PRINCIPAL EXAMINER'S REPORT

BOTSWANA EXAMINATIONS COUNCIL

BSSE AGRICULTURAL SCIENCE

2025

Advancing learning, certifying your future

PAPER 1: WRITTEN PAPER

General Comments

The 2025 cohort demonstrated fair overall performance, with most candidates attempting all questions and presenting neat, well-organised work, including clear and accurate diagrams. Responses showed logical flow, and computational tasks were reasonably handled. However, challenges remain: many candidates struggled with correct SI unit usage and unit conversions, and frequent terminology errors such as pistol instead of piston or diffusion instead of fusion, highlighting a need for greater precision in scientific language. Additionally, while most work was neatly presented, adherence to question rubrics was inconsistent. Centres are encouraged to emphasise careful reading of instructions and reinforce accurate technical vocabulary to improve clarity and correctness.

Comments on Individual Questions

1 (a) (i) Most candidates responded well to the item, correctly identifying key benefits of land use planning such as conflict resolution, environmental protection, or food security and earned full credit. A few lost marks by providing irrelevant answers like "development of towns and cities," which does not directly reflect the core purpose of land use planning. Overall, performance was satisfactory, though precision in linking responses to the concept remains important.

(ii) The item was moderately answered, with most candidates identifying correct harms such as loss of biodiversity or ecosystem imbalance but failing to provide the required explanation, resulting in partial credit. Full marks required linking the harm to specific causes, such as habitat clearing for apiaries or increased foraging pressure on certain plants. While awareness of environmental impacts is evident, candidates need more practice in constructing detailed, cause and effect explanations.

(iii) Most candidates performed well, accurately identifying key factors like climate, soil (edaphic factors), topography, economic viability, and social or cultural norms when planning agricultural land use. Responses showed a solid understanding of the multidimensional considerations involved. A few listed factors without specificity, but overall, the item reflects strong grasp of sustainable land use planning.

(b) The item was poorly answered, with most candidates identifying partial factors like “growing in nutrient solution” or “reduces soil diseases” but failing to link them to sustainability or explain their impact. Full credit required both a correct factor and a connected discussion, such as how precise nutrient delivery optimises yield or how reduced pesticide use supports environmental health. While some recognition of hydroponic benefits was present, candidates struggled with structured, cause-and-effect reasoning. More practice in linking concepts to outcomes is needed.

2 (a) Most candidates answered well, clearly stating valid reasons such as preventing waterlogging, improving aeration, and enhancing crop yield and quality. Many also noted benefits like reduced erosion, minimised leaching, and lower risk of waterborne diseases, demonstrating strong

understanding of soil drainage's role in sustainable agriculture. Overall, responses reflected solid knowledge and earned full marks.

(b) The item was poorly answered, with most candidates stating the practice, like crop rotation or legume inclusion, but failing to explain how it conserves soil. Full credit required clear links: for example, legumes fix nitrogen, which boosts fertility, or alternating root depths improves soil structure. Many missed the cause-and-effect reasoning needed. While basic awareness is present, candidates need more practice connecting agricultural practices to their underlying soil conservation benefits.

3 **(a)** **(i)** Most candidates correctly identified part Q as the cortex, showing good understanding of root anatomy. However, common errors like vacuole, xylem, and pith suggest some confusion between cellular and tissue-level structures. While performance was fair, reinforcing the distinction between organelles and plant tissue regions could help reduce such misconceptions.

(ii) This item was challenging for most candidates. While some mentioned adaptations like large surface area or mitochondria, they often lacked depth, failing to link structure to function. Strong responses explained how thin walls, semi-permeable membranes, and proton pumps support active uptake, or how vacuoles maintain turgor pressure. Many gave partial answers without connecting features to absorption efficiency. Targeted practice on functional adaptations in root hairs is needed.

(b) Most candidates performed well, correctly identifying key vacuole functions such as maintaining turgor pressure, storing nutrients, or regulating protein localisation. Responses were accurate and concise, showing clear understanding of the organelle's role in plant cell function. A few mentioned animal vacuoles or general storage without specificity, but overall, the item was handled confidently.

(c) Most candidates provided partial answers, identifying correct factors like light pollen or feathery stigma, but often missed the linked explanation needed for full credit. Strong responses connected structure to function e.g., "anthers hang outside bracts, making them accessible to wind" or "fluffy stigma traps airborne pollen." While basic knowledge is evident, many need to strengthen cause-and-effect reasoning.

4 **(a)** **(i)** Most candidates performed well, correctly naming biting and chewing pests like locusts, grasshoppers, beetles, and armyworms, earning full marks. Locust and grasshopper were the most common correct responses. However, some incorrectly listed pests such as aphids, weevils, and stalk borers, which feed by piercing and sucking, not chewing. This suggests a need to clarify pest feeding mechanisms.

(ii) The item was poorly attempted, with many candidates unable to name the equipment such as a sprayer or describe the calibration process. Most failed to link calibration to key factors: measuring a known surface area, maintaining constant spraying speed, and keeping correct nozzle height. Some incorrectly mentioned using pesticides during calibration,

rather than water. Clearer practical training on sprayer calibration is needed to improve understanding.

(b) The item was moderately handled, most candidates showed correct calculations using proportions, earning 1 mark for working. However, many lost the second mark by omitting units or using incorrect ones like "ml³" or "litres" instead of "ml." The correct answer was 5 ml, with units clearly stated. Emphasising attention to units and their proper notation will help avoid unnecessary mark loss.

5 **(a)** Most candidates provided a correct definition, fusion of male and female gametes to form a zygote, earning full marks. However, a few confused fertilisation with diffusion, and some mistakenly wrote fusion without context. While understanding is generally sound, reinforcing precise terminology will help eliminate avoidable errors.

(b) Most candidates correctly labelled the gizzard and caecum on the chicken's digestive system, showing good anatomical knowledge. A few confused the gizzard with the crop, while others misplaced the caecum. Overall, performance was strong, though clearer distinction between similar structures should be emphasised in teaching.

(c) Most candidates struggled to describe digestion in part X (proventriculus/gizzard), with many giving vague responses like "food is broken down" without specifying mechanisms. Only a few mentioned hydrochloric acid or pepsin and linked them correctly e.g., pepsin breaks proteins into peptides. Clearer focus on enzyme function and gastric secretions is needed for improvement.

6 **(a)** **(i)** Most candidates provided correct benefits, such as improved growth, enhanced feed digestibility, or disease prevention, earning full marks. A few gave vague responses like "makes animals healthy" without specificity. Overall, understanding is fair, but emphasis on precise, curriculum-aligned terms will help secure full credit.

(ii) Most candidates struggled to accurately describe roughages, often missing key traits like high fibre content, low digestibility, or plant-based origin. Some confused roughages with concentrates. Only a few mentioned satiety or structural role in diets. Clearer teaching on feed classification is needed.

(b) Most candidates identified a relevant nutrient such as protein or fat but often failed to link it clearly to weight gain or development, missing the second mark. Strong responses connected high protein to muscle growth or high fat to energy supply. More practice in explaining cause-and-effect in animal nutrition is needed.

7 **(a)** **(i)** Most candidates correctly identified one or two negative effects of genetic modification, such as deformities, health issues, or reduced fertility, earning partial to full marks. However, some gave vague responses like "bad for animals" without specifics. Overall, understanding is moderate, precision in terminology would improve performance.

(ii) Most candidates misunderstood the question, citing general farming practices instead of biotech-specific methods. Only a few mentioned gene insertions for pest resistance, drought tolerance, or biofortification. Responses like “hybrid seeds” or “fertilisers” reflect confusion between traditional and biotech approaches. Clearer focus on genetic and molecular techniques is needed.

(iii) Most candidates failed to link inbreeding to yield improvement, with many confusing it with crossbreeding or only defining it without explanation. The strongest responses noted that mating closely related high-yield animals helps concentrate desirable traits. Many missed the cause-effect link, indicating a need for clearer teaching on selective breeding goals.

(b) Most candidates attempted the cross but struggled with correct notation and inheritance logic. While some correctly identified parental genotypes (BB × Bb), errors in Punnett squares led to incorrect offspring predictions. Common mistakes included wrong allele combinations or incomplete diagrams. Clearer emphasis on genetic notation and segregation is needed.

8 (a) (i) Most candidates correctly identified the radiator’s role in cooling the coolant, but misunderstood water jackets, often saying they “store” water instead of circulating it around the engine block and head. This confusion suggests a need to clarify the active role of water jackets in heat transfer. A clearer grasp of cooling system dynamics would improve responses.

(ii) Most candidates struggled to link machinery maintenance with pollution control. While some mentioned oil changes or filter replacement, few explained how these reduce emissions or soil contamination. Many gave general maintenance tasks without connecting them to environmental impact. Clearer focus on the environmental benefits of specific upkeep practices is needed.

(b) (i) Most candidates correctly identified the stroke as induction but lost marks by omitting the reason, such as an open inlet valve or downward piston movement. Full credit required both identification and explanation. Strengthening the habit of pairing answers with clear justifications will improve performance.

(ii) Most candidates correctly identified the next stroke as compression and noted the piston moving upward. However, some missed key details like both valves being closed or the compression of air/fuel mixture. While understanding is moderate, more complete descriptions are needed for full marks.

PAPER 3: COURSEWORK

General comments

1.1 Introduction

Candidates presented their research proposals to a panel, conducted projects, and submitted written reports—all marked internally to ensure consistency within centres. These reports were then externally moderated nationally to uphold fairness and alignment with standard benchmarks.

A total of 34 centres were reviewed. Moderators used centre merit lists to sample candidates across mark bands, evaluating whether awarded marks truly reflected performance. Where discrepancies arose, a scaling factor was applied to align centre and moderator marks. These factors help identify marking trends and ensure equitable, standardised assessment across all centres.

1.2 Summary Marksheets

Centres are commended for overall compliance in submitting correct summary mark sheets. However, notable issues were recorded: 4 centres missed the syllabus sheet, 5 omitted either research proposal or project sheets, and 2 used incorrect forms (0599/03). One centre wrongly completed moderator-only sections.

Additionally, several centres submitted sheets without the Chief Invigilator's signature for absent candidates. Both Chief Invigilator and Senior Teacher must sign where required, this was missing in some cases. Accuracy and attention to detail ensure credibility.

1.3 Attendance Registers

Two centres failed to submit attendance registers, a serious lapse, as these are essential for verifying candidate participation and aligning with project counts. Moving forward, this must be strictly enforced.

Most registers were well completed, but some used "pregnant" or "deceased" instead of the standard "A" for absent. Only "A" (Absent) and "P" (Present) should be used. The Chief Invigilator must sign all 'A' entries, and candidates must sign the designated column. Consistency and adherence to exam standards are critical.

1.4 Centre Order of Merit

The Centre Order of Merit, used since 2019, requires centres to rank candidates by Research Project marks, from highest to lowest. This year, five centres failed to comply. This ranking is essential for moderation sampling and ensuring fair, transparent mark validation. Full adherence is mandatory, no exceptions.

1.5 Organising, Packaging and Binding of Scripts

Most centres packaged scripts using BEC-provided materials and separate seals for key documents, enabling smooth moderation. However, some still use oversized boxes, risking damage. Use labelled, sealable envelopes or compact boxes, with contents clearly marked: subject, centre, component, candidate range, and package number (e.g., 1 of 5).

Arrange proposals, projects, and mark sheets in ascending numerical order, not by class. Bind each candidate's proposal and report together in one secure, durable file. Avoid sliding binders,

transparencies, or Manila folders, they compromise integrity. Quotation files remain the best option: neat, flat, and secure.

1.6 Evidence of Internal Standardisation at Centres

Most centres showed signs of internal standardisation, with consistent writing styles across candidate reports, indicating collaborative review or marking alignment. While this suggests effort in maintaining uniformity, care must be taken to preserve individual authenticity. True standardisation should focus on fair assessment, not uniform expression.

1.7 Performance of Centres

Performance bands based on adjustment factors show most centres in the middle stratum, with 16 maintaining marks, 16 requiring downward adjustments. Upper stratum had 3 centres with upward adjustments, while lower had 2 needing deductions. This reflects varied internal marking accuracy, highlighting need for consistent moderation and calibration.

Comments of individual items

2.1 RESEARCH PROPOSAL

2.1.1 Clarity of research question

Most research questions were clear, but some lacked specificity, using vague terms like “growth” instead of “plant height” or “NPK” instead of “2:3:2 (22).” A strong question must name the crop/animal, measurable parameter, treatment, and direction (e.g., “increases” or “improves”). Avoid neutral terms like “effects” or “impacts”. Candidates should be advised to be purposeful and precise.

2.1.2 Relevance of the topic

Most topics were relevant and aligned with the syllabus, showing strong subject grounding. However, some lost marks by omitting specific crops or using generic terms like “fertiliser” instead of named types (e.g., Limestone Ammonium Nitrate or NPK 2:3:2). Centres must note that precision strengthens relevance, hence it is imperative to always name key elements clearly.

2.1.3 Feasibility of methods

Some candidates described basic plot layout e.g., three rows, separate sections. A few named measurable parameters e.g., height, yield, weight. A handful mentioned tools e.g., tape measure, weighing scale. However, most proposals were incomplete, inconsistent, and lacking depth.

- Plot layout missing or vague: Missing dimensions (e.g., 3m × 2m plots), equal size justification, control vs. treatment labelling. Many wrote We made plots with no detail provided.
- Sampling method not mentioned or unjustified: Most did not say how many plants/animals would be measured, e.g., 10 plants per plot will be sampled using random sampling. No justification if full census would be used e.g., All 15 plants will be measured due to small plot size.
- Animal experiment flaws: Mostly missing age of animals, cage/partition size, or grouping method. These invalidate comparison if not standardised.
- Measurement methods unclear: Candidate said: We measured growth. But not plant height from soil to tip using ruler, to nearest cm. In most cases no instrument precision was stated.

- Data analysis incomplete: Most failed to mention basic statistics e.g., mean, percentage change or yield. Division line missing in formulas.

Centres must note that a feasible method is reproducible someone else should be able to repeat it exactly.

2.1.4 Organisation and structure of proposal

Most included all key sections: title, introduction, literature, and methodology, with good order and flow, logical progression from problem to method. Headings and sectioning clear and easy to follow. Strong coherence in linking ideas from one section to the next. This shows solid understanding of proposal format, a consistent strength across centres. However, some were missing Anticipated Results section. Many proposals ended at methodology, missing "Manure is expected to give higher yield". This is part of structure not optional.

Centres must note that a proposal predicts not just plans. A strong proposal does not just say how it says what we expect and why it matters. Centres must enforce completeness.

2.1.5 Communication and understanding

Most centres are doing well here. Many candidates expressed ideas clearly and logically. Language was generally appropriate and understandable. Many showed good grasp of research flow and Ideas were well-connected across sections. The shows solid communication. Nonetheless, some had:

- Incorrect tense usage: Candidates wrote: We planted the seeds, or We measured growth" but this is a proposal, should be future tense. Expectation was: The seeds will be planted, or Growth will be measured.
- No distinction between proposal and report: Often treating it like a past experiment not a plan. This shows misunderstanding of research stages.

Centres must emphasise use of future tense only in proposals. Correct tense is a sign of clear understanding of research process.

2.2 RESEARCH PROJECT REPORT

2.2.1 Title of the research

Candidates should present a clear, concise, and accurate title that includes:

- Specific crop or animal (e.g., maize, broilers)
- Parameter measured (e.g., growth rate, yield, weight)
- Treatment applied (e.g., chicken manure, organic feed)
- Consistency, the title must match the content throughout the report

However, common issues observed were:

- Mismatch between title and content: For example, Title: "Effect of Kraal Manure on Maize Yield", the report uses Chicken Manure. This undermines credibility.

- Vague or incomplete titles: “Study on Fertilisers”, too broad or Growing Maize, missing treatment, and parameter
- Inconsistent terminology: Title says organic manure, report uses cow dung without clarification.

Sample topics based on best practices are:

- Effect of Chicken Manure on the Growth Rate of Maize (Zea mays) in Sandy Soil
- Comparing the Weight Gain of Broilers Fed on Commercial vs. Homemade Feed

Centres are advised to teach the 4-part title formula: [Treatment] on [Parameter] of [Crop/ Animal] in [Context] and enforce consistency.

2.2.2 Introduction

Candidates were expected to write a clear background, problem statement, research question/hypothesis, justification (who benefits?) and Literature. However:

- In some reports, introduction was missing resulting in automatic 4-mark loss
- Unclear purpose or no beneficiaries named
- In some cases, fake or uncredited sources were given.
- Literature not linked to treatment (e.g., no link between manure and nitrogen)
- Vague hypotheses: Yield will improve but what yield? How measured?

Centres must teach proper citation, clear logic, and complete structure e.g. According to [Author, Year], manure improves soil nitrogen which may boost maize growth. Hypothesis must specify crop/animal, parameter, and treatment, e.g., Maize plants treated with chicken manure will have higher cob weight than control.

2.2.3 Methodology

Candidates were expected to outline clear methodology including sampling, data collection, measures, and analysis criteria.

- Research design was done fairly by most centres mentioning the treatments, size, and replication of experimental units.

However, some centres provided shallow information:

- Sampling not described
- Data collection mentioned without describing how the parameters were measured
- Sketches without appropriate labels
- formulas were wrongly done as candidates displayed poor mathematical concepts when conceptualising a formula.

Centres must train on precision, clarity, and basic calculations and check every method for reproducibility.

2.2.4 Results

Most candidates included clear titles for tables and graphs. Duration, units, and research question were often present. Candidates demonstrated good use of visuals (graphs, tables) in main results. Nonetheless:

- Raw data was presented without summary (e.g., full lists instead of averages)
- Appendices were incomplete or missing. This is required for raw data.
- Treatments labelled as T and C but not spelled out (e.g., “Chicken Manure”, “Control”)
- Incorrect calculations were observed in appendices

Centres are advised to emphasise that Results are analysed summarised data (use means, graphs), raw data goes in Appendix: labelled, complete, with no abbreviations. Treatments must be spelled out. Always check math accuracy especially averages and percentages and ensure that every table/graph has title, units, and appropriate labels.

2.2.5 Discussion

Some candidates used data (e.g., “yield increased by 24%”) to support claims. A few showed good insights, linking results to real farming context. Isolated cases mentioned non-treatment factors (e.g., rainfall, soil type). Most of the reports had the following weaknesses:

- Brief or vague discussions, often repeating results without explanation
- No evaluation of limitations (e.g., small sample, short duration)
- Nutrients not linked to treatment (e.g., did not explain how manure adds nitrogen)
- Weak or incorrect literature correlation, linking findings to unrelated studies
- No alternative explanations or suggestions for future research

Advice to Centres:

- Emphasise that discussion demands explaining, not repeating.
- Require one clear limitation + implication e.g., Only one crop cycle tested but results may vary seasonally.
- Train students to connect treatment to science e.g., Chicken manure is rich in nitrogen (N) which promotes leaf growth.
- Insist on accurate literature links, must match topic and findings

A strong discussion shows why results matter not just what they are.

2.2.6 Conclusion

Most candidates accurately summarised key findings, clearly showing links to research question or hypothesis. Conclusions were brief and focused. But:

- Some lacked depth, stated results but not why they matter

- No real-world significance e.g., impact on smallholder farmers, soil health)
- Missing implications, few suggested how findings could guide future research or farming practice

Centres are advised to:

- Teach that Conclusion entails meaning and impact, candidates must be required to have at least one practical implication (e.g., Chicken manure is affordable and effective for small farms).
- Add one future research idea (e.g., Test over two seasons or Compare with NPK fertiliser)

2.2.7 Recommendations

Most candidates gave relevant, practical suggestions, correctly linked to findings. Some mentioned value for future research. However, many reports showed the following weaknesses:

- Missing actionable steps, said use manure but not how (e.g., Apply 5 kg per plot before planting)
- No implementation strategy (who? when? where?)
- Benefits not explained e.g., cost-saving, yield boost, or soil health
- Few linked recommendations to policy or community impact

Centres must push for real-world relevance not just do more research, and require:

Actionable step (clear, doable)

Who should act (farmer, school, government)

Benefits (cheaper, sustainable, higher yield)

A good example: Smallholder farmers should apply chicken manure (5kg/plot) at planting since it is low-cost, improves yield, and enhances soil fertility.

2.2.8 References

Most included at least two sources. References were present showing attempt at research. Nonetheless there were:

- Mismatched citations: Authors in references not cited in literature review
- Wrong APA format: Missing italics, incorrect order, no hanging indent
- Fake or irrelevant sources (e.g., made-up authors, unrelated topics)
- Inconsistent naming: e.g., Smith, 2020 in text but Smit, 2021 in references

Centres must teach basic APA: Author, A. (Year). Title. Publisher. Stress that every in-text citation must match reference list, and use of real, relevant sources.

2.2.9 Appendices

The purpose of the Appendices is to show raw data, calculations, instruments, and supporting materials, clearly presented. The common errors observed in most reports were:

- Raw data tables incomplete or missing

- Incorrect formulas (e.g., wrong % or average)
- Units omitted or computations wrong
- Treatments labelled as T1, C, not spelled out
- Missing crop/animal or parameter details

Centres require the following from the candidates:

- Full raw data table (with dates, replicates)
- Correct formulas (e.g., mean = total ÷ n)
- All steps shown, no missing calculations
- Full treatment names e.g., Chicken Manure, not T2
- Clear labels: crop, parameter, unit