timber for our use. There are two types of trees – coniferous trees and deciduous trees.

Coniferous trees have needle like leaves which they keep all year round, with the exception of larch which turns orange and drops its leaves when the weather turns colder in autumn. Coniferous trees tend to be planted commercially as they grow quickly and produce timber that we need. Scots pine, larch, spruce and firs are all coniferous trees.

Deciduous trees drop their leaves in autumn time and include species like beech, oak, rowan, birch and lime.

Different trees provide home to different types of wildlife and are planted for different reasons. Scots pine, the national tree for Scotland, forms the basis of the Caledonian forest; Oak trees have specific species of parasitic wasps associated with them; and Birch trees are early pioneers in the succession from moorland into woodland.

PRODUCTS and USES

Sustainable Forest Management is the way foresters plant and grow trees for the wide range of benefits they provide us. When trees are felled they are stacked in the forest before being collected and taken for processing.

Timber is used for a range of different products including house building, furniture making, making fence posts, paper and wooden barrels. There are a growing number of businesses and households using wood as a fuel in biomass systems. Sustainably produced timber, provides thousands of jobs and contributes tens of millions of pounds to the Scottish economy. Felled trees are replaced by planting 3 new ones to ensure our forests into the future.

Trees lock up carbon through photosynthesis and this helps combat climate change.

Trees, woods and forests provide a range of different habitats for a wide range of plants and animals, from mosses to badgers. They are great places to visit for either a dog walk in your local wood or mountain biking in one of the forests around Scotland. Forestry is also an important recreational resource within the landscape.



Case Study Silage (1 of 2)

WHAT IS SILAGE?

Silage is grass that has been 'pickled'. This helps to ensure access to grass for livestock over the winter. The grasses are cut and then fermented with the aim of maintaining nutrient levels (sugars and proteins). The fermentation is carried out by microscopic organisms living in the grass. The process must be carried out under acidic conditions (around pH 4-5) in order to keep nutrients and provide a form of food that cows and sheep will like to eat. Fermentation at higher pH results in silage that has a bad taste, and lower amounts of sugars and proteins.

PREPARATION

First, the field must be cut when the grasses contain their highest nutrient levels. This is usually just before they are fully mature. This is important because all forms of preserved grass, such as hay and silage, will have lower amounts of nutrients than fresh pasture, so everything must be done to make the end product be as nutritious as possible.

Grass is allowed to wilt in the field for a few hours to reduce the moisture content to around 60-75%.

This moisture level will allow for optimum fermentation. If the grass is left out longer, it may get too dry, or it may get rained on - and both these will reduce proper fermentation. Also, the longer the grass is left uncut, the higher the loss of nutrients.

Some farmers cut the grass into even smaller pieces and then compact it to get out as much oxygen as possible (this is important because the microorganisms, called lactic acid bacteria, that are needed to carry out the fermentation like living in oxygen-free environments). If the silage is to be stored piled in a large pit, tractors and other machinery are usually driven over the grass pile until it is firm. If the silage is stored as bales, the baling machines will compact the grass as they work.

The next step is to seal the compacted grass with plastic to keep oxygen out. Mounds of silage are covered with huge polythene (plastic) sheets and weighted down to ensure maximum compacting; bales are covered with a plastic wrapping that is recycled in Scotland when it is removed.



Case Study Silage (2 of 2)

THE PROBLEM WITH OXYGEN

Removing and keeping out oxygen is a key part of making silage. This is because fermentation has to happen under anaerobic (oxygen-free) conditions, or the correct type of microorganisms won't grow.

While oxygen remains, plant enzymes and other bacteria and microorganisms react with the plant sugars and proteins to make energy, reducing the amounts of these nutrients in the grass.

Once all of the oxygen is used up, lactic acid bacteria start to multiply. These are bacteria that are needed to make the silage, and they turn the plant sugars into lactic acid. This causes the pH to drop (the mixture becomes more acidic). Once the pH is around 4-5, the sugars stop breaking down and the grass is preserved until the silage is opened and exposed to oxygen.

If the pH isn't low enough, a different kind of bacteria will start fermenting the silage, producing by-products (like ammonia) that taste bad to cows and sheep.

SILAGE EFFLUENT

When grass is fermenting it produces a liquid called 'silage effluent'. This effluent can be a great water pollutant if it escapes into the watercourse. To avoid pollution accidents silage has to be stored and handled properly. The volume of effluent produced can be reduced by ensuring the grass is not excessively wet. The grass silage can also be mixed with other feeds like barley or sugar beet to absorb the moisture and reduce the effluent produced.

Activity Make Your Own Silage (1 of 2)

RISK ASSESSMENT

Making silage is a fantastic way to demonstrate functioning of microorganisms. However please be aware that silage made incorrectly can be a source of bacteria, mould and fungus.

To ensure you make good quality silage you need to harvest only clean green grass and most importantly the bags you pack it in need to have all the air squashed out and be sealed very well. You should wrap the grass at least three times.

Hazard	Who could be harmed	Severity	Likelihood	Overall risk	Precautions and control measures	Rating (with controls)
Poor quality silage	All	High	Low	Medium	Storage of silage in an oxygen free environment – making sure the grass is well wrapped in several bags and sealed well; protected from damage whilst fermenting. Cut good quality living grass that is free from dead material; wilt rapidly to reduce the increase in mould and yeast numbers in the field. Silage to be kept outside	Low
Personal hygiene and safety – silage disease causing agents*	All	High	Low	Medium	ALL TO WEAR DISPOSABLE GLOVES AND WASH HANDS Washing facilities to be sorted prior to event	Low
Contamination caused by cuts, sores, boils and dressings.	All	Medium	Low	Low-Medium	Use of plasters and wearing gloves.	Low
Food contamination caused by bacteria spread by illness	All	Medium	Low	Low-Medium	No participant feeling sick or unwell to get involved. No participant suffering or recently recovered from sickness, diarrhoea to get involved.	Low

Activity Make Your Own Silage (2 of 2)

MAKE YOUR OWN SILAGE

You will need:

- Freshly cut grass
- A roll of heavy duty bin bags
- Duct tape
- Weights
- Steps

Steps

- Fill one of the large bin bags with the grass.
- Compress the grass as much as possible when filling to remove any remaining air.
- Seal the top with duct tape and then put the sealed bag inside another bag and seal. Follow this with a third bag and seal. Make sure that it is well-sealed to keep all air out.
- Use a weight (wood for example) on top of the sealed bags to compact the grass. Fermentation could be finished anywhere from 2 weeks to about 45 days.

Notes

- The optimum moisture content of your fresh grass when making silage is 60-70%. You can test this by taking a clump of grass and tightly squeezing it into a small ball in your hand, then letting your hand

open up. Ideally, no water will come out of the ball when you squeeze, and when you open your hand the ball will slowly fall apart. If water comes out when you are squeezing the grass, the grass is too wet (the moisture content will be over 75%) and it must be allowed to dry a bit more. If the ball falls apart immediately when you open your hand, it is too dry and some water should be added.

- Good fermentation has taken place if the silage smells fresh and fruity, and is yellow-brown or green. Silage is bad if it smells rotten or has any black, slimy parts.

Varying factors

A number of bags can be made at the same time and comparisons made between the silage produced at the end

Possible variables include:

- The length of the grass used : long versus short
- The quantity of grass in the bag
- Moisture content
- Length of fermentation time before opening the bag
- Leaving the bag unsealed (This will allow fungal and other bacterial growth, resulting in compost rather than silage).



Case Study Nairn's Oatcakes (1 of 2)

INGREDIENTS

One of the ingredients we harvest in Scotland is oats.

Once oats are harvested and cleaned, they can be made into different grades of oatmeal. Some of this oatmeal is processed into oatcakes.

Oats arrive in the Nairns factory from Hogarth's mill in Kelso, in the Scottish Borders. Currently all the oats Nairn's use come from the Scottish side of the border. The mill provide four main grades of oatmeal: fine, medium, roughcut and pinhead, with pinhead being the coarsest grade.

As well as oats, oatcakes also contain a few other ingredients, including fat. The fat used in the oatcakes is sustainable palm oil which is imported. This fat is used in preference to locally produced rapeseed oil, as it is stable and does not go rancid (off) when stored, which can happen with rapeseed oil. Palm oil has a high percentage of saturated fatty acids (49%).

Some of the reformulation work (where recipes are adapted) has involved Nairns starting to use a blend of sunflower / palm oil in some selected recipes to reduce the saturated fat content in the final oatcake.

For flavoured oatcakes, additional ingredients are used in the recipes. These are imported from around the world: currents come from Greece; ginger from China; chocolate from the USA; and cheese for the savoury oatcakes from Denmark.



Case Study Nairn's Oatcakes (2 of 2)

PRODUCTION

In the Nairn's factory, there are two production lines where the ingredients are mixed and the oatcakes formed, baked and packaged.

There is one production line which runs 24 hours a day producing plain oatcakes.

The second production line makes the different flavours of oatcake biscuits. The flavoured mixes go through a similar process as the plain oatcakes but when they reach the packing stage there can be a variety of different packing operations depending on pack size and format.

Step 1 is mixing. This involves blending the oatmeal with the other ingredients in a gentle process designed to cause minimal damage to the oats.

Step 2 is rolling. After blending, the dough is then rolled out into a sheet (much as you would do with at home with a rolling pin). It is rolled several times and with each roll it becomes thinner.

Step 3 is cutting. Once the dough reaches the required thickness it goes under a cutting roller which cuts out the round oatcakes, the biscuits are separated from the

cut out dough, which is diverted back to the start of the process and gets used again. This minimises waste.

Step 4 is baking. The raw oatcakes, travel through a hot oven at a temperature of 300°C for almost six minutes. This reduces the moisture content from 30% to less than 0.5%. At this point the biscuits are very hot and have to be cooled down. The cooling happens by sending the oatcakes on a slow trip round the factory on conveyor belts.

Step 5 is packing. The packing process uses robots with minimal manual input. Initially the oatcakes are wrapped in airtight plastic pouches in batches of seven. Four pouches are then packed into a cardboard carton. These are the boxes you will see displayed for sale on the shelves.

Step 6 is transportation. The cartons are packed into larger outer cases, loaded onto pallets and wrapped in cling film before they are ready to leave the factory. They are then sent around the country and overseas.