5.1

Presenter: **5.1. Theme 5: The past, present and future of food**
Lesson 5.1. Vocabulary for listening: Producing and protecting

Exercise B2. Listen to the first part of Malcolm's talk.

Radio presenter: Good morning. Welcome to this week's *Talking Point*. As always, we have someone in the studio this week who feels very strongly about a current issue. With his wife, Heather, Malcolm farms 10,000 hectares in Norfolk, which is in the east of England. Welcome, Malcolm.
Malcolm: Thank you. Good morning.
Radio presenter: Now, Malcolm, I understand that you are worried about where we are going with farming?
Malcolm: Yes, indeed. I am very worried.
Radio presenter: But we're not talking about the EU or supermarkets ...
Malcolm: No, something much more important.
Radio presenter: OK. Over to you then, Malcolm.
Malcolm: Thank you. I need to start with a little bit of history. At one time, all farmers were organic. By that I mean that they only used natural products to help their plants grow and to protect them. Let's look at growth first.

Now, we know, of course, that plants need sunlight and water, but plants need nutrients, too. The nutrients are chemicals like nitrogen, potassium and phosphorus. Nutrients exist naturally in soil, but the problem is, crops take nutrients out of the soil during the growing process. Eventually, the soil becomes exhausted. At this point, farmers must put nutrients back. At one time, farmers put nutrients back organically, with animal waste, particularly manure from the cows and horses on the farm. So that's growth.

Now, what about protection? Farmers must protect their crops from pests, like birds, insects and bacteria. Birds and insects eat the crops, bacteria can give them diseases. From the earliest times, farmers have used natural pesticides like sulphur to destroy pests. It is a vital part of farming because certain pests can completely destroy a crop. On many occasions in history, pests have been responsible for famine in a large area, with farms producing few or no food crops. For example, the Great Famine of the 1850s in Ireland, which was caused by bacteria, destroyed the complete potato crop of the country. This was the main food crop and, as a result, approximately one million people died through starvation.

OK, so that's the past. What about the present? Nowadays, most farmers use artificial fertilizers to help crops to grow. The fertilizers are made in a laboratory. They also use artificial pesticides to protect their crops. However, a small number of farmers, like Heather and me, have gone back to older ways. We are very afraid that artificial fertilizers and pesticides are running out of the soil and polluting the water system – I mean, the streams and rivers and finally the water supply to private houses. In the rivers and streams, they are damaging the environment, killing fish and aquatic plants. In our water supply, they are an enormous danger to public health.

Radio presenter: Thank you, Malcolm. So what's your solution?

5.2

Presenter: **5.2. Exercise B4. Listen to the final part of Malcolm's talk. When he stops, number the next word or phrase.**

Malcolm: My solution is [PAUSE] simple. The future is going back to the [PAUSE] past. Farmers should return to organic [PAUSE] farming. They should stop using chemicals which are made in a [PAUSE] laboratory. They should use only natural fertilizers and natural [PAUSE] pesticides. If these chemicals escape from the farm, they do not damage the [PAUSE] environment. They do not pollute rivers and kill [PAUSE] fish. They do not endanger public [PAUSE] health. Organic farming is not only the [PAUSE] past. It is also the [PAUSE] future.

5.3 DVD 5.A

Presenter: **5.3. Lesson 5.2. Real-time listening: Agriculture – the beginning of civilization**

Lecturer: Agriculture is the name we give to the industry of farming. It has two main branches – producing crops and rearing animals for food. It has been happening for over 14,000 years, according to most sources. Today we are going to look briefly at the history of the industry, and then consider some of the theories of how agriculture started. In later lectures, we will review the *current* situation of agriculture, or 'agribusiness' as we should probably call it now, and, of course, the *future* of agriculture, which concerns all of us on this planet.

5.4 DVD 5.B

Lecturer: Right, so, what I'm going to do first is take you on a quick trip through the history of agriculture. It all started about 14,000 years ago, as I said, in about 12000 BCE, in the area we now call Lebanon. This is part of an area now called the Fertile Crescent – basically, the Middle East. It was the cradle of agriculture – the place where it all started. Actually, perhaps I should have said, *one* place! Recent research suggests that agriculture started independently in many places at about the same time. But, anyway, at the moment, the only important thing is, it started! The local tribes started to harvest wild grasses. If that sounds strange, remember, wheat is just a kind of grass. I remember harvesting wild grass myself. When I was young, I used to pick wild grass and chew the kernel, the bit at the top. There was hardly anything in it, of course, because the grass was wild, but it's interesting to think that 14,000 years ago, people must have done the same thing and thought – hey, we can eat this! OK. So, getting back to the history ...

Early people made flour from the seeds, but the yield – I mean, the amount of flour that they got from each seed – was very, very low. *Yield* is a very important concept in agriculture, so make a note. Oh, of course, I should have said what was happening *before* agriculture started. Well, early man was a hunter-gatherer. In other words he, or in some tribes, she, hunted and killed wild animals for food, or gathered wild berries and fruits from the trees and bushes. Incidentally, when you are a hunter-gatherer, you spend all day hunting and gathering to get enough food to feed yourself and your family. Also, if the animals migrate each season to another area, you have to follow them. I want you to think about that when we consider the theories of the origins of agriculture.

OK. Jump forward to about 8500 BCE. It was then that people first began to grow crops such as barley, wheat, peas and lentils. We know this, of course, from the remains of food that has been found with the bones of early man. Oh, did I mention? … there is some evidence that rice was domesticated in China in about 11500 BCE. OK, let's get back to Lebanon. About 7000 BCE, people began to tame animals such as goats and sheep in Greece and other parts of the eastern Mediterranean. About 1,000 years after that – so where are we now, about 6000 BCE – cows and chickens were added to the list of domesticated animals … that was in Pakistan. It's strange, isn't it, to think of farmyard animals like sheep and cows as wild, but they certainly used to be.

OK. Where did I get to? Oh, yes, 6000 BCE. That's about 8,000 years ago. A thousand years later, in about 5000 BCE, the horse was domesticated, first in the area that we now call the Ukraine. Obviously, some people ate the meat of the domesticated horse – some people still do today – but horses were really much more important as work animals, to pull ploughs, for example, or to transport harvested crops. Actually, I've jumped the gun on the plough – that didn't appear until about 4000 BCE in the area we now call Iraq. That reminds me. I was in a village on the southern edge of the Sahara and I saw *camels* pulling ploughs. They are still using animals because tractors break down too often in the sand, and you can't get the spare parts. Anyway, where was I? Ah, yes – 5000 BCE.

Over the next 5,000 years, there were a lot of small improvements to agriculture, including irrigation and power supply – I mean windmills and watermills to grind corn. I'm not going to spend ages on that today because you have a project on Chinese agriculture and another on Arab agriculture later in the course. So what we'll do now is jump right forward to the Agricultural, or Agrarian, Revolution in 18th-century Britain.

Why is it called a revolution? Because it revolutionized the way people worked the land. Until about 1700, land all over the world was worked mainly by people, with the help, as I mentioned, of horses and other animals. Then, in 1701, a man called Jethro Tull decided to mechanize a basic part of farming. What he invented was the seed drill. This was a mechanical method of sowing seeds. Although it was more than 150 years before the method was widely adopted, it was the start of the mechanization of agriculture. In 1786, for example, Andrew Meikle invented a mechanical threshing machine, which could thresh, or separate, the edible parts of cereal crops from the rest. There was also the steam plough, in the 1850s. It finally replaced horses in many places after about 7,000 years. Other inventions in the Agrarian Revolution were crop rotation and selective breeding, which we'll talk about in another lecture.

Just before we go back to look at theories, I must just mention one more revolution – the Green Revolution, which started in the early 1960s. Because the population of countries like India and China was rising so fast at the time, agriculturalists were terribly worried about famine. Many researchers around the world thought that millions of people were going to die of starvation in the near future because improvements in agriculture could not keep up with the increase in population. But a man called Norman Borlaug suggested an answer. He introduced a new variety of rice to India that had a much higher yield – remember that important word? – a much higher yield than the indigenous variety. It could produce ten times the crop in the best conditions. It was called 'Miracle Rice' by the people of Asia and started a revolution in yield that is still continuing to this day.

5.5 DVD 5.C

Lecturer: So, we've had a brief overview of the history. But how did it all start, 14,000 years ago? Well, there are six main theories about why people moved from hunting and gathering to organized farming. Yes, sorry about that, six! But some, in my view, are much better than others. Here they are, in no particular order. We've got the Oasis theory, the Hilly Flanks theory – that's flanks, or sides – you'll see why in a minute. Next, the Feasting model. Feasting means having a lot of food at one meal. Then we have the Demographic theory – I'm sure you know about demographics. The fifth theory is the Evolutionary theory. And, finally, the Domestication theory. I expect you can guess what some of these theories involve, but let's look at each one in turn.

First, then, the Oasis theory. This was propounded by Raphael Pumpelly in 1908. It's described in Rosen, 2007, on your reference list. The theory argues that climate change caused the start of agriculture. He says that the climate in some areas became drier. When this happened, people moved to oases – or actually, more accurately, to watering holes. Because wild animals came to the watering hole to drink, people came into closer contact with them. Gradually, the animals accepted the humans, which in turn led to their domestication. At least, that's the theory. Also, because the people did not move from the oases or watering holes, they started to plant seeds. It makes sense to me, but it seems that this theory has not received much support, due to the lack of evidence of climatic change at the relevant time.

The second theory is the Hilly Flanks theory, put forward by Robert Braidwood. This is in Sutton and Anderson, 2009. Braidwood did not believe that there was a climatic change, as Pumpelly proposed. Instead, he thought that people living in grassy habitats began to cultivate the edible species such as wheat and barley. This occurred in the subtropical wooded hills of Turkey, Iran and Iraq on the flanks, or sides, of rivers – hence the Hilly Flanks theory. Although this theory sounds reasonable, Sutton and Anderson state that no evidence for it has been found.

A man called Brian Hayden – that's Hayden, 2002 on your list – proposed another theory, the Feasting model. He argues that leaders came to regard feasting as a display of power – in other words, they organized big meals for hundreds of people, to show how powerful they were. This led to agriculture because leaders had to have a reliable source of large

amounts of food. It is difficult to evaluate this theory. There is no evidence for or against. I remember, though, when I lived in Arabia, it was clear that feasting was still very important. There was always too much food for the people invited to a meal – and in the case of rich people, that was often hundreds of people. In fact, I believe, in that culture, if the guests eat all the food, the host is ashamed. In Europe, of course, when people come to dinner, we like them to finish everything on their plate. Anyway, back to the point ...

Theory number 4 – Demographic theory … or perhaps we should say *theories*, because there are several based on the same idea. You will see some sources in your Reading Pack. Basically, they all take the view that people became more sedentary and began to stay in the same place, so the population grew and they needed more food than the area supplied. So they had to plant seeds and grow more food themselves. In my view, these theories start from the wrong end. They suggest that people stopped moving and then started planting crops. But why did they stop moving? If we are to believe this theory, we must understand why people stopped moving. If you are a hunter-gatherer and the animals move away and the berries go out of season, surely you must follow them?

The fifth theory that has been suggested by several scholars is the Evolutionary theory. There are sources for this in your Reading Pack, too. The Evolutionary theory is the idea that agriculture began with the gradual protection of wild plants in order to preserve the resource. You know, they said to each other, 'We must look after these wild plants because we need them to produce fruit or berries next year.' Except of course, there was no spoken language at the time, but maybe they said it with sign language. This in turn led to an understanding of different locations for different plants. This theory gets my vote. If you use something every day, you begin to realize that it is important to protect it. I realize that we still haven't really learnt this lesson, but perhaps early man was closer to nature than us and therefore more protective … which reminds me of one local council in Britain. They realized that a lot of visitors were coming to their town. They were coming, in fact, to see the old trees in the area. The problem was, there was nowhere for them to park. So the council cut down the trees to make a car park. Sorry. That's a silly story and probably not even true. So let's get back to the theories ...

The final theory is the Domestication theory propounded by Daniel Quinn, amongst others. Sorry, I haven't got the reference for him. You'll have to look it up. This theory suggests that people became more domesticated, staying in one area and beginning to domesticate that area. This involved looking after plants and taming the wild animals. Like the Demographic theory, this just doesn't work for me. Why did people become more domesticated? What was the impetus? Again, it seems to be the wrong way round. We need to explain why people became more domesticated in the first place.

So there we have the theories concerning the start of agriculture. Which do you think is most likely?

5.6

Presenter: **5.6. Lesson 5.3. Learning new listening skills: Dealing with digressions**

Exercise A2. Listen and check your ideas.

Voice: agriculture, agricultural, climate, cultivate, domesticated, edible, famine, fertile, harvest, indigenous, irrigate, irrigation, machine, mechanize, preserve, resource, starvation, tractor

5.7

Presenter: **5.7. Exercise C. Listen and make notes. When the lecturer digresses, write one or two words to help you remember.**

Lecture 1: The development of Qatar and Lebanon

Lecturer 1: OK. Now we are going to compare two countries, using these areas and sub-areas. Both countries are located in the Middle East but Qatar is in the Gulf whereas Lebanon is in the eastern end of the Mediterranean Sea. Qatar is a peninsula, only bordered to the south by Saudi Arabia, while Lebanon is almost completely surrounded by Syria. I remember I once had to visit Qatar – that was over 35 years ago – and when I told people where I was going, none of my friends even knew where it was. I went back recently and it's incredible to see the progress that has been made in such a relatively short time. Lots of modern buildings and wide roads. I think perhaps the outlook has changed too. Anyway. Where was I? OK, Qatar in the Gulf, Lebanon on the Mediterranean. Does the location of these countries affect their human development?

Presenter: **Lecture 2: Long-distance communication: semaphore**

Lecturer 2: In 1793, a man called Claude Chappe invented the long-distance semaphore in France. The French government built a network of 556 relay stations all over the country. These were houses with arms on the roof. The arms could move to make different symbols. Urgent messages could travel at about 20 miles an hour now – faster and much more secure. That reminds me of a part from a French novel by Alexandre Dumas, *The Count of Monte Cristo*. He is falsely imprisoned for years and when he gets out, he takes revenge on all the people who falsely accused him. He destroys one man by bribing a semaphore station clerk to send a false message – something about Napoleon winning a battle or losing one – I can't remember which. So of course, this shows that semaphore wasn't completely secure. But getting back to the point, it was very difficult to intercept and stop a message from reaching its destination. It was in code, too, so even if you did intercept it, you couldn't understand it. But the system was very expensive, to build and to maintain. It was very expensive for the customers who wanted to use it, too. But Napoleon used it all the time to send urgent messages about troop movements – you know, how his armies were moving around the country.

Presenter: **Lecture 3: Children and violence on television**

Lecturer 3: Now, I accept that children have to experience fear, and learn how to deal with it. Clearly, this is why we have fairy tales, which are full of murders, kidnappings and violent acts. Fairy tales are very old and presumably perform a useful function in education, so this is a very powerful argument. But we must take into account several factors. Firstly, children are visual learners, and television is a visual medium. It actually *shows* the violence, whereas fairy tales *talk* about it. There is a big difference. I remember when I was a child of about eight, I had to watch a particular TV science fiction programme, with robots and aliens and green monsters with ten heads and so on from behind the sofa, or peeking through my hands because it was so scary. But I could read about the same sort of thing and it had no effect on me at all. Anyway. Why was I saying that? Oh yes, because fairy tales are not visual. Also, most fairy tales are initially told to children by a parent. So the parent has a chance to mediate the experience for the child – in other words, to tone it down, if they think the child will not be able to cope with the events as written. The parent is the medium by which the child receives the story, and they can change the story if necessary. But television is a very different medium. It is unvarying. It does not change to suit the viewer, even if the viewer is eight years old, alone with the television in the sitting room and terrified.

Presenter: **Lecture 4: The central nervous system**

Lecturer 4: It is the central nervous system which controls muscle contraction. The system is two-way. What I mean by that is, the system gathers information from nerves throughout the body and takes it to the brain through the spinal column. It uses electrical impulses. The brain is the primary processing centre for the body. If the decision is taken to react to a particular stimulus, the brain sends the necessary impulses to the muscles – electricity again. Which reminds me that when I was at school, I suppose in about Year 8 or 9, we had to do this experiment with frog's legs – don't worry, the animals were dead, and in fact, the legs were not even on the animal, they had been cut off. We touched them with the two ends of an electrical circuit and the legs twitched, which shows the effect of electricity on the muscle tissue even when the animal is dead. The girls all screamed, I remember, when the legs jumped – I think most of the boys did, too. Anyway, that's enough of that. Let's get back to the nervous system. The main parts are the nerves, as I've just said, the brain, obviously, and the spinal cord, which runs down the spine. We can see now why the skull and the spine are so important. They protect key parts of the central nervous system.

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5.8

Presenter: **5.8. Lesson 5.4. Grammar for listening: Complex sentences (1)**

Grammar box 21. Listen to the examples. Where does the speaker pause in each case?

Voice:
When I was young, I used to pick wild grass.
If the animals migrate, you must follow them.
Because the population was rising fast, agriculturalists were afraid of famine.
Although this theory could be correct, scientists have found no evidence.

5.9

Presenter: **5.9. Exercise B1. Listen to the first clause of some complex sentences. Find a suitable ending.**

Voice:
a. When you are a hunter-gatherer, …
b. If you use something every day, …
c. If guests eat all the food, …
d. Because people stayed in one place, …
e. Because there is a global shortage of fresh water, …
f. Because Lebanon doesn't have any oil resources, …
g. If the Sumerians wanted to communicate over a long distance, …

5.10

Presenter: **5.10. Exercise B2. Listen and check your answers.**

Voice:
a. When you are a hunter-gatherer, you spend all day hunting and gathering.
b. If you use something every day, you begin to protect it.
c. If guests eat all the food, the host is ashamed.
d. Because people stayed in one place, they started to plant seeds.
e. Because there is a global shortage of fresh water, we must retain rainfall in reservoirs.
f. Because Lebanon doesn't have any oil resources, it imports from countries in the region.
g. If the Sumerians wanted to communicate over a long distance, they could send a letter.

5.11

Presenter: **5.11. Exercise C1. Listen to the main clause of some complex sentences. How could the speaker finish each one?**

Voice:
a. I'm not going to talk about Chinese agriculture very much because ...
b. The nerves in your fingers send a message to the brain if ...
c. There is much more agriculture in Lebanon than in Qatar because ...
d. In children's television programmes, people don't die when ...
e. It is possible that children become aggressive because ...
f. You shouldn't let young children watch television when ...

5.12

Presenter: **5.12. Exercise C2. Listen and check your ideas.**

Voice:
a. I'm not going to talk about Chinese agriculture very much because you are going to do a project on this.
b. The nerves in your fingers send a message to the brain if they touch something hot or sharp.
c. There is much more agriculture in Lebanon than in Qatar because it has more fertile land.
d. In children's television programmes, people don't die when they are blown up and shot.
e. It is possible that children become aggressive because they watch violent TV programmes.
f. You shouldn't let young children watch television when they are alone.

5.13

Presenter: **5.13. Exercise D1. Listen to the first clause of some sentences. When the speaker pauses, discuss possible endings to the sentence.**

Voice:
a. Parents often tone down fairy tales if ...
b. Muscles work in pairs because ...
c. When Napoleon had an urgent message for his army …
d. Civilization started when ...
e. Sports injuries usually get better faster if ...
f. Although customers buy *products* …
g. If you provide higher benefits …

5.14

Presenter: **5.14. Exercise D2. Listen and check your ideas.**

Voice:
a. Parents often tone down fairy tales if they are very violent.
b. Muscles work in pairs because they can only contract.
c. When Napoleon had an urgent message for his army he sent it by semaphore.
d. Civilization started when people stayed in the same place.
e. Sports injuries usually get better faster if you rest.
f. Although customers buy *products* they actually want benefits.
g. If you provide higher benefits, some customers will pay more.

5.15

Presenter: **5.15. Lesson 5.5. Applying new listening skills: Same land, more yield**

Exercise A2. Listen and check.

Voice:
a. It all started about 14,000 years ago in an area which we now call Lebanon.
b. I've jumped the gun on the plough – that didn't appear until about 4000 BCE.
c. Improvements in agriculture could not keep up with the increase in population.
d. Here are the theories, in no particular order.
e. But before we look at the theories, I must just mention the Green Revolution.
f. Gradually, the animals accepted the humans, which, in turn, led to their domestication.
g. The Evolutionary theory says that agriculture began with the gradual protection of wild plants to preserve the resource. This theory gets my vote.
h. The Domestication theory suggests that people became domesticated and then stayed in one area. But this seems to be the wrong way round to me.

5.16 DVD 5.D

Lecturer: This week we're going to look at developments in agriculture. For the whole of its long history, agriculture has been an industry that has constantly improved. Or, to put it another way, it has recognized problems and found solutions. The driving force for improvement for thousands of years has been a rising population. If you have more mouths to feed, you need more food. It's obvious. The industry has risen to that challenge time and time again – as we saw to some extent in the last lecture. Which reminds me ... I was reading a blog the other day and the guy was suggesting that the driving force behind agriculture has changed now. He reckoned the driving force now was profit, and now the stronger need is to make bigger and bigger profits from farming. We're not talking about agriculture anymore but 'agribusiness'. Although agriculture does not employ the majority of the population of a particular area anymore, it does make huge profits as a business. Sorry. That's enough of that!

As I was saying, agriculture is about constant improvements. There have been literally thousands of improvements since the first person picked some wild grass and ate the seeds. But nearly all the improvements have been aimed at the same objective – more yield. There are three main ways to increase yield. Firstly, farmers have always tried to get more yield from a particular piece of land. Same land, more yield. Secondly, farmers have tried to get more yield from a particular crop. Same crop, more fruit, more berries, or bigger roots or stems. And thirdly – you've guessed it – farmers have tried to get more yield from a particular animal. Same animal, more meat or milk. Today, we're only going to look at the first way – same land, more yield. Because I'm going to ask *you* to research the other two ways.

Right, let's look at how we can get more yield from the same piece of land. Remember, we're talking about problems and solutions all the time. For the first solution, we need to go back to 3500 BCE. Plants need sunlight, which is probably why early agriculture developed in some of the sunniest parts of the world, the modern-day areas of Iraq, Syria and Egypt, for example. So what's the problem? Well, plants also need *water* to grow, obviously. And those same areas – Iraq, Syria, Egypt – are some of the driest areas on earth, with very little rainfall and hardly any natural rivers or lakes.

So the plants in these areas often did not get enough natural water to grow well. The solution? Irrigation. Throughout the centuries, different peoples have used different methods to irrigate their crops, to provide them with the water they need to grow well. For example, the Ancient Egyptians built reservoirs to retain water and to stop it running to the sea. They also built canals that were filled when the Nile flooded. Because they had to get the water from these canals on to the actual plants, they invented the *shaduf*. This was a pole with a bucket on one end and a heavy weight on the other. The Phoenicians, from what we now call Lebanon, used wells, tunnels and pumps powered by animals or people to bring water to their land. I remember when I lived in Oman in the Gulf, people in the villages on the edge of the desert were using water from a falaj system which brought water hundreds of miles underground from mountain streams. Nothing very strange about that, really, but the irrigation system was built by the Phoenicians hundreds of years before. Incredible. Anyway, irrigation is still needed all over the world, and farmers use systems such as sprinklers or trickle irrigators. This can be done automatically and electronically and so requires no labour and, in some cases, no attention at all once it is set up. Some irrigation systems even move automatically up and down the field to cover every part. So, problem? Not enough water. Solution? Irrigation.

So that's irrigation. Plants need sunlight and water, but – here's the next problem – they also need *nutrients*, like nitrogen, phosphorus and potassium. Although early farmers didn't know exactly what nutrients plants needed, they realized that growing plants on a particular piece of land destroyed the soil. If they farmed the same piece of land for several years, the yields went down. Eventually the soil was exhausted. For thousands of years, some tribes solved this problem by moving on to another piece of land. They were nomadic, in other words, moving from one area to another, and perhaps eventually returning to a previous area. But this is not an efficient use of time. The solution creates a new problem. If you have to keep moving to new areas, you cannot establish towns and cities. In other words, you cannot start a civilization. Which reminds me of my Latin at school because *civis* in Latin is 'town', so *civilization* means something like 'making a town'. Incidentally, *agricola* is Latin for 'farmer' so that's two connections between the ancient world and modern English. I was hopeless at Latin at school so I don't know why I remember that!

Anyway, where was I? Oh, yes. Eventually, someone discovered that if they left the field 'fallow', or unused, for a year, it returned to being good for growing food crops. So the solution, in some areas, was a system in which each person had three strips of land. They grew crops on two of them – so they didn't starve – but left the third one fallow in *rotation*. That's an important word – *rotation*. Remember it. The solution created a new problem. If you leave one-third of your land fallow, you can only produce two-thirds of the potential crop on it. But some cultures solved the problem when they realized that certain crops actually put goodness back into the soil, for example, plants of the pea family. We know now why. Because some plants gather or fix nitrogen from the soil, they replace the nitrogen that other plants use up. Peas, of course, are edible, so with this kind of crop rotation all of the land produced food crops all of the time. Same land, more yield, year after year.

The system of crop rotation is still widely used all over the world today on small farms. But it leads to other problems. Because many farms are worked by huge machines nowadays, you cannot divide a field up into strips. Also, an agribusiness has a particular market for specific products, so it is not possible to change the crop every year. If your business is called Tomatoes Direct, you cannot become Peas Direct every third year. Farmers had to find a way to put nutrients back into the soil without planting different crops. In other words, they had to feed the crops with nitrogen and phosphorus and potassium and other important minerals. What do we call these chemicals, which improve the yield or the fertility of the land? Of course – *fertilizers*.

Actually, I've rather jumped the gun on fertilizer, because animal waste has been used for hundreds of years as a natural fertilizer. Animal waste is rich in nitrogen, so farmers spread this waste, or manure, on the land to improve the yield. Bird waste – called *guano* – was particularly successful in some areas of the world. But of course, if you do not have a local source of animal waste, there is a problem. In the early 19th century, chemists began to solve the problem. They started to experiment with the chemicals in manure. Justus von Liebig was one of these chemists. It was von Liebig who first created an artificial fertilizer but it was not successful. Although it contained useful nutrients, crops could not absorb them. Gradually, the science improved until, in the 1900s, two German chemists, Carl Bosch and Fritz Haber, developed a cheap process for synthesising ammonia, which contains nitrogen. Which reminds me of an interesting piece of information that I came across the other day. Apparently, after the Second World War, the US government had a lot of ammonium nitrate, because it is the main substance in explosives. It also happens to be one of the best sources of nitrogen for crops. Agronomists persuaded the government to spread the chemical on farmland, and yields rose. Look up the story in Pollan, 2006 – it's on the net. I don't know if you realize, but the United Nations motto is 'We shall beat the swords into ploughs', meaning move from war to peaceful occupation. Perhaps we should add, 'And turn the bombs into crops.'

Anyway. What was I talking about? Oh, right. Artificial fertilizers. I should mention that many people feel these artificial fertilizers are damaging the environment. They wash out of the soil and pollute streams and rivers. So, as so often in the past, a solution leads to a new problem. Some farmers have kept traditional methods in order to produce better quality crops and not damage the environment. These traditional methods include crop rotation and the use of natural fertilizers like cow manure. This process is called *organic farming* and we'll talk a lot more about that later in the course. Unfortunately, crops from organic farming often cost more – solution leading to a problem again – so it is a question of whether the consumer is willing to pay more to protect the environment more.

So, where have we got to? We're talking about raising the yield of a particular piece of land, and we can do that with irrigation, crop rotation and with fertilizers, natural or artificial. But there is one final problem to deal with. Once the land is producing a good crop, how are we going to protect it from pests? Farmers call them pests, but of course we are just talking about other inhabitants of the environment – birds and insects, in the main. Pests are a big danger to agriculture.

Birds or insects can completely strip a crop, so protection is needed. Early farmers used simple methods, such as scarecrows – models of people standing in fields – to scare off the birds, or they covered the crops in some way. But chemicals that deter or kill harmful creatures have a very long history. There is evidence that the Sumerians used insecticides in about 2500 BCE. The substance was sulphur, which was burnt to kill the creatures. Salt was used in Ancient Rome, and in Europe in 1600 CE, ants were attracted away from crops by honey and then killed with arsenic. But it was in the 1940s that the first mass use of pesticide occurred. The substance was called DDT, and it became extremely popular in the 1950s because it killed plant pests and insects that carried malaria, yellow fever, etc.

However, in 1962, a woman called Rachel Carson published a book called *Silent Spring* in which she described the dangers of DDT. She said the chemical was washing into rivers. When animals and birds drank from the polluted water, they became ill and sometimes died. DDT was banned in the USA shortly after. Pesticides are still widely used but they are much more targeted at specific pests, and now there are even organic insecticides that use natural ingredients so they do not harm animals or humans. Interestingly, some environmentalists are now calling for a return to DDT spraying on a large scale. Richard Liroff of the World Wildlife Fund said in 2005, 'If the alternatives to DDT aren't working, you've got to use it.' But others still feel that the dangers are too high, with insects that are basic to agriculture, like bees, being killed as well as harmful creatures.

5.17

Presenter: **5.17. Lesson 5.6. Vocabulary for speaking: Using genetics in farming**

Exercise B1. Listen to a student talking to a tutor. Check your answers to Exercise A.

Tutor: Can farmers modify plant species – I mean, change them in certain ways?
Student: Yes. It's called selective breeding.
Tutor: And you do it in a laboratory?
Student: No. Farmers do it on their farms. They have been doing it for thousands of years.
Tutor: What can you breed for, selectively?
Student: Any desirable characteristics, anything you want. For example, size or shape or taste. Put two plants together with the same characteristic and the offspring will probably inherit that characteristic.
Tutor: What about pest resistance? I understand some plants do not suffer so badly from attacks by insects, for example.
Student: Yes, you can breed for that, too. The code for that characteristic is in every cell.
Tutor: OK. Here's a stupid idea. Can you breed from one plant which has large fruit and another one which is resistant to pests?
Student: Yes, and you will probably get large fruit which has pest resistance, because the characteristics are independent. Like blue eyes or green eyes and black hair or brown hair. It's heredity.
Tutor: So is it based on genetics?
Student: Yes, that's right. Each characteristic comes from a gene or a number of genes in the DNA. So you can breed a plant which has a gene for size and a gene for pest resistance, for example.
Tutor: Does it work with animal species, too?
Student: Yes. It works with all organisms.
Tutor: Because they all have a similar genetic code?
Student: Exactly.
Tutor: What if both plants or both animals have a genetic defect? All the offspring might have the same defect.
Student: Well, that could be a problem.

5.18

Presenter: **5.18. Exercise C2. Listen and practise some of the words in sentences.**

Voice:
1. Farmers modify plant species.
2. It's called selective breeding.
3. Any desirable characteristic can be chosen.
4. Offspring inherit characteristics through the genes.
5. Some plants have more pest resistance than others.
6. All living organisms have a similar genetic code.
7. Sometimes parent plants have a genetic defect.
8. They may produce offspring with the same defect.

5.19 DVD **5.E**

Presenter: **5.19. Lesson 5.7. Real-time speaking: The power of the supermarkets**

Student 1: I'm going to talk about one effect of supermarkets on farmers and farming. As we all know, supermarkets are very powerful nowadays. They buy a very large proportion of the output of farming – between 50 and 80 per cent, depending on the country – so they can control the way that farmers operate. For example, they can demand a uniform product. In other words, all the edible parts are a similar size and shape.
According to the website Waste 2, 2011, supermarkets maintain that uniform products appeal more to their customers. But uniformity leads to a lot of waste. It also means food is more expensive for farmers to produce. Let me explain. Uniformity is achieved by selective breeding ...
Student 2: Did you say the website was called Waste 2?
Student 1: Yes, that's right. Waste 2 dot co dot uk.
Student 2: Thanks.

Student 1: OK. Where was I?
Student 3: You were talking about selective ... something.
Student 1: Ah, yes. Selective breeding. Uniformity is achieved by selective breeding. When a farmer notices a desirable characteristic, he or she saves the seeds and breeds from the plants. The result of selective breeding is that the plant species gradually changes. Now, although selective breeding is very effective ...
Student 2: I don't understand. Does selective breeding change the genetic code of the plants?
Student 1: Yes, it does.
Student 2: So what you're saying is, selective breeding is the same as GM ... genetic ... um ... modification?
Student 1: No, not at all. When you breed plants selectively, the genetic changes occur naturally in the plants, whereas if you modify plants genetically, the changes are done artificially in a laboratory.
Student 3: I don't know if this is relevant, but GM crops are banned in my country.
Student 1: Yes, they are in mine, too. But as I said, plant breeding is not the same as GM. It's natural heredity. OK. Um. Sorry. I've forgotten what I was going to say.
Student 2: I think you were going to give us some disadvantages. You said 'Breeding is .. .good ...', or something.
Student 1: Right, yes. Although selective breeding is very effective, it has some drawbacks. Firstly, the British Society of Plant Breeders or BSPB states that it is very time-consuming. Joliffe, writing in *Plant Breeding*, 2006, says it can take up to 12 years to develop a new breed. Because it takes a long time, it is very expensive for farmers.
Student 2: Are you saying that it raises the cost of the products?
Student 1: Yes, exactly. Secondly, there is a lot of waste with uniformity. If a fruit or vegetable does not conform to the uniform size or shape, it is thrown away. For example, Mather et. al., 2010, describe the problem in California. Hundreds of tons of edible fruit and vegetables are ploughed back into the soil because they are the wrong shape or the wrong colour.
Student 3: Sorry. Do you mean *millions* of tons?
Student 1: Yes, sorry. I meant to say *millions*. Finally, Duffy, 2005, argues that breeding for uniformity actually gives us inferior produce. For example, the Italians actually pay more for potatoes with silver scurf, which is a disease affecting the skin colour of potatoes. When you bake them, they are crispier. Duffy also quotes a farmer as saying 'blemishes – that's marks – on melons, for example, are a sign of high sugar content. It means they taste better.'
Student 2: So are you saying that supermarkets want uniform products but nobody else does?
Student 1: I'm not sure. Certainly supermarkets want them and farmers don't want them. But what about customers?

5.20

Presenter: **5.20. Exercise C1. Listen to extracts from the presentation and discussion. Complete each phrase or sentence with one word in the space.**

Student 1: According to the website Waste 2, 2011, supermarkets claim that uniform products appeal more to their customers. But uniformity leads to a lot of waste and more expensive produce. Let me explain. Uniformity is achieved by selective breeding ...
Student 2: Did you say the website was called Waste 2?
Student 1: Yes, that's right. Waste 2 dot co dot uk. OK. Where was I?
Student 2: You were talking about selective ... something.

Student 1: The result of selective breeding is that the plant species gradually changes. Now, ...
Student 2: I don't understand. Does selective breeding change the genetic code of the plants?
Student 1: Yes, it does.
Student 2: So what you're saying is ... plant breeding is the same as GM ... genetic ... um. .. modification?
Student 1: No, not at all.

Student 2: I don't know if this relevant, but GM crops are banned in my country.
Student 1: Yes, they are in mine, too. But, as I said just now, plant breeding is not the same as GM. It's natural heredity. OK. Um. Sorry. I've forgotten what I was going to say.
Student 2: You were going to give us some disadvantages. You said 'Although breeding is ... good ...', or something.

Student 1: Because it takes a long time, plant breeding is very expensive for agribusinesses.
Student 2: Are you saying that it raises the cost of the products?
Student 1: Yes, that's exactly right. Secondly, there is a lot of waste with uniformity ... Hundreds of tons of edible fruit and vegetables are ploughed back into the soil because they are the wrong shape or colour.
Student 2: Sorry. Do you mean *millions* of tons?
Student 1: Yes, sorry. I meant to say *millions*.

5.21

Presenter: **5.21. Exercise C2. Listen again and check your answers.**

[REPEAT OF SCRIPT FROM **5.20**]

5.22

Presenter: **5.22. Exercise C4. Listen to the phrases and sentences in C1 and copy the stress and intonation.**

Voice:
a. Did you say the website was called Waste 2?
b. Where was I?
c. You were talking about selective ... something.
d. Does selective breeding change the genetic code of the plants?
e. So what you're saying is, plant breeding is the same as GM.
f. No, not at all.
g. I don't know if this is relevant, but GM crops are banned in my country.
h. But, as I said just now, plant breeding is not the same as GM.
i. I've forgotten what I was going to say.
j. I think you were going to give us some disadvantages.
k. Are you saying that it raises the cost of the products?
l. Yes, that's exactly right.
m. Do you mean *millions* of tons?
n. Yes, sorry. I meant to say *millions*.

5.23

Presenter: **5.23. Everyday English. At the supermarket**

Exercise B3. Listen and check your ideas.

Conversation 1.

Voice A: Hiya. Can you put the basket on here?
Voice B: Sure.
Voice A: Do you need a bag? They're 5p.
Voice B: Er, no thanks. I can manage.

Presenter: **Conversation 2.**

Voice A: That's £14.50. Have you got a loyalty card?
Voice B: No, I haven't.
Voice A: Are you paying by cash or card?
Voice B: Um, card. Shall I put it in the machine?
Voice A: Yes, please and check the amount.
Voice B: Um. Is it working?
Voice A: Other way round.
Voice B: Oh, yeah. Oh, and can I have cashback?
Voice A: How much would you like?
Voice B: £10, please.
Voice A: OK. Enter your PIN number, please.

Presenter: **Conversation 3.**

Voice A: I'm sorry. Could you go to the next checkout?
Voice B: Why? What's the problem?
Voice A: This checkout is 'baskets only'.
Voice B: Oh, OK. I didn't see the sign.

Presenter: **Conversation 4.**

Voice A: Hi. You alright there?
Voice B: Well, can I return this shirt? It's in this bag.
Voice A: Is there anything wrong with it?
Voice B: No, it's just too small.
Voice A: Do you want to change it for a bigger size?
Voice B: No, thanks. I'd like a refund.
Voice A: OK. Have you got your receipt?
Voice B: Um, oh dear. Did I leave it in the bag?
Voice A: Yes, here you go. Did you pay by card?
Voice B: Yes, here you are.
Voice A: Cheers.

5.24

Presenter: **5.24. Lesson 5.8. Learning new speaking skills: Referring to research**

Exercise A2. Listen to the phrases above and practise.

Voice:
a. selective breeding
b. uniform product
c. desirable characteristic
d. genetic code
e. edible fruit
f. sugar content
g. plant species
h. supermarket buyers

5.25

Presenter: **5.25. Skills Check. Listen and practise the pauses and the intonation pattern.**

Voice: Duffy, 2005, argues that breeding for uniformity actually gives us inferior produce.

Mather et. al., 2010, describe the problem in California.

The British Society of Plant Breeders, 2006, states that selective breeding is very time-consuming.

Joliffe, writing in *Plant Breeding*, 2006, says that it can take up to 12 years to develop a new breed.

Duffy quotes a farmer as saying 'blemishes on melons, for example, are a sign of high sugar content.'

According to the website, Waste 2, 2011, supermarkets claim that uniform products appeal more to their customers.

5.26

Presenter: **5.26. Lesson 5.9. Grammar for speaking: Complex sentences (2)**

Grammar box 22. Listen and repeat the examples. Copy the pauses and the intonation.

Voice:
Supermarkets can control food prices [PAUSE] because they buy so much produce.
Genetic changes occur naturally [PAUSE] when you breed plants selectively.
Selective breeding has drawbacks [PAUSE] although it is very effective.

5.27

Presenter: **5.27. Exercise B2. Listen and check your answers.**

Voice:
1. Farmers can breed from the seeds of the plants when they notice a desirable characteristic.
2. If you breed plants selectively, genetic changes occur naturally in the plants.
3. The changes are done artificially in a laboratory if you modify plants genetically.
4. Selective breeding is very expensive for farmers because it takes a long time.
5. Fruit can actually taste better if a plant has a disease.
6. Because they are the wrong shape, millions of tons of fruit and vegetables are wasted.

5.28

Presenter: **5.28. Exercise C2. Listen and check. Try saying the full sentences.**

Voice:
a. If you buy a BOGOF product, you get a second one free.
b. Film and television personalities sometimes endorse products although they probably don't use them.
c. Bad reviews can kill a new movie, although some people go to see if the reviewer was right or wrong.
d. When a film company puts a trailer of a new movie onto a website like YouTube, it hopes that the film will go viral.
e. Athletes should listen to music during training because it decreases the perception of effort.
f. The majority of asthmatics can prevent attacks if they take medication before doing exercise.
g. Although Braille invented a better system of reading for the blind, he was not allowed to teach it at his own institute.
h. Because Braille's system only used six dots, it is easier to read than previous methods.
i. Because the Yangtze River floods most years, the Chinese government is diverting some water to other parts of the country.
j. The government of Egypt has threatened to use force if any country takes water from the Nile without permission.

5.29

Presenter: **5.29. Lesson 5.10. Applying new speaking skills: Cloning and intensive farming**

Exercise A. Listen to some sentences. Which photograph is each sentence related to?

Voice:

1. Chemicals are used to improve growth.
2. Each animal is an exact copy in genetic terms.
3. Farmers can create animals which are consistent in terms of productivity.
4. There have been several successful trials, although genetic defects mean that many animals die young.
5. The animals live in cramped conditions because it is easier to look after them.
6. Scientists grow cells from selected animals in a laboratory.
7. The living conditions mean that many animals experience stress.
8. The practice has been banned in the European Union.