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SCHOLARSHIP EXEMPLAR



Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Scholarship 2024 Agricultural and Horticultural Science

Time allowed: Three hours
Total score: 24

ANSWER BOOKLET

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

Write your answers in this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–23 in the correct order and that none of these pages is blank.

Do not write in the margins (/////). This area will be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

QUESTION ONE: Agricultural and horticultural production in a regulatory environment

Primary production system: Chicken Farming

code of welfare	PLANNING	SPCA
Chickens: (hyline) (ross vs cobb) → Layers vs broiler → colony (13/m²) → Barn (97/m²) → FR (9/m² and 2500/hectare) → temp, humidity, CO₂, pressure → Broiler: 38kg/m² liveweight		5000/flock 34/m²

130, 3800

FR: +ve marketing
C/B: cheaper/more quantity
able to be produced

harder to set up. Note 1/3
+ maintain.

cheap (desired in cost of living crisis)
becoming less popular
→ calls for ban colony

Note code of welfare ambiguity issues → SPCA accreditation more specific
negative issue → Colony +ve is rate of production - note available → Kelly Drake.
land decrease due to housing etc

international export markets
+ve - overseas values safety of product (bird flu, infectious bursal disease, Newcastle disease)

perspectives:

- some farmers prioritize profit
- some farmers have ability to prioritize welfare (note link to premium)
- Aging farming popn (avg 56) May not want to change long standing systems

Question One:

Primary Production system: chicken farming

In NZ, chickens are farmed for two reasons – for their meat and for their eggs. Broiler chickens are either the Ross or the Cobb breed, each known for their ability to gain lean body mass rapidly, perfect to meet the high demand for chicken domestically and internationally. There are a few common breeds of layer hen (e.g. the Hyline), selected for their early maturity, calm/neutral temperament, and quality eggs. Eggs are one of the most commonly consumed source of protein in NZ, desired for their rich nutrients, affordable price, and versatility in the kitchen. There are regulations for both layer and broiler chickens with regards to their care, set out in the 2013 Animal Code of Welfare which is compulsory for the farmers to abide by. For layer hens, there are three types of production system: colony, barn, and free range. Whereas for broiler chickens, there are only free range and barn raised. Colony chickens have a maximum stocking density of 13 hens per square meter, compared to barn raised hens with maximum of 7 hens per square meter, and finally free ranged chickens with an indoor maximum stocking density of 9 chickens per square meter, and a maximum of 2500 chickens per hectare. Despite this difference in the regulations, production chickens largely have the same enforceable regulations surrounding other areas of their welfare and care. New technology that is becoming more widespread, allows farmers to check their livestock remotely via cameras, and alter any environmental factors such as temperature, light, and ventilation.

In recent years, caged eggs were banned from supermarkets and production due to increasing ethical concerns for the welfare of the hens in such a cramped space, and recent articles indicate the attitude for colony eggs is following a similar path, having one main supermarket take interest in banning colony eggs by the year 2027. However, it is unlikely that outright removing the colony egg system will be sustainable in the long term due to the societal need for cheaper eggs. Eggs are an accessible form of protein, and with the current cost of living crisis showing no sign of decreasing, there is a need for cheap eggs for consumers, which is further supported by the fact that each production system makes up about 1/3 of eggs sold. A benefit of farming in the through colony system is its land security and high productivity. With more farmable land being sold for housing developments, the value of land is increasing and becoming more difficult to find. Colony farms are able to build upwards, not just outwards, meaning that they are more secure than free range in this respect. However, a risk with farming colony eggs is that popularity will decrease as the societal attitude continues to place more weight on welfare, and that demand will decrease as a result. It is also argued that there will always be a substantial level of demand for cheaper eggs due to there naturally always being a market desiring them (e.g. university students).

The barn raised production system is known as the happy medium between free range and colony, where the eggs are closer in price to colony, however the hens are able to move around and interact with each other. The barn production system is currently considered the most stable of the three due to not being the face of a controversial topic, yet also having

high production rates and profitability. Free ranged farming for both broiler and layer chickens is considered the premium system. There are more costs for setting up and maintaining a free range farm, however it is marketed towards the increased number of welfare conscious consumers, especially in the international market. In 2022, \$25 million in value of chicken meat was exported internationally, largely to south-east Asian countries such as Vietnam and Thailand. NZ is known for being 'clean and green', as well as being the only country in the world that is free from the major three poultry diseases: bird flu, infectious bursal disease, and Newcastle disease, each known for its spreadability and fatality rates. For NZ to maintain its reputation of being sustainable, safe, and ethical, it must continue to improve its welfare standards to meet the international demand. Being able to market free range eggs/meat is a worth while investment, further supported by the increasing number of free range poultry farms, now at 33%.

Although NZ has welfare regulations put in place by the government, which is more than many other countries, the regulations in the Code of Welfare have many issues. For both broiler and layer chickens, the Code of Welfare is ambiguous, often leaving certain requirements up for interpretation rather than stating specific boundaries and limits. An example of this being that there are no regulations surrounding broiler chicks and it is left up to the producer. This has led to the development of an external organisation's accreditation certificate. The NZ SPCA has developed their own set of regulations that chicken farmers can choose to complete in return for being labelled as SPCA certified. There are many perspectives farmers have with these extra regulations, with some having the ability to invest further into the farm and make the changes to fulfil the regulation criteria, and gaining the benefit of the SPCA accredited blue tick. This blue tick is excellent when marketing the eggs/meat as premium, encouraging those who have the funds to buy the product. A recent 2024 study investigated consumers' willingness to pay for sustainable / ethically sourced produce, and this number has gone up 40% in the last decade. With this rise in popularity, some farmers find SPCA accreditation worth the extra work.

However, it is important to consider that installing certain features such as scratching posts every other square meter or designating more space per chicken is an expensive shift. Realistically, many farmers have more pressing matters than getting an SPCA certified blue tick, such as farm maintenance and improvement. Production costs have skyrocketed since the Covid-19 pandemic, meaning that many farmers have other priorities. A 2022 report from Beef+Lamb found that the average age for farmers was 56, assuming that this number is similar for chicken farmers (as many farmers have many different types of livestock), it may mean that they are less willing to change their methods as they have worked for so long prior. Education of the benefits of the poultry regulations could be the key to unlocking long term sustainable farming methods that are futureproofed as the consumer preference changes with time.

QUESTION TWO: Weather events and climate change

Primary production system: Lamb

Lamb

PLANNING

- 990 farms damaged
- 2015/16 floods
- 2018 drought
- 1/3 of NZ sheep of affected farms
- 40mm rain per hour
- \$400 million in damages.

Profitability

2020-2022 → \$8-9/kg
 2023 peak (Dec) → \$7/kg
 2024 (Jan/Feb) → \$6.20/kg

1. Lamb - seasonality due to being vulnerable to weather when they are young
 ↳ temperate climate, not too much of anything

2. Yes as unpredictability — droughts / floods / snow
 ↳ farming in sheltered areas

3. ↳ Sustainable sheep farming
 53% NZ GHG emission from Agriculture
 11.4% — sheep methane
 1% — sheep nitrous oxide

~~NZ export reliant~~
~~\$4 billion~~
~~for lamb = a few billion~~

Question Two:

Primary Production system: Lamb

The climate crisis has been increasing in severity, and measures to reduce its impact have become vital both domestically and internationally. In 2016, over 190 countries signed a global climate treaty, the Paris Accord, which commits to efforts to reduce global warming below +2 degrees Celsius before the year 2050. Many countries have been introducing initiatives to reduce greenhouse gas emissions, clean up polluted areas, and focus on preserving the earth's resources, all of which to slow down the effects of climate change that are now no longer ignorable. The globe has seen records of sea level rise that weren't expected for decades to come, and has seen devastation of homes, towns, farms, and livelihoods, as a result of increasing extreme and unpredictable weather events.

Most recently, in 2023, Cyclone Gabrielle caused flooding and destruction of whole towns in the Hawke Bay region, with over 40mm of rain per hour for many days, and further flood damage in Auckland and East Coast regions. Over 990 farms were affected, leaving over a third of all NZ sheep on damaged farms and \$400 million in damages. Many homes and farms in Eskdale, Hawkes Bay, remain abandoned due to the irreparable damage caused, demonstrating the urgency of the climate crisis. The Hawkes Bay region had only just been recovering from more flooding in 2016, followed by a deadly drought in 2018. Much of NZ lamb is farmed in Hawkes Bay, and with the increasing severity and frequency of these weather events in this region, there is uncertainty for the future.

Lambs require a calm and temperate climate during their first few weeks of life while they rely on their mothers for food and protection. Because NZ has such significant seasonality, different regions of the country have lambing at different times. Hawkes Bay experiences such hot and dry summers, having already reached 30 degrees in spring 2024, meaning that lambing should occur in June/July before it gets too hot. This also means that Hawkes Bay farmers are able to reach the early (Christmas) holiday market when demand for lamb is the greatest, around November/December. Conversely, Otago and Southland farms tend to lamb later in spring, around September, due to the freezing winters they experience. Lambs would not easily survive the cold winter of Southland, and those who do would not grow at an efficient rate due to spending a considerable amount of energy staying warm. Ideal conditions for lambs to grow are not too dry as it is important there is enough food and pasture for them/ the ewe to eat, but not too wet/cold as the lambs will waste energy keeping warm and potentially have less nutrition, decreasing growth rates.

Unpredictable weather events are unfortunately showing no sign of slowing down, seen as recently as September 2024 when over 25,000 animal lives were lost in extreme and prolonged snow in Southland, the majority of which being lambs, due to lambing season. Weather events are increasing in many regions of the country, which poses a substantial risk due to the security of farmers livelihoods. A suggested solution to mitigate the negative impacts of climate change in terms of sheep/lamb farming is to favour the genetics of more hardy breeds, and increase the allele frequency in many sheep herds. For example, merino are known for their ability to adapt to their environment, however crossing lamb meat breeds with the merino may decrease the quality/quantity of the produce. Another method

altering genetics is choosing to breed the more hardy of the Romneys, but it would take many generations for this trait to become noticeably improved.

Ultimately, in terms of lamb production, the focus should be turned towards reducing emissions and contributions to climate change. Agriculture makes up 53% of all NZ's greenhouse gas (GHG) emissions, with 12.4% of all emissions being from sheep, meaning there is room for substantial improvement that may slow down the effects of climate change. About 10% of sheep GHG emissions are nitrous oxide, which is found in nitrogen fertilizers and urine. Reducing degree of nitrogen used as a pasture fertilizer is a method of decreasing this number, as most of the nitrogen consumed by the sheep is excreted out in the urine just to be emitted to the atmosphere as the nitrogen content is too concentrated for plants to absorb. As for the remaining portion of sheep GHG emissions, methane is responsible. Methane is produced in ruminant animals as a byproduct of the fermentation of cellulose due to microbes, which is present in all plant matter but highly concentrated in fibrous plants. Methanogens react to breakdown the cellulose for digestion, however produce methane gas which is subsequently excreted through burbs and farts, and absorbed into the atmosphere. Feed alteration is the most accessible and researched method to reduce GHG emissions from ruminants. Plants such as chicory and forage rape decrease methane emissions up to 30% when consumed alone, and are a sustainable feature to have on the farm. Plantain is especially beneficial due to its ability to decrease both nitrogen and methane content, and can be planted by waterways to absorb nitrogen runoff, as well as decrease methane emissions by up to 20% when consumed by ruminants. Other solutions such as methanogen inhibiting vaccines and capsules are being investigated in sheep, however are in the very early stages of research, but the research is promising.

QUESTION THREE: Exporting New Zealand's agricultural and horticultural production

Primary production system (1): Kiwifruit

Primary production system (2): Lamb.

Lamb + kiwifruit

PLANNING

Note profitability
on other pg.

- NZ export reliant
- \$5k Billion
 - ↳ lamb large portion

1) Boost economy, better trade relations
↳ FTA

2. 20% of people in NZ don't have food security
 ↳ impact western markets
 \$800m to EU in 2022 → FTA → Sustainability review
~~FTA~~ due to opinion shift

3.

Question Three:

Primary production system 1: Kiwifruit

Primary production system 2: Lamb

NZ small country with a low population density and a temperate climate, meaning our agriculture exports play a major role in the stability of our economy. NZ exports are valued over half a hundred billion dollars, agriculture/horticulture makes up about 53% of this. Our export markets mean that there is more money coming into the economy for uses such as infrastructure improvement, sustainability/environmental measures, vital public services, and research/education.

In 2022, kiwifruit exports made up a significant portion of the ag/hort exports, valued in the several billions. The European Union (EU) made up over \$800 million in value of kiwifruit exports, which was a 26% increase from two years prior. As well as this, a fair trade agreement (FTA) was signed with the EU in 2024, indicating the value and quantity of kiwifruit exports is on the rise. Over \$60 million was a cost due to tariffs in 2022, a number set to substantially shrink in the coming years. This growing market with a bright outlook due to the new FTA makes it an extremely important one for NZ, and because of this we must fulfil certain consumer demands of theirs. Concern for climate change and sustainability is an issue that is growing on consumers' minds, especially Western European

markets. There has been an increase push to source local food items to reduce emissions from variables such as the fuel from transportation via boat or plane. This has also been prompted by the Paris Accord, which has become increasingly more important as it plays a large role in the FTA with the EU. Because of this, it is important for kiwifruit growers to be able to sustain their practices in an environmentally friendly way, targeting the 0-carbon policy, especially with regards to shipping. Another concern the EU has been forecasted to put emphasis on is the state of food security in NZ. NZ has a reputation of being clean, green, and sustainable, however 1 in 5 New Zealanders do not have food security, despite our largest source of national income is from the food sector. This issue has only become worse since the Covid-19 pandemic, which prompted the cost of living to spike and fail to return down. International consumers from export markets are likely to hold concerns for NZ if food poverty continues or worsens, posing a threat to NZ produces' export value.

An action that can be taken to allow greater resilience when supplying export markets is to supply to many places, and avoid putting all eggs in one basket. 90% of kiwifruit is exported to the top three export markets, China, the EU, and Japan, meaning that competition or consumer demand shifting can cause ripple effects for Zespri growers. An example of this could be with India, who NZ has hopes of signing an FTA with, which would allow reduced tariff trade for kiwifruit. This would significantly increase the number of kiwifruit exported there and provide another market for stability.

Lamb is another primary product that makes up a large proportion of NZ's agricultural and horticultural exports. Since the Covid-19 pandemic, production costs such as animal health, wages, interest rates, mechanical repairs, and fertilizers have all increased. However, these costs were offset by large returns in the industry, as in 2020-2022, the returns for lamb were \$8-\$9 per kg. In peak season, December 2023, returns did not reach these numbers and were closer to \$7 per kg, falling even further to \$6.20 per kg in January 2024. With returns decreasing and production costs remaining high, many farmers are reducing the amount of lamb they are producing and switching to more sustainable products such as dairy. The top three export markets for lamb are China (all parts often used for broths), the UK (56% of lamb exported there is lamb leg, used for soups/stews/roasts in the winter time), and the USA (largely the lamb rack for BBQ's). It is important to be able to sustain the demand from each of these large consumers for the reliability of the sector. With the USA's new government change, we can expect to see changes in the quantity and value of lamb exported there. With the European concern for the environment, it is important for farmers to consider to sustainable methods to futureproof these markets. An action that could be taken to allow greater resilience would be prioritising the domestic market due to the food insecurity crisis. It may actually attract more export markets if our own country is not in such a dire situation. This can be seen in Australia, who have three times the amount of lamb as NZ, and are in the same hemisphere so target the same export markets, however, they do not export much lamb due to their own domestic population eating all of it.

If the government can subsidise farmers providing for NZ's domestic market, it will not only increase the stability of income for farmers, but also provide New Zealanders with more food and decrease poverty rates. As well as this, it decreases the amount of emissions as fuel isn't used transporting the produce so far away. Overall, this action will have many positive impacts and likely attract markets such as the EU to more NZ products.

Scholarship

Subject: Agricultural and Horticultural Science

Standard: 93105

Total score: 16

Q	Score	Marker commentary
1	06	The candidate identified a range of compliances that the primary production system must or could adhere to, as well as the positive and negative impacts of the compliances. The candidate identified a range of views on the compliances and justified why those views are held.
2	05	The candidate provided some discussion on the climate requirements for the primary production system, as well as detailed discussion on the weather events that have impacted the primary production system. The candidate has provided some options to mitigate the impacts of climate change, but more detail could have been provided.
3	05	The candidate understands the needs or advantages of the export market to their primary production system. The candidate provides some evidence of the risks that New Zealand faces due to its reliance on exporting. The candidate discusses some options to allow for greater resilience when supplying export markets.