Agricultural Science subject report

2022 cohort

February 2023

Contents

Introduction

Throughout 2022, schools and the QCAA worked together to further consolidate the new Queensland Certificate of Education (QCE) system. The familiar challenges of flood disruption and pandemic restrictions were managed, and the system continued to mature regardless.

We have now accumulated three years of assessment information, and our growing experience of the new system is helping us to deliver more authentic learning experiences for students. An independent evaluation will commence in 2023 so that we can better understand how well the system is achieving its goals and, as required, make strategic improvements. The subject reports are a good example of what is available for the evaluators to use in their research.

This report analyses the summative assessment cycle for the past year — from endorsing internal assessment instruments to confirming internal assessment marks, and marking external assessment. It also gives readers information about:

- how schools have applied syllabus objectives in the design and marking of internal assessments
- how syllabus objectives have been applied in the marking of external assessments
- patterns of student achievement.

The report promotes continuous improvement by:

- identifying effective practices in the design and marking of valid, accessible and reliable assessments
- recommending where and how to enhance the design and marking of valid, accessible and reliable assessment instruments
- providing examples, including those that demonstrate best practice.

Schools are encouraged to reflect on the effective practices identified for each assessment, consider the recommendations to strengthen assessment design and explore the authentic student work samples provided.

Audience and use

This report should be read by school leaders, subject leaders and teachers to:

- inform teaching and learning and assessment preparation
- assist in assessment design practice
- assist in making assessment decisions
- help prepare students for external assessment.

The report is publicly available to promote transparency and accountability. Students, parents, community members and other education stakeholders can use it to learn about the assessment practices and outcomes for General subjects (including alternative sequences (AS) and Senior External Examination (SEE) subjects, where relevant) and General (Extension) subjects.

Report preparation

The report includes analyses of data and other information from endorsement, confirmation and external assessment processes. It also includes advice from the chief confirmer, chief endorser and chief marker, developed in consultation with and support from QCAA subject matter experts.

Subject data summary
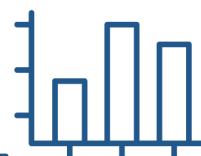
Subject completion

The following data includes students who completed the General subject or AS.

Note: All data is correct as at 31 January 2023. Where percentages are provided, these are rounded to two decimal places and, therefore, may not add up to 100%.

Number of schools that offered the subject: 52.

Completion of units	Unit 1	Unit 2	Units 3 and 4
Number of students completed	510	485	423

Units 1 and 2 results

Number of students	Satisfactory	Unsatisfactory
Unit 1	469	41
Unit 2	449	36

Units 3 and 4 internal assessment (IA) results

Total marks for IA
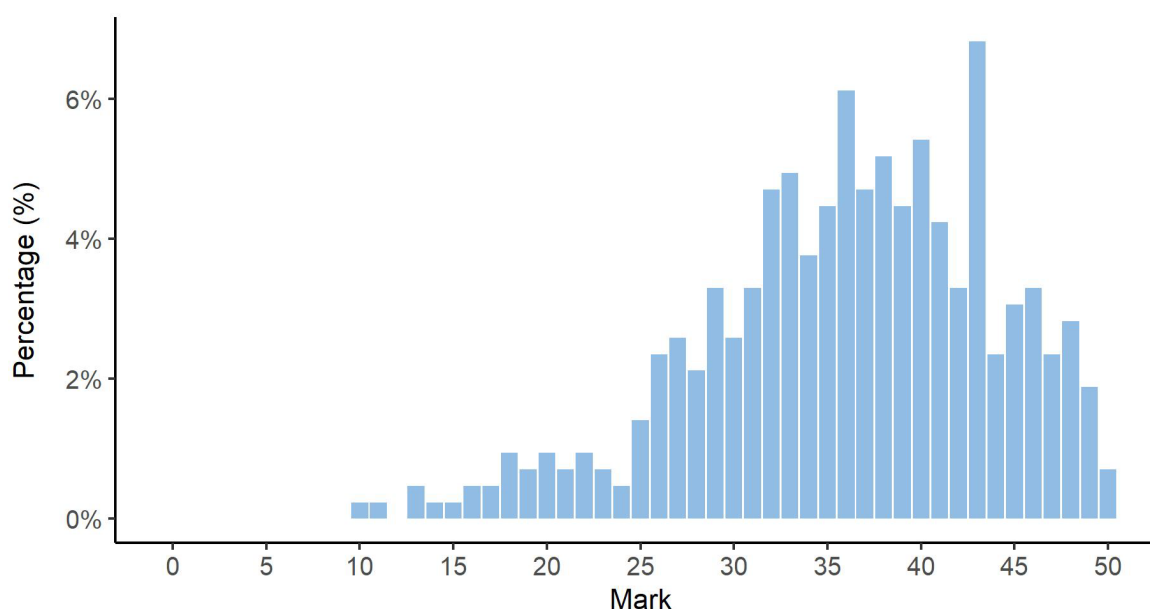
IA1 marks

IA1 total
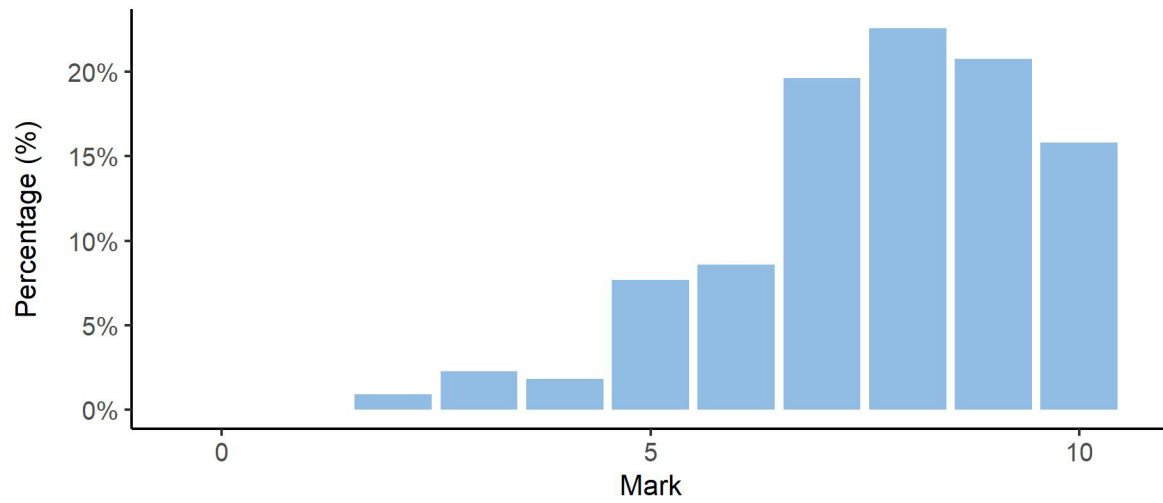
IA1 Criterion: Data test
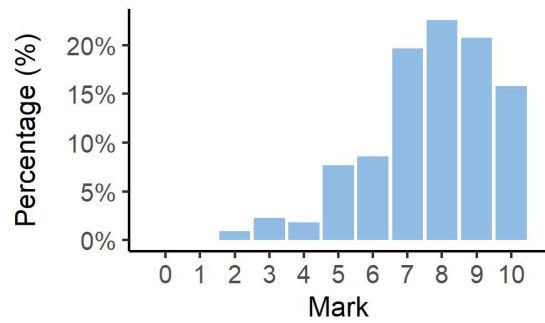
IA2 marks

IA2 total
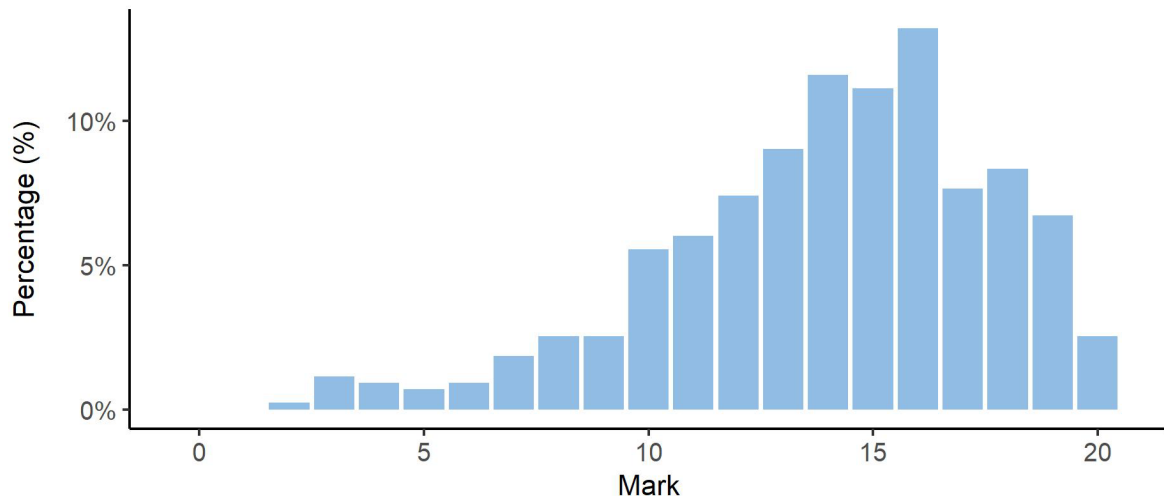
IA2 Criterion: Research and planning
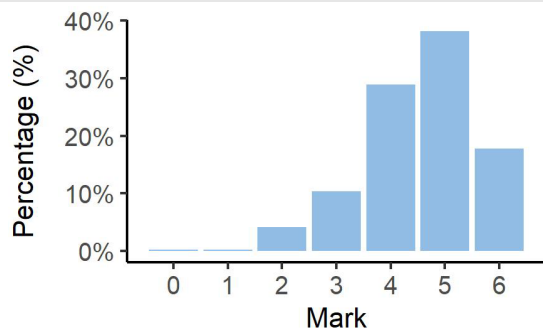
IA2 Criterion: Analysing of evidence
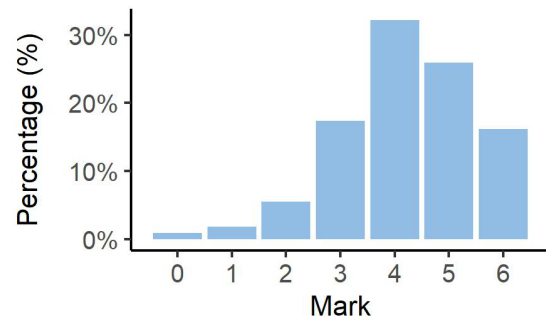
IA2 Criterion: Interpretation and evaluation
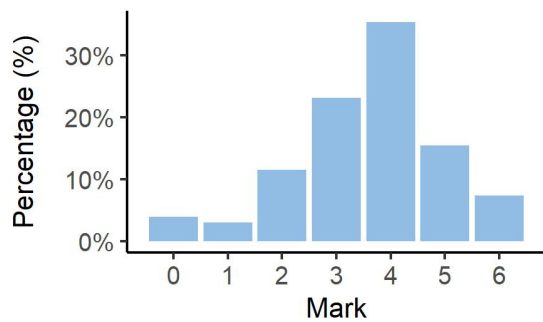
IA2 Criterion: Communication
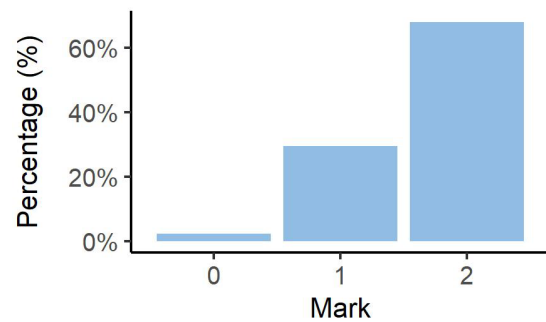
IA3 marks

IA3 total
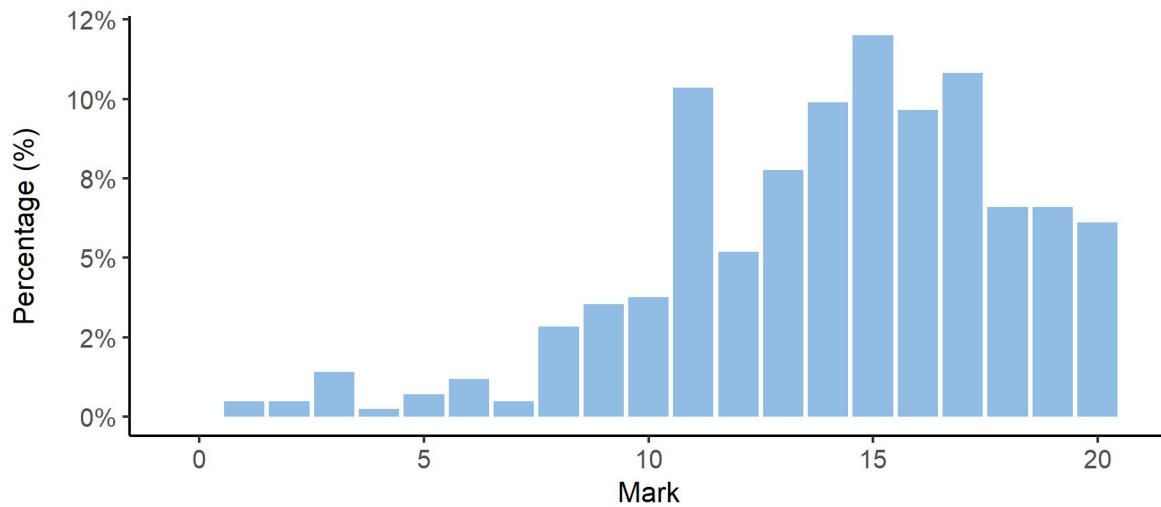
IA3 Criterion: Research and planning
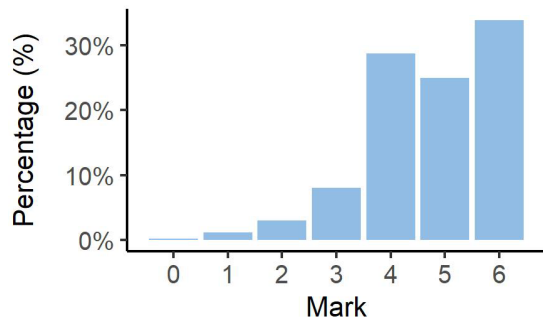
IA3 Criterion: Analysis and interpretation
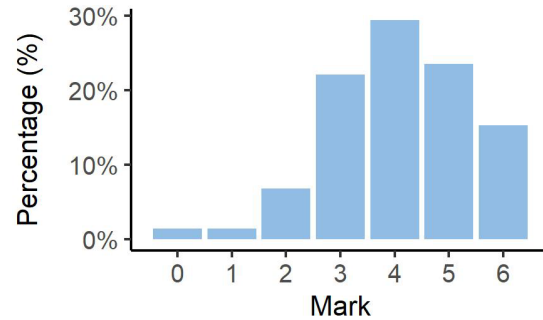
IA3 Criterion: Conclusion and evaluation
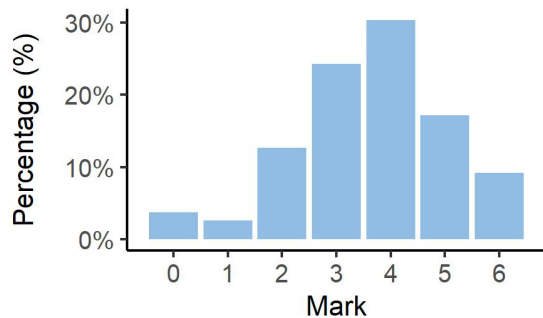
IA3 Criterion: Communication
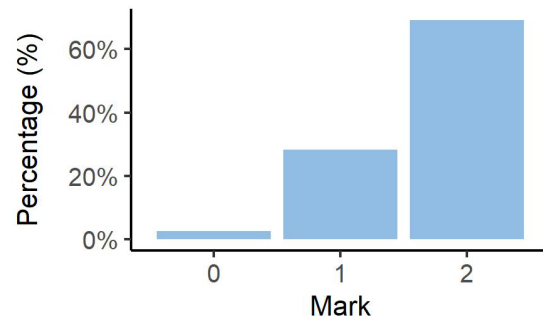
External assessment (EA) marks
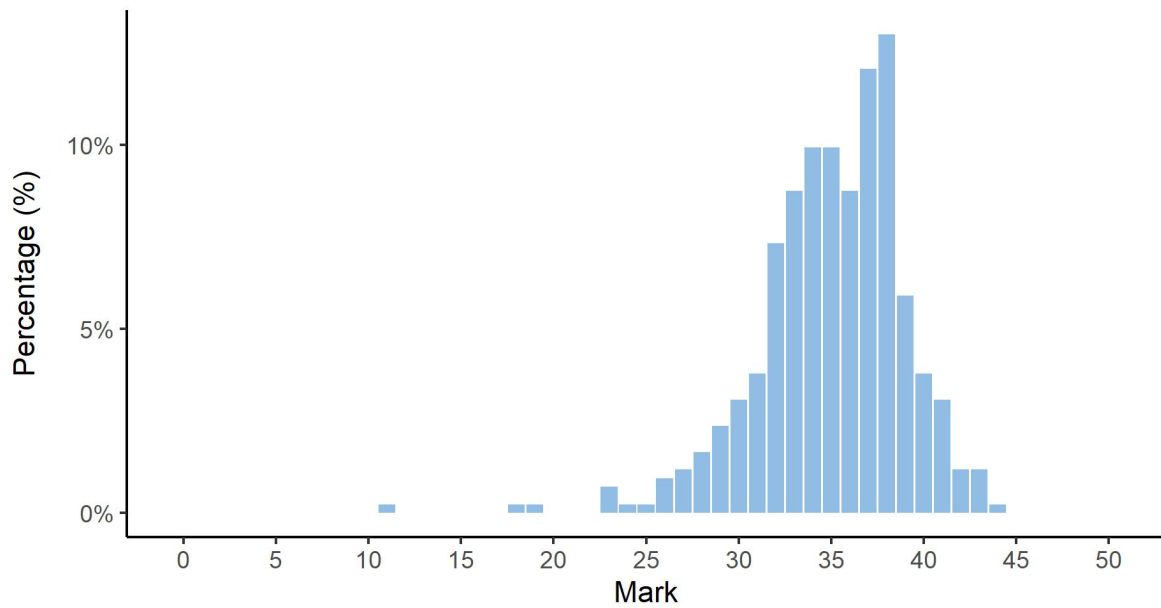
Final subject results

Final marks for IA and EA
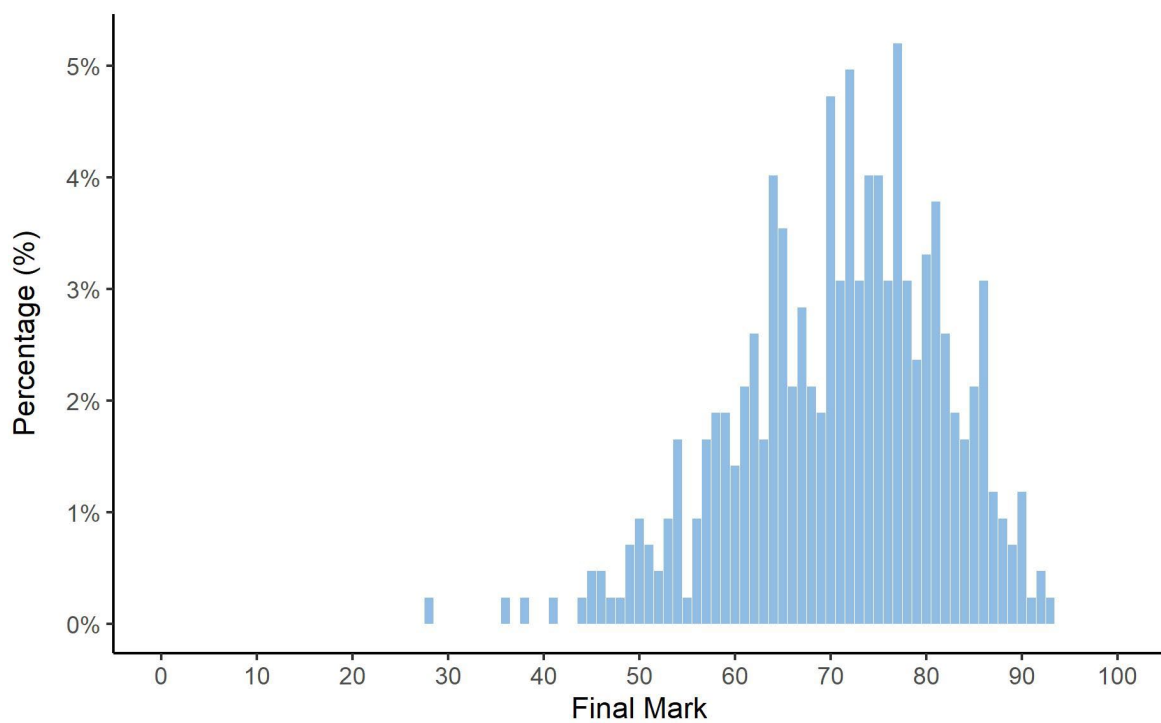
Grade boundaries

The grade boundaries are determined using a process to compare results on a numeric scale to the reporting standards.

Standard	A	B	C	D	E
Marks achieved	100–82	81–66	65–45	44–21	20–0

Distribution of standards

The number of students who achieved each standard across the state is as follows.

Standard	A	B	C	D	E
Number of students	69	227	122	5	0

Internal assessment

The following information and advice relate to the assessment design and assessment decisions for each IA in Units 3 and 4. These instruments have undergone quality assurance processes informed by the attributes of quality assessment (validity, accessibility and reliability).

Endorsement

Endorsement is the quality assurance process based on the attributes of validity and accessibility. These attributes are categorised further as priorities for assessment, and each priority can be further broken down into assessment practices.

Data presented in the Assessment design section identifies the reasons why IA instruments were not endorsed at Application 1, by the priority for assessments. An IA may have been identified more than once for a priority for assessment, e.g. it may have demonstrated a misalignment to both the subject matter and the assessment objective/s.

Refer to *QCE and QCIA policy and procedures handbook v4.0*, Section 9.5.

Percentage of instruments endorsed in Application 1

Number of instruments submitted	IA1	IA2	IA3
Total number of instruments	51	51	51
Percentage endorsed in Application 1	31%	80%	78%

Confirmation

Confirmation is the quality assurance process based on the attribute of reliability. The QCAA uses provisional criterion marks determined by teachers to identify the samples of student responses that schools are required to submit for confirmation.

Confirmation samples are representative of the school's decisions about the quality of student work in relation to the instrument-specific marking guide (ISMG), and are used to make decisions about the cohort's results.

Refer to *QCE and QCIA policy and procedures handbook v4.0*, Section 9.6.

The following table includes the percentage agreement between the provisional marks and confirmed marks by assessment instrument. The Assessment decisions section of this report for each assessment instrument identifies the agreement trends between provisional and confirmed marks by criterion.

Number of samples reviewed and percentage agreement

IA	Number of schools	Number of samples requested	Number of additional samples requested	Percentage agreement with provisional marks
1	51	260	0	98.04%
2	51	260	0	66.67%
3	51	257	7	76.47%

Internal assessment 1 (IA1)

Data test (10%)

The IA1 data test requires students to apply a range of cognitions to multiple questions. Students respond to items using qualitative and/or quantitative data derived from practicals, activities or case studies on topics from Unit 3. The task requires students to identify unknown scientific quantities or features; identify trends, patterns, relationships, limitations or uncertainty in datasets; and draw conclusions based on the analysis of data.

Assessment design

Validity

Validity in assessment design considers the extent to which an assessment item accurately measures what it is intended to measure and that the evidence of student learning collected from an assessment can be legitimately used for the purpose specified in the syllabus.

Reasons for non-endorsement by priority of assessment

Validity priority	Number of times priority was identified in decisions*
Alignment	26
Authentication	0
Authenticity	0
Item construction	2
Scope and scale	6

*Each priority might contain up to four assessment practices.

Total number of submissions: 51.

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- included datasets that were meaningful, realistic and challenging, e.g.
    - average daily weight gain of an agricultural animal fed different rations
    - mean dry weight yield of a forage crop supplied with different application rates of a nominated nutrient, e.g. nitrogen or phosphorus
    - effect of post-harvest conditions on the shelf-life of a nominated crop, e.g. apples or lettuce
- used items that required single word, sentence or short paragraph responses, calculation using algorithms and interpretation of datasets
- provided a suitable number of questions for students to complete the task within 60 minutes.

Practices to strengthen

It is recommended that assessment instruments:

- use datasets that are clearly associated with Unit 3 subject matter (e.g. plant production or vegetative yield) and not Unit 1, e.g. plant growth

- use cognitive verbs associated with the objective being assessed, e.g. 'distinguish' aligns with objective 3, analyse evidence; 'infer' aligns with objective 4, interpret evidence as per Marks allocation table (General Syllabus section 4.5.1)

- contain items that assess only one cognition, e.g. 'contrast the data' instead of 'contrast the data to determine its statistical significance'

- avoid items that assess objective 1 (e.g. 'explain what a p-value demonstrates') or objective 6, e.g. 'evaluate the ability of a ration to provide the nutritional needs of an agricultural animal'

- contain items that can be answered using the stimulus supplied in the dataset

- allow unique student responses by avoiding unnecessary scaffolding, e.g. 'in your response, refer to …'

Accessibility

Accessibility in assessment design ensures that no student or group of students is disadvantaged in their capacity to access an assessment.

Reasons for non-endorsement by priority of assessment

Accessibility priority	Number of times priority was identified in decisions*
Bias avoidance	6
Language	13
Layout	10
Transparency	7

*Each priority might contain up to four assessment practices.

Total number of submissions: 51.

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- avoided stereotypes, distressing content and cultural, social or gender bias

- contained clear instructions that used cues that align to the specifications, objectives and/or ISMG.

Practices to strengthen

It is recommended that assessment instruments:

- use consistent language in datasets and associated items, e.g. 'meat chickens or broiler chickens' not 'both meat and broiler chickens'

- use datasets that contain only the information required to answer the associated items. Datasets should be modified, if necessary, to be made more concise

- contain relevant textual features including dataset headings (e.g. Dataset 1), figure headings (e.g. Figure 2: Market specifications for cattle carcasses) and column/row headings, e.g. initial weight, final weight.

Assessment decisions

Reliability

Reliability is a judgment about the measurements of assessment. It refers to the extent to which the results of assessments are consistent, replicable and free from error.

Agreement trends between provisional and confirmed marks

Criterion number	Criterion name	Percentage agreement with provisional	Percentage less than provisional	Percentage greater than provisional	Percentage both less and greater than provisional
1	Data test	98.4%	0%	0%	1.96%

Effective practices

Accuracy and consistency of the application of the ISMG for this IA was most effective when:

- 'follow through' marks were clearly indicated in the marking scheme, e.g. 'allow for FT from Question 2 to Question 3'

- the use of part marks was avoided

- the marking scheme provided an accepted range for a valid quantitative response, e.g. when reading 130 from a graph, accept between 125–135 inclusive.

Samples of effective practices

The following excerpt demonstrates the use of annotations on a student response to indicate where evidence matches to the marking scheme in an objective 4 item that required students to interpret values for different dependent variables from the dataset.

Note: The characteristic/s identified may not be the only time the characteristic/s has occurred throughout a response.

The following excerpt demonstrates the use of annotations on a student response to indicate where evidence matches the marking scheme in an objective 3 item that required students to identify a relationship between two carcass characteristics from a graph.

Note: The characteristic/s identified may not be the only time the characteristic/s has occurred throughout a response.

Practices to strengthen

To further ensure accuracy and consistency of the application of the ISMG for this IA, it is recommended that:

- the marking scheme be updated during and after marking student work to ensure that decision-making is consistent across the cohort

- marking schemes are clear, accurate, complete and clearly match the endorsed assessment instrument.

Additional advice

- Schools are encouraged to ensure that sufficient context is provided with each dataset to allow students to interpret the evidence and draw appropriate conclusions.

- An appropriate marking scheme should be uploaded for confirmation where a comparable assessment instrument has been administered.

Internal assessment 2 (IA2)

Student experiment (20%)

The IA2 student experiment requires students to modify (i.e. refine, extend or redirect) an experiment to address their own hypothesis or question related to topics from Unit 3. Students may use a practical performed in class as the basis for their methodology. They develop a research question, collect and process primary data, analyse and interpret evidence, and evaluate the reliability and validity of their experimental process.

Assessment design

Validity

Validity in assessment design considers the extent to which an assessment item accurately measures what it is intended to measure and that the evidence of student learning collected from an assessment can be legitimately used for the purpose specified in the syllabus.

Reasons for non-endorsement by priority of assessment

Validity priority	Number of times priority was identified in decisions*
Alignment	8
Authentication	0
Authenticity	0
Item construction	1
Scope and scale	0

*Each priority might contain up to four assessment practices.

Total number of submissions: 51.

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- provided practicals for modification that are directly related to Unit 3 subject matter, e.g. 'Analyse primary or secondary growth data to make judgments about animal nutrition', 'Compare the bone, muscle and fat percentages of different carcasses or cuts that are commercially available'

- allowed for unique student responses by indicating how students would be assessed during group work.

Practices to strengthen

It is recommended that assessment instruments:

- contain consistent information in the condition and context sections of the task sheet, i.e. the practicals listed must align to the topics identified in the assessment conditions.

Accessibility

Accessibility in assessment design ensures that no student or group of students is disadvantaged in their capacity to access an assessment.

Reasons for non-endorsement by priority of assessment

Accessibility priority	Number of times priority was identified in decisions*
Bias avoidance	0
Language	1
Layout	0
Transparency	0

*Each priority might contain up to four assessment practices.

Total number of submissions: 51.

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- provided clear instructions that aligned to the specifications of the syllabus, the assessment objectives and the ISMG

- avoided bias and inappropriate content

- avoided leading students to a predetermined response by providing appropriate scaffolding to support development of the research question

- included clear communication of task elements, using succinct language and accurate spelling and grammar.

Practices to strengthen

> There were no significant issues identified for improvement.

Additional advice

- Teachers should encourage students to develop a research question that looks at a difference between groups or a correlation between variables, e.g. 'Does the level of available nitrogen affect the dry matter yield of forage oats?'

Assessment decisions

Reliability

Reliability is a judgment about the measurements of assessment. It refers to the extent to which the results of assessments are consistent, replicable and free from error.

Agreement trends between provisional and confirmed marks

Criterion number	Criterion name	Percentage agreement with provisional	Percentage less than provisional	Percentage greater than provisional	Percentage both less and greater than provisional
1	Research and planning	82.35%	15.69%	1.96%	0%
2	Analysis of evidence	72.55%	25.49%	1.96%	0%
3	Interpretation and evaluation	86.27%	13.73%	0%	0%
4	Communication	100%	0%	0%	0%

Effective practices

Accuracy and consistency of the application of the ISMG for this IA was most effective when:

- in the Research and planning criterion

  - a *specific and relevant* research question

    - was clearly aligned with Unit 3 content, e.g. 'yield' or 'production' rather than 'height' or 'germination'

    - involved only one independent variable to allow students to answer it within the scope of the response

    - clearly identified the dependent variable (e.g. biomass) to allow for the collection of relevant data from an appropriate harvested product, e.g. pasture species or lettuce

  - responses clearly indicated the methodology of the teacher-led practical used as the basis for the experiment when *justifying* modifications

  - ethical considerations were considered when conducting animal trials and environmental issues (such as nutrient run-off) were considered when conducting plant trials

- in the Interpretation and evaluation criterion

  - conclusions were *justified* by referring to the trends, patterns or relationships and the uncertainty and limitations identified in the analysis of evidence to determine how the evidence matched with the theoretical concepts identified in the rationale

  - discussion of the reliability and validity of the experimental process was *justified* by

    - providing an explanation of research informed by types of reliability and validity rather than a simple list of issues

    - referring to the uncertainty and limitations identified in the analysis of evidence

  - suggestions of improvements and extensions were based upon the evaluation of the reliability and validity of the data.

Samples of effective practices

The following research question is clearly aligned to the subject matter in Unit 3 (i.e. plant production) by measuring yield.

Note: The characteristic/s identified may not be the only time the characteristic/s has occurred throughout a response.

Research Question

What effect does fertiliser type of, Organic Supergrowth and Nitroshoska Special, have on forage dry matter yield of Brigalow Oats?

A specific & relevant R.Q ✓

The following excerpt demonstrates considered management of the ethical issues of tagging, competition and nutrient requirements and of risks to human safety.

Note: The characteristic/s identified may not be the only time the characteristic/s has occurred throughout a response.

Table 2: Management of risks:

Identified risks	Strategies preventing risk
Inhalation of Non-anthropogenic particles	To prevent inhaling the feed particles, feed bags must be opened at a distance. Masks may also be used to further decrease the risk of respiratory conditions.
Documentation of Ethical Consideration	Considering welfare, broilers are provided with clean water and fresh feed daily. The flooring of their pen is lined with saw dust to allow the birds to express natural behaviours without any hazardous conditions. All feed is medicated preventing disease. Pens were cleaned weekly to decrease the possibility of pathogen growth allowing freedom from disease.
Zip ties causing poor circulation in chickens' feet	Cable ties are used to mark individuals, a wide gap will allow for leg development without pressure inflicted onto the foot.
Competition between chickens	To prevent unhealthy pecking orders, adequate supply of feed will be provided to prevent competition.
Minimum crude protein	Ethical welfare states that broilers must be fed more than 20% CP (Macklin, 2019). This impacted the experiment's protein variables.
Irritation in eyes	To prevent any foreign materials irritating the eyes, personal protection equipment such as glasses must be worn.

The following excerpts demonstrate thorough and appropriate identification of uncertainty and limitations linked to the standard deviation and R^2 values and an insightful discussion of the quality of the evidence.

Note: The characteristic/s identified may not be the only time the characteristic/s has occurred throughout a response.

Excerpt 1

The standard deviation shown in Table 5 is large for all trials. Table 3 shows that the weights for 0.3ml/L range from 23.44 to 112.96; this is a very large difference. This results in a higher uncertainty regarding the accuracy of the data collected. Similarly, the standard deviation presented in Table 6 is high, considering the means of the number of fruit collected. Higher standard deviation leads to a higher standard error, which increases the uncertainty of the accuracy of the data collected. The standard error of both the weights and the amount collected was substantially high in respect to the means. This is a result of the large variation of the data collected for each trial.

Figures 1 and 2 show a relationship that increases slightly and then decreases regarding the concentration of GA₃ and the amount of fruit per plant. An R^2 value of 0.73 for the total number of fruit per treatment level shows that 73% of the variance seen is due to the relationship between GA₃ and yield of tomatoes, which is considered a substantially strong relationship. The total number of fruit per plant has a very weak R^2 value at 0.17, due to the widespread nature of the data collected. However, a similar, albeit weak, relationship to that presented in Figure 1 can be seen.

Excerpt 2

The methods of data collection used were moderately effective, however, due to several uncontrolled factors, the reliability and the validity have been decreased. Due to a high standard deviation and standard error, the reliability of this experiment is not optimal, due to the large variance in individual plant data. In the same way, due to many limiting factors such as unpredictable weather, the validity for the purpose of this experiment has been decreased. External factors were not controlled, and it is highly possible that they will have impacted the yield and size of the cherry tomatoes.

Practices to strengthen

To further ensure accuracy and consistency of the application of the ISMG for this IA, it is recommended that:

- in the Analysis of evidence criterion

    – *correct and relevant* processing of data should be demonstrated using techniques that align to the research question, e.g. data for a question about correlation between variables should be analysed using a scatterplot and R^2 value, while data for a question about a difference between groups should be analysed using a column graph with error bars and t-tests

    – *thorough* identification of trends, patterns or relationships should consider all dependent variables

    – *thorough and appropriate* identification of the uncertainty of evidence should use measures such as standard error, confidence intervals, standard deviation or R^2 values

- *thorough and appropriate* identification of the limitations of evidence should refer to specific points of interest, such as possible outliers for a dataset or large variations between values within a dataset.

Additional advice

- Marked ISMGs must clearly indicate the characteristics evident in the student response and the mark awarded for each criterion (*QCE and QCIA policy and procedures handbook v4.0*, Section 9.6.3).

- Schools should review advice about how to determine provisional marks when applying the best-fit model to decisions about marks awarded on the ISMG (Making judgments webinar).

Internal assessment 3 (IA3)

Research investigation (20%)

The IA3 research investigation requires students to gather secondary evidence related to a research question in order to evaluate a claim about Unit 4. Students develop a research question, collect and analyse secondary data, interpret evidence to form a justified conclusion, discuss the quality of the evidence and extrapolate the findings of the research to the claim.

Assessment design

Validity

Validity in assessment design considers the extent to which an assessment item accurately measures what it is intended to measure and that the evidence of student learning collected from an assessment can be legitimately used for the purpose specified in the syllabus.

Reasons for non-endorsement by priority of assessment

Validity priority	Number of times priority was identified in decisions*
Alignment	7
Authentication	1
Authenticity	3
Item construction	0
Scope and scale	0

*Each priority might contain up to four assessment practices.

Total number of submissions: 51.

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- gave students the opportunity to cover the required assessable objectives and performance-level descriptors of the ISMG
- contained claims that allowed the generation of multiple research questions, e.g. 'Effective waste management systems are essential in intensive animal production systems'
- considered the knowledge and skills students were required to demonstrate to complete the task within syllabus conditions.

Practices to strengthen

It is recommended that assessment instruments:

- contain a comprehensive list of the task description dot points (General Syllabus section 5.6.1)
- contain claims directly aligned with Unit 4 subject matter

- contain claims that allow for a unique student response, e.g. 'Minimal tillage requires the use of glyphosate' is a narrowly focused claim while 'Conservation tillage requires a disproportionate use of pesticides' may elicit a wider range of research questions from students.

Accessibility

Accessibility in assessment design ensures that no student or group of students is disadvantaged in their capacity to access an assessment.

Reasons for non-endorsement by priority of assessment

Accessibility priority	Number of times priority was identified in decisions*
Bias avoidance	0
Language	0
Layout	0
Transparency	0

*Each priority might contain up to four assessment practices.

Total number of submissions: 51.

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- provided clear instructions that used cues aligned to the specifications, objectives and ISMG

- contained clear communication of the genre to be used, e.g. scientific report or multimodal presentation

- used appropriate language and avoided unnecessary jargon, specialist language and colloquial language

- were free of errors and modelled accurate spelling, grammar, punctuation and other textual features.

Practices to strengthen

There were no significant issues identified for improvement.

Additional advice

- Claims should be clear and concise.

- Claims that include more than one variable, e.g. 'Animal welfare requirements are influenced by social, economic, cultural and ethical perceptions', may be difficult to answer in the allocated word limit without a highly focused research question that considers an aspect of the claim.

Assessment decisions

Reliability

Reliability is a judgment about the measurements of assessment. It refers to the extent to which the results of assessments are consistent, replicable and free from error.

Agreement trends between provisional and confirmed marks

Criterion number	Criterion name	Percentage agreement with provisional	Percentage less than provisional	Percentage greater than provisional	Percentage both less and greater than provisional
1	Research and planning	94.12%	1.96%	3.92%	0%
2	Analysis and interpretation	88.24%	11.76%	0%	0%
3	Conclusion and evaluation	82.35%	17.65%	0%	0%
4	Communication	98.04%	0%	1.96%	0%

Effective practices

Accuracy and consistency of the application of the ISMG for this IA was most effective when:

- in the Research and planning criterion
  - a *considered* rationale demonstrated an understanding of subject matter from Unit 4 and applied this to the development of the research question from the claim
  - *sufficient and relevant* sources were drawn from a variety of scientifically credible sources
- in the Analysis and interpretation criterion
  - *thorough* identification of trends, patterns or relationships discussed key aspects of the analysed data
  - *thorough and appropriate* identification of limitations considered limitations that would impact the usefulness of the evidence in answering the research question
  - *justified* scientific arguments were drawn from the evidence identified in the analysis.

Samples of effective practices

The following excerpts demonstrate a conclusion to the research question that is justified by making reference to the evidence presented and suggested extensions to the investigation that logically derived from the analysis of evidence.

Note: The characteristic/s identified may not be the only time the characteristic/s has occurred throughout a response.

Excerpt 1

wh   Furthermore, it can be seen in *figure 1* that when DS1 (digested solids) and S2 (solid form manure) were applied, they produced significantly less Methane and Carbon Dioxide when compared to the remaining treatments (Digested liquid, liquid MMS). *Figure 4* shows that liquid MMS systems are most commonly used (80% of permitted farms, 30% of large farms) by significant scale dairy produces. This supports the claim and shows that manure is not sustainably managed as the current most common MMS has significantly higher GHG and nitrogen emissions when compared to other available systems

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Excerpt 2

Whilst it has been shown that MMS can influence the impact of GHG and other emissions, the effect of MMS on economic and social factors has not been investigated in this report. Further investigations could investigate the effect of MMS on economic factors, such as maintenance cost and initial cost of purchase/instalment. Furthermore, investigation into the effect of MMS on social factors, such as the amount of manual labour (dependent on the amount of automation in the system), the level of experience/education needed to maintain chosen system and the risk level for employees and public.

The breed of cattle used were not accounted for when studying the amount of GHG emissions. Further research using two different breeds of cattle could be conducted to identify breeds/genes/diets that could reduce the amount of GHG emissions before storage and application, thus possibly making MMS more effective for agricultural producers.

Practices to strengthen

To further ensure accuracy and consistency of the application of the ISMG for this IA, it is recommended that:

- in the Conclusion and evaluation criterion

    - *justified* conclusions should answer all aspects of the research question by drawing on the evidence presented

    - credible findings of the research are *extrapolated* by considering their implications for other aspects of the claim

    - the quality of the evidence is *insightfully* discussed by considering the limitations identified in the analysis of evidence.

Additional advice

- Teachers should use resources and teaching strategies that enable students to understand the specific requirements of a research investigation (IA3 effective processes and practices resource).

- Schools are encouraged to use scaffolding checkpoints as opportunities to check that students have identified sufficient and relevant evidence before finalising their research question.

- The use of appendixes is restricted to supporting data that are not imperative to the response.

External assessment

External assessment (EA) is developed and marked by the QCAA. The external assessment for a subject is common to all schools and administered under the same conditions, at the same time, on the same day.

Examination (50%)

Assessment design

The assessment instrument was designed using the specifications, conditions and assessment objectives described in the summative external assessment section of the syllabus. The examination consisted of two papers:

- Paper 1, Section 1 consisted of multiple choice questions (20 marks)

- Paper 1, Section 2 consisted of short response questions (33 marks)

- Paper 2, Section 1 consisted of short response questions (34 marks)

- Paper 2, Section 2 consisted of an extended response question (17 marks).

The examination assessed subject matter from Units 3 and 4. Questions were derived from the context of Animal production B, Plant production B, Agricultural enterprises B, Enterprise management and Evaluation of an agricultural enterprise's sustainability.

The assessment required students to respond to multiple choice, short response and an extended response question.

Assessment decisions

Assessment decisions are made by markers by matching student responses to the external assessment marking guide (EAMG). The external assessment papers and the EAMG are published in the year after they are administered.

Multiple choice question responses

There were 20 multiple choice questions in Paper 1.

Percentage of student responses to each option

Note:

- The correct answer is **bold** and in a blue shaded table cell.

- Some students may not have responded to every question.

Question	A	B	C	D
1	6.44	34.37	25.78	**32.46**
2	13.6	0.48	50.36	**34.61**
3	**33.17**	46.06	15.51	4.06
4	19.33	11.46	7.4	**60.62**
5	11.93	**40.1**	35.8	11.22
6	29.83	24.82	**18.62**	25.54
7	17.9	25.78	20.53	**34.61**
8	**33.17**	10.26	39.62	15.51
9	14.32	**22.67**	25.06	36.75
10	7.88	**37.23**	41.53	12.41
11	27.45	27.92	15.04	**28.4**
12	23.15	12.89	**47.97**	15.04
13	**25.78**	36.75	9.07	27.45
14	68.97	**13.37**	3.58	13.13
15	13.84	40.81	**36.75**	7.4
16	5.25	63.25	7.88	**22.67**
17	3.1	9.31	**77.57**	8.83
18	**66.11**	5.97	10.74	16.23
19	13.84	**33.89**	32.7	18.62
20	12.41	**26.73**	14.8	44.87

Effective practices

Overall, students responded well to:

- questions that involved the interpretation of evidence in relation to animal health

- questions on factors affecting plant production

- questions that required simple analysis of relationships between two variables

- opportunities to discuss the social sustainability of agricultural enterprises.

Samples of effective practices

Short response

The following excerpts are from Question 22b from Paper 1. It required students to determine the ultimate feeding system for weaned lambs by analysis of tabulated data.

Effective student responses:

- calculated a 60-day gain for both feedlot and green fodder

- calculated final live weight for both feedlot and green fodder

- identified the correct dressing percentage for first-cross lambs, i.e. 45%

- calculated the carcass weight for both feedlot and green fodder

- determined the optimal feeding system.

These excerpts have been included:

- to demonstrate the use of calculations in response to the prompt 'Show your reasoning'.

Excerpt 1

60 days multiplied by weight gain   (Initial) weight is 32kg)

- green fodder is 0.18 kg/head/day x 60 days. Feedlot is 0.3kg x 60days

- therefore 32 + 10.8 | therefore 32kg + 18

- fat score 3, dressing % is 45% so | therefore dressing percentage for

multiply weight by 0.45 | fat score is 45%

- 42.8 x 0.45 = 19.26 < 20kg | - 50 x 0.45   22.5kg > 20kg

Because max carcass weight is 20kg the best

feeding system is green fodder because it is less then

20kg (19.26kg) but greater then MSA of 18kg it

so green fodder is best.

Excerpt 2

Final weight = initial + (days x weight gain)

Green fodder final weight = 32kg + (60 x 0.18kg) = 42.8 Kg

Feedlot rations = 32 + (60 x 0.3) = 50Kg

Carcass weight = final weight x dressing percentage (Fat score 3)

GF carcass = 42.8 x 0.45 = 19.26 kg < 20kg

FR carcass = 50 x 0.45 = 22.5kg > 20kg

The optimal feeding system to use if weaned lambs are to go to

market in 60 days, with a fat score of 3 and a maximum carcass

weight of 20 kg is the Green fodder crops finishing system as it can

provide a fat score of 3 and fits under the maximum 20kg required

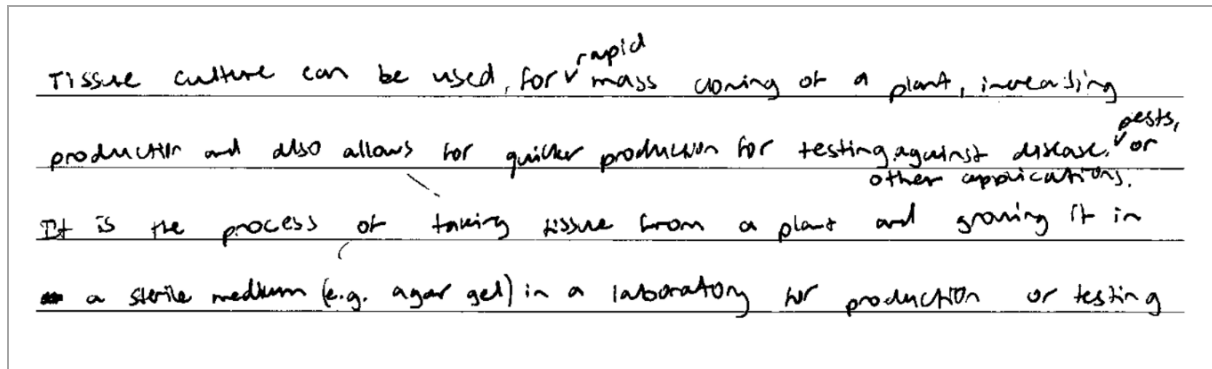with an average carcass weight of 19.26 kg.

The following excerpt is from Question 23 from Paper 1. It required students to explain the process of tissue culture in the context of agricultural production.

Effective student responses:

- explained the process of tissue culture

- explained its use in agricultural production.

This excerpt has been included:

- to demonstrate a complete explanation of the process of tissue culture.

Tissue culture can be used, for ✓ rapid mass cloning of a plant, increasing production and also allows for quicker production for testing against disease, ✓ pests, or other applications. It is the process of taking tissue from a plant and growing it in a sterile medium (e.g. agar gel) in a laboratory for production or testing

The following excerpt is from Question 7a from Paper 2. It required students to draw conclusions about the effect of African Swine Fever (ASF) based on analysis of graphical data.

Effective student responses:

- drew a conclusion about an impact of ASF on protein availability

- justified the conclusion using evidence from the stimulus

- drew a conclusion about a second impact of ASF on protein availability

- justified the second conclusion using evidence from the stimulus.

This excerpt has been included:

- to demonstrate interpretation of evidence from the stimulus to support justified conclusions.

ASF greatly reduced the amount of pork protein availability in China. This is shown in the drop in pork consumption from in 2015 (pre-ASF) and 2020 (post-ASF), going from 40.5 kg/person/year to 23.2 kg/person (year), a decrease of 17.3 kg/person/year. This subsequently also greatly reduced overall meat (and further animal protein) consumption as the overall consumption dropped from 105kg/person/year overall to 94 kg/person/year in 2020 after ASF had occurred and resulted in the decrease of available pork as 44 million pigs died. It can be seen that the decrease in pork protein availability also lead to slight increased consumption of other meats in 2020. However, as shown by the predictions for 2025, it an overall increase in consumption can be assumed that ASF only temporarily reduced protein availability in China.

Extended response

The following excerpt is from Question 9 from Paper 2. It required students to identify appropriate strategies for each element of the PPRR management model.

Effective student responses:

- correctly identified strategies that align with the PPRR model
- justified each of the identified strategies for the anticipated risk.

This excerpt has been included:

- to highlight appropriate strategies for anticipated risks
- to demonstrate justification of each identified strategy to address the anticipated risks.

> Drought
>
> Prevention → managing long distance weather forecasts to ensure that in the case of minimal ~~to~~ rain, there is time to start preparing
>
> Preparedness → managing water sources in an efficient manner → storing water ahead of time to ensure you'll have enough to get through the drought
> → cutting down on stock (keep young breeders and get rid of weaners) to try and reduce amount of feed/water
>
> Response → continue monitoring and managing water and feed sources efficiently to ensure there is enough to get you through the drought
>
> Recovery → restock herd to keep making money → start recovering from drought loss

Practices to strengthen

It is recommended that when preparing students for external assessment, teachers consider:

- reviewing the multiple choice items students answered incorrectly to ensure that subject matter is sufficiently covered

- practising mathematical processing of quantitative data to determine the most appropriate market for the sale of agricultural animals

- providing opportunities for students to apply their understanding of concepts, theories, models and systems to unseen stimulus under examination conditions

- encouraging students to correctly address all aspects of an extended response question.

Additional advice

- Teachers should provide opportunities for students to engage with multiple choice questions.