

L3 Lead Examiner Report 1906

June 2019

**L3 Qualification in Applied
Science**

**Unit 7: Contemporary Issues in
Science (31629H)**

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Unit 7 (31629_H01)

Grade	Unclassified	Level 3			
		N	P	M	D
Boundary Mark	0	8	16	25	35

Introduction

This is the third examination series for Unit 7 (Contemporary Issues in Science).

The scientific issue covered by the three articles was Food technology – genetically modified crops (A1). The articles were:

- a recent newspaper article which gave a brief overview of genetically modified crops for general information
- a publication (within the last 10 years) against genetically modified Golden Rice crops by Greenpeace International
- a recent journal review paper in favour of genetically modified crops by the project manager of the Golden Rice project

The learning aims covered by the questions were:

- Question 1: understanding the scientific issues in terms of ethical/ social/ economic/ environmental impact (A1)
- Question 2: understanding the influence of different organisations/ individuals on scientific issues (A2)
- Question 3: interpretation and analysis of scientific information (B1); evaluation of scientific information (B2)
- Question 4: potential areas for further research and development (B2)
- Question 5: knowledge of how science is reported in different media and for different audiences (C1); understanding the presentation of science reporting and its relationship with the reporting medium and the target audience (C2)

Introduction to the Overall Performance of the Unit

In general, candidates performed similarly or slightly better on this paper by comparison to recent series.

Areas where candidates performed well were:

- Question 1 – discussing implications from the scientific issues
- Question 2 – identifying different organisations or individuals from the articles
- Question 3 – discussing the reliability of sources and references in article 3
- Question 5 – discussing the benefits and concerns surrounding genetically modified crops
- Question 5 – selecting an appropriate format and tone for the target audience

Areas where candidates did not perform as well were:

- Question 1 – linking different impact areas
- Question 2 – explaining the sphere of influence of identified organisations or individuals
- Question 3 – identifying and explaining evidence from article 3 to discuss the validity of the judgements being made
- Question 4 – expanding upon the areas of further research or development that were identified from the articles
- Question 5 – addressing the target audience and relevance of the information selected

Individual Questions

Question 1

“Discuss the implications of the scientific issue identified in the articles.

(12)”

This question was typically answered best by learners, placing the majority in Band 3. Although this could be that as the first question, candidates invested more time and effort, the cohort generally revealed a good comprehension of the three articles and preparation to tackle this question. However, it should be noted that candidates do need to proportion their time appropriately so that all questions are covered sufficiently

There were very few completely Level 1 responses with most candidates appearing to be able to at least identify a reasonable number of scientific issues but then failed to give clear implications related to these or consider both sides as required for a discussion. A small proportion simply summarised each article which revealed a weak understanding of what the question required.

Most candidates were able to draw out “implications” (ie ethical, environmental, economic and social) from the issues raised and this provided a focus. However, relatively few would identify and explain a specific issue in the first instance.

Therefore, the way in which the response was approached determined how well it scored. Many candidates tended to either group their responses by article or by implication. The former “article-by-article” approach tended to be more limiting, as points were either being repeated or would later contradict or ignore previous points made. The latter “implication-by-implication” approach tended to score better as it allowed for integration of points from the different sources or consider differing opinions. However, a drawback with this approach was that links **between** the implications were often missed and therefore candidates were unlikely to get into Band 4 unless the other traits were good enough to raise the overall mark. Those that grouped their answer by an identified scientific issue tended to give fuller responses with little repetition and good linkage to and between the implications. A few responses at this Band also demonstrated research beyond the three articles, which enhanced the scope of the discussion.

Band 4 response

The main issue found in all ^{three} ~~is~~ articles is the fact that not enough science research is done on GM crops meaning that the consequences of growing GM crops isn't yet understood. All three articles talk about how GM crops are becoming popular. In article ~~one~~ it states that the EU ~~is~~ has banned GM crops to be grown in Europe as well as banning exports from ~~east~~ America. This is a social issue because ~~GM crops~~ farmers struggle to maintain their produce and due to crop disease and bad weather conditions they struggle meeting demands. A social issue for GM crops is the fact that poverty is increasing around the world due to GM crops becoming popular due to advances in biotechnology. Farmers will lose their jobs due to no income coming through as well as too expensive for them to buy the GM seeds from companies. Article 3 states that farming isn't a high-status operation, in addition, not only farmers but other people in ~~low~~ developing countries would struggle because 50% of available family income in developing ~~and~~ country. People would begin to starve to death and an increase in death rate. ~~Farmers~~ 2% of the population are farmers and they produce food for people around the world. 98% of farmers are uneducated about the risks and effects on GM crops if they are able to afford it. GM crops interest ~~large~~ ^{big} multi-national companies at the expense of smaller providers. This creates another ethical issue about even though farmers grow GM crops they must have a contract with bio-tec companies and therefore have a limited say of what crops they would like to grow which is morally wrong. GM seeds are very expensive and would continue to increase causing farmers to migrate.

to the city to get a stable job with better income to provide for their families. This would have an economic impact as global demands won't be met as well as people would end up paying more to buy food from the local supermarket, this overall will increase poverty worldwide. People consuming GM crops is an ethical concern as it may harm human health such as triggering allergies or ~~diseases~~ ^{diseases} in humans. There could be effects on animal protein due to animals ^{or live stock} consuming GM crops, this leads to animal rights as it could harm them. GM crops can develop toxins that is harmful for us. Developed western ~~most~~ countries hold the highest food security whilst in sub-saharan africa are at the bottom.

"Why should africa be prohibited from growing the most technological advanced and sustainable crops." ^{"said one of the african} ~~farmers~~ ^{choice} farmers. They have a ^{these are more}

right to have choice. Everyone should be equal and respect farmers in developing countries compared to developed countries. Another ethical issue that was mentioned in Article 3 was ~~claimed~~ were made that golden rice was

a "Trojan Horse" as they were ~~manipulating~~ ^{manipulated} by proponents to create more farmer dependencies and remove farmers choice which is morally wrong. In article 2 it has mentioned that there were many fundings involved for GM crops, roughly 2.6 ~~million~~ million dollars for the golden rice campaign.

These fundings could have been used to help poverty around the world and have a long-term effect such as providing more jobs, better sustainable living. ~~Creating~~ ~~Article~~ Article 2 also mentions that GM crops helped people who are ~~are~~ vitamin A deficient meaning that overall it

lacks other vitamins causing ~~its~~ malnutrition. Environmental impact on GM crops ~~is~~ it is it can cause a reduction in biodiversity meaning that animals and other habitats are in danger. There are risks that potentially cause

an unexpected gene transfer between plants which could become out of control and irreversible. In addition, many acres of land will be used for GM farming causing habitats and animals to be in danger due to deforestation. The GM Crops can become rejected and not enough research is done on the effect of GM Crops on ecosystem. People in the Community are concerned with GM Crops being "unnatural" due to the transfer of genes between species which is unacceptable and violates boundaries between natural & species. An ethical concern is spiritual believers say that it doesn't suit their duty requirement and that God's creation must not be tampered with. This is also a socio-economic issue because farmers who only grow organic crops would raise the price of their food produce ~~the~~ dramatically meaning people would find it expensive and some won't be able to afford it. Development of pests are not affected by insecticides meaning there's more crop damage. This results in farmers not able to earn enough and less food produce in general to feed the world.

Lead Examiner comment:

In this example, the candidate begins by considering what the scientific issue of genetically modified crops and the four types of impact that it has. The response covers four major implication categories (social, economic, ethical and environmental) and considers a number of strands within each area but also how it links to another. The candidate selects evidence well from the three articles to support their discussion, and particularly uses information, statistics and quotes to make their point. The response explores positive and negative impacts, which provides an effective mode of discussion. The discussion shows development of ideas rather than repeating similar points. The response is written clearly and coherently, showing a comprehensive understanding of the scientific issue and its implications.

Band 3 response

1 Discuss the implications of the scientific issue identified in the articles.

(12)

The first, second and third articles ~~are~~ primarily discuss the implications of the use of genetically modified crops (GMO's).

Article 1 * Titled: "What is a Genetically Modified Crop? A European Ruling Sows Confusion"; discusses the change ~~in~~ laws surrounding the production of GMO crops and the possible effects they may have.

~~In~~ In this article, economic, ethical, social and Environmental implications are discussed to validate and justify the information given in the article.

The economic implications of GMO's are arguably the cost of the research, production and distribution.

Due to the tough laws of the European Union ~~that~~ that are "blocking useful gene-edited crops from reaching farms and marketplaces"; ~~genetically~~ genetically modified crops are more costly to produce ~~than~~. However, due to the U.S.A's more lenient laws on GMO's, ~~at~~ up to "325,000 acres were planted across the continent" which in contrast to ~~the~~ Europe where "Over 185 million acres" were planted during 2017; providing jobs and were able to be sold commercially. This in turn bettered the USA's economic status.

However, due to the large amount of space that GMO's have taken up (185 million acres in the US and 325000 acres in the EU), it can be argued that they have a harmful environmental impact as they can destroy and alter natural habitats; as well as, reduce biodiversity. For example; GMO's that ~~have~~ have a "insect-killing toxin" and as discussed in Article 3 there is also the risk of "cross-breeding".

There is also the Ethical impacts of GMO's; as Article 2 & 3 mention, crops such as "Golden rice" have been used to treat Vitamin A Deficiency (VAD) in countries such as: Bangladesh, Philippines and ~~and~~ Pakistan; where severe VAD cases are found. Therefore it can be said that GMO's like "Golden rice" have positively impacted both socially and ethically developing countries where ~~normal~~ GMO's can be designed to grow under harsh conditions and improve the wellbeing, ~~of the~~ ~~and life~~ life expectancy and ~~by~~ lifestyle of the population. However, as organisations such as Greenpeace have discussed; There are arguably unethical aspects to the use of GMO's. Firstly, as Greenpeace have said "It is incredibly disturbing to think that an American research body used Chinese children as guinea pigs for genetically engineered food..."

which brings to light the fact that these less socially developed countries ~~to~~ could be taken advantage of due to the use of GMO's on individuals that may not be ~~aware~~ fully aware of the types of food they are eating and the possibly ~~egg~~ harmful effects they may have.

Therefore, it can be concluded that these articles as a whole identify Economic, Ethical, Social and Environmental impacts that come with Genetically modified crops.

The Economic impacts include the large cost of research & production to GMO's, although they have been found to have a positive economic impact when sold ~~commercially~~ commercially.

Environmental impacts include the chance of cross-breeding, the negative effect on biodiversity and the unknown effects it may have in the future.

Ethical implications include the use of vulnerable populations for research, although it is ~~contrain-~~ contrasted by the positive outcome it has had ~~to~~ stopping diseases such as VAD.

Social impacts include the increase in job opportunities in the growth, ~~or~~ production & distribution of GMO's as well as the improvement it has proven to make in developing countries

(Total for Question 1 = 12 marks)

Lead Examiner comment:

The candidate has not clearly thought through the structure of their response to the question. The response alternates between article-by-article and implication-based approaches. Information is selected but is not always put them together to make a coherent discussion and often reads as a series of facts or quotes which do not always relate to the factor. Links between implications are weak, and the summary at the end emphasises these as being different.

Question 2

“Identify the different organisations/individuals mentioned in the articles and suggest how they may have an influence on the scientific issue. (6)”

The majority of candidates were able to identify organisations and/or individuals mentioned in the articles and provide some indication of how they were relevant to a scientific issue raised in the articles. Most candidates scored in Band 2 for their responses, but many restricted themselves to Band 1 or the bottom of Band 2 as they did not qualify the organisation/individual’s purpose and influence. This suggests that many candidates did not understand what the question required in relation to “influence” (eg field of expertise, economic, legal, political, etc). Instead reliability or validity was considered, pre-empting the focus of Question 3.

A frequent shortcoming in responses was to give the names of the people or organisations and then give a quote from the article without making a point or actually explaining who/what they represented. Conversely, some learners provided general detail about how a particular organisation influences rather than linking this to the issue in the article (eg the European Union court influencing a legal outcome). Sometimes there was a disproportionate focus on one particular type of organisation (eg Greenpeace) which did not show a breadth of consideration.

A number of responses examined the authors of the articles instead, despite the question explicitly requiring the organisations/individuals mentioned in the articles. This would occasionally produce some valid points, if the author represented a pressure or research group, but more often made for a limited response.

Responses in Band 3 were observed and were generally marked out by first clearly identifying the organisation/individual, their background or purpose, how they might influence the scientific issue and who they might influence. The number of examples given were generally fewer in number than those in a weaker learner response but provided a detailed exploration.

It is not necessary for learners to produce an exhaustive list of all the organisations or individuals referenced in the articles but it would be advisable to provide an example from each of the categories listed in the essential content for Unit 7: Government and global organisations; Non-government organisations, professional bodies and associations; Universities and research groups; Private and multinational organisations; Voluntary pressure groups. This will then allow learners to describe different types of influence. In this particular

case, it was noted that there was a lack of knowledge concerning Government and its agencies and their relationship to one another and to lobbying groups, private sector organisations, and foreign and world organisations.

Band 3 response

- 2 Identify the different organisations/individuals mentioned in the articles and suggest how they may have an influence on the scientific issue.

(6)

The European Union was featured in about two articles. In one, they judged a particular GM crop while in the other, they were taking stricter measures against GM crops. However, the second article was a first article was written after the third, so it would seem as if the EU was reconsidering if GM really was a good option.

Europe is a really influential and powerful continent, likewise the European Union as an organisation. So when they announced their stance about GM crops, countries like the USA began to panic because they thought other countries would agree with the EU or just follow their tone their opinion and not create stricter GM regulations or just ban it completely. The effect of this would be reduced exports in ~~at~~ those countries and which could lead to

loss of jobs and ~~financial~~ maybe, a temporary financial crisis or economic recession.

In addition, Greenpeace made their opinion very clear about GM crops. They referred to Golden Rice, a GM crop for treating Vitamin A deficiency, as a waste of resources and time. They claimed the ~~the~~ funds, research and effort being put into that particular project was not worth it as other methods of treating the deficiency had been identified and ~~could even~~ others could even be tested rather than just focus on one ~~that~~ solution that wasn't guaranteed. This would cause the people to either agree with them or not and the result of that could be political inclusion which was identified earlier.

On the other hand, the United States Department of Agriculture appear to have a different opinion as they ~~write a~~ produce a research report that says GM crops are not all that different from usual crops.

They say their contribution to the scientific issue would cause people to carry out more research to validate their report, give those ~~who~~ who were sceptical about GM crops ~~but~~ one reason not to be and this is mainly because of the status and position they hold.

Another ~~of most~~ influential organisation mentioned is the Bill and Melinda Gates Foundation who have been funding the Golden Rice Project. The Bill and Melinda Gates Foundation ~~is~~ a private ~~and not~~ organisation that chooses to fund certain projects they believe could benefit the world in one way or another.

By funding the Golden Rice Project, they are encouraging other wealthy organisations who might be interested in helping out in a world project to also get involved. Also, the people that are benefitting from the project would view them as philanthropists who played a part in the success of the project. However, it could ~~be~~ result in people saying it's only for their benefit and that they are influencing the project "behind the scenes" so it plays out according to what they have planned. And this ~~would~~ ^{not could} make people ~~dis~~trust the ~~credit~~ question the credibility of the project and other GM crops.

Lead Examiner comment:

In this example, the candidate has structured their response so that an organisation / individual is considered. A good range of different types of organisation has been given, and this provides different view-points and vested interests in the issue of genetically modified crops. The sphere of influence is examined in specific cases such as funding, scientific research or who would be influenced. The response shows understanding of how or in what way the organisation/individual has or may influence the issue, and to what extent.

Band 1 response

- 2 Identify the different organisations/individuals mentioned in the articles and suggest how they may have an influence on the scientific issue.

(6)

Organisations:

- Friends of the Earth they're used for funding developing and researching.
- Greenpeace Fund / research and developing Golden rice
- National academy of science research and development
- ETH Zurich, The Rockefeller Foundation, the Biotech programme of the European Union, all these organisations used to fund Golden rice.
- Bill & Melinda Gates Foundation they also fund Golden rice, they have provided 71% of the funds so far this is the biggest organisation to fund and support Golden rice.
- World Health Organization: WHO fund.

Individuals:

- The Royal Society Fund
- The seminal Ye et al. paper fund
- UNICEF Fund

Individuals:

Dana Perls: The senior food and agriculture campaigner for recognizing gene editing as a genetic modification.

- Jeffery D. Walt, a professor of agronomy and toxicology at Iowa state university

- Helena Keller international in Bangladesh over the last four decades provides undernourished regions for the education of VAD.

Lead Examiner comment:

In this example, the candidate has simply provided a list of organisations and individuals that have been referred to in the three articles. Whilst this is a good starting point, there is only a brief mention of who they are or what they might do. Responses must be able to explain how the identified party would be able to influence the issue, who they may influence and to what extent.

Question 3

“Discuss whether article 3 has made valid judgements. (12)”

This question focuses only on one article and provided several cues as to what responses should consist of (eg validity, reliability, referencing, etc). Whilst there were occasionally good responses, the majority of candidates were in Band 2.

Some candidates clearly had not read the question carefully and instead of focusing only on article 3, wasted valuable time discussing articles 1 and 2. Occasionally, credit could be awarded for a comparison but it was generally not a good investment of time to look outside of the specified article. Another misconception of the question was when candidates offered a critique of the format and layout of article 3 and its intended audience – whilst there were elements that could be credited, it was again not the requirement of the question and is not a measure of the validity or reliability of the article.

Candidates that did focus on the validity of conclusions in article 3 were not always clear what they were trying to achieve. This may be because they found it difficult to extract information that demonstrated valid judgements or possibly they did not fully understand the terms “validity” and “reliability” in this context. At the other extreme, some candidates prefaced their discussion with definitions of these terms, reflecting some sound teaching of what to look out for – however, this did have to be applied to the article in question and if it was not supported by evidence from article 3 then it lacked relevance. In any event, many responses did not consider the validity and reliability of the article, which restricted them to the lower bands.

Often candidates were able to gain some credit for understanding that because the information was referenced then it was reliable, whilst better responses discussed the source, expertise of the authors, currency of the article and the quality of its references. However, some candidates did forget that the requirement was for a “discussion” and would either hold an overwhelmingly positive or negative position on the article.

Some candidates had investigated some key references which gave further scope to their discussion, particularly as the article was largely an overview of the issue of Golden Rice and genetically modified organisms.

Few candidates actually discussed how the article interpreted and analysed information, the quality of the statistics and data cited, nor the validity of the conclusion and judgements drawn by the article. Those that did attempt to go beyond generic statements and provide specifics were able to move into Band 3 and above.

Band 4 response

3 Discuss whether Article 3 has made valid judgements.

In your answer you should consider:

- how the article has interpreted and analysed the scientific information to support the conclusions/judgements being made
- the validity and reliability of data
- references to other sources of information.

(12)

Article 3 is supported with both Qualitative and Quantitative information. This is good as it shows a variety of data, However, not all is referenced.

A drawn conclusion from the article is that Vitamin A deficiency (VAD) mostly affects children less than 5 years old. This is a qualitative piece of information. The reference for this conclusion does not state the exact age range of 'young children' affected. The age range added by the author is therefore unreliable. A reference sourced by myself, stated, 'VAD, a public health problem, hitting hardest at young children and pregnant women in low income countries.' - World Health Organisation. The ^{inability} ~~inability~~ to reference the claimed age means the ~~conclusion~~ conclusion is not reliable though, is not invalid as those aged 5 and below could be amongst the 'young children' affected.

Another drawn conclusion, is 'A universally available source of vitamin A [could] save 23-34% of all 5 and younger deaths.' This point is a Quantitative piece of

evidence. The provided source supports the statistics and age range quoted. However, the data from the reference is dated 2012 and so the reliability of these statistics may be affected as they are based on older data. Another source 'The Golden Rice Humanitarian board' said WHO in 2012 quoted 'about 1/3 of under 5's deaths could be prevented'. This supports the drawn conclusion and suggests it is valid and reliable to the date it is resourced from.

Another conclusion is that there are 500,000 cases of VAD annually and 2/3 die if untreated. This is a quantitative piece of information. However, the article is 2 years out of date and so statistical measurements may no longer be as accurate ^{as} when first published. A researched source by the World Health Organisation (WHO) quoted 250,000 - 500,000 cases occur each year and that half die within 12 months of losing sight. This reference means the drawn conclusion is invalid as the specific statistics and points of information (losing sight, 12 months) are not mentioned. However, the amount of cases is still valid but is not reliable as 250,000 - 500,000 occur per annum.

The Golden rice delay is due to suspicion and interference, is a ~~drawn~~ conclusion stated in article 3. This is a qualitative point with no reference to support it. Another reference provided though ~~drawn~~ ^{quoted} required safety parameters, ~~drawn~~ regulatory process and difficult decisions (such as where to promote as Europe had little to no VAD so promotion would not be required) as reason for the delay. This conclusion is invalid as there is no reference or supporting reference.

The table on page 3 of article 3 is a quantitative source showing a decreased mortality rate from 2010 to 2014.

These statistics are only referenced to himself meaning they are not reliable though they are valid as Global Health images show the same trend in graphs but ~~not~~ ^{using} quoted diseases whereas the author uses only 'common diseases' so exact figures cannot be known.

A Quantitative conclusion is that golden rice will be 6 times cheaper per disability adjusted life per year, fully costed. This is invalid as the reference supplied quotes himself and there are no other calculations to support his claim.

Lead Examiner comment:

In this example, the candidate begins their response well by selecting conclusions that the author has drawn and critiquing the validity, based upon the data or information presented. This is supported by a discussion of limitations of information, the reliability and source of the references, and is very specific about where this is observed within the article. The response has a well-developed structure, and is coherent and logical.

Band 1 response

3 Discuss whether Article 3 has made valid judgements.

In your answer you should consider:

- how the article has interpreted and analysed the scientific information to support the conclusions/judgements being made
- the validity and reliability of data
- references to other sources of information.

(12)
Firstly, I believe that article 3 has made valid judgment as both sides of the argument are present and fully addressed throughout the whole argument. There is also data and statistics present throughout each point being made for both sides of the argument, this makes the article non-bias. The data used throughout the article is also from reliable sources who are either from credible source such as doctors or organisations but from published journals as well. As well as this, there has been 36 total references, however, 3 of these references are not dated and therefore raise question to whether or not the data collected is reliable and valid. However, it is over all valid and reliable as the other 33 references are new and in date making the data used valid and reliable.

Lead Examiner comment:

In this example, the candidate provides a response with some structure and coherence but is limited to basic points. There is comment upon the validity of the judgments but it is very general and lacks specific detail. There is consideration of bias but the evidence for this is weak. Finally there is some reference to the sources of information and reliability, and some points are made. However, the candidate has made only a limited attempt to support their arguments and many of the points would benefit from greater exploration.

Question 4

“Suggest potential areas for further development and/or research of the scientific issue from the three articles. (5)”

Most candidates were in Band 1 or 2, with equal proportions at each of the three marks. A minority of candidates left this question unanswered, suggesting that they struggled to understand what was required and/or were running short of time. Only candidates that had researched beyond the articles or were able to show some creative thinking were able to score in Band 3.

It was very common to find that learners had simply discussed an article itself, regarding validity and intended audience, seemingly as a continuation or repetition of Question 3. These learners had clearly misunderstood the focus of this question and tended to offer suggestions of how the articles themselves could be improved rather than the scientific issues raised. There were occasionally ideas around research that crossed over from the article and into genetic modified organisms, vitamin/nutrient deficiency and other issues – this could sometimes just be credited but the approach restricted learners to the lowest bands.

Others missed the point of research and development posed in the question altogether and simply summarized the current situation with genetically modified crops and other methods, neglecting to comment upon what could be done to develop these techniques in the future. This additionally revealed limitations in learner’s understanding of the topic in general.

Some learners took an approach that was essentially a list of developments that they had drawn from the three articles. This could sometimes present itself as a call for further research or development, but there were no suggestions to how this should be done, or problems/barriers that may be encountered. This then restricted these learners to the lower bands.

Responses that were in Band 3 were rare. The best responses referred to several possible areas for further research and development, drawn from all three articles, giving a rationale and approach. For example, crops with particular properties (eg more efficient photosynthesising, insect resistant, other vitamins) to tackle a specific problem, or how to limit/resolve environmental problems (eg cross-contamination of other plant species).

Band 3 response

- 4 Suggest potential areas for further development and/or research of the scientific issue from the three articles.

(5)

In further development of GM crops they could potentially make them disease resistant. They would do this by adding the disease resistance gene from a wild relative and transferring it into the commercial ~~one~~ crop. This is currently undergoing research but could ~~do~~ more. This is being done with the blight-resistant potato. They did this by taking the gene from the wild relative in South America and inserting it into the potatoes immune system. Another area of development is making crops have a drought increased tolerance. This would mean that in countries which don't see much rain could still plant crops as they would still be able to grow with the little amount of rain they get.

There is another development which is being researched but could be useful to go into more depth and analysis and this is nitrogen fixing cereals. These are plants which would harness nitrogen as a nutrient. Doing this would improve photosynthesis as plants wouldn't just need carbon dioxide, this

would also improve the world's atmosphere. Therefore
would increase the efficiency of photosynthesis
and would create ~~pro~~ perennial crops which
wouldn't need planting each year.

GM crops can be used to help decrease pollution.
The crop's aim is to reduce environmental
impacts of manure. There is a compound in
seed animal food which contains high levels of
~~a~~ phytic acid but not in all seeds. This then
gets into manure undigested and contaminates
waters and soils with phosphate. By creating a
GM crop which is low ~~to~~ in phytic acid this
would ~~stop~~ ^{reduce} the contamination and would
cause less harm to the ~~agatic~~ aquatic life. ~~and~~ This
means the pollution risk would be reduced.

Lead Examiner comment:

In this example, the response is very well structured and developed. It is in clear sections, selecting three areas of interest. Each section takes a point from the articles and identifies how it could be researched or developed further. The candidate has been very specific and clear in suggesting how this could be done and why. There is evidence of other research and reading to exemplify the point, and exploration of the potential benefits beyond what is established within the articles.

Band 2 response

- 4 Suggest potential areas for further development and/or research of the scientific issue from the three articles.

(5)

In order for GM crops to expand, research is required. ~~For~~ This may take up to several years to determine the possible negative side effects GM crops can actually have, as well as the positive. In the future, GM crops can be created for animals which can be disease resistant. Further development for GM crops can be they become more resistant to weed, insects, ^{and} pesticides. If GM crops are placed around crops ~~that~~ are non-GM. They can provide protection for them. This will help and strengthen the growth of GM crops as well as non GM crops. With more research, new GM crops can be created which will be more resistant to the surroundings. They can ~~improve~~ resistance to crops as GM crops can be created which can survive in any ^{weather} condition. ~~It~~ furthermore, with more research the GM crops can be developed into crops that

are able to ~~increase~~ increase vitamin intake. They can also produce crops which have an even less impact on the environment and produce less carbon dioxide emission.

Lead Examiner comment:

In this example, the response shows structure and attempts to expand upon identified areas of further research. Although the areas are relevant, there is little additional expansion upon the points beyond what is already mentioned in the articles. There are a couple of suggestions based upon these areas but these are not explored or justified, and have a vague or inaccurate scientific standing.

Question 5

“You are a junior researcher working for the European Commission for Health and Food Safety. The European Commission decides whether genetically modified crops can be used. Many people have concerns about the use of genetically modified crops.

Your task is to write a report about the benefits and concerns of using genetically modified crops. Your report will be sent to the European Commission, a group of professionals. The professionals are not all scientists. (15)”

The majority of learners were scored in Band 2 with their responses, with equal proportions at each of the four marks. About a third of the examination cohort scored in Band 3 or above, but Band 4 was extremely rare. Although the majority of learners did attempt this question, answers were often too brief, which suggested time management issues.

The required format was a report, and on the whole, candidates responded to this with an introduction and discussion of benefits/concerns, occasionally with an appropriate title and sections. A conclusion to the report for the European Commission was often not presented by the candidate – whilst this did not limit the discussion, this would be an effective way to demonstrate summary and synthesis needed for the first trait in Bands 3 and 4. In weaker responses, discussions could be one-sided or exclusively focused on one issue (eg environmental or health concerns). Sometimes, there was little to distinguish candidates’ answers from what was actually an essay.

It was not entirely evident that answers reflected an awareness of the audience and the tone that the report should take, but credit was awarded to responses that showed clarity, informed the reader, were balanced and provided a justified opinion. The context indicated that the audience were professionals but not all scientists, and the tone of voice of responses was, in general, appropriate avoiding slang and colloquialisms. However, candidates that gained higher marks did use more scientifically appropriate language and were discerning in their selection of evidence from the articles for the audience.

The focus of the report was genetically modified crops, so better responses tended to:

- outline what genetically modified crops were and what problems they solved or caused
- consider different factors that would influence the use of the crops (ie technology, economic, environmental, political, etc)
- discuss each point in a balanced way
- justify points made with information from the articles
- provide an overall conclusion or recommendation on their use

Band 4 response

Introduction: Genetically Modified crops.

Genetically modified crops are crops that have been altered or disturbed within their genetic information (DNA) other way than a naturally occurring process. Stated by the European Court they are not genetically modified organisms and are produced through altering methods, such as x-rays and other chemicals that will affect the sequencing of the DNA causing a random mutation. Recently scientist have started using other methods to produce genetically modified crops such as stripping the plants DNA or other species and inserting it inside the plant. By doing this scientists, farmers are able to develop any type of crop that could potentially reach the market place if reached the European health and safety regulations which was ruled by the European's legislation. There are many advantages as well as disadvantages of the

usage of genetically modified crops.

Advantages of genetically modified crops

- Insect killing toxins produced within the crops.
- Speed up crop production.
- Treatment for serious health deficiencies, VAD (Vitamin A deficiency).

Genetically modified crops are carefully produced altered DNA and carefully inserted into the plants, scientists carefully alter the DNA sequence of the plant to make it beneficial to the ecosystem. Making sure that there are no harmful traits.

Genetically modified crops are now able to produce insect killing toxins that are beneficial to the crops, killing any possible pests that could affect the crops

and therefore affecting the products sold onto the market place. Allowing farmers to produce a much bigger profit whilst spending little on the production of the crops itself. This could ^{also} lead to ~~reducing~~ ^{reduction to} the food deserts as the crops can be genetically modified to withstand any climate changes, this is essentially important as currently the climate change is increasing and affecting the whole population as well as crops, ~~making~~ therefore this could lead to reduction of world hunger in many places where the climate change is extreme allowing ~~the people~~ individuals to receive perfect crops that will allow them to feed on.

Genetically modified crops are well known for decrease of vitamin A deficiencies, through the production of Golden rice, genetically modified rice that will produce B-carotene which is responsible for production of vitamin A, this ~~and~~ will reduce night blindness and reduce chances of deaths, reducing the need to buy vitamin A supplementation as it is an increasing problem. The genetically modified crops will allow the essential micronutrients to reach the ones that need it. "Micronutrient deficiencies affect 50% of children and women of reproductive age". This shows that genetically modified crops could solve the continuously developing problem and decrease incidence of deaths and supplementation tablets that are costly to produce.

Although there are many benefits associated with genetically modified crops there are few risks that could affect the health of ^{that may be associated} with genetically modified crops.

These include:

- Spread of GMC over the wild ecosystem.
- Contamination of supply chain
- tests that have to be carried out.

Spread of genetically modified crops is highly risky, as the pollen can spread kilometers away it may cause a cross pollination, affecting other crops in a disadvantaged way. If the crops are not what the farmer determined it to be it may affect the whole ecosystem and cause damages therefore it is highly essential crops are tested, which may cause costs to increase.

Insect killing toxins could cause beneficial insects to be killed such as bees which would have a much bigger impact on our ecosystem than the spread of cross-pollination. As the number of bees are continuously declining affecting our crop development and production.

Although there are risks associated, genetically modified crops may decrease chances of other risks, such as reduction in food poverty, reduction in poor crop production, increase of speed of the production. The crops have to be genetically modified in such a way to not affect the population of beneficial insects that produce honey and spread pollen for plant production. The genetically modified crops are useful and should be used however modified in such way not to affect certain things such as bees.

(Total for Question 5 = 15 marks)

Lead Examiner comment:

In this example, the candidate begins their report with a title and introduction to genetically modified crops, outlining what this is and providing an overview for the reader. Advantages are listed and considered in detail with well selected examples drawn from the articles. This is also done for disadvantages. This is concluded with a weighing up of the benefits and risks, to provide the reader with the candidate's judgement.

It is not entirely clear who the report is intended for as it does not specifically relate to the European Union, but it has been written in an accessible way with a consistent tone, which would be appropriate for a professional audience. The layout and effectiveness of the report could be improved to provide sub-headings and sections for ease of reference and to break up the text a bit more. There are a few flaws in spelling and grammar which should have been corrected by the learner on re-reading, but overall the report has a well-developed structure that is coherent and logical which would allow it to reach Band 4.

Band 2 response

The advantages of using Genetically modified crops.

It can have more than one use, such as making extra vitamins.

It is easy for third world countries to sustain while growing them, which is helpful as they can farm it themselves, and not have to ~~rely~~^{Rely} on others.

Another advantage is it can resist herbicides.

It increases the yield for one crop to feed a increasing population, this is a major advantage because it shows we need Genetically modified crops for the population as it'll increase another 3 billion by 2050.

It can be replanted and reused so it will not go to waste.

The disadvantages of Genetically modified crops
Ethical issues are raised such as religion,
it can be portrayed as people are trying
to pray as God. That what God created in
his image should not be changed.

It can cause health issues ~~as it can have~~

The low income countries will become dependant
of Genetically modified crops. This will become
an issue as to do genetically modified crops
is expensive. But over time cost effective
methods can come out.

Another disadvantage is the fact that
Genetically modified plants are not fully
understood by society, as everyone has
different opinions on them. It is easily
mistaken and not everyone understand the
~~dis~~ advantages of Genetically
modified crops.

Lead Examiner comment:

In this example, the candidate would appear to make little attempt to produce a report and could be regarded as an essay. There is no title but there are section headings which consider advantages or disadvantages of genetically modified crops. The discussion in each section is narrow but generic in its focus, often with little reference to the articles and showing no attempt to synthesise points. There is no summary or conclusion to provide the reader with the candidate's judgement on the issue.

It is not clear who the report is intended for and holds a global / general position. It has been written in an accessible way with a consistent tone, but would be rather basic for a professional audience. The layout of the response is also basic, and flaws

in grammar and punctuation are noticeable. Overall the response has some structure and coherent which would allow it to reach Band 2.

Summary

Question 1:

- Candidates should clearly establish the scientific issue/issues before examining evidence from the articles for the implication areas
- Responses that simply take an article-by-article or implication-by-implication approach are unlikely to show links to and between implication areas
- Candidates must be careful to proportionate their time so that they do not spend too long on this particular question

Question 2:

- Candidates must provide more depth than simply provide a list of organisations/individuals mentioned in the articles and should investigate who they are and what they represent as part of their preparation for this examination
- Responses need to consider how wide and deep the organisation or individual's sphere of influence is in respect of the scientific issue. This may be evident from the article but further research may be needed
- Consideration of a range of different organisations or individuals will allow candidates to discuss different view-points and motivations

Question 3:

- The key focus of this question is the validity of the judgements being made by the article, so candidates must identify what the conclusions are and whether these are justified and supported
- Whilst candidates need to be clear about validity and reliability, they must be taught to be able to recognise and articulate the evidence for this within the article
- The question requires a discussion so positives and negatives must be drawn out
- Candidates should try to avoid reliance on generic statements such as the number and currency of references

Question 4:

- Identification of areas for further research or development within articles is a good starting point, but candidates must be able to extrapolate from this within their own suggestions and ideas
- Whilst there should be reference and identification of areas from the articles, candidates should undertake their own wider research to integrate with what they have learnt from the articles

Question 5:

- Candidates need to respond to the format of the evidence required by the question eg a report would generally be expected to have a title, introduction / background, discussion and conclusion / recommendation
- Responses need to consider their target audience. Some key considerations are who is the audience, what is relevant to the audience, what is the level of understanding of the issue, what should be the tone they should be addressed in, and should the evidence be advising or informing.
- Candidates must be careful to proportionate their time so that they have sufficient time on this particular question, which is almost one-third of the marks available.

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