



Who owns the plants you eat?

The vegetables we eat are the results of thousands of years of selection by growers.

Plant breeding is the science of producing new plants with desirable traits such as larger size, better nutrition, more resilience to pests and disease. Plant breeding is practised by all sorts of people worldwide, from individual gardeners to large global companies who produce the seeds that are used to grow the plants you buy at the supermarket.

Why breed plants?

Plants found in the wild are very diverse and possess some traits that are desirable to humans along with others that are not. For thousands of years, people have intelligently selected plants with

desirable traits to breed with each other over many generations. This process of selection and breeding by man is called artificial selection.

Today's cultivated plants are easier to eat or digest, taste better and are more nutritious than their wild forebears. An example of this is the maize that is grown and eaten by us today. Over thousands of years we have artificially selected this plant so much so that it is almost unrecognisable compared to its ancestor, teosinte. However, we know that they are the same species because scientists have analysed the DNA of both plants and found they are very alike.

How has plant breeding changed?

Until relatively recently, most plant breeding was carried out by farmers. There wasn't a question of who owned the seeds as the farmers had sole responsibility for sowing, selecting and saving the seeds they grew. However, in most developed countries these days, global industrial companies such as Monsanto, DuPont, Syngenta and Bayer own the seed that farmers grow for food crops. These companies specialise in plant breeding to produce quality seed that they sell to farmers based on the plants' desirable characteristics.

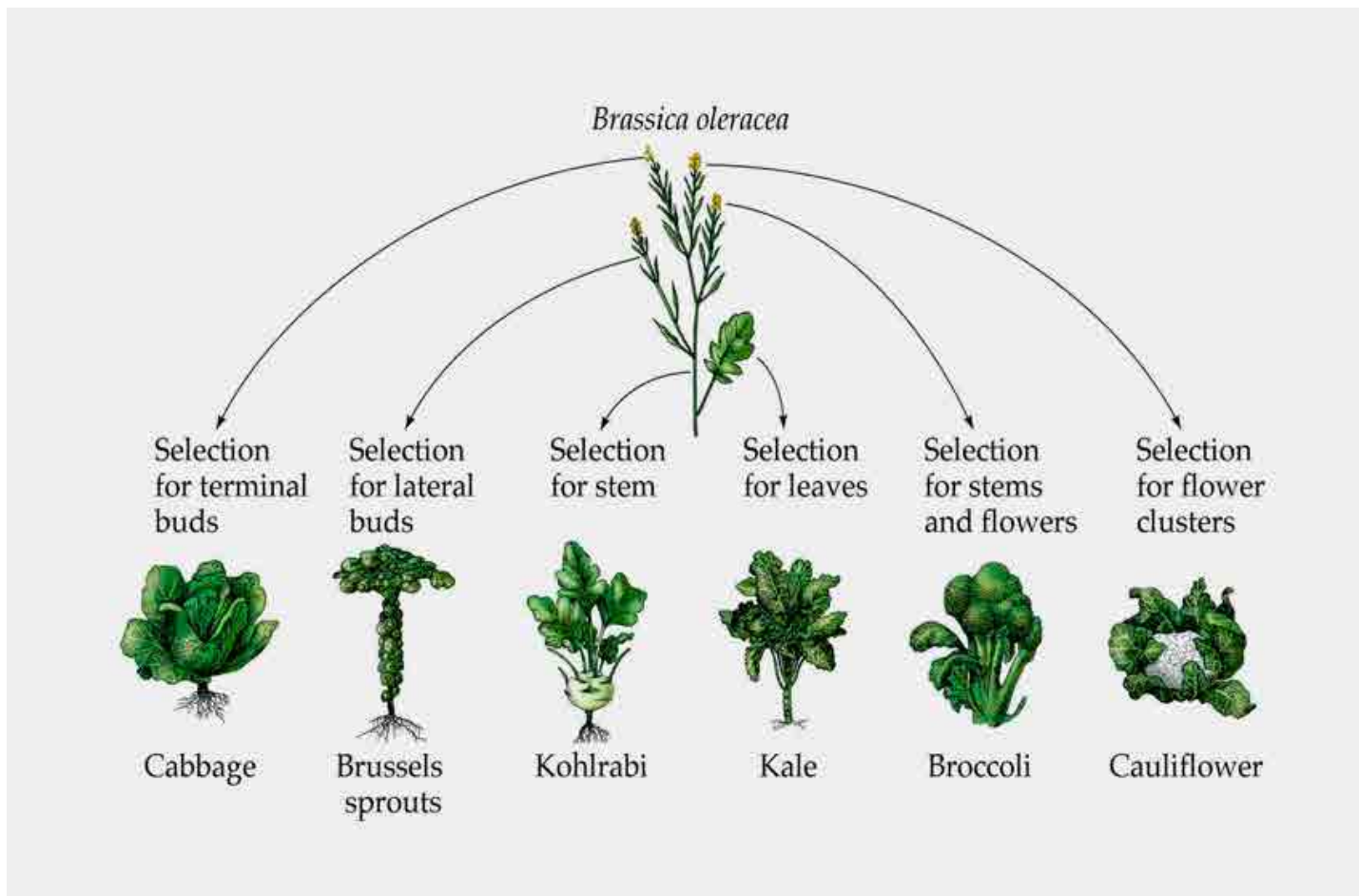
Plant breeders can protect the plants they breed through laws called intellectual property rights, IPR (see *Box opposite*). This means that no one can grow or sell their plants unless they are licensed to do so. They can then make a profit from the plants they have bred to have the desirable traits that farmers want to buy.

In the US it is very common for companies such as Monsanto to hold patents to protect their plant varieties. A patent is a stronger form of IPR that prohibits others from using the variety unless licensed; a licence can be expensive. In Europe, plant varieties themselves cannot be the subject of



John Doebley

Teosinte (left), the ancestor of modern maize (corn) (right). In the centre is an ear of a first generation hybrid of a cross between teosinte and maize.



a patent as they are specifically exempt and can be protected through PBR.

However, more recently in the UK, companies have been granted patents on naturally occurring traits that they have successfully bred into their varieties. This means that any plant variety bred to possess a particular patented trait will infringe the patent unless a licence is applied for. This is hugely controversial and many people, including organisations such as No-Patents-On-Seeds, strongly believe that naturally occurring traits shouldn't be owned by anyone.

Intellectual property rights

Intellectual property refers to creations of the mind, anything from song lyrics to inventions. Intellectual property rights (IPR) allow the creator to benefit from their work or investment in the creation. For plant breeders there are many different types of IPR they can apply for. Two of the most debated are:

Plant Breeders' Rights: Allows plant breeders to protect a plant variety as their own property. Valid for 20 to 30 years depending on the plant species.

Patents: Used to protect many different types of inventions but more recently used to protect plant traits. Many varieties possessing the patented trait can then be covered by one patent. Valid for 20 years.

Using biotechnology

Breeders can use a variety of biotechnology tools to select which plants to breed. In genetic modification, genes from other species are inserted into a plant genome to introduce a physical trait, while in genetic engineering the genome of the plant is edited by molecular probes.

One of the most commonly used tools for breeding is marker-assisted selection (MAS). This allows breeders to enhance conventional breeding methods (sexual and asexual reproduction). Markers are typically DNA sequences, genes, or chromosome attributes that link to a particular gene producing a trait of interest. Using genetic markers, scientists can accurately identify which plants will possess the desirable trait before they are fully grown. This is very different from the days before biotechnology where selection would be done solely on traits that can be observed.

The protection of breeders' rights is a complicated issue, particularly as plant breeding has changed a lot in the last century. Companies invest a huge amount of time, effort and money into breeding programmes which don't always have the desired effect. Therefore they argue that without IPR protection the companies would not be able to sustain themselves as anyone could sell the plants as their own and then plant breeding as an industry would cease.

Sarah Cook is a PhD student in the School of Chemistry, Food & Pharmacy at the University of Reading, UK.

*A single species, wild mustard (*Brassica oleracea*) is the ancestor of many different vegetable varieties.*