SECTION 3 *Questions 28–40*

Read the text below and answer Questions 28–40.

RESEARCH ON IMPROVING AGRICULTURAL YIELDS IN AFRICA

Three programmes are investigating ways of improving agricultural productivity in Africa.

More than half of the global population growth between now and 2050 is expected to occur in Africa. And more people means a requirement for more food.

Ethiopia, for example, has the largest livestock population in Africa but with a growing population even its 53 million cattle are not enough. And now efforts to develop farming there are bringing a significant health concern. Professor James Wood from the University of Cambridge explains that new breeds that are being introduced are more vulnerable to bovine TB (tuberculosis) than the zebu cattle which were previously reared there. 'This may have health implications for those who work with and live alongside infected cattle, and also raises concerns about transmission to areas which previously had low levels of TB,' he warns.

Wood leads a research programme which is looking at the feasibility of control strategies, including cattle vaccination. The programme brings together veterinary scientists, epidemiologists, geneticists, immunologists and social scientists in eight Ethiopian and UK institutions. 'We need this mix because we are not only asking how effective strategies will be, but also whether farmers will accept them, and what the consequences are for prosperity and wellbeing,' says Wood.

The impact that increasing productivity can have on farmers' livelihoods is not lost on an insect expert at the University of Ghana, Dr Ken Fening, who is working on another food-related research project. Cabbages are not indigenous to Africa but have become a major cash crop for Ghanaian farmers and an important source of income for traders from markets and hotels. 'A good crop can bring in money to buy fertilisers and farm equipment, and also help to pay for healthcare and education for the family,' he says. Recently, however, fields of stunted, yellowing cabbages, their leaves curled and dotted with mould, have become a familiar and devastating sight for the farmers of Ghana.

From his field station base in Kpong, Ghana, Fening works closely with smallholder farmers on pest-control strategies. Two years ago they started reporting that a new disease was attacking their crops. 'It seemed to be associated with massive infestations of pink and green aphids*,' says Fening, 'and from my studies of the way insects interact with many different vegetables, I'm familiar with the types of damage they can cause.'

But farmers were typically seeing the total loss of their crops, and he realised that the devastation couldn't just be caused by sap-sucking insects. Despite no previous reports of viral diseases affecting cabbage crops in Ghana, the symptoms suggested a viral pathogen.

* aphids: small insects which feed by sucking liquid from plants

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Together with Cambridge plant biologist Dr John Carr, Fening collected samples of cabbage plants in Ghana showing signs of disease, and also aphids on the diseased plants. Back in Cambridge, Fening used screening techniques including a type of DNA 'fingerprinting' to identify the aphid species, and sophisticated molecular biology methods to try to identify the offending virus.

'Aphids are a common carrier of plant-infecting viruses,' explains Carr. 'The "usual suspects" are turnip mosaic virus and cauliflower mosaic virus, which affect cabbages in Europe and the US.'

'We found that two different species of aphids, pink and green, were generally found on the diseased cabbages,' says Fening. 'It turned out this was the first record of the green aphid species ever being seen in Ghana.' The pink aphid was identified as *Myzus persicae* (Sulzer).

What's more, the virus was not what they expected, and work is now ongoing to identify the culprit. The sooner it can be characterised, the sooner sustainable crop protection strategies can be developed to prevent further spread of the disease not only in Ghana, but also in other countries in the region.

Another researcher who hopes that eradication strategies will be the outcome of her research project is Dr Theresa Manful. Like Fening, she is a researcher at the University of Ghana. She has been working with Cambridge biochemist Professor Mark Carrington on a disease known as trypanosomiasis.

'This is a major constraint to cattle rearing in Africa,' she explains. 'Although trypanosomiasis is also a disease of humans, the number of cases is low, and the more serious concerns about the disease relate to the economic impact on agricultural production.'

The parasite that causes the disease is carried by the tsetse fly, which colonises vast swathes of sub-Saharan Africa. Carrington says that a lot is now known about the parasite's molecular mechanisms, in particular the way it evades the immune system of the animal acting as its host by altering the proteins in its coat so as to remain 'invisible'. 'But then when you look at the effect on large animals, you realise that there is almost nothing known about the dynamics of an infection, and even whether an infection acquired at an early age persists for its lifetime,' he says. So Manful and Carrington set about testing cattle in Ghana. They discovered that nearly all were infected most of the time.

For Manful, one of the important gains has been the ability to expand the research in Ghana: 'I now have a fully functional lab and can do DNA extraction and analysis in Ghana – I don't have to bring samples to Cambridge. We are teaching students from five Ghanaian institutions the diagnostic methods.'

'Agriculture faces increasing challenges,' adds Carr. 'Bioscience is playing a crucial part in developing ways to mitigate pest impact and reduce the spread of parasites. We want to ensure not only that every harvest is successful, but also that it's maximally successful.'

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Questions 28–32

Choose the correct letter, ***A, B, C*** *or* ***D****.*

Write the correct letter in boxes 28–32 on your answer sheet.

28 What is the main problem faced by cattle farmers in Ethiopia, according to Professor Wood?

- **A** TB is being transmitted from people to cattle.
- **B** New breeds of cattle have led to an increase in TB.
- **C** The traditional breeds of cattle are being affected by TB.
- **D** TB has spread into places where it was previously unknown.

29 When discussing the cultivation of cabbages in Ghana, the writer says that this crop

- **A** was introduced from outside Africa.
- **B** is not eaten much by local people.
- **C** is not grown correctly by many farmers.
- **D** requires the use of fertiliser and special equipment.

30 Fening believed that the new disease destroying cabbages was

- **A** caused by overuse of pesticides.
- **B** also affecting other locally grown vegetables.
- **C** linked to insect attacks on these vegetables.
- **D** connected with the development of new insect breeds.

31 Fening first suspected that the cabbage disease was caused by a virus because

- **A** evidence of viral disease could be seen on the cabbage leaves.
- **B** pink and green aphids did not commonly attack cabbages.
- **C** viral diseases affecting vegetables had occurred elsewhere in Africa.
- **D** aphids would not have caused so much damage to the crops.

32 When doing further research in Cambridge, Fening and Carr discovered that

- **A** the virus was unfamiliar to them.
- **B** two different viruses were present.
- **C** the aphids' DNA was more complex than expected.
- **D** one aphid was more harmful than the other.

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Questions 33–36

Look at the following statements (Questions 33–36) and the list of researchers below.

Match each statement with the correct researcher, ***A–E****.*

Write the correct letter, ***A–E****, in boxes 33–36 on your answer sheet.*

NB *You may use any letter more than once.*

33 A particular crop may make an important contribution to the local economy in one African country.

34 Tests will be carried out by local people in the country where the research is focused.

35 Different specialists must work together to ensure the success of a programme.

36 One type of insect attacking plants in Ghana was previously unknown there.

List of Researchers	
A	James Wood
B	Ken Fening
C	John Carr
D	Theresa Manful
E	Mark Carrington

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Questions 37–40

Complete the summary below.

*Choose **NO MORE THAN TWO WORDS** from the text for each answer.*

Write your answers in boxes 37–40 on your answer sheet.

Trypanosomiasis

Trypanosomiasis is a disease caused by a parasite which is spread by an insect called the **37** ..... . The parasite can remain unaffected by the host's **38** ..... because it is able to change the **39** ..... on its outer covering. It is uncommon among humans but has been found to affect most **40** ..... in Ghana.

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