Stage 2 Agricultural Production

Assessment Type 3: Production Investigation

Students individually undertake one production investigation. In negotiation with the teacher they develop and conduct their own individual practical investigation based on a primary production enterprise in agriculture. The management of the timeline for the production needs to be considered in the planning, as estimated yields may be necessary rather than actual yields.

Examples of suitable enterprises for an investigation include:

aquaculture, hydroponic crops, growing herbs, seedlings or ornamental plants in containers, growing horticultural crops in the field, intensive animal systems like poultry (meat or eggs), feedlotting sheep or cattle, pigs, bee-keeping, orchard production, native tree production, and fodder crop production

Students design a production plan. One draft of the plan should be submitted for teacher feedback and approval. Students may modify their plan in response to teacher feedback before they undertake their investigation.

Students collect both primary data and secondary data, and analyse and evaluate their findings. Students may need to collect data in different time frames and support each other in collection of primary data for the purpose of ensuring safe and ethical work practices, depending on contexts and/or resources.

Students submit their modified production plan with their production report for assessment.

Production Plan

The production plan should include:

An introduction that:

* identifies the purpose of the investigation (IAE1)
* describes the background research and significance of the aspect of agricultural production being investigated (KA1)
* identifies the specific production goals. (IAE1)

The procedure to be undertaken (IAE1), including:

* a list of resources required, such as equipment, chemicals, and facilities, and some justification of the chosen types and quantities of resources
* management strategies such as a calendar of activities
* projected gross margin
* marketing considerations, such as risk management, quality assurance requirements, and strategies for selling the product
* safety considerations, such as risk assessments, and personal protective equipment (PPE) and standard operating procedures (SOPs) required
* environmental and animal welfare considerations.

Production Report

The production report should include:

* tables, graphs, and photographs for production records (such as weights, volumes, counts, health status) (IAE2)
* actual and/or projected financial records (such as income and costs, profit and loss) (IAE2)
* analysis of the records in relation to the production and financial goals (IAE3)
* evaluation of procedures and results to identify limitations of, and improvements to, the investigation (IAE4)
* a conclusion for the investigation and how the findings relate to current industry practice (IAE3)
* expression of ideas, using appropriate agricultural terminology and referencing. (KA4)

The combined word count for the production plan and the production report should be a maximum of 2000 words, if written, or the equivalent in multimodal form.

**Performance Standards for Stage 2 Agricultural Production**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | **A** | **B** | **C** | **D** | **E** |
| **Investigation, Analysis and Evaluation** | **1**  **2**  **3**  **4** | Critically deconstructs a problem and designs a logical, coherent, and detailed agricultural investigation.  Obtains records, and represents data, using appropriate conventions and formats accurately and highly effectively.  Systematically analyses and interprets data and evidence to formulate logical conclusions with detailed justification.  Critically and logically evaluates procedures and their effects on data. | Logically deconstructs a problem and designs a well-considered and clear agricultural investigation.  Obtains, records, and represents data, using appropriate conventions and formats mostly accurately and effectively.  Logically analyses and interprets data and evidence to formulate suitable conclusions with reasonable justification.  Logically evaluates procedures and their effects on data. | Deconstructs a problem and designs a considered and generally clear agricultural investigation.  Obtains, records, and represents data, using generally appropriate conventions and formats with some errors but generally accurately and effectively.  Undertakes some analysis and interpretation of data and evidence to formulate generally appropriate conclusions with some justification.  Evaluates procedures and some of their effects on data. | Prepares a basic deconstruction of a problem and an outline of a agricultural investigation.  Obtains, records, and represents data, using conventions and formats inconsistently, with occasional accuracy and effectiveness.  Describes data and undertakes some basic interpretation to formulate a basic conclusion.  Attempts to evaluate procedures or suggest an effect on data. | Attempts a simple deconstruction of a problem and a procedure for an agricultural investigation.  Attempts to record and represent some data with limited accuracy or effectiveness.  Attempts to describe results and/or interpret data to formulate a basic conclusion.  Acknowledges that procedures affect data. |
| **Knowledge and Application** | **1**  **2**  **3**  **4** | Demonstrates deep and broad knowledge and understanding of a range of agricultural concepts.  Applies agricultural concepts highly effectively in new and familiar contexts.  Critically explores and understands in depth the interaction between agricultural science and society.  Communicates knowledge and understanding of agriculture coherently with highly effective use of appropriate terms, conventions and representations. | Demonstrates some depth and breadth of knowledge and understanding of a range of agricultural concepts.  Applies agricultural concepts mostly effectively in new and familiar contexts.  Logically explores and understands in some depth the interaction between agricultural science and society.  Communicates knowledge and understanding of agriculture mostly coherently with effective use of appropriate terms, conventions, and representations. | Demonstrates knowledge and understanding of a general range of agricultural concepts.  Applies agricultural concepts generally effectively in new or familiar contexts.  Explores and understands aspects of the interaction between agricultural science and society.  Communicates knowledge and understanding of agriculture generally effectively using some appropriate terms, conventions, and representations. | Demonstrates some basic knowledge and partial understanding of agricultural concepts.  Applies some agricultural concepts in familiar contexts.  Partially explores and recognises aspects of the interaction between agricultural science and society.  Communicates basic information about agriculture, using some appropriate terms, conventions, and/or representations. | Demonstrates some limited recognition and awareness of agricultural concepts.  Attempts to apply agricultural concepts in familiar contexts.  Attempts to explore and identify an aspect of the interaction between agricultural science and society.  Attempts to communicate information about agriculture. |

**Stage Two Agricultural Production**

**External Assessment: Production Investigation Exemplar**

**Lambs in a feedlot**

**Part A: Production Plan**

**Introduction**

The purpose of this production investigation is to explore lamb production in a feedlot. In Australia, there are approximately 33 million lambs, with the sheep meat industry being worth over $5 billion in 2014/15 (MLA, 2015). According to Meat and Livestock Australia, in excess of 40,000 farm businesses include sheep in their enterprise mix and around 6 % of these farmers finish their lambs on grain. The benefits for producers include increased carcase weights and higher average prices (Haynes, 2017). This shows that there are clear incentives for including feedlotting but there are some negative aspects for farmers too. These include high input costs (especially for feed) and fluctuations in the market demand and pricing (Michael, 2017). There can also be animal welfare issues whenever animals are confined in large numbers and some animal rights groups actively campaign for an end to feedlotting (RSPCA, 2015).

The goal for this production investigation is to put ten crossbred wether lambs through a 6 week period in a feedlot. I plan to sell them on the hoof at Dublin Livestock Exchange. I am aiming for 400g daily weight gain and a feed conversion ratio (FCR) of 6:1 (Duddy, 2016).

**Procedure**

**Resources required**

* 10 crossbred wether lambs: proven performance as hardy, fast growing lambs; all wethers to reduce the chance of shy feeders from smaller, female lambs.
* Sheep yard 6 m x 5 m (30 m2) which exceeds the minimum of 1 m2 per head (Primary Industries Standing Committee, 2006).
* Water trough. 1.5 m long which exceeds the minimum of 30 cm plus 1.5 cm per head (Primary Industries Standing Committee, 2006).
* Grain feeder with lid, 1m long, which exceeds the minimum of 2cm/hd as recommended.
* Hay ring to allow ad lib access to hay.
* 1 roll bale oaten hay
* Grain mix (roller-milled barley, lupins and lamb vitamin and mineral mix), purchased ready mixed from local sheep feedlot
* Scales
* Glanvac 6 B12 vaccine, Cydectin plus Tape drench
* Shearing plant

**Management plan**

|  |  |
| --- | --- |
| Week 1 | Weigh lambs, vaccinate, drench. Start on oaten hay. Check daily |
| Week 2 | Introduce 250 g grain mix per lamb per day in grain troughs with ad lib hay.  Check daily. Clean water trough as needed |
| Week 3 | Increase to 500 g grain mix per lamb per day plus ad lib hay, if no signs of ill health |
| Week 4 | Weigh lambs. Maintain feed ration if no signs of ill health.  Book lambs in to Dublin Livestock Exchange |
| Week 5 | Increase grain ration to 750 g per lamb per day |
| Week 6 | Weigh & crutch lambs. Complete Vendor Declaration and Sheep Health Statement. Load on trailer and take to Dublin |

**Financial plans**

**Gross Margin for lambs in a feedlot**

|  |  |  |
| --- | --- | --- |
| **Income** | | |
| Lamb sales | 24 kg carcase weight X $5 /kg x 10 lambs | $1200 |
| Skin value | $10 per head | $100 |
|  | **TOTAL INCOME** | **$1300** |
| **Expenses** | | |
| Lamb purchase | $75 per head | $750 |
| Hay | 1 oaten hay roll @ $65 each | $65 |
| Grain mix | 20 kg each = 200 kg @ $550/tonne | $110 |
| Vaccine | 50 c each | $5 |
| Drench | 30 c each | $3 |
| Crutching | $1 each | $10 |
| Transport | $1.50 each | $15 |
|  | **TOTAL EXPENSES** | **$958** |
| **GROSS MARGIN** | | **$342** |

**Marketing**

I am planning to sell my lambs at the Adelaide Livestock Exchange at Dublin. I will book them in through Landmark Balaklava to sell to the butcher’s trade as ten is too many to sell privately. I am hoping to get $5 per kg. I will crutch them prior to sale to make them more attractive to the butchers.

**Risk Management**

The biggest risk in a lamb feedlot is death from grain poisoning. I will watch for signs of acidosis such as scours and lethargy and reduce the amount of grain available to the lambs if suspected. I plan to feed the grain ration in the mornings but I could split the quantity in half and feed them morning and night to manage the risk.

**WHS : RISK ASSESSMENT**

RATING: 2D Low. I selected a Low risk rating on the Risk assessment matrix because I have experience working with sheep and am physically capable of handling them. I will also be supervised by an experienced sheep farmer and the equipment I am using is simple and not dangerous.

**Quality Assurance**

I am aiming for my lambs to reach 50 kg liveweight which should convert to 24 kg dressed, in the light tradeweight category. I expect their growth rates to increase in the last two weeks. They must not have any adult teeth. I will check the withholding periods of the drench and vaccine and any other veterinary treatments I might need.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | **Consequences** | | | | |
|  |  |  | **1 – Insignificant**  Dealt with by in-house first aid, etc | **2 – Minor**  Medical help needed. Treatment by medical professional/hospital outpatient, etc | **3 – Moderate**  Significant non-permanent injury.  Overnight hospitalisation (inpatient) | **4 – Major**  Extensive permanent injury  (eg loss of finger/s)  Extended hospitalisation | **5 – Catastrophic**  Death.  Permanent disabling injury  (eg blindness, loss of hand/s, quadriplegia) |
| **Likelihood** | **A -** | Almost certain to occur in most circumstances | High (H) | High (H) | Extreme (X) | Extreme (X) | Extreme (X) |
| **B -** | Likely to occur frequently | Moderate (M) | High (H) | High (H) | Extreme (X) | Extreme (X) |
| **C -** | Possible and likely to occur at some time | Low (L) | Moderate(M) | High (H) | Extreme (X) | Extreme (X) |
| **D -** | Unlikely to occur but could happen | Low (L) | Low (L) | Moderate(M) | High (H) | Extreme (X) |
| **E -** | May occur but only in rare and exceptional circumstances | Low (L) | Low (L) | Moderate (M) | High (H) | High (H) |

|  |  |  |
| --- | --- | --- |
| **Most likely hazards** | **Standard Operating Procedure** | **PPE & other safety**  **equipment required** |
| Manual handling injuries from feed bags | Use a sack truck with inflated tyres to move the bags. Turn body, don’t twist at the hips when lifting from the ute. Bend knees as you lower the bag. | Sack truck  boots |
| Zoonoses | Wash hands prior to working with sheep and once handling is completed. Clean up manure and damp bedding and place in the compost bay | Trough  Soap  Hand sanitiser  Gloves |
| Manual handling injury when weighing sheep | Check all gates and yards and lubricate if necessary. Lubricate gates on scales prior to use. Clear area of any tripping hazards. Get assistance to muster sheep and move them through the scales | Boots  Yards |
| Sunburn | Work earlier in the morning or late afternoon. Use PPE listed | Sunscreen, hat, longsleeved shirt |

**Ethics**

The lambs will all be vaccinated and drenched to reduce the risk of disease and parasites. I will weigh the grain ration carefully to minimise the risk of acidosis and check the lambs daily to ensure no problems. I will ensure ad lib access to clean fresh water and the hay feeder. The grain trough has a shelter to reduce the risk of grain spoilage from the rain. If there are any shy feeders I will put an extra grain trough in to help all the lambs be able to access the grain mix.

If the weather remains dry I will control dust in the yards with sprinklers.

At the end of the six week period, the manure and feed residue from the yards will be composted in the school’s compost bays.

992 words

**Part B: Production Report**

**Production records**

See Appendix for raw data and weather records.

***Table One: Mean Lamb weights (kg)for lambs in the feedlot***

|  |  |
| --- | --- |
| Days on feed | Mean lamb weight (kg) |
| 1 | 33 |
| 29 | 43 |
| 40 | 48 |
| Mean Daily Weight Gain  =375 g/day | |

***Table Two: Lamb condition scores for lambs in the feedlot***

|  |  |
| --- | --- |
| Days on feed | Mean lamb Condition Score |
| 1 | 2.6 |
| 29 | 3.0 |
| 40 | 3.3 |
| Mean condition score gain = 0.6 | |

**



Photo 1 (Above), Weighing the lambs, and Photo 2 (right), the feedlot area.

**Actual Gross Margin for Lamb feedlot**

|  |  |  |
| --- | --- | --- |
| **Income** | | |
| Lamb sales | 21.2 kg carcase weight X $4.80/kg x 9 lambs | $915.84 |
| Skin value | $7 per head | $63 |
| Lamb on hand | Valued at $85 | $85 |
|  | **TOTAL INCOME** | **$1063.84** |
| **Expenses** | | |
| Lamb purchase | $75 per head | $750 |
| Hay | 1 oaten hay roll @ $65 each | $65 |
| Grain mix | 35 kg each @ $350/tonne | $192.50 |
| Vaccine | 50 c each | $5 |
| Drench | $2.50 each | $25 |
| Crutching | $1 each | $9 |
| Transport | $20 for ute | $20 |
| Commission | $15 | $15 |
| SI Levy | 80c each | $7.20 |
| Eartags | $1 each | $10 |
|  | **TOTAL EXPENSES** | **$1098.70** |
| **GROSS MARGIN** | | **-$34.86** |

**Evaluation**

The lambs were sold at Dublin Livestock Exchange. The average weight was less than I expected and because of this, the price was also lower. I had not budgeted for the commission to Landmark, sheep industry levy and transport costs. In addition, I used *Maverick* backliner as it was recommended because there had been lice detected, which was more expensive than the planned drench. The owner recommended eartags so that I could tell which lamb was which. This was a good idea especially when I was worried about Number 2 having acidosis.

The lambs gained an average of 15 kg in the six weeks, equivalent to 375 g per day, which was under the 400g goal. The average live weight at the end was 48 kg. This meant the average carcase weight was also less than I expected at 21.2 kg instead of 24 kg. This put them in the lightweight trade category and according to the Stock Journal market report this category eased by an average of $3 per head this week, for sales to processors (Thompson, May 4th 2017).

I think the growth rates did not increase (see Graph One) in the last two weeks because the weather was so cold and rainy (Bureau of Meteorology, 2017) which meant the sheep were converting some of the energy in their ration into keeping warm rather than muscle growth. Despite this, their condition score did improve.

The sheep ate 342.5 kg of grain mix plus nearly all of the roll bale of hay. This was more than expected. The owner recommended I increase the daily ration more quickly as I was underfeeding them. I finished on 1.5 kg per lamb when I had planned to be only 750 g per lamb. If I had used the amount of feed I had planned too I would not have got the weight gain that I did so I would have saved some money on feed but lost out on the sale income.

This meant the sheep ate 692.5 kg of feed. In total, they gained 111 kg in weight, so the Feed Conversion Ratio was 692.5:111 or 6.24:1. This was a little higher than I had estimated at 6:1 and I think this was due to the cold weather and the shy feeders like Number 2 so I was actually quite satisfied with this. It also compares quite well to industry expectations (MLA, 2015).

The slower growth rate, higher costs and higher feed consumption combined to mean I made a loss of $34.86 instead of the profit I had predicted. When you factor in the time I spent on the project it is very disappointing. If it was being considered in a commercial setting careful planning would be needed to ensure that the costs were controlled.

I think my goals were realistic but because of the cold weather I did not get the growth rates expected. I think the grain ration was suitable because the lambs ate it willingly and there was never any left over. The analysis showed that it had appropriate levels of metabolisable energy and protein (Duddy, 2016).

All of my sheep lived even though Number 2 was returned to the paddock to remove him from the grain ration. Feedlots can expect a mortality rate of 2% (MLA, 2015). Given that I only had 10 lambs if one had died it would have exceeded this, so it was not unusual to have no deaths. I was satisfied that my supervision program worked effectively because I identified some potential problems quickly and fixed them before my lambs suffered in any way or I wasted any feed.

In a commercial setting I would be careful to plan my feed and monitoring routines carefully and check for shy feeders regularly and remove them quickly. I would also look to lock in a contract at a set price. I have researched it and found that Quality Meats offers contracts for small numbers of lambs at $5.10 per kg (Haynes, 2017). This would save me the Landmark commission costs and reduce the transport costs. If I had this contract in place I would have made a profit of $52.38 instead of the loss of $34.86, even with the smaller growth rates that I achieved. In a larger feedlot I would not individually eartag each sheep but mark out shy feeders with a spray marker to save money and time. I would save money by buying my vaccine and drench in larger quantities which is cheaper per dose. Another way to save money would be to find a different source of mixed grain or even to mix it myself. I don’t have the right equipment for this though so this would not be a practical option for small numbers of sheep. However, if I was doing a lot of sheep I may be able to justify buying the mixer. Just by buying in larger quantities I may be able to reduce the cost of buying the mixed grain.

In the planning phase I would do a “worst case scenario” gross margin to see what would happen if everything went wrong. I also should do a break even budget to see what price I would need to make sure I covered my fixed costs.

This production investigation showed that putting lambs through a feedlot can be achieved successfully with simple equipment and good quality feed. It is time consuming and the sheep must be checked and fed every day. Careful selection and monitoring of lambs is also crucial in meeting growth rates and financial goals.

1023 words

**The overall grade for this student work is A-.**

The analysis of data could have been improved. For example; an explanation of the significance of calculating a mean daily weight gain, an explanation of why the average carcass weight would be expected to be 24 kg and the expected weight gain and FRC values, a discussion of appropriate levels of metabolisable energy and protein.

The results for mean daily weight gain seem to contradict the explanation about the cold weather.

The student could have considered some of the points in the evaluation paragraph about a commercial setting before beginning the trial.

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**Appendices**

***Table 1: Lamb weights (kg)***

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Lamb ear tag number | | | | | | | | | |  |
| Day | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Mean weight (kg) |
| 1 | 32 | 34 | 34 | 35 | 31 | 32 | 36 | 32 | 32 | 29 | 33 |
| 29 | 40 | 39 | 43 | 42 | 39 | 41 | 45 | 38 | 41 | 36 | 43 |
| 40 | 44 | 40 | 46 | 45 | 44 | 45 | 49 | 43 | 44 | 38 | 47.80 |

***Table 2: Lamb condition scores***

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Lamb ear tag number | | | | | | | | | |  |
| Day | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Mean Condition Score |
| 1 | 2.0 | 3.0 | 2.0 | 2.0 | 3.0 | 3.0 | 4.0 | 3.0 | 2.0 | 2.0 | 2.6 |
| 29 | 2.5 | 2.0 | 3.0 | 3.0 | 3.5 | 3.0 | 5.0 | 3.0 | 3.0 | 2.0 | 3.0 |
| 40 | 3.0 | 2.0 | 4.0 | 3.0 | 4.0 | 4.0 | 5.0 | 3.0 | 3.0 | 2.0 | 3.3 |

***Table 3: Weather records – from Bureau of Meteorology website***

|  |  |  |
| --- | --- | --- |
| Day | Minimum temperature (0C) | Rainfall (mm) |
| 1 | 20 | 0 |
| 2 | 19 | 0 |
| 3 | 16 | 1 |
| 4 | 18 | 0 |
| 5 | 15 | 0 |
| 6 | 18 | 0 |
| 7 | 23 | 0 |
| 8 | 22 | 0 |
| 9 | 21 | 0 |
| 10 | 20 | 0 |
| 11 | 17 | 0 |
| 12 | 18 | 3 |
| 13 | 20 | 0 |
| 14 | 19 | 0 |
| 15 | 18 | 0 |
| 16 | 16 | 7 |
| 17 | 14 | 0 |
| 18 | 13 | 0 |
| 19 | 18 | 0 |
| 20 | 16 | 0 |
| 21 | 17 | 0 |
| 22 | 16 | 3 |
| 23 | 14 | 4 |
| 24 | 16 | 0 |
| 25 | 13 | 0 |
| 26 | 14 | 0 |
| 27 | 10 | 12 |
| 28 | 13 | 16 |
| 29 | 14 | 0 |
| 30 | 11 | 0 |
| 31 | 9 | 24 |
| 32 | 8 | 0 |
| 33 | 8 | 0 |
| 34 | 12 | 12 |
| 35 | 9 | 0 |
| 36 | 12 | 0 |
| 37 | 8 | 10 |
| 38 | 7 | 0 |
| 39 | 10 | 0 |
| 40 | 12 | 0 |