In this, the third part of *Milk marketing and production*, you will use milk as an example to develop an understanding of how farm performance can be assessed based on the quality and quantity of the outputs. You also examine forces that affect farm performance and how farm managers schedule the timing of operations to enhance performance.

This part contributes towards an understanding of Outcomes H3.1 and H3.2 from the Agriculture Stage 6 HSC Course. The syllabus can be found on the [Board of Studies, NSW](http://www.boardofstudies.nsw.edu.au) website at http://www.boardofstudies.nsw.edu.au
Problems and product specifications

As with the production of any commodity, the production of agricultural produce and the processing of it into consumable products requires quality control. In part 2 you looked at how processing problems can prevent a product from meeting market specifications. Now you will look at problems on the farm.

In dairy production, things happen that can jeopardise the quality of the product. Problems can arise on or off the farm.

**On farm problems**

Look at figure 3.1 representing a model of a dairy farm system. All the subsystems are connected by lines representing interactions between them, such as when an output from one subsystem becomes the input for another.

These interactions can affect the quality of the product from the farm. For example, if the soil fertility is low, then the quality and quantity of the pasture will be poor. Poor quality pasture will reduce the quality and quantity of the milk, making it difficult for the farmer to meet product specifications.

A farmer attempts to optimise the farming system so that there is a high level of productivity. Testing the soil will indicate low nutrient levels, which the farmer can then remedy using applications of manure or fertiliser, or by growing legume crops. Because of the interactive nature of the system the farmer also has to be careful to keep any solution in balance so that it does not cause more problems, for example, too much fertiliser could result in runoff and damage to local waterways.
There are five factors we can identify as limiting that can affect subsystems on a farm and create a problem that will affect production.

1. Identify the five factors of production that can limit quality and quantity of a farm product.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
2 Identify which of the five factors is most associated with the following examples that affect milk quality or quantity on a dairy farm.

<table>
<thead>
<tr>
<th>Example</th>
<th>Factor of production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor pasture quality due to low soil fertility.</td>
<td></td>
</tr>
<tr>
<td>Mastitis.</td>
<td></td>
</tr>
<tr>
<td>Bacteria in the milking equipment.</td>
<td></td>
</tr>
<tr>
<td>Heatwave, causing lowered production.</td>
<td></td>
</tr>
<tr>
<td>Low individual production records.</td>
<td></td>
</tr>
<tr>
<td>Antibiotics in the milk.</td>
<td></td>
</tr>
</tbody>
</table>

Check your answers.

Off farm problems

Figure 3.2: External forces that affect farming systems.
Adapted from Bawden, R.J. Paper for Annual Conference of Agricultural Technologists of Australia, August 1995, Sydney.
The farm system does not exist in isolation. Figure 3.2 summarises how the farm and its products are subject to external forces from society and nature. Throughout the agriculture course you should have been considering the impacts of these forces.

The following table shows examples of how each of these external factors can affect how milk meets market specifications.

<table>
<thead>
<tr>
<th>Force</th>
<th>Effect on the ability to meet market specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
<td>One of the issues with family farms is the passing on of skills and continuation of the farm as a family unit. Many young people are moving away from farming. It is not always easy for farmers to get skilled farm workers. Dairy farmers often find it difficult to find suitable casual workers, so they are unable to take family holidays away from the farm and their ongoing milking responsibilities. Lack of skills associated with milking may lead to lower milk quality, making it more difficult to meet product specifications.</td>
</tr>
<tr>
<td>Historical</td>
<td>In the past many chemicals were widely used that are now associated with health and environmental problems and have been banned from use. Some of these chemicals persist for long periods in the environment and can cause contamination of milk many years later, often far from the point of contamination.</td>
</tr>
<tr>
<td>Economic</td>
<td>Because of rising costs, farmers may not invest as much money in maintaining the resources of the farm. Older equipment may not be maintained or replaced as often. Older equipment breaks down often. If there are places in the milk line that are difficult to clean properly this can be a source of contamination. Poor milking equipment can make it harder for the farmer to meet product specifications.</td>
</tr>
<tr>
<td>Physical</td>
<td>Extended periods of drought conditions make it more difficult to supply the lactating cows with enough feed concentrates (such as grain or meal). These high protein, high carbohydrate feeds affect the protein and solids not fat (SNF) in the milk. Dairy farms use a lot of water for cleaning. If this water is restricted or of lower quality then milk quality can be affected.</td>
</tr>
<tr>
<td>Biological</td>
<td>The use of AI, importing superior semen from all over the world, gives the farm manager the opportunity to improve quality factors and so meet market specifications more easily. However, inferior genetic traits or genetic disease can also be imported.</td>
</tr>
</tbody>
</table>

Figure 3.3: How forces can affect milk quality.

Complete the following table with examples of how external forces can affect the meeting of market specifications for your case study product. You may need to refer back to On the case.
<table>
<thead>
<tr>
<th>Force</th>
<th>Effect on the ability to meet market specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
<td></td>
</tr>
<tr>
<td>Historical</td>
<td></td>
</tr>
<tr>
<td>Economic</td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td></td>
</tr>
<tr>
<td>Biological</td>
<td></td>
</tr>
</tbody>
</table>

Turn to Exercise 3.1 and develop a summary for the HSC style extended response question about your case study product.
One common feature of agriculture is that it takes time to produce a product. All agricultural products take time to produce and in many cases this is related to the seasons. The amount of time to complete one production run or period is referred to as the production cycle.

The production cycle for an annual crop such as wheat or potatoes can be considered to start when ground preparation begins, and ends when the crop is harvested and sent off to market. In the case of perennial crops such as fruit trees, the production period may be considered to be an annual cycle, once the plant has matured.

In the case of animal production for meat, the production cycle may relate to the time taken for development and growth of animals to a stage where they are ready for marketing. For animal products such as wool, the production cycle can be considered to be annual and begins and ends at shearing.

Production cycles can be related to a flock, herd or orchard or may revolve around individual animals or an area of land.

**Scheduling animal operations**

In all forms of animal production certain operations are undertaken at specific times of the year or at a particular point in the production cycle. In the example of dairy cattle, the production cycle is connected to the lactation period of individual cows. On a commercial dairy farm, a lactation lasts for about 300 days from the birth of the calf. At the end of this time the volume of milk has dropped sufficiently to make it economically unviable to keep milking her. The cow is dried off and runs with the dry herd until the birth of her next calf. In this way the pregnant cow can be ‘steamed up’ in preparation for parturition (birth) and the next lactation.
Production cycle

The dairy cow production cycle can be thought of as a twelve month period from the birth of the calf, on through the lactation, drying up and on until the birth of the next calf.

Figure 3.4 contains production records for a single cow over twelve months. The table also indicates scheduled events that take place during the year.

<table>
<thead>
<tr>
<th>Time (months after calving)</th>
<th>Milk production (litres / cow / day)</th>
<th>Scheduled events</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>22.5</td>
<td>Calf born.  Lactation begins.</td>
</tr>
<tr>
<td>1</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>24</td>
<td>Oestrus synchronized.</td>
</tr>
<tr>
<td>3</td>
<td>21.5</td>
<td>Cow artificially inseminated.</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>18.5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>8</td>
<td>Cow dried off (milking stops).</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>Cow with dry herd.</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
<td>Cow with dry herd.</td>
</tr>
<tr>
<td>12 / 0</td>
<td>22</td>
<td>Calf born.  Lactation begins.</td>
</tr>
</tbody>
</table>

Figure 3.4: Production cycle of a dairy cow.

Graph milk production on the axes in figure 3.5 using the data in figure 3.4. Mark the scheduled events that management performs during the year onto your graph.
In a dairy herd, management processes are scheduled to ensure that each cow goes through a lactation period each year. The farm manager must schedule the lactation of each and every cow in the herd. This is to ensure that the farm is able to supply milk all year round and so receive a steady income. Since lactation does not begin until the cow has had her calf, the farm manager must coordinate the time each cow is to calve. This means that that a proportion of the herd is in calf (pregnant) at any one time. The result of this is that the farm has a series of overlapping lactation curves.
The farmers’ goal is to maximise milk production for the whole herd and produce a constant amount of milk all year round (to assure supply to the milk factory and provide a consistent source of income).

**Scheduling pregnancy**

How can the farm manager ensure that the required numbers of cows are in calf at any one time?

In the past a dairy farmer may have kept one or more bulls that ran with the cows at specific times of the year. The bulls' job was to ensure that the cows were serviced (mated), so that they would lactate after parturition.

However, with the introduction of artificial insemination in conjunction with oestrus synchronisation most dairy farmers either disposed of their bulls or continued to use them only as a stand by or for young cows (heifers). Artificial insemination can be carried out by the farmer after suitable training and if the farm has the necessary equipment, or it can be done by a vet or specialist AI technician.

![Figure 3.7: AI means that semen is available from a number of bulls.](image)

Oestrus synchronisation involves treating a batch of cows with hormones so that they will all come into oestrus and ovulate at about the same time. Artificial insemination involves using instruments to place specially prepared and stored semen in the female’s reproductive tract to achieve pregnancy at a specific time with a known sire. Oestrus synchronisation
allows a group of cows to be artificially inseminated together, scheduling parturition and the onset of lactation as required by the farm manager.

AI has a number of advantages for the dairy farmer:

• cows are seen twice a day at milking, so heat detection is simplified
• using natural insemination by one or two farm bulls means that the gene pool is limited
• a bull needs feeding and, depending on his temperament, stronger fencing, all of which costs the farmer
• AI straws can be kept for many years, stored in liquid nitrogen, meaning that even after a bull has died he can still sire calves
• because the semen is diluted a single bull can father thousands of calves through artificial insemination, far more than by natural means.

AI also has disadvantages:

• heat detection at milking takes additional time and some cows may be missed
• damage to semen and poor operator technique can reduce cow in calf rates
• a good AI technician still only has a success rate similar to using a bull, while a poor operator can have a significantly lower rate
• disease may be spread through poor hygiene.

1 Outline how the use of oestrus synchronisation could help with scheduling of the production cycle on a dairy farm.

________________________

________________________

Turn to the Additional resources section in this part and read the transcript of part 1 Reproduction - an interview with Barry, a dairy farmer on the north coast of NSW.

Use the information in the interviews to answer the following questions.

2 Explain why Barry uses a combination of AI and bulls.

________________________

________________________

3 Outline the reason for selection of the breed of bull used on this farm.

________________________

________________________

Check your answers.
Scheduling plant operations

In many dairy areas of NSW a problem facing dairy farmers is the lack of pasture growth during winter. Low winter temperatures and in many areas low winter rainfall mean that there may not be enough high quality pasture growing to supply the needs of a lactating dairy cow.

The winter feed gap

When the amount of available pasture falls below the requirements of a lactating dairy cow the situation is often referred to as a 'winter feed gap'. In other words there is not enough pasture to keep the cows producing over the winter months. This situation is illustrated in figure 3.8.

To replace pasture insufficient in quantity or quality two sets of operations are scheduled on Barry’s farm:

- sowing of a winter pasture or forage species such as annual ryegrass
- conservation of fodder such as hay or silage from those periods with excess pasture production.

Concentrates are fed all year round to maintain high yield and protein in the milk.
Look at figure 3.9, showing the production of different pasture species on a dairy farm. Use this information to complete the following table that shows when plant production operations are scheduled on the farm.

<table>
<thead>
<tr>
<th>Plant production operation</th>
<th>Scheduled month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cut kikuyu and conserve for silage or hay.</td>
<td></td>
</tr>
<tr>
<td>Feed hay or silage.</td>
<td></td>
</tr>
<tr>
<td>Slash or mulch ryegrass and fertilise perennial kikuyu.</td>
<td></td>
</tr>
<tr>
<td>Mulch kikuyu and direct drill ryegrass and fertilizer.</td>
<td></td>
</tr>
</tbody>
</table>

Check your answers.

Turn to Exercise 3.2 and draw a time line or production graph that represents a calendar of operations for a production cycle of your case study product.
Assessing farm performance

How do farmers assess the performance of their farms? How do they know how effective their decisions are when it comes to meeting market requirements for quality and quantity?

In this section you will look at assessment of the performance of systems and decision making based on measurement of quality and quantity.

Assessment of the performance of a farm system uses three steps:

- monitoring
- evaluation
- feedback.

![Figure 3.10: Dynamic model of a farm system. Monitoring, evaluation and feedback are essential features of this model.](image)
Monitoring – collecting information

In assessing performance the first step is recognising and collecting data for outputs and processes that can be measured or described. In selecting outputs and processes for monitoring, the farm manager needs to look for aspects of the system that can be evaluated and the results fed back into the system to improve it.

Monitoring relates to the collection of information. Information can be:

• qualitative (uses words to describe the situation) or quantitative (uses numbers that can be analysed statistically to describe the situation)
• objective (information collected without bias usually by an outside agency) or subjective (information collected on the farm by farm personnel)
• anecdotal (descriptive information related to specific events or situations that have occurred) or investigative (information derived from trials or studies that have been set up with clearly defined parameters).

Some forms of information are more reliable than others. Generally the most reliable information comes from measurements made through independent study of the farm system. The most unreliable, comes from subjective anecdotal reminiscences (stories about something that has happened in the past).

Evaluation – analysing information

Information collected needs to be analysed so that the farm manager can see where areas of improvement can be made. Information can be analysed by comparison with other sources including:

• comparison with set standards
• between farm comparisons
• before and after comparisons.

Comparison with set standards

In all industries there are quality standards that are applied to the farm product. Sometimes these standards are agreed ‘best practice’ standards devised by farmer groups. Sometimes the standards are imposed by manufacturers or government. Food Standards Australia, a government organisation, sets standards such as the temperature of milk stored on the farm and the acceptable bacterial and somatic cell counts of milk.
## A MILK PROCESSOR LIMITED
Dairy Lane, North Somewhere, NSW
Phone (02) …… Fax (02) ……

50/1000
PHARMER B & P RMB …. DAIRYVILLE ROAD SOMEWHERE NSW

<table>
<thead>
<tr>
<th>Pick-up date</th>
<th>First grade litres</th>
<th>Second grade litres</th>
<th>Total litres received at factory</th>
<th>Milk temperature °C</th>
<th>Litres disposed of on-farm</th>
</tr>
</thead>
<tbody>
<tr>
<td>17/07/2003</td>
<td>11299</td>
<td>11299</td>
<td>3.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18/07/2003</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19/07/2003</td>
<td>11513</td>
<td>11513</td>
<td>3.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20/07/2003</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21/07/2003</td>
<td>11511</td>
<td>11511</td>
<td>3.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22/07/2003</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23/07/2003</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekly total</td>
<td>34323</td>
<td></td>
<td>34323</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Month to date</td>
<td>149252</td>
<td></td>
<td>149252</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### MILK COMPOSITION – WEEKLY SUMMARY

<table>
<thead>
<tr>
<th>Week ending</th>
<th>Av. milk fat %</th>
<th>Av. milk protein %</th>
<th>Av. BMCC (000’s)</th>
<th>Av. BC (000’s)</th>
<th>Av. sediment</th>
<th>Av. freezing point °C</th>
<th>Av. antibiotics µg/ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>23/07/2003</td>
<td>3.8</td>
<td>3.19</td>
<td>1095</td>
<td>225</td>
<td>9</td>
<td>Satisfact.</td>
<td>0.524</td>
</tr>
</tbody>
</table>

Figure 3.11: Processing factory feedback sheet. Weekly farm performance. (Farmer and processor details have been altered to protect confidentiality.)
1 Complete the following table using information from the weekly farm performance processing factory feedback sheet in figure 3.11 and the milk standards outlined in part 2 of this module.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Set standard</th>
<th>Farm performance</th>
<th>Acceptable Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk fat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMCC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freezing point</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antibiotics</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2 Predict, based on the weekly summary in figure 3.11, whether or not the farmer would be eligible for a bonus from the processor.

______________________________________________________
______________________________________________________
______________________________________________________

Check your answers.

Between farm comparisons

Under some circumstances, it may be that the farmer is able to compare their performance against other farms in the district.

In some agricultural industries, on farm testing of outputs is possible. In the dairy industry, herd recording services enable farmers to obtain data about the performance of the herd on a regular basis. Not only does this data provide information about individual cows, it compares on farm production with other farms in the district.

Examine figure 3.12, a table of herd recording data from the Coffs Harbour area on the north coast of NSW. The report is compiled by an outside agency that is contracted to conduct the tests.
### PRODUCTION SUMMARY REPORT

**Pharmer B & P**  
**Sampled 09/04/2003**

Comparison with herds in farming district: Coffs Harbour  
Test day averages

<table>
<thead>
<tr>
<th>Age group</th>
<th>No. cows</th>
<th>Milk litres</th>
<th>Protein %</th>
<th>Fat kg</th>
<th>Av SCC</th>
<th>Prot:Fat Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 year</td>
<td>Herd</td>
<td>45</td>
<td>15.3</td>
<td>3.6</td>
<td>0.55</td>
<td>4.2</td>
</tr>
<tr>
<td></td>
<td>District</td>
<td>815</td>
<td>15.4</td>
<td>3.4</td>
<td>0.53</td>
<td>4.0</td>
</tr>
<tr>
<td>3 year</td>
<td>Herd</td>
<td>70</td>
<td>19.4</td>
<td>3.4</td>
<td>0.66</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>District</td>
<td>882</td>
<td>17.8</td>
<td>3.4</td>
<td>0.61</td>
<td>4.0</td>
</tr>
<tr>
<td>4 year</td>
<td>Herd</td>
<td>45</td>
<td>21.3</td>
<td>3.4</td>
<td>0.73</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>District</td>
<td>683</td>
<td>19.5</td>
<td>3.4</td>
<td>0.66</td>
<td>3.9</td>
</tr>
<tr>
<td>Mature</td>
<td>Herd</td>
<td>132</td>
<td>21.1</td>
<td>3.4</td>
<td>0.72</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>District</td>
<td>1839</td>
<td>19.3</td>
<td>3.3</td>
<td>0.64</td>
<td>3.9</td>
</tr>
<tr>
<td>Total</td>
<td>Herd</td>
<td>292</td>
<td>19.9</td>
<td>3.4</td>
<td>0.68</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>District</td>
<td>4219</td>
<td>18.2</td>
<td>3.4</td>
<td>0.62</td>
<td>3.9</td>
</tr>
</tbody>
</table>

Figure 3.12: Herd performance compared to the rest of the district.

1. Identify the quantity and quality information supplied to the farmer in figure 3.12.
2. Outline the advantages of using a company not associated with the farm to perform the quality and quantity analysis.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

Check your answers.

In addition to the test day averages supplied in figure 3.12, the data is collated and averaged over time, providing a rolling herd average.

<table>
<thead>
<tr>
<th>PRODUCTION SUMMARY REPORT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmer B &amp; P</td>
</tr>
</tbody>
</table>

Comparison with herds in farming district: Coffs Harbour

Rolling herd averages

<table>
<thead>
<tr>
<th>Age group</th>
<th>No. cows</th>
<th>Milk litres</th>
<th>Protein %</th>
<th>Fat kg</th>
<th>% cows with SCC &gt; 200 000</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 year</td>
<td>Herd</td>
<td>49</td>
<td>4798</td>
<td>3.2</td>
<td>151</td>
</tr>
<tr>
<td></td>
<td>District</td>
<td>945</td>
<td>4625</td>
<td>3.3</td>
<td>153</td>
</tr>
<tr>
<td>3 year</td>
<td>Herd</td>
<td>63</td>
<td>5243</td>
<td>3.3</td>
<td>172</td>
</tr>
<tr>
<td></td>
<td>District</td>
<td>804</td>
<td>5021</td>
<td>3.3</td>
<td>166</td>
</tr>
<tr>
<td>4 year</td>
<td>Herd</td>
<td>35</td>
<td>6150</td>
<td>3.2</td>
<td>194</td>
</tr>
<tr>
<td></td>
<td>District</td>
<td>616</td>
<td>5409</td>
<td>3.3</td>
<td>178</td>
</tr>
<tr>
<td>Mature</td>
<td>Herd</td>
<td>130</td>
<td>6271</td>
<td>3.2</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>District</td>
<td>1754</td>
<td>5711</td>
<td>3.2</td>
<td>184</td>
</tr>
<tr>
<td>Total</td>
<td>Herd</td>
<td>277</td>
<td>5761</td>
<td>3.2</td>
<td>184</td>
</tr>
<tr>
<td></td>
<td>District</td>
<td>4119</td>
<td>5282</td>
<td>3.3</td>
<td>173</td>
</tr>
</tbody>
</table>

Figure 3.13: Average herd performance compared to the district.
The information presented in figure 3.13 is useful, but a graph can make this information more easily understood.

3. Draw a histogram (column graph) on the figure 3.14 axes to compare herd and district performance for milk yield, using the rolling test averages from figure 3.13.

4. Assess the milk production of the farm compared to other dairy farms in the district.
5. Draw a histogram on the figure 3.15 axes to compare herd and district performance for protein content using the rolling test averages from figure 3.13.

![Histogram diagram](image)

Figure 3.15: Average daily milk protein for herd and district.

6. Assess the milk protein content of the farm compared to other dairy farms in the district.

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________
7 Draw a histogram on the figure 3.16 axes to compare herd and district performance for milk fat using the rolling test averages from figure 3.13.

![Histogram of Average Milk Fat Production](image)

Figure 3.16: Average daily milk fat production for herd and district.

8 Assess the milk fat production of the farm compared to other dairy farms in the district.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Check your answers.

Another set of data is provided in figure 3.17 for the somatic cell count average at the time of testing. Individual farm results are compared with all the other farms that pay for the service.
9. Draw a histogram on the figure 3.18 axes to compare herd and district performance for somatic cell count using the cell count details from figure 3.17.
10. Assess the somatic cell count of the farm compared to other dairy farms in the district.

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

Check your answers.

The information available to dairy farmers that allows them to compare the performance of their farms with others is very comprehensive. Are there similar processes used to compare farm performance for the farm product you are studying?

Turn to Exercise 3.3 and describe the criteria used to compare quantity and quality of produce for the farm product you are studying.

**Before and after comparisons**

Assessing performance can also take a linear approach. The farmer can note performance at a particular point in time and compare it to performance at later date. This is a useful mechanism to examine the effects of change on the farm.

Turn to the Additional resources section in this part and read a transcript of the interview part 2 – Herd organization and Production goals 2003 with Barry, a dairy farmer on the north coast of NSW.

Answer the following questions using information from the interview.

1. Describe how Barry has changed the organisation of the milking herd.

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

2. Outline the reasons for making these changes.

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
The information collected has little purpose unless it can be used to improve production. Management can use the information to plan and implement changes to inputs and processes in order to improve yield and quality of outputs.

Look at the figure 3.19, a report on the performance of individual cows prepared by a herd recording company:

CHECK YOUR ANSWERS.

Feedback – applying information

The information collected has little purpose unless it can be used to improve production. Management can use the information to plan and implement changes to inputs and processes in order to improve yield and quality of outputs.

3 Suggest the effects of the change to herd structure on milk quality and quantity.


5 Identify a problem that Barry has had with calf survival.

6 Describe changes that have been made in the management of calves and the effect this has had on calf survival rates.
<table>
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<th>Calving date</th>
<th>Age</th>
<th>Milk litres</th>
<th>Protein %</th>
<th>Fat %</th>
<th>Cell count</th>
<th>Days</th>
<th>Milk litres</th>
<th>Protein %</th>
<th>Protein kg</th>
<th>Fat %</th>
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<td>4</td>
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</table>

**Pharmer B & P**

Report no. 209874657

Sampled on 09/04/03

DAIRY HERD TESTING COMPANY

PRODUCTION REPORT

Sorted by cow no.

Last test day

Lactation to date

Cell counts

Dry on 18/03/03

Days

Milk litres

Protein %

Protein kg

Fat %

Fat kg

No test

Peak count

No > 200

30/05/02

24/06/02

*** day 305 due 25/04/03

324
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<th>Dry Date</th>
<th>Elevation</th>
<th>Treatment</th>
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<th>Fat</th>
<th>Protein</th>
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<td>9528</td>
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</tr>
</tbody>
</table>

Figure 3.19: Individual cow performance.
Answer the following questions about information feedback and how the farmer may choose to use it to change the farm system using information from figure 3.19.

1. Identify the number of the cow that had the highest production in the last day of testing.

2. Assess whether the high production of the high producing cow from question 1 is sustained for the duration of her lactation or whether she was outperformed on a total litre / day basis.

3. Outline how the farmer could use this information.

4. Identify the cow that has the worst somatic cell count on the last test day.

5. Outline how the farmer could use this information.

6. Cow number 541 was milked for 495 days rather than being dried off on about day 305 of the lactation. Propose possible reasons the farmer could have had for continuing her lactation for this extended period.

7. Explain the significance of the date 28/05/03 for cow number 480.
8 Outline decisions that the farmer could make about the future of cow 480, considering her age and her performance on the last test day.

9 The last column of figure 3.19 shows cows with a repeated somatic cell count of over 200,000. Outline the likely effect that the SCC of this herd is having on financial returns to the farm.

10 Explain how the farm manager could use the feedback information on SCC to change the farm system.

Check your answers.

Turn to Exercise 3.4 and complete the performance assessment part of a dynamic systems model for your case study product. You may need to refer back to your preliminary farm case study and the case study product information you collected in parts 1 and 2 of this module.
Government intervention in farm production

Commonwealth, state and local government all impact on agricultural production and rural life. Communication and transport systems, irrigation schemes and agricultural research and advisory services have all been established to aid farm production. In addition governments create laws and regulations that are concerned with land, water and native species conservation. Such governmental departments provide guidelines and limits on the way resources can be used and management practices carried out.

For many agricultural industries, particularly food producers, it is the government that is ultimately responsible for setting the standards for quality of farm products. Government bodies are responsible for setting up guidelines for the production of many agricultural products as well as the way in which they are stored, transported, processed and marketed.

Deregulation of the dairy industry

In the milk sector, as with most other Australian agricultural industries, there has been a change from a very controlled, protected industry towards complete deregulation.

- Pre 1990s – market milk sector controlled by the state governments. The different state governments ensured year round supplies of fresh milk with different methods including pooling or quota systems to source milk from farms and controlled prices and distribution from farm gate to consumer.
- 1990s – some controls were phased out – farm pricing and sourcing regulations remained.
- Late 1990s – state and federal governments signed the National Competition Policy (NCP), which concerns government intervention in industry. Under this policy, there should be no government intervention that restricts competition unless it can be shown that it is in the public interest.
- 1998 – establishment of state government authority SafeFood NSW, with responsibility for food safety and food safety regulation.
- Early 1999 – the dairy industry took a national plan for deregulation to the federal government.
• July 1999 – SafeFood NSW took over responsibility for milk safety from the Dairy Corporation.

• 28 September 1999 – the federal government announced the Dairy Structural Adjustment Program (DSAP), to be administered by the Dairy Adjustment Authority. This program involves DSAP payments to dairy farmers based on 1998/99 milk production, made quarterly over eight years. These payments are intended to assist dairy farmers to adjust to deregulation. It is funded by a Dairy Adjustment Levy of 11 cents per litre on products marketed as dairy beverages.

• 1 July 2000 – state governments removed laws concerning pricing and sourcing of drinking milk. The generic marketing of milk, previously carried out in NSW by Milk Marketing Ltd., was replaced by the Australian Dairy Corporation (now Dairy Australia) which is owned by dairy farmers. The only specific remaining government involvement in drinking milk is in food safety assurance.

• Now – the government body Food Standards Australia New Zealand (FSANZ) has responsibility for development of primary production and processing standards.

**Government organisations**

There are a range of government organisations that affect many aspects of day to day farm life. These include:

- local council
- NSW Department of Primary Industries
- Rural Lands Protection Board
- NSW Area Health Services
- NSW Police
- NSW Environmental Protection Authority (EPA)
- State Rail Authority of NSW
- Workcover NSW
- Rural Fire Service
- State Emergency Services
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Australian Quarantine and Inspection Service (AQIS)
- Department of Infrastructure, Planning and Natural Resources
- Australian Taxation Office
- National Parks and Wildlife

Think about how each of these might affect farms. Can you think of others?
Food Standards Australia New Zealand

FSANZ is the Government agency responsible for developing food standards for the entire food supply chain (paddock to plate) for all of Australia. It was established in July 1996 and operates under the Food Production (Safety) Act 1998. The chief executive reports to Federal parliament.

The FSANZ food safety schemes are developed through HACCP risk analysis, the aim being to prevent rather than react to food safety issues.

HACCP

Hazard Analysis and Critical Control Points (HACCP) is a concept that uses a step–by–step approach to the identification of risks. The principles were first used in the British chemical industry, and then further developed by NASA in the 1960s when producing food supplies for astronauts.

- **Hazard** – identifying biological, physical or chemical aspects of the food chain that have the potential to cause a food safety problem.
- **Analysis** – assessment of the seriousness of a hazard in the raw materials, processing, storage or distribution of a product.
- **Critical Control Point** – identifying a point, step or procedure that can be controlled to minimise or remove a hazard.

HACCP is a world recognised system to ensure food safety. It has been taken up by Australian government regulators, and gives local and international consumers of Australian produce confidence in the quality of food products as well as giving better access to some markets.

Dairy farms must undergo an initial HACCP audit, followed by a compliance audit every 6 months to 1 year. Failure of an audit can lead to suspension of their dairy farmers licence. Some areas that are checked in a HACCP audit of a dairy farm are:

- identification and recording of treated cows
- correct observance of chemical withholding periods
- people with infectious diseases are not involved in milking
- using appropriate dairy chemicals such as sanitiser, teat dip and detergents to recommendations of manufacturer
- keeping records of purchased feed
- maintenance of dairy buildings to an approved level
- cleaning procedures
- correct storage of chemicals and medicines.

Areas that are considered more serious are given a greater weighting in the audit.
If you have Internet access you can find out more about HACCP from the Food and Agriculture Organisation of the United Nations at http://www.fao.org/.

Turn to the Additional resources section in this part and read a transcript of the dairy farmer interview part 3 – Milk quality assurance.

Use the information in the interview to answer the following questions.

1 Identify one thing that Barry needed to do to satisfy the HACCP program.

________________________________________________________________________
________________________________________________________________________

2 Describe how Barry sees the worth of the HACCP program.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Check your answers.

**NSW Department of Primary Industries**

The NSW state department of agriculture (NSW DPI) has had a big impact on farming in NSW. NSW DPI conducts government and industry funded research into specific production problems.


Maybe you can speak to a NSW DPI officer for help with your study of a case study product.
Summary

- Problems that affect the production of a product can arise from on farm or off-farm sources.
- Production problems can affect the meeting of product specifications.
- Solutions to production problems may be complex due to the interactive nature of farming systems.
- Events in a production cycle need to be carefully scheduled so that production can be optimised.
- Some events are scheduled by the season or time of year, while others are related to the biological requirements of plants or animals.
- The performance of a farm can be assessed using a process of monitoring, evaluation and feedback.
- In the past there was a high level of government intervention in most Australian agricultural industries.
- In recent times there has been a process of deregulation, which has resulted in much less government intervention in Australian agriculture.
- The dairy industry and many other agricultural industries are now self regulated apart from matters relating to food safety.
- Many government organisations still exist that influence aspects of agriculture and rural life.


Dairy farmer interviews

Part 1 – Reproduction

_I want to talk to you a bit about reproduction. Do you use AI on the farm?_

Yeah, we actually run our herd in two lots. We run a herd of what we call our fresh herd, which are all our cows who’ve calved under 100 days and we run a breeding program on that particular herd using prostaglandin to get them cycling at around about 35 days after calving. They are all artificially inseminated then and from there, at about 110 days, we transfer them to our other herd and we run a bull with them.

_So you use prostaglandin, so you’re using oestrus synchronisation to make sure that they all cycle at the same time. So do you do your own AI?_

We do our own AI. Currently my herd manager does all our preg testing – he went away and did a course not so long ago.

_So you’ve answered the question “is there a bull kept on the farm”, there is._

Yes. There’s about five bulls.

_Five bulls. And they stay to clean up any misses through artificial insemination?_

Yes. We run bulls with the herd and we also run bulls with our dry cows just as a back stop.

_Are they predominantly again Friesian bulls?_

They are all Friesian bulls.
Are they? Because I know that some people put a beef bull over the Fresians just so they can sell off their calves.

With our dry heifers in Tamworth, our young heifers – we mate those to a beef bull, only because of the situation out there and for easy calving. We don’t have any problems with heifers calving if we mate them with, say, a Murray Grey.

Where do your straws come from for your AI? Do you import or do you get local?

With artificial insemination we use a variety of semen. We try to use about 50% proven bulls, which is either Canadian or American semen, and then the other 50% we look for unproven bulls either out of Australia or Canada.

Part 2 – Herd organization and production goals 2003

We run two herds on this farm – we are probably one of the only farms in the district that do it. A couple of years ago when the floods were on (before all this **drought) we got pretty desperate here, most of the farm was just mud. We split the herd. We have what we call our fresh cows, which are basically cows that have calved, and they are in their lactation. Up to about 110 to 130 days of that lactation is when a cow is really going to give most of the milk so we really try and utilise that and really push the cows. From there we flick them into the other herd if weather permits. We always try and keep them fairly even herds.

We have a twelve-a-side herringbone dairy, which is really not big enough for our size herd, and that’s another reason for having the two herds because if we tried to milk 300 plus cows we’d have them standing around all day. They’d be waiting for three hours before they went back into the paddock. This way, with the split herd; they come in, they’re milked, they’re back out in an hour and a half and back onto the feed and that’s where you make your milk. The infrastructure’s really only set up for 200 cows, so that’s another good reason for splitting.

As we are today, I think we’re milking somewhere around 310 cows, averaging around 21.5 to 22 litres per cow per day. We’re actually 2.1 million litres off the farm this last financial year. My budget for this year is somewhere around about $2.5 million, and at this point (if July is anything to go by) I was up 30 thousand litres for the month from this time last year. So if I can continue to carry that through I should easily get my 2.5 million litres.
So what’s the difference?

It’s cow numbers, number one, and we’ve just been feeding the cows better and got a little bit more organised over time.

The other thing is too, once we’ve got our property at Tamworth up and running better, and we know we’ve got the hay there (because currently I buy in hay), we’ll bring it back over and I’ll go up to 400 cows. I would like to get 3 million litres. Now that sounds a lot, but nowadays with deregulation it’s a numbers game. You’ve got to have big numbers to make a dollar.

Calf rearing here. We’ve actually just changed that system too. We did have moveable sheds so we could actually transport them around the paddock and the calves used to be up off the ground because we have a Salmonella problem here that’s actually in the soil. We had a lot of calves dying. At one stage here, some five years ago, I’d be lucky to keep two calves out of ten. I didn’t know what I did with them – I’d move them down the road and tie them up and they still kept dying on me so I went into this shed system. That worked for about five years and then all of a sudden we started to have problems again for some reason, so now all we do is we’ve just got pens out the back here. We just basically have our young calves that we get them started for a week or so, then they go into a bigger lot. We try and keep fresh sawdust for their bedding where they sleep and then we just rotate them and they go into the bigger lot and then we just swap them around.

When they’re about ten weeks old we truck them to Tamworth and we put them on an automatic feeder out there. They get ad-lib pellets (as much as they want). They grow really well when they go out there. It costs us a fair bit of money. The calves probably eat 3 – 4 kilos of pellets a day, so you’re looking at around about $2 a day to feed them. But, it’s worth it because I get a good animal back here a lot younger. I can actually get my heifers to calve back on the farm at two year old. Now if I left them over here and tried to rear them on this coastal country, they’d be three year old before I could actually get them back into production. So they’re costing me a lot of money for twelve months.
Part 3 – Milk quality assurance

How is milk quality assured by the farmer and the milk factory?

Currently we’re on a program here which is called HACCP - Hazard Analysis of Critical Control Points. It’s been hard for farmers to accept and to handle. Quite a bit of paperwork. But at this point it seems to be coming out fairly good. We do an audit every twelve months which probably takes around about four or five hours. What it has done for the farm is it has actually helped us keep better records of where we are and what we do on the farm. It’s really not an issue any more. The initial teething was difficult, but I think nowadays at least we can guarantee our product from the plate right back to the farm.

So do you keep a record of every cow?

Every cow’s on computer. Every month, once a month, we actually get a guy to come in and herd record the cows. So, they set up 24 meters in here that individually tests their milk production for the day, which is averaged over the 30 days in between. They take a sample away. They do a fat test, protein test and a somatic cell count. Now a lot of farmers used to use this – this is just a book that they supply – you can fill it in. You can actually send it off to the company, and they’ll do it for you, but we just get the books and then we just have our own program here. Mark, my herd manager, sits down a couple of days a week and enters it all. We can pull any report we want out of that – cows due to calve, cows due to be Aled. It gives us a history right back.
Problems and product specifications

On farm problems

1 Management
   Nutrients
   Disease
   Genetics
   Climate.

2 Example | Factor of production
----------|---------------------
Poor pasture quality due to low soil fertility. | Nutrients (climate)
Mastitis. | Management (genetics)
Bacteria in the milking equipment. | Management (climate)
Heatwave, causing lowered production. | Climate (management)
Low individual production records. | Genetics (management / nutrients / disease)
Antibiotics in the milk. | Management (disease)
Scheduling operations

Production cycle

Scheduling pregnancy

1 The use of oestrus synchronisation can help with production cycle scheduling because the manager can make decisions about when a cow will fall pregnant and can therefore manipulate when the highs and lows of her production will occur. Staggered calving means that overall production can be evened out, ensuring year round supply contracts are met.

2 Bulls are much better at detecting oestrus than people, so the bulls are used as a ‘backup’ to the artificial insemination program in case the insemination was unsuccessful. Barry considers that the extra expenses of keeping bulls on the farm are less than the expenses involved in keeping unproductive cows.

3 Fresian bulls father higher milk producing daughters that can be reared for use as replacements in the dairy herd.

The winter feed gap

<table>
<thead>
<tr>
<th>Plant production operation</th>
<th>Scheduled month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cut kikuyu and conserve for silage or hay.</td>
<td>November – February</td>
</tr>
<tr>
<td>Feed hay or silage.</td>
<td>March – July</td>
</tr>
<tr>
<td>Slash or mulch ryegrass and fertilise perennial kikuyu.</td>
<td>October</td>
</tr>
<tr>
<td>Mulch kikuyu and direct drill ryegrass and fertilizer.</td>
<td>March</td>
</tr>
</tbody>
</table>
Assessing farm performance

Comparison with set standards

<table>
<thead>
<tr>
<th></th>
<th>Criteria</th>
<th>Set standard</th>
<th>Farm performance</th>
<th>Acceptable Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Milk fat</td>
<td>Base level 3.95 %</td>
<td>3.8</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Protein</td>
<td>Base level 3.15 %</td>
<td>3.19</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>&lt; 4 °C</td>
<td>3.6 – 3.8</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>BMCC</td>
<td>&lt;200 000 top bonus</td>
<td>225 000</td>
<td>Yes – low bonus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;300 000 low bonus</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BC</td>
<td>≤ 50 000</td>
<td>9 000</td>
<td>Yes – bonus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(≤ 20 000 bonus)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Freezing point</td>
<td>≤ 0.517 °C</td>
<td>0.524 °C</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Antibiotics</td>
<td>0.003 µg/ml</td>
<td>0.003 µg/ml</td>
<td>Yes</td>
</tr>
</tbody>
</table>

2 The farmer would be eligible to get a low range bonus for BMCC and a bonus for BC. Prices for milk based on fat and protein will be close to base price.

Between farm comparisons

1 Milk quantity in litres
Milk protein and fat percentages and kg per litre
Ratio of protein to fat
Average somatic cell count

2 An independent company is able to support the expertise necessary in their staff in order to produce accurate and unbiased results. Farmers who did testing themselves would not have the expertise or specialised equipment.

As the company services a number of dairies in the district they are also able to provide comparative figures so that a farmer can check their progress against others.

An independent advisor can often pinpoint problem areas more easily, and use their expertise to provide advice on solutions.
In all cow age groups the farm herd outperforms the district averages for quantity of milk.
Overall the farm herd outperforms the district averages for milk protein in terms of kilograms produced, although the district average is slightly higher for 2 year old cows. The percentage protein shows a different story, with herd averages slightly lower or equal to district averages for all age groups and lower overall. This comes about because although there is a high amount of protein produced, there is a very high quantity, so the protein as a percentage of the milk is lowered.

A similar picture appears for milk fat as was found for milk protein. Overall the farm herd outperforms the district averages for milk fat in terms of kilograms produced, although the district average is higher for 2 year old cows. The percentage fat shows herd averages lower or equal to district averages for all age groups and lower overall.
10 Except for the group of 3 year old cows, the herd has consistently higher percentages of cows with high cell counts than the district average. The farm herd also has higher percentages in all the cell counts above 200,000 except for 500,000 – 600,000. The percentage is particularly high compared to district averages in the very high range (>600,000), which should be a concern.

**Before and after comparisons**

1 Barry has split his milking herd into two. The herd of fresh cows are in the first half of their lactation (110 – 130 days). The other herd are in the second half of their lactation.

2 Initially the change was made due to muddy conditions caused by a flood, but the structure has been kept because it has several advantages. The main advantage is that the cows spend less time in the milking shed waiting to be milked with the limited equipment available, and more time in the paddock eating grass and producing more milk. The herd split also makes management operations more efficient.
3  The original change to the two herd system was made to decrease the muddiness of the cows. Mud on cows, and particularly on their udders can affect milk quality. With a decrease in the mud or dust on a cow this should not affect quality. With less time spent at the milking shed it is suggested that there is an increase in milk yield as a result.

4  In 2003 Barry has 310 cows, producing an average of 21.5 to 22 litres per day. Barry aims to produce 2.5 million litres in 2004, compared to 2.1 million litres in 2003. His long term aim is to increase cow numbers to 400 and produce 3 million litres.

5  Salmonella has had a severe effect of the survival of calves on the farm, with 8 in 10 calves dying from this bacteria 5 years ago.

6  Calf survival rates have improved with the introduction of a rotation system. Calves are kept in pens for a week, and then moved to a series of bigger pens with fresh sawdust as bedding. At ten weeks the calves are sent to Tamworth where they are fed ad lib on pellets with an automatic feeder to rapidly bring them up to a suitable weight for breeding.

Feedback – applying information

1  Cow 513 had the highest level of production on the last day of testing, producing 31 litres.

2  Cow 513 appears to be a consistently high producer. Comparing cow 513 to other cows with a similar lactation length shows a much higher level of production. Cow 513 produced 4267 litres at 119 days of lactation, compared to cow 84 at 113 days producing 2990 litres, and cow 508 at 120 days producing 2810 litres.

3  Cows identified as high producers are less likely to be culled, and the producer is more likely to select them as recipients for high quality semen, so their daughters can be used as replacements in the herd. Some producers will identify high producing cows so they can get special attention such as increased amounts of concentrates to support their high production levels.

4  The cow with the worst somatic cell count on the last test day is cow 513, with a cell count of 1742.

5  Careful monitoring of known susceptible animals might be helpful for early detection and prompt treatment before mastitis becomes a problem. Extra care could be taken with milking procedures, such as removal of cups as soon as the cow is milked out, and correct teat dipping to help prevent mastitis. The farmer could cull cows with consistently high counts and avoid using their daughters as replacements in the herd.
6 Cow 541 is an older cow that may be due to be culled from the herd for age or because she has not fallen pregnant or took a long time. Despite this she is still a very high producer, so the farmer may have decided to continue milking until her production level falls off and she is no longer of use. Cow 541 also has high butterfat and protein levels in her milk which helps to lift these characteristics in the bulk milk.

7 The date 28/5/03 is when cow 480 is due to calve.

8 Cow 480 is an old cow at 10 years. Her recent performance on the test day showed a good amount of milk considering the stage of her lactation, and also good levels of fat and protein. She is also due to calve soon, which means her milk production will rise again. The decision of the farmer at this point must be whether to cull her or keep her on in the herd.

9 High somatic cell counts mean that the farmer does not get bonuses. Particularly high levels can even result in no payment for the milk. This affects the farmer financially as they are not getting as much income from the milk they sell.

10 The feedback on SCC can be used to help improve milking techniques and to select cows for culling.

Government intervention in farm production

HACCP

1 To satisfy HACCP requirements Barry has to undergo a 4 to 5 hour audit every 12 months.

2 The HACCP program has improved record keeping on the farm. They have instituted independent testing which once a month records milk production, and supplies information on fat, protein and SCC. These records allow them to access information on calving times, cows due for AI and individual histories.
Exercises 3.1 to 3.4  Name: _________________________________

Exercise 3.1

Develop a summary for the following extended response question using your farm case study product.

For a product you have studied

(a) Identify the product and describe its market specifications.  

   3 marks

(b) Describe ONE on-farm problem and ONE off-farm problem that may occur in meeting quality specifications when marketing this farm product.

   6 marks

(c) Explain how ONE of the problems described in (b) is managed.

   6 marks

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Exercise 3.2

Develop a time line or production graph that represents a calendar of operations for a production cycle of your case study product.

Exercise 3.3

Describe the criteria used to compare quality and quantity for the farm product you are studying.
Exercise 3.4

For your case study product select one of the criteria used to compare quality or quantity, and describe how it can be assessed using the following headings.

Monitoring

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Evaluation

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Feedback

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