South Canterbury North Otago Branch NZ Deer Farmers Association

Deer Master

Deer Production Guide

December 2000

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Preface

Endorsement comment from Collier Isacs - NZGIB
Introduction

- Background to group
- How to use the handbook
- Acknowledgement of outside material
Reproduction
How does your overall reproductive performance compare?

Reproductive efficiency (see page 61 for full definition) which is sometimes called fawning rate or true weaning percentage, refers to the number of hinds mated which successfully wean a fawn. This figure provides an overall indication of the efficiency of the breeding system.

Table 3. Reproductive efficiency (fawning rate) of R2YO and MA hinds for surveys of commercial farms over 2 - 3 years (Source: Wilson et. al. 2000).

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Mated</th>
<th>RE</th>
<th>Range</th>
<th>Mated</th>
<th>RE</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massey University 1999</td>
<td>1</td>
<td>378</td>
<td>62.6</td>
<td>50-88</td>
<td>1783</td>
<td>81.1</td>
<td>69-94</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>413</td>
<td>77.4</td>
<td>52-92</td>
<td>1683</td>
<td>88.9</td>
<td>73-93</td>
</tr>
<tr>
<td>Deer Master</td>
<td>1</td>
<td>1136</td>
<td>69.8</td>
<td></td>
<td>4639</td>
<td>79.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1146</td>
<td>74.6</td>
<td>62-88</td>
<td>3681</td>
<td>81.2</td>
<td>72-94</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1614</td>
<td>71</td>
<td>56-86</td>
<td>4480</td>
<td>87.1</td>
<td>79-94</td>
</tr>
</tbody>
</table>

The mean reproductive efficiency recorded in each survey can be broken down into its component reproductive outcomes (Figure 1-3) to illustrate where losses occur. Figure 1 and 2 present the mean reproductive efficiency of the three surveys for R2YO and MA hinds respectively.
Figure 3. The individual reproductive outcomes which combine to make reproductive efficiency for MA hinds in three surveys over 2 - 3 years.

For every 100 MA hinds put to the stag

<table>
<thead>
<tr>
<th>Deer Master</th>
<th>RWDPP</th>
<th>Massey University</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 hinds to stag</td>
<td>100 hinds to stag</td>
<td>100 hinds to stag</td>
</tr>
<tr>
<td>7 dries</td>
<td>5 dries</td>
<td>3 dries</td>
</tr>
<tr>
<td>93 hinds conceive</td>
<td>95 hinds conceive</td>
<td>97 hinds conceive</td>
</tr>
<tr>
<td>1 lost during gestation</td>
<td>1 lost during gestation</td>
<td>1 lost during gestation</td>
</tr>
<tr>
<td>92 hinds carry to term</td>
<td>94 hinds carry to term</td>
<td>96 hinds carry to term</td>
</tr>
<tr>
<td>7 lost at or after birth</td>
<td>5 lost at or after birth</td>
<td>7 lost at or after birth</td>
</tr>
<tr>
<td>85 hinds rear a fawn</td>
<td>89 hinds rear a fawn</td>
<td>89 hinds rear a fawn</td>
</tr>
</tbody>
</table>

For every 100 R2YO hinds put to the stag

<table>
<thead>
<tr>
<th>Deer Master</th>
<th>RWDPP</th>
<th>Massey University</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 hinds to stag</td>
<td>100 hinds to stag</td>
<td>100 hinds to stag</td>
</tr>
<tr>
<td>18 dries</td>
<td>dries</td>
<td>15 dries</td>
</tr>
<tr>
<td>82 hinds conceive</td>
<td>hinds conceive</td>
<td>85 hinds conceive</td>
</tr>
<tr>
<td>1 lost during gestation</td>
<td>lost during gestation</td>
<td>1 lost during gestation</td>
</tr>
<tr>
<td>81 hinds carry to term</td>
<td>hinds carry to term</td>
<td>84 hinds carry to term</td>
</tr>
<tr>
<td>9 lost at or after birth</td>
<td>lost at or after birth</td>
<td>14 lost at or after birth</td>
</tr>
<tr>
<td>72 hinds rear a fawn</td>
<td>hinds rear a fawn</td>
<td>70 hinds rear a fawn</td>
</tr>
</tbody>
</table>

Figure 4. The individual reproductive outcomes which combine to make reproductive efficiency for R2YO hinds in three surveys over 2 - 3 years.
KEY POINTS

• All 3 studies were similar in terms of mean reproductive output.

• A large range in reproductive efficiency for both MA hinds (69-94%) and R2YO hinds (42-92%) indicates there is room for improvement on many farms.

• R2YO hinds have the potential for high reproductive efficiency (92%) under optimum conditions.

• Individual farmers differ in the magnitude of losses at each stage and identifying these is the first stage to improvement.
Steps to achieve a high reproductive performance

1. Achieve a 93% or greater pregnancy rate
   The range of pregnancy rates on-farm for your comparison are shown on Page 13
   The requirements for a high pregnancy rate are covered on Page 22

2. Have more than 50% of hinds pregnant before 1 April.
   The range of pregnancy rates on-farm for your comparison are shown on Page 15
   The requirements for early conceptions are covered on Page 22

Achieve a 92% or greater weaning rate
   The range of pregnancy rates on-farm for your comparison are shown on Page 18
   The requirements for early conceptions are covered on Page 39
**PREGNANCY RATE BENCHMARKS**

How does my pregnancy rate (see page 61 for definition) compare with other?

This section describes pregnancy rate data from commercial deer farms collected by Massey University, Deer Master and Richmond/Wrightsons Deer Performance Projects.

These data record reproductive success of R2YO and mixed aged hinds collected over a number of different properties in consecutive years and provide a record of performance by you can measure your property against. How do you compare with this data?

**Table 1.** Survey results pregnancy rates determined by for ultrasound scanning for R2YO and MA farmed red deer in New Zealand (Source: Wilson et. al. 2000).

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Scanned</th>
<th>RE</th>
<th>Range</th>
<th>Mated</th>
<th>RE</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massey University</td>
<td>1</td>
<td>378</td>
<td>83.6</td>
<td>50-100</td>
<td>1783</td>
<td>96.9</td>
<td>93-99</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>413</td>
<td>85.8</td>
<td>50-100</td>
<td>1683</td>
<td>96.8</td>
<td>85-100</td>
</tr>
<tr>
<td>Lawrence &amp; Linney</td>
<td>1</td>
<td>NS</td>
<td>76.7</td>
<td>33-98</td>
<td>NS</td>
<td>93.0</td>
<td>89-99</td>
</tr>
<tr>
<td>Deer Master*</td>
<td>1</td>
<td>1136</td>
<td>82.9</td>
<td>57-100</td>
<td>4638</td>
<td>89.3</td>
<td>73-100</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1146</td>
<td>85.2</td>
<td>80-100</td>
<td>3681</td>
<td>91.6</td>
<td>78-98</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1614</td>
<td>77.8</td>
<td>52-96</td>
<td>4480</td>
<td>94.8</td>
<td>89-98</td>
</tr>
<tr>
<td>RWDPP</td>
<td>1</td>
<td>616</td>
<td>81.2</td>
<td>38-100</td>
<td>2180</td>
<td>92.3</td>
<td>78-98</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>932</td>
<td>82.2</td>
<td></td>
<td>2194</td>
<td>97.3</td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td>6235</td>
<td>81.8</td>
<td>38-100</td>
<td>20639</td>
<td>92.9</td>
<td>73-100</td>
</tr>
</tbody>
</table>

| RWDPP          | Richmond Wrightsons Deer Performance Project |
| NS             | Not stated                                   |
| *              | Farms studied by Massey University and Deer Master were studied in sequential years |
**KEY POINTS**

- The 3 studies showed similar mean R2YO pregnancy rate which was between 77 and 86% in all studies but individual herds varied from 38-100%.

- The proportion of herds recording pregnancy rates of 95+% indicates R2YO hinds have the potential to achieve a high pregnancy rate under optimal conditions.

- Mean MA hind pregnancy rate was between 92 and 97% in all studies but individual herds varied between 73 and 100%.

- There is significant opportunity for improvement in pregnancy rate for both R2YO and MA hinds on many deer farms.
CONCEPTION DATE BENCHMARKS

How does your mean conception date and pregnancy profile (see page 61 for definition) compare with other? A summary of pregnancy profiles from the Massey University, Deer Master and Richmond/Wrightsons Deer performance studies is provided in Table 2 and 3 for R2YO hinds and MA hinds respectively.

Table 2. Pregnancy profiles of rising 2-year-old hinds on commercial deer farms with individual "earliest" and "latest" herds shown to illustrate the range (Source: Wilson et al 2000).

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>No. farms</th>
<th>Group</th>
<th>No deer</th>
<th>% Conceiving (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt; May</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&gt; May 1</td>
</tr>
<tr>
<td>Massey University</td>
<td>1</td>
<td>14</td>
<td>All</td>
<td>378</td>
<td>56 (17-100)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>27.5 (0-76)</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Earliest farm 14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>92.9</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>7.1</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Latest farm 47</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17.4</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>76.1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>14</td>
<td>All</td>
<td>413</td>
<td>72.7 (8-100)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13.0 (0-42)</td>
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<td></td>
<td></td>
<td>Earliest farm 20</td>
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<td></td>
<td></td>
<td>95</td>
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<td>5</td>
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<td></td>
<td>Latest farm 12</td>
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<td></td>
<td></td>
<td>8.3</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>41.7</td>
</tr>
<tr>
<td>Deer Master</td>
<td>1</td>
<td>13</td>
<td>All</td>
<td>1136</td>
<td>4 (0-14)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>33 (5-100)</td>
</tr>
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<td>46 (0-64)</td>
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<td></td>
<td></td>
<td></td>
<td>Earliest farm 63</td>
</tr>
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<td>14</td>
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<td></td>
<td></td>
<td></td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>12</td>
<td>All</td>
<td>1146</td>
<td>4 (0-55)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24 (0-54)</td>
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<td></td>
<td>57 (18-95)</td>
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<td></td>
<td>Earliest farm 11</td>
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<td>55</td>
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<td>18</td>
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<td>Latest farm 123</td>
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<td></td>
<td></td>
<td></td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>10</td>
<td>All</td>
<td>1614</td>
<td>6 (0-34)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16 (1-52)</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>60 (12-81)</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Earliest farm 164</td>
</tr>
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<td>34</td>
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<td>34</td>
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<td>Latest farm 117</td>
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<td>1</td>
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<td>9</td>
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<td></td>
<td></td>
<td></td>
<td>81</td>
</tr>
<tr>
<td>RWDPP</td>
<td>1</td>
<td>11</td>
<td>All</td>
<td>616</td>
<td>0.3 (0-3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>38.8 (15-69)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>42.5 (16-83)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Earliest farm 80</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>69</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Latest farm 17</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>83</td>
</tr>
</tbody>
</table>

RWDPP Richmond / Wrightsons Deer Performance Project
Table 3. Pregnancy profiles of mixed age hinds (3 years and older) on commercial deer farm with individual "earliest" and "latest" herds shown to illustrate range.

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>No. farms</th>
<th>Group</th>
<th>No deer</th>
<th>% Conceiving/range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt; May (78-97)</td>
</tr>
<tr>
<td>Massey University</td>
<td>1</td>
<td>15</td>
<td>All</td>
<td>1783</td>
<td>89.3 (78-97)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>14</td>
<td>All</td>
<td>1683</td>
<td>93.7 (85-98)</td>
</tr>
<tr>
<td>Deer Master</td>
<td>1</td>
<td>14</td>
<td>All</td>
<td>2591</td>
<td>24 (5-45)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>13</td>
<td>All</td>
<td>2589</td>
<td>27 (0-72)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>12</td>
<td>All</td>
<td>3171</td>
<td>26 (0-75)</td>
</tr>
<tr>
<td>RWDPP</td>
<td>1</td>
<td>12</td>
<td>All</td>
<td>2180</td>
<td>13.2 (0-41)</td>
</tr>
</tbody>
</table>

RWDPP Richmond / Wrightsons Deer Performance Project
**KEY POINTS**

- **Average conception date and range of conception dates are important reproductive outcomes**

- **For R2YO herds, a majority of hinds in the Deer Master herds conceived after 17th April although some herds conceived early indicating R2YO hinds have the potential to achieve an early conception date rate under optimal conditions.**

- **For MA hinds a majority of Deer Master hinds conceived between 1April and 17 April although some herds (high producing) had 75% of hinds in-fawn before 1 April.**

- **There is significant opportunity for improvement in average conception date for both R2YO and MA hinds on many deer farms.**
Weaning rate benchmarks

How does my weaning rate (see page 3 for definition and calculation) compare with other? This section describes weaning rate data collected in 3 studies of commercial deer farms. These data record reproductive success of R2YO and Mixed aged hinds collected over a number of different properties in consecutive years and provide a record of performance by you can measure your property against.

Table 1. Survey results for weaning rates for R2YO and MA red deer(from Wilson et al 1999).

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>No. farms</th>
<th>Total no. fawning</th>
<th>Mean herd wean (%)</th>
<th>Range between herds (%)</th>
<th>No. farms</th>
<th>Total no. fawning</th>
<th>Mean herd wean %</th>
<th>Range between herds (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audigé et al 1999</td>
<td>1</td>
<td>13</td>
<td>336</td>
<td>81.6</td>
<td>64.3 - 100</td>
<td>15</td>
<td>1852</td>
<td>91.5</td>
<td>84.1 - 98.3</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>14</td>
<td>386</td>
<td>86.1</td>
<td>73.3 - 100</td>
<td>14</td>
<td>1687</td>
<td>91.7</td>
<td>81.4 - 93.3</td>
</tr>
<tr>
<td>Deer Master*</td>
<td>1</td>
<td>14</td>
<td>930</td>
<td>85.2</td>
<td></td>
<td>14</td>
<td>2586</td>
<td>89.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>11</td>
<td>944</td>
<td>87.2</td>
<td>76.9 - 97.4</td>
<td>9</td>
<td>3185</td>
<td>90.8</td>
<td>78.3 - 96.8</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>11</td>
<td>1151</td>
<td>85.8</td>
<td>78.8 - 92.8</td>
<td>12</td>
<td>4605</td>
<td>92.4</td>
<td>89.7 - 97.9</td>
</tr>
</tbody>
</table>

RWDPP

1

2

Overall*

RWDPP = Richmond / Wrightson's Deer Performance Project
NS = not stated
× = Farms studied by Audigé et al (1999) and Beatson et al were studied on sequential years
+ = Data of Lawrence not included because number scanned was not stated
Key points

- Mean weaning percentage for R2YO hinds in all studies was between 81 and 87% but individual herd weaning percentages ranged between 64 and 100%.
- The proportion of herds recording weaning rates of 95+% indicates R2YO hinds have the potential to achieve a high weaning rate under optimal conditions.
- Mean weaning percentage for MA hinds in all studies was between 89 and 92% but individual herd weaning percentages ranged between 78 and 98%.
- There is significant opportunity for improvement in weaning rate for both R2YO and MA hinds on many deer farms.

Fawn loss during gestation

Loss of fawns between pregnancy scanning in June and set stocking in November (in utero loss) is generally small (max 1.2%) compared with those lost through failure to conceive and through losses post-birth. Mean in utero loss and the range between properties in 2 studies is given in Table 3.

Table 3. Proportion of hinds loosing fawns during gestation in two independent studies.

<table>
<thead>
<tr>
<th>Study</th>
<th>R2YO hinds</th>
<th></th>
<th></th>
<th></th>
<th>MA hinds</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. hinds</td>
<td>Average %</td>
<td>Range</td>
<td>No. hinds</td>
<td>Average %</td>
<td>Range</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Massey University</td>
<td>303</td>
<td>0.66</td>
<td>NR</td>
<td>1639</td>
<td>0.79</td>
<td>NR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deer Master</td>
<td>453</td>
<td>0.0</td>
<td>-</td>
<td>1604</td>
<td>0.62</td>
<td>0 - 1.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NR = not recorded</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Causes of fawn loss between birth and weaning

Fawn loss represents a significant loss of potential fawns with 15% and 8% losses on average for R2YO and MA hinds respectively but can be as high as 36 and 22% respectively.

Understanding the cause of loss may help formulate management aimed at reducing fawn loss.

Causes of fawn loss reported by Massey University (Audige 1995) and Agresearch Invermay records (Pearse, unpublished data) are presented in Table 1.

Table 1. Causes of fawn death in two studies

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Audige</th>
<th>Invermay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hind - fawn factor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dystocia</td>
<td>22.1</td>
<td>42</td>
</tr>
<tr>
<td>Still birth</td>
<td>9.5</td>
<td>25</td>
</tr>
<tr>
<td>Small weak fawn</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td>Over-mothering</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Mis mothering</td>
<td>6.3</td>
<td>13</td>
</tr>
<tr>
<td>Fawn victimisation</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>Ruptured stomach</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>50.5</td>
<td>80</td>
</tr>
<tr>
<td>Disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malformation</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Cryptosoridium</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Liver abscesses</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3.3</td>
<td>0</td>
</tr>
<tr>
<td>Management factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weather stress</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td>Handling stress</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Fawn lost</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Lost through fence</td>
<td>8.4</td>
<td></td>
</tr>
<tr>
<td>Left behind</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td>Misadventure</td>
<td>2.1</td>
<td>6</td>
</tr>
<tr>
<td>Broken bones</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>20.0</td>
<td>6</td>
</tr>
<tr>
<td>Unconfirmed/other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>26.3</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

However a major limitation is that an estimated 77% of fawns which appeared to have died were not located due to the extensive nature of the farm or because carcasses decomposed or were removed by scavengers and therefore cause of death could not be determined.

- About half of all recorded deaths were as a result of hind-fawn relationship factors with dystocia being the single biggest diagnosed cause of death.
- Although sporadic disease or deficiency outbreaks such as cryptosporidium or vitamin E deficiency may occur on individual properties and cause significant losses, generally disease and deficiency accounts for very few fawn deaths on average.
• Between 5 and 20% of deaths are management related and this is likely to vary between individual properties, years and areas within farms. A significant proportion of management related deaths have been identified as fawns escaping through paddock fences. Variable success has been achieved with attempts to stop fawn escape (see section X).
## Factors affecting pregnancy rate and conception date

This section describes the factors known to influence both pregnancy rate and conception date in deer herds. Generally those factors which increase pregnancy rate also advance conception date.

1. **Age**
   Older hinds generally have a higher pregnancy rate and conceive earlier than younger hinds

2. **Body condition**
   Hinds in good condition prior to mating generally have a higher pregnancy rate and conceive earlier than poorer conditioned hinds

3. **Herd size**
   Generally there is little difference between small and large herds in terms of pregnancy rate

4. **Weaning date**
   Hinds weaned pre-rut (early March) are more likely to conceive early than hinds weaned post-rut (May-June)

5. **Mating group size**
   Increasing mating group size up to 100 hinds does not compromise conception date or pregnancy rate but it is strongly recommended stags with large mating groups should be backed-up.

6. **R2YO liveweight**
   R2YO hinds achieving at least 70% of mature liveweight have a greater chance of pregnancy and an early conception than hinds that do not achieve this weight by mating.

7. **Management advise**
   Farms monitoring production and implementing management strategies had greater reproductive success than other farms (district average) not implementing these strategies.

8. **Sire**
   Generally there is no difference in pregnancy rate or conception date of hinds mated with a red sire or elk sire.

9. **Stag introduction date**
   Hinds which have access to a stag from late February - early March generally have a greater change of pregnancy than hinds with a later stag introduction.

10. **Stag back-up**

11. **Pre-mating management of hinds**

12. **Artificial techniques**

---

**DEER PRODUCTION GUIDE**

**REPRODUCTION**
Age of hind

Pregnancy rate and conception date information for a group of hinds with known age is given in Table 1.10.

Table 1.10. Median conception date and scan –ve rate of hinds grouped by age.

<table>
<thead>
<tr>
<th>Age</th>
<th>Scan –ve</th>
<th>Median</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>R2YO</td>
<td>13.9</td>
<td>28-April</td>
<td>1101</td>
</tr>
<tr>
<td>R3YO</td>
<td>9.1</td>
<td>14-April</td>
<td>887</td>
</tr>
<tr>
<td>R4YO</td>
<td>8.2</td>
<td>11-April</td>
<td>623</td>
</tr>
<tr>
<td>R5YO</td>
<td>7.7</td>
<td>9-April</td>
<td>1977</td>
</tr>
</tbody>
</table>

For R2YO hinds in the Deer Master Group, the median estimated conception date occurred 17 days later than all other age groups combined (28 April vs 11 April). This data demonstrates the difference between R2YO hinds and those older but also differences between R3YO, R4YO and R5YO hinds.

Hinds fawning for the second time (R3YO) were 5 days later on average than hinds 5 years old and older. Hinds at their second mating may be still to reach mature body weight and may be of lower body condition having fawned and lactated later than older hinds. This is known to delay oestrus. They may also be lower in social hierarchy and therefore subject to more social stress which may also affect their ability to conceive early. Later and therefore shorter lactation as first calvers may affect ability to conceive early.

Scan-negative rates in R2YO (13.9%) were almost twice those recorded in the R5YO and older animals (7.7%) and similar to the 15.3% reported by Massey University (Audigé 1995) for R2YO and 3.2% for older hinds.

Reproductive performance of R2YO hinds remains an area for improvement on many deer farms (see section X). However, the biological potential of this age group is demonstrated by the high pregnancy rate on some farms.
Key Points

- *MA* hinds in Deer Master conceived on average 17 days earlier than R2YO.
- Massey University recorded a 15-day difference in conception date between MA and R2YO hinds.
- Differences between old hinds (≥ R5YO) and young hinds in terms of conception date do not disappear after their first fawning so older MA herds will conceive earlier than younger MA herds.
- R2YO hinds have a higher chance of not conceiving than MA hinds.
Hind Body Condition

Massey University research (Audigé, 1995) developed a system for assessing the body condition of hinds (body condition score) and showed it to be an important component of reproductive success.

In this study body condition score (BCS) of MA hinds taken at mating confirms an influence on both pregnancy rate and conception date (Table 1.11).

Table 1.11. Effect of BCS at weaning on subsequent conception date and pregnancy rate of a subset of MA hinds in the Deer Master herd.

<table>
<thead>
<tr>
<th>BCS</th>
<th>Mean Conception Date</th>
<th>Pregnancy rate %</th>
<th>Number scanned</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2.5</td>
<td>11-April</td>
<td>84.6</td>
<td>609</td>
</tr>
<tr>
<td>3.0-3.5</td>
<td>11-April</td>
<td>95.1</td>
<td>2053</td>
</tr>
<tr>
<td>4.0-5.0</td>
<td>6-April</td>
<td>95.5</td>
<td>668</td>
</tr>
</tbody>
</table>

MA hinds with a low BCS (0-2.5) had a lower pregnancy rate than hinds of a higher body condition. Hinds of greater than 3.5 were no more likely to conceive than those at 3-3.5 confirming a threshold exists between 2.5 and 3. The difference between hinds in poor condition (2.5) and those in good condition (4-5) is about 10%age points in pregnancy rate.

For deer in the Deer Master herd, R2YO hinds with BCS >4.0 had the highest pregnancy rate and earliest conception date. This differs from the observation made by Massey University research (Audigé 1995) that “over conditioned” (>3.5) hinds were less likely to conceive. These observations may be reconcilable by the fact that there were no hinds recorded with BCS over 4.5 in this study but BCS 5 hinds were recorded by Massey University. In this respect the two studies may be comparing two different degrees of conditioning. More observations of “well conditioned” deer are required to fully understand the effect high body condition has on reproductive performance. However this conflicting evidence suggests any positive or negative effect of very high BCS is likely to be small.

BCS also appears to have an effect on conception date. Hinds in good condition (4-5) conceived 5 days earlier than those in lesser condition (0-3.5). It is unclear from this work whether this
relationship is causal. Factors such as weaning status and previous fawning date for example which are likely to affect subsequent conception date, may also influence BCS at mating.

As previously discussed, BCS may be related to age. A majority of hinds with BCS below 3.0 at mating were identified as R3YO. A later birth date and lactation period for hinds fawning for the first time may represent a significant draw on body reserves, which are not recovered before mating. Early weaning date, allowing recovery time may be important if high pregnancy rates and early conception dates are desirable.

In many cases lactation and declining pasture quality and quantity make increasing BCS of hinds prior to mating difficult. Increasing BCS post lactation, during the mating period may be seen as another option.

This data suggests that for hinds in good condition (>2.5) there is little benefit in increasing BCS over the mating period in terms of conception date or pregnancy rate. Pregnancy rate and conception date were similar for hinds which increasing BCS by 1 and hinds that had little (loss or gain of 0.5) or no change in body condition.

However for hinds which were in poor body condition (BCS<3) there was benefit to conception date and possibly pregnancy rate by increasing BCS over mating. Hinds which added 1 body condition score were 5 days earlier on average than those that showed little or no change. Research from Massey University indicates it is likely the effect would be larger if hinds below 2.5 rather than 3 had been studied.

There was a disadvantage in large (-1) BCS loss during mating. Large BCS loss reduced (by up to 11%) pregnancy rate of hinds compared to those which stayed static. There appeared to be little effect on conception date. BCS immediately prior to mating was by far the biggest effect. (Table 1.12). Hinds in good condition prior to mating were more likely to conceive and were more likely to conceive early than those in poorer condition.
Table 1.12. Effect of BCS at mating and the change of BCS between mating and scanning (June-July) on the conception date and pregnancy rate of a subset of deer from the Deer Master herd.

<table>
<thead>
<tr>
<th>BCS at mating</th>
<th>BCS change</th>
<th>Conception date</th>
<th>Pregnancy rate %</th>
<th>Number of hinds</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2.5</td>
<td>-1</td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>-0.5 - 0.5</td>
<td>13 April</td>
<td>84</td>
<td>219</td>
</tr>
<tr>
<td></td>
<td>+1</td>
<td>8 April</td>
<td>86</td>
<td>133</td>
</tr>
<tr>
<td>3.0 – 3.5</td>
<td>-1</td>
<td>12 April</td>
<td>83</td>
<td>260</td>
</tr>
<tr>
<td></td>
<td>-0.5 - 0.5</td>
<td>5 April</td>
<td>94</td>
<td>341</td>
</tr>
<tr>
<td></td>
<td>+1</td>
<td>9 April</td>
<td>95</td>
<td>98</td>
</tr>
<tr>
<td>4.0 – 5.0</td>
<td>-1</td>
<td>31 March</td>
<td>87</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>-0.5 - 0.5</td>
<td>25 March</td>
<td>95</td>
<td>220</td>
</tr>
<tr>
<td></td>
<td>+1</td>
<td>31 March</td>
<td>100</td>
<td>7</td>
</tr>
</tbody>
</table>

**Key points**
This data suggests that to achieve high pregnancy rate and an early conception date:

- **Hind BCS needs to be 2.5 or better at mating.** There could be a 10% difference between poor conditioned and well conditioned hinds.

- **Hinds need to be in good condition before mating rather than increasing condition during mating although increasing condition of very poor hinds during mating will have a beneficial effect.**

- **It is critical to avoid loss of body condition during the mating period.**

- **Be wary of very fat R2YO hinds**
**Total Herd size**

There is a belief amongst some deer farmers that small farms have higher reproductive performance compared with larger units. Scatter plots of pregnancy rate for MA and R2YO hinds related to the number of hinds on the farm are presented in Figures 1.2 and 1.3, respectively. These data suggests that high conception rate in MA hinds can be achieved with optimum management on farms with large numbers of hinds. There is greater variation in data from R2YO hinds with farms with larger numbers tending to have a slightly lower pregnancy rate.

![Figure 1.2. Scatter plot of number of MA hinds/farm and pregnancy rate from 79 farms.](image-url)

![Figure 1.3. Scatter plot of number of R2YO hinds/farm and pregnancy rate from 73 farms.](image-url)
**Mating Management**

General description (dates stag into/withdrawn (later cycle), backups etc)

**Techniques for rising 2 year old hinds**

- Spiker stags
- CIDRs

**Artificial techniques**

- Artificial Insemination
- Embryo Transfer

**Management for elk mating**

- No younger than 3 years with some 3YO suspect
- Avoid late transport (2 weeks before onset of mating) to new environment
- Put stag out early
- Single sire mating preferable
- Mating groups of 40 hinds max
- Backing-up stags is critical not optional
- Observe behaviour and act if the stag doesn't
- Avoid psychological "turn offs" such as red stag close, disturbance etc.

**Rising 2-year old hinds**

The objective with R2YO mating is to get more hinds in fawn and as early as possible. Hinds fawning early have a financial advantage (see section 1.3). There have been several techniques used and these include running melatonin treated stags, melatonin treated stags & CIDR dry hinds, rising 2-year stags at different ratios.

Results from one property in 1997/8 season where we were able to get three-treatment group information are presented in Table 1.13.
Table 1.13 Summary of information relating to two different treatments on rising 2-year-old hinds

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>Average birth date</th>
<th>No. Early</th>
<th>No. Middle</th>
<th>No. Late</th>
<th>No. non-pregnant (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>44</td>
<td>16 Dec 97</td>
<td>2 (4.5)</td>
<td>9 (20.5)</td>
<td>22 (50)</td>
<td>11 (75)</td>
</tr>
<tr>
<td>Teasers*</td>
<td>44</td>
<td>19 Dec 97</td>
<td>1 (2.3)</td>
<td>12 (27.7)</td>
<td>26 (59)</td>
<td>5 (88.6)</td>
</tr>
<tr>
<td>Rising 2 stags⊥</td>
<td>45</td>
<td>13 Dec 97</td>
<td>6 (13.3)</td>
<td>9 (20.0)</td>
<td>25 (55.5)</td>
<td>5 (86.6)</td>
</tr>
</tbody>
</table>

*Melatonin-treated teaser stags used early pre-rut
⊥ R-2yo stags run in large numbers with the herds pre-rut

It has been difficult to take too much from this result, the treatment of including rising 2-year stags with the yearlings from January and then replacing them with the sire stag did get some early pregnancies (in October), while this is not too desirable to have only a few, if we can get more to fawn in November and less in December it will be a more desirable option.

Weaning date

The effect of weaning practice on the subsequent reproductive performance of hinds has been recently described by Invermay research (Pollard et al. 2000). In a study of 6 Otago/Southland farms 550 hind calf pairs were either early weaned (11 March) or late weaned (30 May). Deer in both groups were of similar age and genotype and stags of the same experience and genotype were added to hind groups on the same day in March.

Estimated conception dates were earlier (28 March) in early weaned hinds compared to late weaned hinds (10 April). Early weaned hinds had higher body condition scores (3.8) than late weaned hinds (3.3).

However early weaned fawns gained less liveweight (99g/d) from weaning through to September compared with late weaned fawns (125g/d) largely due to poorer liveweight gain between March-June.

Although this data was collected in a drought year and further work in this area is planned, there appears to be a trade off between fawn liveweight gain and the subsequent reproductive performance of the hind when considering whether to wean late or early.
An analysis of the outputs of early and late weaned herds is presented in section 2.2.

**Mating Group Size**

In the past, stag ratios of 1 stag to 40-60 have been described as optimal although there is little data on performance of large single sire mating groups. Deer Master has investigated the use of much higher ratio for experienced red sires. Higher ratios would have the advantage of

1) increase the potential number of offspring from superior sires
2) reduce the need for a large number of mating paddocks
3) reduce the investment in sires or increase the value of sires used

Results for the last three years (Figure 1.4) are given below

![Pregnancy rate of MA hinds of 187 different single red sire groups sizes recorded between 1997 and 1999.](image)

**Figure 1.4** Pregnancy rate of MA hinds of 187 different single red sire groups sizes recorded between 1997 and 1999.

When conditions are optimised stags are able to mate many more hinds than are traditionally recommended. In this study stags mated up to 137 hinds with equivalent pregnancy rates and pregnancy profiles than stags with fewer hinds. Although cases of low pregnancy rates did occurred in some large mating groups, the incidence was not greater than amongst smaller mating groups.
However in terms of the total number of hinds at risk of not conceiving, the losses incurred by a stag failure are much higher with large mating groups. For this reason it is suggested stags with large mating groups are replaced in mid-April.

Although one stag was able to successfully mate a sire group of 137 hinds, there are only a few (5) observations on mating groups above 120 hinds and as yet it is unclear what the upper limit is. A sire group of up to 100 hinds per stag is recommended until further investigations are carried out.

**Key points**

For proven, red sires, mating red hinds under optimal conditions:

- Increasing mating group size up to 137 does not compromise conception date or pregnancy rate if all animal and management factors are optimal

- More data is need to establish the upper mating group size limit of a single stag

- Stags with large mating groups should be backed-up.
**R2YO hind liveweight**

About 18 years ago Kelly *et. al.* (1982) established a threshold liveweight of 65kg for the onset of puberty in R2YO hinds. Further evidence suggests both red deer and wapiti reach puberty when they attain at least 60% of their mature liveweight and that a 50% probability of conception results from animals at 70% of mature body weight. On this evidence, the higher the proportion of elk genes, the greater the liveweight required to reach puberty.

The pre-mating liveweight of R2YO was investigated to determine a target weight useful for management.

R2YO hinds averaged $85.4 \pm 0.49$ (mean $\pm$ SEM) in 1998 and $82.1 \pm 0.37$ (mean $\pm$ SEM) in 1999 (Table 1.15.) The difference is likely to be due to the adverse feed conditions which prevailed in the area during the 1998-99 summer.

**Table 1.15.** Mean pre-mating (March) liveweight (kg) and the corresponding median conception date and pregnancy rate of R2YO in 1998 and 1999

<table>
<thead>
<tr>
<th>Year</th>
<th>Mean (kg)</th>
<th>SD</th>
<th>N</th>
<th>Median concept</th>
<th>Scan + ve %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>85.4</td>
<td>9.1</td>
<td>441</td>
<td>18 April</td>
<td>86.2</td>
</tr>
<tr>
<td>1999</td>
<td>82.1</td>
<td>6.6</td>
<td>314</td>
<td>9 April</td>
<td>85.0</td>
</tr>
</tbody>
</table>
Data from both years were combined and were sorted on liveweight prior to mating (Table 1.16).

**Table 1.16. Pregnancy rate and conception date of R2YO with various pre-mating liveweight.**

<table>
<thead>
<tr>
<th>Weight Range (kg)</th>
<th>Number of hinds</th>
<th>Pregnancy rate %</th>
<th>Average conception date</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;65</td>
<td>6</td>
<td>33.3</td>
<td>18 April</td>
</tr>
<tr>
<td>66-70</td>
<td>11</td>
<td>72.7</td>
<td>22 April</td>
</tr>
<tr>
<td>71-75</td>
<td>81</td>
<td>82.6</td>
<td>28 April</td>
</tr>
<tr>
<td>76-80</td>
<td>147</td>
<td>85.5</td>
<td>9 April</td>
</tr>
<tr>
<td>81-85</td>
<td>173</td>
<td>85.0</td>
<td>9 April</td>
</tr>
<tr>
<td>86-90</td>
<td>111</td>
<td>89.6</td>
<td>9 April</td>
</tr>
<tr>
<td>91-95</td>
<td>63</td>
<td>87.5</td>
<td>20 April</td>
</tr>
<tr>
<td>96-100</td>
<td>34</td>
<td>89.7</td>
<td>20 April</td>
</tr>
<tr>
<td>&gt;100</td>
<td>32</td>
<td>88.2</td>
<td>20 April</td>
</tr>
</tbody>
</table>

**Summary**

- This data suggests a mating liveweight target of greater than 75 kg is required in R2YO red hinds for average or better pregnancy rates.

**Elk and Red sires**

In recent times, some farmers have held the view that the reproductive performance of wapiti type sires is inferior to that of red stags. Massey University data (Audigé 1999) could not find evidence of this. The reproductive performance information of Deer Master herds provided a further opportunity to compare elk type sires with red deer sires.

An analysis was undertaken to determine whether there was a difference in pregnancy rate and conception date between MA (R3YO and older) red hinds mated to elk type stags and those mated to red stags. Only pregnancy scanning data collected from farms which used both red deer and elk sires was used to estimate sire type effects on pregnancy rate and conception date.

This analysis showed that neither the date by which half the herd had conceived (9 April) or the average day of conception (15 April) differed between elk mated and red mated hinds.
On the surface this is an interesting observation given claims elk bulls have a lower reproductive success than their red deer counterparts. This information indicates that over a number of herds reproductive success of wapiti-type and red sires was similar.

**Summary**
- There is no evidence to suggest hinds mated to either red stags and elk bulls consistently differ in their reproductive performance.

**Management advice and intervention on reproductive outcomes**

Massey University studies (Audigé et. al. 1999 a,b,c,d) defined production outcomes and developed hypotheses for methods of improving reproduction, based on reproductive profiles collected from commercial deer farms. These models have been applied in the Richmond-Wrightsons Deer Performance project (Walker et. al. 1999a). District average pregnancy rates were available from veterinary practice records to compare "intervention" (those applying the proposed management model) and "district average" farms. These are presented in Table 1.19.

**Table 1.19** *Pregnancy rates in MA and rising 2 year hinds from farms receiving intensive management advice to improve reproductive performance (intervention farms) compared with veterinary practice data for other farms in the district (district other farms) (from Walker et. al., 1999).*

<table>
<thead>
<tr>
<th>Yearling</th>
<th>MA</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. scanned</td>
<td>% pregnant</td>
</tr>
<tr>
<td>No. scanned</td>
<td>% pregnant</td>
</tr>
<tr>
<td>Intervention farms</td>
<td>616</td>
</tr>
<tr>
<td>District other farms</td>
<td>2327</td>
</tr>
<tr>
<td>Difference (% points)</td>
<td>+20</td>
</tr>
<tr>
<td>2180</td>
<td>92.25</td>
</tr>
<tr>
<td>5954</td>
<td>82.35</td>
</tr>
</tbody>
</table>


While differences may not be statistically comparable because district average farms were not selected and paired in accordance with conventional criteria, they do provide interesting and possibly significant signals. A similar difference has been recorded in a subsequent year (Walker et. al. 2000). Economically, the differences recorded are significant to the individual farmer. It is notable that the data in Table 1.19 was collected during a severe drought, indicating that productivity can be maintained when appropriate decisions are made. The motivation for the “intervention” farmers was originally based on pregnancy profiles from other studies, but development of group-specific profiles as the extension project progressed, allowed direct comparison amongst a small peer group. This allowed participating farmers to analyse factors contributing to different profiles within the group, which in turn provided stimulation, along with adding to knowledge of how to achieve desired outcomes.

This comparison demonstrates the value of pregnancy profiling as a motivational tool for improving performance of farmed red deer.
Recommendations for high reproductive performance in MA hinds

In order to achieve high pregnancy rates and an early mean conception date for MA hinds farmers need to consider:

- Ensure hinds are in good condition (BCS >3.0) before mating. Identify and preferentially feed hinds that are in poor condition at weaning.
- Introduce stags early in March or before
- Consider using a CIDR programme
- Use back up stags for single sire mating

Other recommendations from Massey University research suggest farmers should:

- Cull hinds which have failed to conceive previously or wean a fawn
- Wean early (late Feb – early March)
- Cull hinds which cannot be handled easily or change management to improve handling
- Keep mating mobs away from disturbance such as roads, buildings and houses and avoid shifting and handling during the mating period
Recommendations for high reproductive performance in R2YO hinds

This data suggests that in order to achieve high pregnancy rates and an early mean conception date for R2YO hinds farmers need to consider:

- Ensuring all R2YO red hinds are above 75kg before mating
- Ensuring hinds are in good condition (BCS 3 or better) before mating.
- Running spiker stags with R2YO hinds during Jan and February
- Keeping stags with hinds for an additional cycle
- Back up single sire stags

Other recommendations from Massey University research suggest farmers should

- Keep mating mobs away from disturbance such as roads, buildings and houses and avoid shifting and handling during the mating period
- Keep hinds below BCS 5
Factors affecting weaning rate

This section describes the factors known to influence weaning rate to help those farmers who have identified areas for improvement through monitoring.

Likely areas for improvement

1. **Fawn proof fences**  
   Some farms in some years may gain a benefit in weaning rate by fawn proofing paddocks

2. **Vitamin E supplementation**  
   Across a large number of hinds vitamin E supplementation had no effect on weaning rate

3. **Fawning paddocks**  
   Hinds fawning in paddocks that were fawn proofed and contained significant areas of shade had a higher weaning percentage than hinds in other paddocks.

4. **Weather conditions**  
   In some environments maximum daily temperature may represent a challenge to newly born fawns

5. **Techniques for weaning**  
   Some techniques for weaning are discussed

6. **Fawning date**  
   Hinds fawning late are less likely to wean a fawn than those fawning earlier
Increasing weaning rate

Establishing the proportion of hinds that do not wean a fawn and how this proportion compares with others may highlight opportunities for improvement. Section X described the likely cause of fawn loss and their relative importance.

This section describes some options for weaning and some attempts at improving weaning rate through reducing management related losses.

Likely areas for improvement

Based on the surveys of fawn loss from Massey and Invermay (see section X) a majority of fawn wastage (50-80%) occurs as a result of hind/fawn factors which from a management point of view appear hard to influence. Apart from management to avoid dystocia (see section X) much depends upon the hind. Generally disease and deficiency account for very few deaths although problems on individual properties may cause substantial loss. Major diseases of deer and their treatment are covered in section X.

While these surveys provide valuable information, the magnitude and relative importance of losses is likely to vary with region, individual property and even between years. It is important to benchmark the level of loss on individual properties to identify any problems. Attempts at increasing fawning percentage are outlined below.

Fawn proof fencing

Fawn loss occurs primarily during the peri-natal/lactation period. The reasons for this fawn loss are not well understood although attempts have been made identify causes (see section Y). Fawn loss may occur as a result of paddock escape, mis-mothering, mis-adventure, savaging, stillborn, disease or dystocia.

Anecdotal evidence suggests in some years on some farms and in some paddocks fawn movement between paddocks occurs frequently and this may lead to death by mis-mothering or mis-adventure. Where this occurs, reducing the opportunity for fawns to move through fences by ensuring that the fawn paddock perimeter fence is “fawn proof” may improve weaning
percentage. Based on previous surveys (see section G) there is the potential to increase weaning rate by 5-10 percentage points by preventing paddock escape.

Weaning rate from MA hinds set stocked in fawn-proof paddocks tended to be higher than MA hinds set stocked in paddocks with conventional (12 inch stay) deer fences (Figure 1) although this varied between years. Fawn-proofing involved either lining existing fences (ground to 110mm) with chicken netting (15mm mesh) or overlaying netting on existing fences so to reduce the gap to approximately 1/3.

The study was conducted over 2 years with 617 and 2271 hinds set stocked in fawn proofed (FP) and conventionally deer fenced (CDF) paddocks respectively in 1998 and 703 and 1681 hinds set stocked in FP and CDF paddocks in 1999. The mean weaning rate of each FP paddock compared with the mean of all other CDF paddocks is presented in Figure 2.4. Solid bars indicate the mean fawning percentage of CDF paddocks on each farm and the grey bar the higher mean weaning percentage recorded from FP paddocks. Where FP paddocks were lower than the mean for CDF paddocks the solid bar represents the FP weaning rate and the open bar the CDF weaning.

**Figure 2.4. The 1998 weaning percentage of MA hinds in CDF paddocks (solid bars) and FP paddocks (grey bars) for 5 farms.**
In 7 of the 9 FP paddocks mean weaning rate was greater than the mean weaning rate of CDF paddocks for that farm. However only 3 FP paddocks had a mean weaning percentage that was statistically greater than the CDF paddock mean weaning percentage on the corresponding farm. Across farm there was no difference in mean weaning rate between CDF paddocks and FP paddocks.

Four additional FP paddocks were included in 1999. The outcome is presented in Figure 2.5

**Figure 2.5.** The 1999 weaning rate of MA hinds in CDF paddocks (solid bars) and FP paddocks presented with the 95% confidence interval of the CDF weaning rate.

In 1999 only 6 of 13 FP paddocks recorded weaning rates above the mean for CDF paddocks. On average FP paddocks and CDF paddocks recorded similar weaning rates (91%). Results from this study suggest there is no consistent benefit in weaning rate from fawning mixed age hinds in fawn-proof paddocks compared with normal deer fences.

For some FP paddocks weaning percentage were higher than CDF paddocks by between 2-9% which in some cases represented 100% of the possible improvement. For other paddocks CDF paddocks were up to 25 percentage units higher than FP paddocks.
As highlighted previously, many factors affect the survival of fawns to weaning and fawn escape is not the only reason for fawn loss. These other factors may have a greater or lesser influence in any one year on fawn loss and may be the reason for the inconsistent results between years.

**Key Points**

- There was a strong trend for fawn proof paddocks to have a higher weaning rate than conventionally fenced paddocks in year 1 but not year 2.
- Improvement in weaning performance by fawn proofing fawning paddock fences should not be discounted on the basis of these results.
- Evidence that fawn losses were due to paddock escape would be advised before fawn-proofing was installed.

**Vitamin E supplementation**

The work of Wagner (1998) indicated that supplementation of hinds with vitamin E immediately prior to set stocking was associated with an increase in weaning rate. A single dose of 300 IU of vitamin E was administered orally to the hinds in that trial. This reduced the dry rate from 9.3 to 5.5% and from 7.6 to 2.0% on the same group of animals in two consecutive years. It was unclear whether this effect was specific to that herd or whether the same effect could be measured in a wider group of animals.

Data from a range of farms with large herds where half the hinds were treated with 300 IU of vitamin E and the other half untreated is presented in table 1.
Table 2.5 Vitamin E Supplementation Trial Results.

<table>
<thead>
<tr>
<th>Farm</th>
<th>Non-supplemented hinds</th>
<th>Supplemented hinds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fawns</td>
<td>Hinds</td>
</tr>
<tr>
<td>A</td>
<td>394</td>
<td>442</td>
</tr>
<tr>
<td>B</td>
<td>284</td>
<td>341</td>
</tr>
<tr>
<td>C</td>
<td>348</td>
<td>351</td>
</tr>
<tr>
<td>D</td>
<td>49</td>
<td>56</td>
</tr>
<tr>
<td>Total</td>
<td>1075</td>
<td>1190</td>
</tr>
</tbody>
</table>

It must be noted that this trial did not consider the prior Vitamin E status of the hinds, nor did it consider that the type of doses given was in any way a supplementary regime required for elevating Vitamin E in hinds. This trial attempted only to reproduce the effect seen by Wagner (1998).

Paddock variables

Introduction
The aim of this study was to record and measure fawning paddock environment factors which may influence the successfully rearing of a fawn.

Methods.
Fawning paddocks (85) were scored for a range of features (Table 2.6) prior to set stocking in November. Data was analysed to determine if any of these factors significantly influenced weaning percentage.
Table 2.6 Paddock variable data collected prior to weaning (based on Massey University research, Audige 1995)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Assessment System</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paddock size</td>
<td>Area in hectares</td>
<td>Measured or in some cases taken from accurate farm maps</td>
</tr>
<tr>
<td>Paddock disturbance Distance</td>
<td>Meters</td>
<td>Approx. distance in m from source</td>
</tr>
<tr>
<td>Paddock disturbance Severity</td>
<td>Scored 1-3</td>
<td>1=constantly on an hourly basis, 2=daily, 3=less than daily</td>
</tr>
<tr>
<td>Topography</td>
<td>Proportion of paddock flat (no obvious inclines) or steep (need support when climbing)</td>
<td>% flat and % steep with the difference being neither (rolling)</td>
</tr>
<tr>
<td>Hill</td>
<td>Score 0-3</td>
<td>0=no hill, 1=less than 5m high, 2=5-10m high, 3=over 10m high</td>
</tr>
<tr>
<td>Tree</td>
<td>Score 0-2</td>
<td>0=no trees, 1=one or more isolated trees, 2=one or more groups of trees,</td>
</tr>
<tr>
<td>Stump</td>
<td>Score 0-2</td>
<td>0=no or few stumps, 3=many stumps.</td>
</tr>
<tr>
<td>Gorse</td>
<td>Score 0-3</td>
<td>0=no gorse, 1=few plants, 2=groups of plants in some areas, 3=large area</td>
</tr>
<tr>
<td>Shelter belt</td>
<td>Score 0-2</td>
<td>0=no shelter belt or less than 0.5, 1=shelter 1-5m high, 2=over 5m high.</td>
</tr>
<tr>
<td>Stones</td>
<td>Score 0-1</td>
<td>0=no or few stones, 1=many.</td>
</tr>
<tr>
<td>Shade</td>
<td>Score 0-1</td>
<td>0=limited shade at most times during the day, 1=shade at all times.</td>
</tr>
<tr>
<td>Area of shade</td>
<td>Percentage of paddock shaded</td>
<td>Estimated as per mid-afternoon</td>
</tr>
<tr>
<td>Thistles</td>
<td>Score 0-3</td>
<td>0=no or few thistles, 1=many single plants, 2=small areas, 3=covering 10% or more of paddock</td>
</tr>
<tr>
<td>Fences type</td>
<td>Netting/wire description</td>
<td>Identify 12 and 6 inch netting, additional wires, sheep top-ups and fawn-proofing.</td>
</tr>
<tr>
<td>Dam</td>
<td>Present or not</td>
<td>Dam or ponding of any description</td>
</tr>
<tr>
<td>River</td>
<td>Present or not</td>
<td>River, stream, drain or water race</td>
</tr>
<tr>
<td>Trough</td>
<td>Present or not</td>
<td>Drinking trough</td>
</tr>
<tr>
<td>Pasture type</td>
<td>Pasture species</td>
<td></td>
</tr>
<tr>
<td>Estimated clover content</td>
<td>Percentage</td>
<td></td>
</tr>
<tr>
<td>Pasture height at set stocking</td>
<td>Average height in cm</td>
<td>Measured using a pasture stick</td>
</tr>
<tr>
<td>Number of hinds set stocked</td>
<td></td>
<td>Does not include any which died</td>
</tr>
</tbody>
</table>

**Summary**

For this data set and using logistic regression statistic analysis only shade score and fawn proof fencing were significant terms.

- Hinds with access to shade in the form of trees, scrub or gorse cover throughout the paddocks were 2.5 times more likely to wean a fawn than those in more exposed paddocks. This would be equivalent to increasing weaning percentage from 90 to 95%
• Using this method of analysis, fawn proof fencing was associated with higher weaning percentage with hinds 1.8 times more likely to wean a fawn behind fawn proof fencing than behind conventional deer fencing. This would be equivalent to increasing weaning percentage from 90 to 94%.

**Weaning performance in relation to fawning date.**

Massey University work (Audigé, 1995) identified that hinds which conceived before 1 May were 2.5 times more likely to rear a fawn compared to those hinds conceiving after the this date. It is hypothesised that late born fawns are lighter and therefore less likely to survive and have access to a smaller milk supply as a consequence of their dam missing the benefit of high quality spring pasture. Further, late fawning hinds are generally higher in BCS which is a risk for dystocia. As discussed above environmental conditions may also have an effect. However from this data it is unclear how fawn loss varies with date.

Deer Master data for hinds which were diagnosed pregnant, were recorded with an estimated birth date and known subsequent weaning status was used in the analysis. The proportion of hinds which were pregnant but failed to rear a fawn in the early, middle and late conception date categories is presented in Table 2.7.

<table>
<thead>
<tr>
<th>Conception date</th>
<th>Early</th>
<th>Middle</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA Wet-Dry</td>
<td>12%</td>
<td>11%</td>
<td>19%</td>
</tr>
<tr>
<td>Total Wet</td>
<td>559</td>
<td>588</td>
<td>124</td>
</tr>
<tr>
<td>R2YO Wet-Dry</td>
<td>15%</td>
<td>11%</td>
<td>27%</td>
</tr>
<tr>
<td>Total Wet</td>
<td>13</td>
<td>268</td>
<td>71</td>
</tr>
</tbody>
</table>

There was a trend for both MA and R2YO hinds which conceived late to have a lower weaning rate than those hinds conceiving earlier. For late conceiving MA hinds, there was a fawn loss rate of 19% compared with 11-12% for earlier conceptions. The trend was much greater in R2YO hinds where late conceiving hinds lost 27% of fawns compared with 11-15% for earlier conceiving hinds.
From this data, the cause of fawn loss cannot be determined and therefore it is unclear whether the effect is conception date \textit{per se} or another factor closely correlated with conception date. Body condition is probably an important factor because at set stocking pasture is usually abundant and the late fawning hinds have several weeks of above maintenance feeding which increases body condition. The incidence rate of dystocia increases as fawning proceeds.

However if conception date was the true effect (through better nutrition in the early part of the season or more favourable environmental temperatures), reducing the MA hind late conception rate from 20\% to 10\% would increase fawning rate by an estimated 6 fawns per 1000 hinds fawning. For R2YO hinds, reducing late conceptions from 55\% to 28\% would increase fawning rate by an estimated 4.4\%. 

Weaning strategies

Establishing what your reproductive performance is and how this compares with others may highlight weakness in some areas.

This section describes the factors known to influence both pregnancy rate and conception date in deer herds

Techniques for weaning

The primary aim of weaning is to separate hinds from fawns but in deciding how and when this should be done farmers need to consider

- The welfare and nutrition of the fawn
- The condition of hind prior to mating
- Maximise fawn liveweight gain

Weaning involves the separation of fawns from hinds. Apart from the geographical separation the fawn loses both psychological and nutritional support from the dam. Farmers have developed a range of techniques and practices to minimise the stress of weaning on fawns. A smooth transition at weaning insures a continuation of rapid fawn liveweight gain and reduces undesirable behaviors such as fence pacing.

The key components of any weaning technique is the timing of separation and how fawns and hinds are separated. The various options are outlined below.

Preparation for weaning

The stresses of weaning can be minimised by good preparation before weaning. Management considerations include;

- Early mean fawning date
- Ensure fawns are consuming solid feed before weaning.
- Contact with humans prior to weaning may reduce flight syndrome and prevent injury
- Wean in good weather
Traditional weaning

Traditional weaning involves the removal of all fawns from the herd at one time usually by drafting through the yards. This is normally followed by a period (of about 1 week) of fawns and hinds displaying agitated and anxious behaviours. Most farmers using this method try and move fawn and hinds groups as far away from each other as possible so there is no response to fawn calls and fawn settle more quickly.

Disadvantages
- Sudden removal of milk supply may result in a depression of fawn liveweight gain (weaning check). This may be substantial if fawns have been born late, are not consuming large amounts of pasture/grain and rely heavily on milk for their nutritional requirements.
- Fawns are usually moved into unfamiliar surroundings
- May be combined with unfamiliar weaners and have social heirachies disturbed.
- May be trucked

Advantages
- The technique is fast, final, simple and is not labour intensive.
- Ensures better pasture management?

Soft Weaning

Soft weaning described the gradual removal of hinds from a herd over a period of 1-2 weeks. At the start, about one third of the hinds are removed from the herd leaving their fawns behind. Weaned fawns remain in a familiar environment and the remaining hinds and un-weened fawns have a calming influence. A third more hinds are removed a few days later and the final third a few day later. Behaviour studies have shown fawns had lower heart rates, spent less time fence pacing and more time grazing than fawns weaned in the traditional way.

Nurse hinds

Soft weaning provides the advantage of
- Not disrupting fawn social structures
- Fawns remain in familiar environments
Soft weaning has the disadvantage of
- Being an on going drawn out process.
- Repetitive yarding

**Indoor weaning**

Indoor weaning is based on the theory that deer settle quickly in dark environments and quickly become accustomed to close human contact. Indoor weaning involves separation of fawns from hinds with fawns being held indoors for a few days. Fawns are fed a couple of times a day and experience close human contact. Fawns may remain indoors for a period of just a few days or up to a couple of weeks.

In undertaking this technique farmers need to ensure housing facilities are clean and are free from objects which may cause injury. Such facilities require good ventilation especially when house occurs over a period of more than a few days.

Proponents of this method cite advantages in
- Lower weaning stress in darkened environment
- Eliminates fence pacing
- Become accustomed to close human contact which leads to quiet weaners and adult animals
- Familiarisation with yarding facilities
- Able to ensure good nutrition immediately after

But
- Requires large enough holding facilities
- Requires labor and maybe additional input (bedding) over housing period
- Concentration of animals in housed environment may increase risk of disease.

**Fence-line weaning**

Fence-line weaning as the name suggests is a technique similar to traditional weaning except hinds and fawns are grazed together in adjacent paddocks after weaning. This technique gives the fawn some limited contact with its mother through the fence. Although some studies show
fawns fence-lined weaned appeared more settled than traditionally weaned fawns, a difference in liveweight gain was not seen. However there may be advantages other than liveweight attributable to this form of weaning.

The advantage of fence-line weaning is

- Allows limited contact with hind and may lead to more settle fawns

But

- Requires secure and hazard free fences

**Pre- vs Post-rut weaning**

Some farmers choose to wean after the rut when fawns are about 6 months old rather than pre-rut at about 3 months of age. Delaying the date of weaning is likely to be beneficial for fawns, especially late born animals, but this practice may have consequences for subsequent hind reproductive performance.

In recent AgResearch studies at Invermay (Pollard *et al* 2000) pre-rut weaned fawns had a lower liveweight gain (99g/d) between March - September than post-rut weaned fawns (125g/d). This difference was largely due to poorer liveweight gain of weaned fawns in the March to June period probably as a result of a weaning check. However, mean subsequent conception dates of early weaned hinds were earlier (29 March) than hinds still running with fawns (10 April). Hinds body condition scores in early June were higher (3.8) in hinds weaned pre-rut compared with hinds weaned after the rut (3.3).

Pre - vs post-rut weaning decisions need to consider all factors (fawn, dam, reproductive effects, nutrition, management and animal health). Either option may be appropriate depending on circumstances, goals and objectives.
Table 4. A model of total weight of weaners produced at 1 September based on either an early or late weaning system with equal pregnancy rates (a) or rates which differ by 5% (b). Conception date and liveweight gain figure from Pollard et al 2000.

<table>
<thead>
<tr>
<th>(a)</th>
<th>Herd 1</th>
<th>Herd 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weaning</td>
<td>Early March</td>
<td>Late May</td>
</tr>
<tr>
<td>No. MA Hinds</td>
<td>323</td>
<td>323</td>
</tr>
<tr>
<td>Pregnancy Rate</td>
<td>90%</td>
<td>90%</td>
</tr>
<tr>
<td>Potential Fawns</td>
<td>291</td>
<td>291</td>
</tr>
<tr>
<td>Conception Date</td>
<td>28 March</td>
<td>10 April</td>
</tr>
<tr>
<td>Fawning Date</td>
<td>18 November</td>
<td>1 December</td>
</tr>
<tr>
<td>Weaning rate</td>
<td>90%</td>
<td>90%</td>
</tr>
<tr>
<td>No. Fawns</td>
<td>267</td>
<td>267</td>
</tr>
<tr>
<td>March Weight (kg)</td>
<td>40.2</td>
<td>36.3</td>
</tr>
<tr>
<td>March -May LWG (g/d)</td>
<td>141</td>
<td>209</td>
</tr>
<tr>
<td>May-Sept LWG (g/d)</td>
<td>56</td>
<td>41</td>
</tr>
<tr>
<td>AV LWG (g/d)</td>
<td>99</td>
<td>125</td>
</tr>
<tr>
<td>Sept Weight</td>
<td>58.4</td>
<td>59.3</td>
</tr>
<tr>
<td>+ $950</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.9kg difference</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(b)</th>
<th>Herd 1</th>
<th>Herd 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weaning</td>
<td>Early March</td>
<td>Late May</td>
</tr>
<tr>
<td>No. MA Hinds</td>
<td>323</td>
<td>323</td>
</tr>
<tr>
<td>Pregnancy Rate</td>
<td>90%</td>
<td>85%</td>
</tr>
<tr>
<td>Potential Fawns</td>
<td>291</td>
<td>275</td>
</tr>
<tr>
<td>Conception Date</td>
<td>28 March</td>
<td>10 April</td>
</tr>
<tr>
<td>Fawning Date</td>
<td>18 November</td>
<td>1 December</td>
</tr>
<tr>
<td>Weaning rate</td>
<td>90%</td>
<td>90%</td>
</tr>
<tr>
<td>No. Fawns</td>
<td>267</td>
<td>253</td>
</tr>
<tr>
<td>March Weight (kg)</td>
<td>40.2</td>
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</tr>
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</tr>
<tr>
<td>AV LWG (g/d)</td>
<td>99</td>
<td>125</td>
</tr>
<tr>
<td>Sept weight (kg)</td>
<td>58.4</td>
<td>59.3</td>
</tr>
<tr>
<td>Total weight (kg)</td>
<td>15620</td>
<td>14980</td>
</tr>
<tr>
<td>+ $2579</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On average, based on a 13 day later birth date but a 26g/d faster liveweight gain (March-September) late-weaned fawns show a slight (0.9kg liveweight) advantage by September over early born fawns. However if late weaning reduces subsequent pregnancy rate (or weaning rate) through poorer body condition at mating by more than 1%, the advantage falls with early weaning.
Key Points

- Early-weaned hinds are likely to be in better body condition than late-weaned hinds given normal pasture supply.
- Late-weaned fawns gained liveweight faster between March and June than early-weaned fawns on most but not all properties.
- Subsequent conception date can be 13 days earlier for early-weaned hinds compared with late-weaned hinds.
- Based on current research, economics appear to favour late-weaning only if late-weaning does not cause reduction in subsequent pregnancy or weaning rate.
- Liveweight of weaners is not the sole consideration in selecting weaning date. There are additional management implications such as pasture control and quality of pasture for young stock which should also be considered.
Recommendations for achieving a high weaning rate

This data suggests that in order to achieve high pregnancy rates and an early mean conception date farmers need to consider

- Achieve an early conception date
- Reduce the proportion of R2YO hinds in the herd
- Provide fawn proof fences
- Provide fawning paddocks that offer shade

Other recommendations from Massey University research (Audige 1995) for adult hinds suggests

- Cull non-lactating hinds at weaning or before
- Ensure hinds are in good body condition (>2) and do not lose condition over winter
- Graze hinds on pasture higher than 5cm
- Do not mix adult hinds and mature stags at fawning
- Do not tag fawns at birth
- Minimising disturbance at fawning
Production Goals

Once the production parameters have been established and a comparison with other drawn, some future target reproduction performance goals may be formulated. Source (Wilson et al 1999)

Target setting from benchmarks

- Targets should be set in relation to farmer ability, the environment, the overall farm goals and aims, and motivation.
- Targets can be chosen to achieve minimum performance, to set realistic and achievable targets for incremental improvement, and/or to achieve targets for the ultimate performance potential of the biological and management system.
- Implicit in the concept of target setting and monitoring is the ability to accurately define and measure the desired outcome.
- A description of reproductive outcomes has been presented in section 1.1.

Importance of pregnancy rate and date

Reproductive success (live fawns at weaning) is a major factor that determines the profitability of breeding herds. The reproductive profile of the two extreme herds in the example above have been used to generate a cost-benefit comparison. Data from these herds is presented in Figure 1.

The following assumptions have been made:

- Average MA breeding herd size (for Deer Master farms n=323)
- Non-pregnant deer have been retained;
- Birth weight average is 9.0 kg for both sexes
- Liveweight gain from birth to weaning averages 300 g/day;
- Survival from birth to weaning is 92%
- Average value of weaner is $4/kg liveweight
- Date of valuation is March 1

The cost-benefit data is presented in Table 1.
Table 1. Performance data and financial return for herds 1 and 2 (Figure 1) based on the above assumptions.

<table>
<thead>
<tr>
<th></th>
<th>Late Low Herd</th>
<th>Early High Herd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herd size</td>
<td>323</td>
<td>323</td>
</tr>
<tr>
<td>Pregnancy. Rate (%)</td>
<td>85</td>
<td>95</td>
</tr>
<tr>
<td>Number. Pregnant</td>
<td>275</td>
<td>307</td>
</tr>
<tr>
<td>Mean fawning date</td>
<td>Dec 20</td>
<td>Nov 20</td>
</tr>
<tr>
<td>Number fawns weaned</td>
<td>253</td>
<td>282</td>
</tr>
<tr>
<td>Ave. Lwt. Mar 1 (kg)</td>
<td>30.6</td>
<td>39.6</td>
</tr>
<tr>
<td>Ave. value ($/head)</td>
<td>122</td>
<td>158</td>
</tr>
<tr>
<td>Total value ($)</td>
<td>30 917</td>
<td>44 717</td>
</tr>
</tbody>
</table>

**Difference**                   **$13 800**

- This simple analysis shows a $13 800 or 46% increase in return for early high producing herds over low late producing herds

- Although it is based on farms of 2 extremes, it does highlight that there are significant financial advantages in improving reproductive performance. A 5% difference in pregnancy rate and an 11-day difference in mean fawning date still produces a $5 900 difference.

- In the present scenario 65% of the increased return was as a result of the 30-day difference in fawning date and only 26% as a result of the 10% difference in pregnancy rate.

- In the present scenario, fawning 6 days earlier results in an equivalent total weaner liveweight to a 5% increase in pregnancy rate. However it is generally accepted that the majority of factors which contribute to a high pregnancy rate also contribute to an early conception date so in reality these cannot be separated.

---

**Summary**

- Poor reproductive performance in terms of conception date but also pregnancy rate costs money.
Definition and measurement of Reproductive success

Reproductive performance can be broken down into specific areas that when combined represent the reproductive output of the herd. High producing farms maximise each area of reproduction to attain the overall goal of getting a high proportion of hinds to wean a fawn in any given year.

This section defines the terms which represent each area of reproduction and describes the practical methods used to measure these. Some of the methods are less practical than other but may suit some individual properties.

Definition of reproductive terms

- **Pregnancy rate**
  Pregnancy rate refers to the proportion of hinds that conceive to a stag within a defined mating period. In this handbook that period is defined as 15 March through to 10 May. Higher pregnancy rates are likely if stags are left with hinds for a longer period but fawn born later than December are not considered of little benefit in a high producing herd.

  Pregnancy rate can be calculated as
  
  \[
  \frac{275 \text{ scanned in-fawn from } 300 \text{ hinds mated}}{275 \text{ scanned pregnant} / 300 \text{hinds mated}} = 92\% \text{ pregnancy rate.}
  \]

- **Conception rate**
  Conception rate is the proportion of hinds which conceive in any given cycle. Pregnancy rate may be high (high proportion of hinds in fawn) but this may have taken many cycles to achieve and therefore conception rate would be low. Conception rate is not normally determined in deer herds.
Conception date

Conception date refers to the date on which conception was achieved. The dates over which fawning is spread within a herd is referred to as a pregnancy profile (Figure 1). Pregnancy profiles are based on the estimation of conception date from ageing pregnancies at scanning and assume a common gestation length (red hinds 235 days, hybrid hinds 245, elk hinds 260 days). Pregnancy profiles describe the pattern of fawning within a herd. While pregnancy rates provide a broad measure of reproductive success in terms of the number of potential fawns, a pregnancy profile provide a detailed description of the spread of fawning dates within a herd.

Figure 1. Predicted fawning dates based on pregnancy scanning from a farm with a late mean conception date and a low pregnancy rate (a) and a farm with an mean early conception date and a high pregnancy rate. Individual properties (open bars) are compared with the average for the group.

This information is critical in achieving a producing herd since it is generally desirable to fawn hinds as early as possible. This is because

a) Fawning date has a large influence on weaning weight (see section X). At the same rate of liveweight gain fawns born earlier are heavier simply because they are older.

b) Late born fawns may not achieve the same rate of liveweight gain as early born fawns because spring pasture growth, providing abundant high quality feed, precedes a majority of
lactation and more so in summer dry environments where moisture stress reduces both quality and quantity of pasture during lactation.

Hinds fawning late will lactate on poorer quality pasture, risking a reduction in body condition score as mating approaches. This in turn may have a negative effect on subsequent conception date and pregnancy rate. Thus, a cycle of late conception and calving may be perpetuated. Late fawning hinds are also less likely to wean a fawn compared to those fawning early. Late fawning represents a significant economic disadvantage (see section h). In terms of productivity from a breeding herd, median conception date (or fawning date) is as important as pregnancy rate (see section D). This is normally estimated by ageing the pregnancy. (See page 7)

- **Fawn loss during gestation**
  Loss of fawns between conception and birth can be determined by pregnancy diagnosing hinds immediately prior to fawning that were pregnant after mating.

- **Weaning rate**
  Weaning rate is the number of fawns weaned as a proportion of the hinds set stocked and diagnosed pregnant in June. Weaning rate, in this handbook include the small number of fawns lost during gestation.

  Weaning rate can be calculated as
  
  \[
  \frac{255 \text{ weaned fawns}}{275 \text{ diagnosed pregnant}} = 93\% \text{ weaning rate}
  \]

- **Reproductive efficiency or fawning rate**
  Fawning rate or the reproductive efficiency of the herd refers to the proportion of hinds mated that wean a fawn. This is a combination of pregnancy rate and weaning rate. The total number of hinds mated includes hinds which did not conceive, those which loss fawns during gestation and those that lost fawns between birth and weaning.

  Reproductive efficiency or fawning rate can be calculated as
255 weaned fawns from 300 mated

\[
\frac{255}{300} = 85\% \text{ fawning rate (reproductive efficiency)}
\]

**Measurement of reproductive success**

In order to compare the reproductive success of individual property with industry benchmarks or a farm's past performance, reproductive success needs to be measured. This technique used to measure different aspects of reproductive success are outlined below.
**Measurement of pregnancy rate**

The optimum method for determining pregnancy is rectal ultrasound scanning. This technique, when applied correctly, is quick, minimally invasive, safe and accurate.

- Pregnancy diagnosis using ultra-sound scanning is accurate from 28 days after mating to beyond the mid-point of pregnancy (approx. 130 days +).

- The optimum time for scanning is 28-60 days post-mating.

- Used with care, ultra-sound scanning using a rectal probe provides a quick, accurate diagnosis. It is not responsible for fawn losses during gestation or for hinds dry at weaning.

**Measurement of conception date**

The optimum and only practical method for determining pregnancy is rectal ultrasound scanning.

- The optimum time for scanning to determine conception date is 28-60 days post-mating (i.e. approx. 28 days after stag withdrawal).

- Scanning later (60 days +) reduces the accuracy of estimating conception date and therefore fawning date.

- Due to the natural variation in gestation length and the error (a few days) of estimating conception date, this technique does not always provide an accurate predictor of fawning date for an individual hind but provides an accurate pregnancy date profile for a herd.
Determining fawn loss during pregnancy
Loss of fawns during pregnancy can be determined by pregnancy diagnosing hinds in November that were pregnant in June.

Pregnancy in late gestation (October-November) can be determined by;

**Udder Palpation**
Within approximately 2 weeks of the onset of calving, e.g. around November 1, udder development will be felt by hand in most pregnant hinds. This technique is not 100% accurate on its own, particularly in yearling hinds and later calving hinds.

**Abdominal Palpation (balotment)**
Placing the arms around the abdomen and applying rapid compression will often enable the foetus to be felt as a hard lump in the abdomen. This is useful particularly for those hinds where udder development is not present.

**Visual assessment**
Observation of the lower abdominal profile is a useful confirmatory sign. The classic “racehorse” shape is an indication of a likely non-pregnant hind but again this technique is not always 100% accurate.

**Combination**
The three methods above used in combination should achieve close to 100% accuracy. However rounded hinds not showing an udder and deemed non-pregnant based on balotment need be ultrasound scanned to confirm diagnosis. Ultrasound scanning using either a rectal probe or lower abdominal flank scanning can be done at this time.
**Weight changes**

Pregnant hinds generally have a higher bodyweight gain from September to November compared with non-pregnant hinds (due to the increasing weight of the foetus). Pregnancy diagnosis using liveweight change relies on weighing hinds twice, calculating weight gains, and attempting to distinguish between pregnant and non-pregnant hinds. Because hind liveweight changes occur not only as a result of foetal growth, this is likely to be the least accurate method of determining pregnancy.

**Hormonal**

Pregnancy can be diagnosed from elevated blood progesterone levels but this technique requires a blood sample and consequently diagnosis is not immediate. The diagnosis of pregnancy is more accurate closer to term rather than in the early to mid-stage of pregnancy but overall the technique is quite variable. Hinds with progesterone levels above 6ng/ml are probably pregnant although some pregnant hinds have progesterone levels below 6ng/ml even late in gestation (day 210).

**Measurement of weaning rate**

The number of hinds successfully rearing fawns to weaning (weaning rate) can be determined by recording the lactation status of hinds at weaning in March and/or by tallying the number of hinds and fawns present at weaning in March.

- **Tally up hinds and fawns**

  Recording accurately the number of hinds and fawns present at weaning is the simplest and most effective way of calculating weaning percentage. The number of hinds present should not include those hinds known to be dry after mating that were retained.

- **Post-calving udder palpation**

  Palpation of the udder at weaning should enable a distinction between wet, and wet/dry hinds. Udder palpation should be done in conjunction with a hind-fawn tally when identification of individual wet/dry hinds is required. It can be done if hinds are yarded for tagging in early Jan
or February or at weaning in March. Diagnosis may be made more easily if palpation is left for a few days after weaning as hinds truly lactating will be full and more easily identified. However, hinds that fawn early (early November) may show little or no sign of lactation at weaning in March and this may lead to an incorrect diagnosis. There is also little chance of determining weaning status if post-rut weaning is practised and palpation occurs in June.
Animal Health
Animal Health problems can be categorised into 3 broad areas

1. Disease
A description of the major disease of deer and there treatment are shown on Page 103

2. Internal parasites
A description of the major disease of deer and there treatment are shown on Page 105

3. Trace elements
A description of the trace element deficiencies of deer are shown on Page 107
Disease

Establishing what your reproductive performance is and how this compares with others may highlight weakness in some areas.

This section describes the factors known to influence both pregnancy rate and conception date in deer herds.

The three major causes of death for deer are accidental, fawning difficulties and disease. High accidental deaths may require a close look at facility design or stockmanship issues. Recommendations for reducing the risk of death by disease and fawning difficulties are outlined below.

Yersiniosis

Caused by the bacterium *Yerinia pseudotuberculosis*. Deer become infected when consuming pasture or water contaminated by infected faeces. Newly born fawns are protected by maternal antibodies and later develop immunity when exposed to the bacteria. All deer probably experience a sub-clinical infection during their first winter.

Risk factors of clinical disease are

- Feed shortage during winter
- High stocking rate
- Cold and wet weather conditions
- Lack of substantial shelter
- Lungworm infection
- Social stresses
- Stresses such as transportation, excessive yarding and nutritional changes
- Small late fawns

Symptoms

- Stop eating
- Remain separated from the herd
- Diarrhoea
- Faeces may be watery, bloody and odorous
- Ill thrift
- Death
For un-vaccinated weaners

- Ensure good liveweight in autumn (lower liveweight associated with a poor immune response)

Ensure weaners put on liveweight over autumn

- Provide shelter for weaners against cold weather
- Removed infected stock from herd

A Yersinia vaccine (Yersiniavax, AgVax Developments Ltd) is available requiring vaccination at 3-4 months of age (around weaning) with a booster dose 4-6 weeks later.

At the current cost of $72-00 for 50 doses, a 2 dose per head program works out to be

$72-00/50 doses = $1.44/does x 2 treatments/head = $2-88/head.

Based on, 55 kg weaner at $200, vaccination need only save 1.44 weaners/100 on average to recover the cost of the vaccine. Fewer weaners need to be saved if weaners are more valuable (greater liveweight).

**Dystocia**

Fawning difficulties accounted for 19 and 25% of all deaths in MAs and R2YO hinds respectively. The actual cause of death was not diagnosed but at least some deaths would be attributable to dystocia or big fawns.

**Recommendations**

- Restrict the use of large terminal sires on R2YO hinds and small MA hinds
- Aim to have hinds in good condition (BCS 3-3.5) prior to fawning but not fat (BCS 4)
- Restrict feed to over-fat hinds in spring
- Exercise
Malignant Catarrhal Fever (MCF)

MCF is a common fatal disease of deer and is probably the most frequently diagnosed disease in deer. Although MCF is known to be caused by a virus carried and transmitted by sheep, the actual mode of transmission to deer is not well understood. Observations of MCF occurring in deer isolated from sheep indicate close contact with sheep may not be necessary or that infection maybe latent for long periods.

Recommendations
Avoid direct sheep contact

Johnes

TB

Brucella ovis

Crypto

Fusiformus
Internal Parasites of Deer

There are only two major types of internal parasites of importance in New Zealand Deer, lungworm and abomasal worms.

Lung worm (Dictyocaulus viviparus)

Distribution
- Found throughout the country.

Life cycle
- Adult worms live in the air passages in the lungs. The eggs hatch in the lungs shortly after being laid and the first stage larvae are expelled from the lungs. Larvae are subsequently swallowed, travel through the gut of the host and are shed in the faeces. These larvae then develop on pasture (in as little as 5 days under optimum conditions) to an infective stage. When this pasture is consumed the larvae leave the intestines and migrate to the lungs to complete the life cycle. The period between the deer eating infected pasture to the production of eggs can be as short as 20 days.

Symptoms
- Loss of condition
- Retarded growth
- Rough coat
- Coughing may only occur in severe infestations
- Most at risk are fawns in their first autumn early winter

Treatment
Where there is significant risk of re-infection
- 2nd generation benzimidazoles at 3 weekly intervals
- oral ivermectin at 4 weekly intervals
- injectable ivermectins 5 weekly periods
- pour-on at 7 weekly intervals

On most farms however where larval challenge is not as high drenching need not be as frequent. Monitoring of faecal larval counts between March and June would indicate drenching requirements through this period and insure maximum cost/benefit from drenching.
Ostertagia-like Abomasal Nematodes

Life Cycle

Mature worms in the abomasum produce eggs which are passed in the faeces. The larvae develop on the pasture through to the infective third stage which may take anything between 5-70 days depending on environmental temperature. The infective stage is eaten by deer, progress through two more stages in the abomasum before becoming adults and producing eggs. The period between ingestion and production of eggs may vary between 17-21 days.

Symptoms

- Ill thrift

Protection of Adult Hinds

There is some debate on whether adult hinds should be drenched and how often. This decision should be made in conjunction with your Vet but keep in mind:

- Relatively low worm burdens (compared with sheep) can cause ill thrift
- Significant worm burdens have been recorded in hinds during the winter
- Elk type animals may be more susceptible compared with red deer
- Faecal egg counts are not a good indicator of parasite burden
- Plasma pepsinogen levels may give some indication on parasite status at a herd basis but not at an individual animal level.
- Contamination from infected hinds may be a source of significant parasitic challenge of weaners
- There may be some level of immunity in adult hinds
- Prior to fawning and at mating appear to be the most appropriate times
Trace elements

This section sets out the clinical signs of trace element deficiencies and provides direction on its treatment. It also sets out a diagnostic protocol for the monitoring of trace element status on deer farms.

Copper

Selenium

Cobalt
Nutrition
Seasonal feed requirements for farmed Deer

When assessing the nutritional requirements of deer, three factors need to be considered.

These are
- Size of the animal
- Season
- Relative level of production

Table 1 shows the approximate intake (kg DM/hd/d) of mature red deer, hybrids and wapiti/elk at different times of the year and reflect both changes in animal requirement and pasture quality.

<table>
<thead>
<tr>
<th></th>
<th>Autumn</th>
<th>Winter</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stags</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NZ red</td>
<td>1.7</td>
<td>3.2</td>
<td>3.4</td>
<td>3.8</td>
</tr>
<tr>
<td>Wapiti/red X</td>
<td>2.3</td>
<td>4.3</td>
<td>4.5</td>
<td>5.1</td>
</tr>
<tr>
<td>Canadian Wapiti/Elk</td>
<td>3.1</td>
<td>5.6</td>
<td>5.7</td>
<td>6.6</td>
</tr>
<tr>
<td>Hinds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NZ red</td>
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<td>2.4</td>
<td>2.2</td>
<td>4.9</td>
</tr>
<tr>
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<td>4.4</td>
<td>4.2</td>
<td>4.0</td>
<td>8.5</td>
</tr>
<tr>
<td>Canadian Wapiti/Elk</td>
<td>5.8</td>
<td>5.5</td>
<td>5.4</td>
<td>12.0</td>
</tr>
</tbody>
</table>

Key points to note are
- The much larger requirement of elk type animals compared to red deer
- The high requirement for lactating hinds in spring
- The lower requirement for stags during the rut

The relative level of production also influences nutritional requirement. For example fast growing deer will have a higher requirement than more slower growing deer. Similarly lactating hinds require a higher intake than dry or non-lactating hinds. The required intake for liveweight gain in stags and hinds is given in Table 2.
<table>
<thead>
<tr>
<th>Liveweight (kg)</th>
<th>40</th>
<th>60</th>
<th>80</th>
<th>100</th>
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</tr>
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<tbody>
<tr>
<td>Hinds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0g/d</td>
<td>1.1</td>
<td>1.6</td>
<td>2.0</td>
<td>2.3</td>
<td>3.3</td>
</tr>
<tr>
<td>100g/d</td>
<td>1.5</td>
<td>1.9</td>
<td>2.3</td>
<td>2.6</td>
<td>3.7</td>
</tr>
<tr>
<td>200g/d</td>
<td>1.7</td>
<td>2.2</td>
<td>2.6</td>
<td>3.0</td>
<td>4.0</td>
</tr>
<tr>
<td>400g/d</td>
<td>2.4</td>
<td>2.9</td>
<td>3.3</td>
<td>3.6</td>
<td>4.6</td>
</tr>
<tr>
<td>Stags</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0g/d</td>
<td>1.1</td>
<td>1.6</td>
<td>2.0</td>
<td>2.3</td>
<td>3.3</td>
</tr>
<tr>
<td>100g/d</td>
<td>1.7</td>
<td>2.1</td>
<td>2.5</td>
<td>2.9</td>
<td>3.8</td>
</tr>
<tr>
<td>200g/d</td>
<td>2.1</td>
<td>2.5</td>
<td>3.0</td>
<td>3.3</td>
<td>4.3</td>
</tr>
<tr>
<td>300g/d</td>
<td>2.6</td>
<td>3.0</td>
<td>3.5</td>
<td>3.8</td>
<td>4.8</td>
</tr>
</tbody>
</table>

As a general rule the intake required to maintain body weight increases by 70% when liveweight is doubled.
Pasture as a feed source

Quantity - LWG curve

**Figure 1.** Decline in quality of perennial ryegrass with stage of growth

![Figure 1: Decline in quality of perennial ryegrass with stage of growth](image1.png)

**Figure 2.** The liveweight gain response to increasing pasture quality in late lactation, and in 2 post-weaning periods

![Figure 2: Liveweight gain response to increasing pasture quality](image2.png)
Figure 3. Liveweight gain on pastures with varying clover content.
Late Lactation (mid January to early March)

Performance of unweaned calves ranged from 220 to 700 g/d

- Feed quality was the over-riding determinant of calf growth rate
- To get calf growth rates of > 400g/d you need:
  - Green leaf content > 60% (45% will give < 300 g/d)
  - Feed ME > 10.5 MJ/kg
  - High quality component > 15% (legume plus chicory)
  - Pasture mass > 2500 kgDM/ha
- Hind weight loss was not a good predictor of calf growth
- Body condition score decrease is a very variable predictor of calf growth rate – this may be due to operator variability in scoring.

Early Post Weaning (early March to mid April)

Performance of weaners ranged from 150 to 330 g/d

- Green leaf % and ME content of feed were not well related to weaner growth. This may have been a drought effect.

Late Post Weaning (mid April to early June)

Performance of weaners ranged from 60 to 180 g/d

- Growth rate was highly correlated to feed quality
- To get growth rates of > 150g/d you need:
  - Green leaf content >90% (a change in green leaf content of 10% will change weaner growth by 40 g/d)

Feed ME > 11.5 MJ/kg

Often the lactation ability of the hind is expected to make up for lower pasture quality, and body weight or condition score seen as the buffer that maintains good calf growth rates.
Pasture species and cultivars

Much improvements in production within deer herds is a result of better feeding. Having high quality preferred pasture on hand at critical times is a key element of good nutritional management. In New Zealand production systems this relies almost exclusively on the selection and maintenance of suitable pastures. This section details the options in pasture species available to farmers and explains the broad characteristics of each species.

Matching the pasture species with the grazing situation is critical. Finding the right cultivar within that species is the fine tuning.

<table>
<thead>
<tr>
<th>Other grass species</th>
<th>Erect type</th>
<th>Kara Savento</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Semi-erect</td>
<td>Vision</td>
</tr>
<tr>
<td></td>
<td>Dense type</td>
<td>Tekapo Wana Excel</td>
</tr>
<tr>
<td>Tall Fescue</td>
<td>Very early flowering</td>
<td>Au Triumph Dovey Fletcha</td>
</tr>
<tr>
<td></td>
<td>Early flowering</td>
<td>Advance Vulcan Lunibelle</td>
</tr>
<tr>
<td></td>
<td>mid season flowering</td>
<td>Torpedo</td>
</tr>
<tr>
<td>Phalaris</td>
<td>Maru</td>
<td></td>
</tr>
<tr>
<td>Grazing Brome</td>
<td>Gala</td>
<td></td>
</tr>
<tr>
<td>Pasture brome</td>
<td>Barenno</td>
<td></td>
</tr>
<tr>
<td>Prairie Grass</td>
<td>Matua Atom</td>
<td></td>
</tr>
<tr>
<td>Timothy</td>
<td>Late flowering (compared with RG)</td>
<td>Charleston Viking</td>
</tr>
<tr>
<td></td>
<td>Very late flowering (compared with RG)</td>
<td>Kahu</td>
</tr>
</tbody>
</table>
| **Legumes** | **White clover** | **Large leaf** | **Aran**  
**Sustain**  
**Challenge**  
**Pitau**  
**Kopu**  
**Will**  
**Medium leaf** | **Prestige**  
**Huia**  
**Demand**  
**Nusiral**  
**Small leaf** | **Prop**  
**Tahora**  
**Red Clover** | **Diploid** | **Colenso**  
**Sensation**  
**Astred**  
**Turoa**  
**Tetraploid** | **Pawera**  
**G27**  
**Lotus** | **Diploid** | **Sunrise**  
**Tetraploid** | **Maku**  
**Barsilvi**  
**Birdsfoot trefoil** | | **Goldie**  
**Lucerne** | | **Kaituna**  
**Otaio**  
**Pioneer 5454**  
**Pioneer 5681**  
**Wairau**  
**WL325HQ**  
**Grazing Herbs** | **Chicory** | | **Puna**  
**Chico**  
**Grouse**  
**Plantain** | | **Lancelot**  
**Tonic** |
**Perennial Ryegrass**
- Most widely used temperate grass in New Zealand
- Compatible with clovers and several other grasses
- Able to withstand hard grazing and trampling
- Performs poorly in hot dry environments when other species maintain production
- Rapid establishment (first grazing 30-40 days)
- High quality
- Requires an endophyte fungus for persistence but can affect animal performance (see section X).

**Hybrid ryegrass**
- Results from crossing perennial and annual types to combine best features of both
- Range from Italian type which persist for 1-4 years to types which persist almost as long as perennials
- Combine strong winter growth of annuals with persistence of perennials
- Commonly added to perennial mixes to increase production in 1st winter and spring

**Italian Ryegrass**
- Erect large-leafed ryegrass producing large, high, quality forage for up to 3 years
- Westerwold ryegrass is an annual type which only persist past 10 months through seed
- Some biennial types may persist through a moist summer
- Provide large quantities of quality feed in winter and early spring
- If sown in spring will quickly develop seedhead.

**Prairie grass**
- Large leaved, large tillered, short lived perennial grass
- Provides a high quality pasture for 2-4 years
- Requires high fertility, free draining soil with pH above 5.5
- Requires rotational grazing
- Intolerant of set stocking, pugging, water logging or acid soils
- High winter early spring growth
- Drought tolerant
- Flower head is palatable to stock

**Grazing brome**
- Perennial grass closely related to Prairie grass but finer in leaf and tiller and able to withstand closer grazing
- Provides strong winter growth
- Persists under good fertility and free-draining soils
- Intolerant to water logging and pugging
- Requires close frequent grazing to perform well
- Useful as a pasture for quality feed over summer in dry environments
Pasture Brome
- Medium tiller perennial brome grass which is more persistant than Prairie grass
- Provides strong spring-summer growth with drought tolerance
- Moderate winter growth
- Does not tolerate waterlogging or pugging but may tolerate higher rainfall than other brome grasses

Cocksfoot
- Productive drought tolerant grass species with strong summer growth
- Forage quality is lower than ryegrass especially when seed head is present
- Slower establishment compared to ryegrass
- Suited to light free-draining soils
- Very aggressive in mixtures and may dominate clover to the extent of exclusion
- Requires close spring grazing to prevent excessive seeding and associated unpalatability
- Usually winter dormant
- Nil endophyte and pest tolerant

Tall Fescue
- Deep rooted drought tolerant perennial grass
- Best suited to highly fertile heavier soils
- Useful in dry conditions as a special pasture
- Requires close spring grazing to prevent excessive seeding and associated unpalatability
- Not recommended as a mix with ryegrass as is dominated and disappears

Phalaris
- Hardy perennial grass suited to drier soils of moderate fertility
- Very drought tolerant
- Strong winter growth but dormancy over summer
- Withstands hard grazing and treading once established
- Useful as a minor component of pasture in dry environments

Timothy
- Perennial grass producing high quality forage during spring summer
- Dormant in winter
- Suited to wetter or heavier soils
- Not very drought tolerant
- Late flowering compared with ryegrass
- Retains quality even at seed head stage

White Clover
- Perennial legume spreading by creeping stolons and naturally reseeds itself
- Plants with high stolon density tend to persist best
- Enhances pasture quality
- Valuable source of Nitrogen
- May not persist under very dry conditions
Red Clover
- Tap-rooted plant which is highly preferred by deer
- Suits lax grazing and does not tolerate hard continuous grazing
- High quality
- High summer production
- Persists 2-4 years in pasture mixes but may last up to 7 under more favourable management

Subterranean Clover
- Annual clover regenerating from seed each autumn
- Requires lax grazing during flowering to maximise seed production
- Provides valuable high quality production during winter and spring
- Suited for light dry country

Lucerne

Lotus

Considerations for Deer Farmers

Deer in New Zealand are farmed on in a variety of environments that differ in soil fertility, rainfall and temperature. Choices on cultivars and pasture systems should reflect these environmental conditions but should also address the seasonal requirements of deer, their preference and the grazing system each property employs.

When selecting cultivars remember
- Deer actively avoid if possible high endophyte ryegrass or when given no choice exhibit poor performance.
- Deer have a preference for red clover, other legumes and herbs but will readily eat low endophyte ryegrass.
- Deer have specific requirements depending upon the time of year and class of stock ie. hinds lactating between November and March respond to quality pasture over this period but weaners require attention in autumn and spring.

In light of this ideal deer pastures should contain endophyte free grasses, legumes and herbs. If high endophyte grasses are required for persistence, it is essential non-endophyte companion grasses are also included in any mix

The choice of grass will depend on environment and what the pasture will be used for. Some options are included in section X
. Pasture species characteristics

Some physical and nutritional characteristics of pasture plants can have an affect on the performance of pasture. This section outlines the effects of characteristics such as endophyte and flowering date have.

- Quality-key aspect of pasture (see section X)
  Graph with change in quality with reproductive growth
  Other effects lowering quality
  Disease
  Age of foliage

- Flowering date
  Flowering date differs between regions and environments but even under the same conditions cultivars can differ by up to 38 days in flowering date

  Early flowering means rapid August-September growth but early deterioration to reproductive state. Early flowering types are ideal to provide quantities of early spring feed for early slaughtered weaners

  Late flowering varieties grow more slowly in early spring but maintain quality longer into the spring. This may be undesirable in a summer dry environment as moisture stress may limit late flowering varieties at their time of greatest potential. However the ability of late flowering varieties to hold quality late into the spring better fits the demands of a lactating hind.

- Tiller / leaf size
  Cultivars such as Ruanui have smaller tillers compared with types like Nui. Cultivars with smaller tillars are suited to close grazing but may not be as productive under lax grazing. Large tillering types particularly tetraploids are more suited to lax grazing and may not persist under close grazing.

- Growth periods

- Clover types
  White clovers are classified into groups based on large medium and small leaf size.
  - Large leaf types are normally associated with with upright plant growth, thick stolons and large roots and large flower heads. However large leaf types have fewer stolons and a low stolon density.
  - Small leaf types grow close to the ground with many small leaves. The low growth habit and high stolon density offer excellent tolerance to close contineous grazing.
  - Medium leaf types combine advantages from both small and large leaf types.
• High stolon density provides the greatest persistence
• Large leafed white clovers perform best under lax rotational grazing
• Small leafed types perform best under close continuous grazing.

• Larger leaf sizes are more suited to taller pasture and smaller leaf size to more closely grazed pastures.
**Diploids and Tetraploid forms**

An important characteristic of the cultivars of many pasture species is their diploid/tetraploid nature. This simply refers to the number of chromosomes the plants contain. Naturally occurring ryegrasses have 14 chromosomes and are referred to as **diploids**.

Treating plants with chemical 'Colchicine' produces plants with twice the normal number of chromosomes is known as a **Tetraploid**.

**Tetraploid ryegrasses**
- Have fewer tillers per plant
- Are darker green in colour and have larger leaves and seeds than diploids
- Have larger cells, less cell wall and have a higher soluble carbohydrate content
- Are generally more palatable and support higher animal performance than diploids

But
- Are best suited to higher fertility, summer moist or irrigated environments and lax or rotational grazing (5-7cm post-grazing).

**Diploids**

Are best suited to lower fertility sites, drier environments and low (2-5cm) post grazing masses.

**Endophytes and Ryegrass: a complex relationship.**

**What is endophyte**
- Endophyte is a fungus (Neotyphodium lolii) that lives in ryegrass plants.
- The fungus produces toxins which benefit the plant by providing protection from insects and overgrazing but also have affects on animal health and production.
- Plants containing endophyte are not visually different to uninfected plants but infection can be tested for.
• The endophyte does not spread between plants in a pasture but is present in the seed of infected plants and plants grown from that seed will also be infected with the endophyte. Storage of seed will reduce the endophyte infection level.
• The infection level of a pasture refers to the proportion of plants within the pasture which are infected with endophyte. For example a 5% infected pasture (low) will contain 5 infected plants in every 100 plants present.
• As pastures age they usually increase in endophyte because nil endophyte plants are grazed out or removed by insect attacked. Seeding through feeding high endophyte hay will also increase endophyte status of pasture.

Endophyte effects

There are three families of toxins produced by the endophyte/ryegrass complex.

• Tremogens including Lolitrem B and Paxilline. These compounds affect the nervous system of animals and produce ryegrass staggers, the disorder which makes walking and in severe cases standing difficult. Deer are known to be very susceptible to this condition.

• Peramines help confer resistance to some insect species (including Argentine Stem Weevil) and are not known to have any animal effect.

• Ergovalines cause elevated temperature by constricting blood vessels thus reducing the animals ability to cool itself. This probably is the cause of the lower intake recorded on high endophyte pastures.

Problems associated with the ryegrass/endophyte complex include

• Ryegrass staggers

• Low liveweight gain

• Increased dags in sheep

• Reduced clover growth in pasture

• Low milk production in dairy cows, especially when night temperatures or humidity are high

• Inhibiting onset of milking in autumn calving cows.

• Slightly longer gestation period
• Lower weaning weights in lambs.

• Avoidance of endophyte infected ryegrass in mixtures can promote overgrazing of other components of the mix.

However the association between ryegrass and endophyte does ensure that insect damage is minimalised, maintaining pasture longevity. Nil endophyte ryegrasses do not persist under high stem weevil challenge or high grazing pressure.

In an effort to create a pasture that is long-lived without toxic effects on livestock, AgResearch scientist have put much effort into screening endophytes that will produce the Peramines (to protect against insect attack) without producing Lolitrems and Ergovalines that are responsible for animal health and production problems.

The first success from this programme was the Endosafe cultivar Greenstone. This is moderately Stem Weevil resistant, while having no measurable toxicity to grazing animals. A lesson that was learned from that development was that each endophyte interacts with its host ryegrass cultivar in different ways. When Endosafe was put into Pacific ryegrass, it proved to have high Ergovaline levels and was removed from the market.

Current breeding and screening efforts are going into the development of AR1, an endophyte that, so far, has a good interaction with ryegrass cultivars, producing Peramine without Lolitrem or Ergovaline.

**Managing the Problems**

**Ryegrass Staggers**

Problems are mainly related to a build-up of dead material in a stressful environment. This is seen by the difference in staggers between irrigated and non-irrigated pastures in Canterbury. When relatively unstressed by using irrigation, ryegrass staggers are seldom seen. The same pasture, when unirrigated, can become quite toxic in mid and late summer.
This is often made worse by having to graze these pastures harder during summer, eating the dead material, seedhead and base of the plant where the toxins concentrate.

Management practises to help alleviate the problem are:

- avoidance of set-stocking,
- close grazing and
- dead material build-up where possible.

However often these measures are not an option, and removal of animals to endophyte free pastures, like tall fescue or cocksfoot, and using supplementary feeding must be considered. The recent use of Roundup to chemically top pastures should also be avoided in regions prone to ryegrass staggers.

**Lower Animal Production**

Deer are particularly sensitive to endophyte. There is a growing body of evidence that suggests that the low performance of livestock may be related more to the presence of the Ergovalines than the Lolitrems. These peak in late spring, with seedhead production, and again later in summer. Even very small amounts can cause changes in animal production. The delays in shedding of the winter coat seen in elk affected by ryegrass staggers may be caused by the Ergovalines that affect prolactin production, rather than the ryegrass staggers itself.

Managing Ergovaline level is similar to managing ryegrass staggers, except that the problem can occur earlier, in December, as well as in late January and February. This means that it has implications for deer farmers in particular when hinds begin lactation at this time. Topping to remove seedhead is one good option, as well as using velvetted stags to clean up toppings. Again, keeping grazing height high helps reduce toxin intake. Irrigation to reduce stress on pastures will also help if possible. Supplementation may also be required to avoid prolonged hard grazing into the base of the pasture.

Another option is to maximise intake of clover and reduce ryegrass intakes in summer. This can be done by close grazing in early and mid spring (set stocking at 1500 kgDM/ha), by using cattle to graze in mid to late spring, or by taking early silage or hay (when 10 to 20% of the
seedheads have emerged). These practises also tend to reduce the amount of dead material that builds up in summer pastures.

**Pasture Matters**

Two problems that need to be addressed are lower clover growth and preferential selection of other components of the pasture. Low endophyte ryegrasses can only be sown in cool moist environments such as Otago and Southland, or where reliable irrigation, or summer rainfall, is available. Finer leafed cultivars may be more suited to marginal environments, as fine tillers are less preferred sites for Stem Weevil attack. When sowing high endophyte ryegrasses, lower seeding rates of between 12 and 15kg/ha should be used to allow more room for clover growth. Sowing seed lines with moderate endophyte status may provide some short term protection from toxin related problems, but preferential grazing and stem weevil damage of the non-endophyte plants within the pasture will soon result in a high endophyte pasture.

Selection of Endosafe Greenstone has been a standard option for deer farmers facing the endophyte problem. This provides some protection, but it must be remembered that Greenstone is a hybrid ryegrass with a life of 5 to 7 years, regardless of Argentine Stem Weevil attack. That means pasture renewal will still be required with this option, and will hopefully consist of new AR1 infected cultivars in future (2 to 4 years away from commercial availability).

Another cultivar that has been tested for staggers and Ergovaline levels is AriesHD. It produces lower amounts of both and can be considered one of the more animal friendly cultivars available. Older cultivars such as Nui have relatively high Ergovaline levels, and have been superseded by other options.
Velvet
Selection of velveting stags as spikers

It is desirable to select young stags for the velveting herd as spikers so cull stags with poor velvet production can be available for slaughter as prime venison and farmers can avoid the costs of wintering these animals for a second year. The following section outlines a method of selecting stags with high velvet weight as a 2 year old based on measurements on spiker velvet.

Introduction

Current selection methods are based on either liveweight as a spiker, which is relatively imprecise (see below) or 2YO velvet weight that incurs additional cost in retaining stags for 2 years.

Research on seven separate farms has established a better method than liveweight of selecting velvet stags as spikers. This method requires the measurement the circumference of velvet. A suggested programme is;

1. Stags are brought in about halfway through velvet antler growth or when antlers are 260-300mm from base to tip (TL) see figure.
2. The mid-circumference (MC) (mm) of the spike is measured half way between the pedicle and the tip on one of the spikes.
3. Stags are culled or retained on the MC measurement.

Note: The circumference around the base of spiker velvet (BC) or the weight of the velvet antler (Awt1) can also be used but these have been found to be slightly less precise but still acceptable.
Culling criteria

Once MC (or BC or Awt1) is known for an individual stag, the decision of whether to cull or retain the individual is made. The culling criteria can be determined in 2 ways (Figure 2). It can either be

a) determined from knowledge of the mean MC measurement for the un-culled herd which allows a specific proportion of stags to be retained or

b) can be a pre-determined value as recorded here. Raising or lowering the cull criteria would increase or decrease the severity of the cull.

In subsequent years the relationship between weight antler in year 2 and year 3 (Figure 2) means stags producing heavy velvet should be retained.
**Figure 2.** The weight of antler (1 side) as a R2YO generally reflects the weight on antler in the subsequent year.

**Culling to retain a proportion of the herd**

The proportion of animals retained based on MC cull criteria and the mean MC value of the unculled herd is presented in Table 1. For example a farmer wanting to retain 30% of the spiker herd for the velveting herd from a group with a mean MC measurement of 90mm would need to retain only those about 95mm or above.

**Table 1.** Predicted proportion of the spiker herd remaining after culling below MC1 measurements based on knowledge of pre-cull MC1 herd mean.

<table>
<thead>
<tr>
<th>Herd mean MC (mm) before cull</th>
<th>MC (mm) below which animals are culled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>80</td>
</tr>
<tr>
<td>80</td>
<td>50</td>
</tr>
<tr>
<td>85</td>
<td>68</td>
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<td>90</td>
<td>82</td>
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<td>100</td>
<td>97</td>
</tr>
<tr>
<td>105</td>
<td>99</td>
</tr>
<tr>
<td>110</td>
<td>100</td>
</tr>
</tbody>
</table>
Although on most farms selecting on the MC measurement results in the best selection of R2YO velvet, individual farms vary in the effect. The number of stags remaining after culling and the subsequent weight of 2YO velvet based on different culling criteria for the seven properties is presented in Table 2.

This table shows that;
- selecting spikers based on MC measurement will increase 2YO velvet weight over the unselected herd
- the increase will vary between properties depending on mean MC measurement and the range within the herd.

**Table 2. Actual proportion of spikers remaining and the mean antler weight as 2YO stags after culling below various MC measurements.**

<table>
<thead>
<tr>
<th>Farm</th>
<th>Non-culled herd mean</th>
<th>MC (mm) below which animals are culled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MC (mm)</td>
<td>Awt 2 (g)</td>
</tr>
<tr>
<td>A</td>
<td>89</td>
<td>1126</td>
</tr>
<tr>
<td>B</td>
<td>95</td>
<td>1101</td>
</tr>
<tr>
<td>C</td>
<td>97</td>
<td>1297</td>
</tr>
<tr>
<td>D</td>
<td>88</td>
<td>1080</td>
</tr>
<tr>
<td>E</td>
<td>87</td>
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<tr>
<td>F</td>
<td>97</td>
<td>1440</td>
</tr>
<tr>
<td>G</td>
<td>93</td>
<td>1341</td>
</tr>
</tbody>
</table>

For example if Farm C culled all spikers below 95mm, 51% of animals would be retained and the R2YO antler weight from the remaining stags would average 1442g compared with the average of 1297 for the unselected herd
Comparison between this method and using liveweight
In the previous example MC measurement improves selection over non-selected herds but it is unlikely spiker herds are not culled or culled randomly. Table 3 compares the resulting R2YO velvet weight from the three options available
a) selection as spikers on liveweight (Lwt) at velvet harvest
b) selection of spikers on MC measurement
c) selection of stags on R2YO velvet weight.

Table 3. A comparison between using MC and liveweight for selecting spikers

<table>
<thead>
<tr>
<th>Farm</th>
<th>Un culled</th>
<th>Percentage of herd culled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Criteria</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MC</td>
</tr>
<tr>
<td>A</td>
<td>1101</td>
<td>MC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lwt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R2YO</td>
</tr>
<tr>
<td>B</td>
<td>1126</td>
<td>MC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lwt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R2YO</td>
</tr>
<tr>
<td>C</td>
<td>1296</td>
<td>MC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lwt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R2YO</td>
</tr>
<tr>
<td>D</td>
<td>1080</td>
<td>MC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lwt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R2YO</td>
</tr>
<tr>
<td>E</td>
<td>1392</td>
<td>MC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lwt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R2YO</td>
</tr>
<tr>
<td>F</td>
<td>1440</td>
<td>MC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lwt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R2YO</td>
</tr>
<tr>
<td>F</td>
<td>1341</td>
<td>MC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lwt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R2YO</td>
</tr>
</tbody>
</table>

For Example

The advantage of using MC rather than liveweight is shown in table 3 for the seven properties.
- Culling on either criteria increased mean weight of antlers in year 2 but for all properties at most culling severities, selection based on MC produced a higher mean antler weight in year 2 than selections based on liveweight.
- Selection based on spiker velvet is not as good as selection based on 2YO velvet weight. On average, the top 20% of stags selected on MC had 241g/stag less velvet than the top 20% of stags based on 2YO antler weight but on average 91g/stag more than if selected on liveweight.

<table>
<thead>
<tr>
<th>Un-culled</th>
<th>Criteria</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
<th>80%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1272</td>
<td>MC</td>
<td>1291</td>
<td>1309</td>
<td>1337</td>
<td>1400</td>
</tr>
<tr>
<td></td>
<td>Lwt</td>
<td>1277</td>
<td>1285</td>
<td>1300</td>
<td>1386</td>
</tr>
<tr>
<td></td>
<td>R2YO</td>
<td>1361</td>
<td>1444</td>
<td>1545</td>
<td>1699</td>
</tr>
</tbody>
</table>
Weaner Liveweight
Steps to achieve a high slaughter weight or high liveweight at 12 months of age

1. **High (>60kg) weaning weight**
   The range of weaning weights on-farm for your comparison are shown on Page 100
   The requirements for a high weaning weight are covered on Page 101

2. **High (>70kg) 1 June weight**
   The range of 1 June weights on-farm for your comparison are shown on Page 103
   The requirements for a high 1 June weight are covered on Page 106

3. **Fast (>250g/d) spring liveweight gain**
   The range of spring LWG on-farm for your comparison are shown on Page 103
   The requirements for a high spring LWG are covered on Page 106
4. Weaning weight benchmarks

The liveweight of fawns at weaning and their subsequent rate of liveweight gain is important for both breeder and finishes. For breeders, the weight of fawns at weaning is a major component of financial return while the weaning weight and the subsequent rate of liveweight gain dictate the final slaughter weight, slaughter date and ultimately the financial return for the finisher.

This section provides a description of fawn liveweight and liveweight gain prior to weaning and between weaning and winter on commercial farms.

**Table 1. Survey results for ultrasound scanning pregnancy rates for 1-year-old and adult farmed red deer in New Zealand**

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Birth Date</th>
<th>Lact. Lwt (kg)</th>
<th>Range (kg)</th>
<th>Weaning Lwt (kg)</th>
<th>Range</th>
<th>Birth -Jan LWG (g/d)</th>
<th>Jan - weaning LWG (g/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RWDPP</td>
<td>1</td>
<td>27 Nov</td>
<td>36.8</td>
<td></td>
<td>44.8</td>
<td></td>
<td>454</td>
<td>246</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>29 Nov</td>
<td>32.7</td>
<td></td>
<td>48.5</td>
<td></td>
<td>494</td>
<td>344</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>21 Nov</td>
<td>35.4</td>
<td>30.9-39.0</td>
<td>49.7</td>
<td>47.3-53.8</td>
<td>469</td>
<td>288</td>
</tr>
<tr>
<td>Deer Master</td>
<td>1</td>
<td>30/11</td>
<td></td>
<td></td>
<td>47.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>30/11</td>
<td></td>
<td></td>
<td>43.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1/12</td>
<td></td>
<td></td>
<td>45.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Audgie</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>47.9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Description of weaning liveweight data

Between 1996 and 1999 average weaning weight of red deer across all participating properties varied between 42.6 and 46.9kg and 45.1 and 49.1kg for hind and stag fawns respectively (Table 3.1). These weaning weights are similar to those recorded in the Hawkes Bay Richmond/Wrightson’s project (44.8-48.5kg) but less than the target weaning weight for this project of 55 and 51kg for stags and hinds respectively.

Table 3.1. Weaning weight (kg) (corrected to 10 March weight) of male and female fawns for each year between 1996 and 1999.

<table>
<thead>
<tr>
<th>Year</th>
<th>N farms</th>
<th>N animals</th>
<th>Sex</th>
<th>Wt</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>96</td>
<td>3</td>
<td>316</td>
<td>F</td>
<td>44.1</td>
<td>8.8</td>
</tr>
<tr>
<td>96</td>
<td>2</td>
<td>191</td>
<td>M</td>
<td>46.7</td>
<td>9.8</td>
</tr>
<tr>
<td>97</td>
<td>6</td>
<td>1015</td>
<td>F</td>
<td>46.9</td>
<td>9.6</td>
</tr>
<tr>
<td>97</td>
<td>5</td>
<td>758</td>
<td>M</td>
<td>49.1</td>
<td>7.8</td>
</tr>
<tr>
<td>98</td>
<td>4</td>
<td>614</td>
<td>F</td>
<td>42.6</td>
<td>7.2</td>
</tr>
<tr>
<td>98</td>
<td>4</td>
<td>417</td>
<td>M</td>
<td>45.1</td>
<td>6.8</td>
</tr>
<tr>
<td>99</td>
<td>4</td>
<td>680</td>
<td>F</td>
<td>43.6</td>
<td>6.8</td>
</tr>
<tr>
<td>99</td>
<td>4</td>
<td>685</td>
<td>M</td>
<td>47.4</td>
<td>7.9</td>
</tr>
</tbody>
</table>

Some of the variation between years is likely to be attributable to differences in feed supply although other effects such as the individual sires used, date of birth and the farms participating are also likely to have an effect.

Stags fawns were between 2.6 and 3.8kg heavier at weaning than their hind counterparts and were heavier at all subsequent time. Stag fawns are heavier at birth and have a greater liveweight gain during lactation compared with hinds (Audigé, 1995).

For the complete mixed sex herd in all 4 years, mean liveweight was 46.0kg and was normally distributed (Figure 3.1) with a standard deviation of 6.3kg.
Figure 3.1. Distribution of liveweight (corrected to weight on 10 March) for mixed sex red deer weaners between 1996-1999.
4 Factors affecting weaning weight
This section presents some factors which may affect liveweight gain of fawns at weaning.

Birth date
The effect of birth date is presented in Figure 3.2. Birth date was estimated from foetal ageing at scanning and weaning weight and hind fawn pairs recorded at weaning. Mean birth date was 1 December and 17 December from mixed age (MA) and rising 2-year-old (R2YO) hinds, respectively.

Figure 3.2. Estimated birth date and subsequent weaning weight (kg) of fawns born to MA (●) and R2YO (∆) hinds.

- For MA hinds, birth date had a positive effect on weaning weight with an average increase of 278g for every day earlier the fawn was born.
- Birth date also had a positive effect on R2YO fawns, resulting in increased weaning weight by 344g for every day earlier the fawn was born.
- Advancing birth date by 2 weeks would result in fawns that were 3.9 and 4.8kg heavier at weaning for MA and R2YO hinds respectively.
- The range of 16 days between farms in mean birth date of MA hinds recorded in the Deer Master group would explain a range in weaning liveweight difference between farms of 4.4kg.
• This range of data is similar to that measured by Asher and Adam (1985) in red deer who found an average increase in weaning weight of 310g for every day earlier the fawn was born.

**Dam age**

The standardised mean weaning weight of fawns from R2YO hinds from a sample of herds was compared with the weaning weight of fawns from MA hinds (Table 3.2). Mean weaning weight of fawns from MA hinds was between 5.1 and 13.2kg heavier than their counterparts from R2YO dams with the mean being 11.2kg.

**Table 3.2** Mean weaning weight of mixed sex fawns from R2YO hinds and mixed age hinds for three properties over 5 years.

<table>
<thead>
<tr>
<th>Farm</th>
<th>Year</th>
<th>Dam Age</th>
<th>n</th>
<th>Weaning Lwt (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>94</td>
<td>R2YO</td>
<td>97</td>
<td>45.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MA</td>
<td>189</td>
<td>50.9</td>
</tr>
<tr>
<td>95</td>
<td></td>
<td>R2YO</td>
<td>84</td>
<td>36.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MA</td>
<td>221</td>
<td>44.0</td>
</tr>
<tr>
<td>96</td>
<td></td>
<td>R2YO</td>
<td>61</td>
<td>36.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MA</td>
<td>173</td>
<td>44.8</td>
</tr>
<tr>
<td>97</td>
<td></td>
<td>R2YO</td>
<td>55</td>
<td>34.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MA</td>
<td>215</td>
<td>44.9</td>
</tr>
<tr>
<td>B</td>
<td>99</td>
<td>R2YO</td>
<td>79</td>
<td>47.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MA</td>
<td>321</td>
<td>59.3</td>
</tr>
<tr>
<td>C</td>
<td>99</td>
<td>R2YO</td>
<td>127</td>
<td>49.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MA</td>
<td>581</td>
<td>62.9</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>R2YO</td>
<td>503</td>
<td>43.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MA</td>
<td>1700</td>
<td>54.3</td>
</tr>
</tbody>
</table>

The difference caused by the 17-day later mean calving date would be 5.8kg calculated from the relationship in Figure 2. Further differences are likely to have been the effects of birth weight and dam weight. Asher and Adams (1985) documented an increase in birth weight and growth rate to weaning as a result of increased dam weight. A birth weight increase of 1kg was associated with a weaning weight increase of 1.4kg. An increase in hind weight of 1 kg was associated with an increased birth weight of 0.036kg and weaning weight of 0.074kg. The difference between an 85kg R2YO and a 105kg MA hind is associated with an increase in
weaning weight of 2.5kg. This adds up to a total of 8.3kg of weaning weight, compared to the 11.2kg that was recorded in this study. Herd differences also contribute to the higher than expected average difference between dam ages.

**Red vs Elk sires**

Compared with red deer, hybrid weaners were on average 10.3kg heavier at weaning. The distribution of liveweight at weaning for both types is given in Figure 3.3.

![Figure 3.3. Distribution of liveweight at weaning for red deer (hatched) and hybrids (black).](image)

The difference of 10.3 kg between red and hybrid weaners is similar to the 10kg difference observed by Judson and Nicol (1997). These authors concluded that between 60-80% of the difference between red deer and hybrids in liveweight at slaughter was evident at weaning.
Liveweight Gain

Late lactation liveweight gain in fawns

A frequent weighing programme was implemented on some farms to determine the change in liveweight of fawns between birth and weaning. Fawns were weighed in early January, early February, and at weaning in March. The mean liveweight change and the highest and lowest mean herd liveweight on each weighing date is presented in Figure 3.4

*Figure 3.4. Overall mean liveweight change (♦) and highest (△) and lowest (□) mean herd liveweight on each weighing date of stag (a) and hind (b) fawns between birth and weaning (10 March).*

In early January fawns averaged 30.5kg with no difference between sexes. Based on an average fawning date of 1 Dec and a birth weight of 10kg, mean liveweight gain during this period was 713g/d. It is likely those fawns heavier than the mean in early January were born early rather than having extremely high growth rates from birth to early January.

Overall liveweight gain between January and February was less than for the earlier period, averaging 310 and 258g/d for stag and hind fawns respectively. The best herds were able to
achieve a gain of 468g/d while the poorer herds gained at 235g/d. This suggests feed management factors influence liveweight gain at this time.

Liveweight gain in the month prior to weaning averaged 184g/d.

Overall between an estimated birth weight of 10kg on Dec 1 and weaning (10 March) liveweight gain averaged 387g/d. This level of liveweight gain is comparable with Richmond – Wrightsons Project results of 398-426g/d.

**Pasture quality in late lactation**

Liveweight of fawns during late lactation and the period post-weaning was recorded on several deer herds along with monthly pasture quality analysis (Stevens, 2000). The primary component for this discussion was energy content measured in megajoules of metabolisable energy per kg of dry matter (MJ M/kg DM)

Fawn growth varied between 200 and nearly 700 g/day during late lactation. This depended mainly on feed quality, as feed quantity offered was adequate in most cases, with minimum or post-grazing pasture mass ranging from 1800 to 3500 kg DM/ha, or adequate supplement being offered to offset the effects of drought. Several relationships were tested to help define the parameters most affecting fawn liveweight gain at this time.

Fawn liveweight gain in late lactation increased as overall feed quality increased, with this relationship accounting for 71% of the variation (Figure 3.5). Fawn liveweight gain increased by 51g/day for each unit (MJ ME/kg DM) improvement in feed quality. The chicory data (690g/d) was outstanding and was not included in the regression equation.

The quantity of green leaf was also related to fawn liveweight gain during late lactation with liveweight gain increasing by approximately 60 g/d for every 10% increase in green leaf. The use of specialist pastures such as chicory and red clover provided extra improvements to fawn liveweight gain.
To achieve fawn liveweight gains of over 400 g/d in late lactation, pastures needed to be more than 60% green leaf, have an energy content over 10.5 MJME/kg and a minimum or post-grazing pasture mass greater than 2500kg DM/ha.
Post-weaning liveweight gain

This section presents some factors which may affect liveweight gain of fawns at weaning.

**Effects of feed value on liveweight gain in the post-weaning period**

Mean liveweight gain of fawns ranged from 0 to over 300 g/day between farms in the March to May period.

The response of fawn liveweight gain was only partially accounted for by increasing the energy concentration of feed in the early post-weaning period (Figure 3.5). During this period fawns gained an extra 24g/d for every 1 unit increase in pasture energy concentration (MJ ME/kg DM).

Fawn liveweight gain in the late post-weaning period was related to energy concentration of the feed (Figure 3.5), with 81% of the variation being accounted for by this relationship. During this period fawns also gained on average an extra 24g/d for every 1 unit increase in pasture energy concentration.

**Figure 3.5.** Fawn liveweight gain at pasture in late lactation (●) the 6 weeks post-weaning (early post-weaning) and (○) and the 6 weeks before 1 June (late post-weaning) (▲) over a range of pasture energy concentrations (pasture quality).
This data illustrates clearly the effect of time of the year on the liveweight gain response to pasture quality. For example during lactation 413g/d would be expected from a pasture with an energy concentration of 11 MJ ME/kg DM provided the minimum pasture mass was achieved. The same quality pasture offered immediately after weaning would support a liveweight gain of 236g/d and in May/June a liveweight gain of 138g/d.

The response of liveweight gain to pasture energy content was similar for early and late post-weaning (24g/d more per 1 unit increase in energy content) but half that recorded in late lactation (51g/d more per 1 unit increase in energy content).

**Summary**

- For any given pasture quality, liveweight gain declined from late lactation to early post-weaning to late post-weaning
- To achieve maximum liveweight gain benefit from quality summer/autumn pasture (or supplement) it should be fed during lactation
- Summer feed crops are more efficient in producing weaner liveweight than similar crops fed in winter.
- Liveweight gains over 400 g/d in late lactation, requires pastures with 60% green leaf, an energy content over 10.5 MJME/kg, and a minimum or post-grazing pasture mass greater than 2500kg DM/ha.
- Liveweight gain greater than 150g/d requires green leaf content greater than 90% and an energy content greater than 11.5 MJ ME/kg DM.

**Post-weaning management**

While post-weaning management was not documented, the variability of the liveweight gain in the period immediately following weaning (Figure 3.5) indicated that weaning management had a large effect in some situations.

Pollard *et. al.* 2000 presented data on management options to reduce the effect of weaning on liveweight gain. Options for the Deer Master group included feeding grain pre and post-
weaning, weaning into adjacent paddocks or holding weaners indoors on hard feed for a period of up to 1 week.

**Winter Liveweight gain**

Winter liveweight gain recorded from 1997 to 1999 on a sample of farms is given in Table 3.3. Liveweight gain during winter was low (63.2g/d). The range between property (44-75g/d) and between years (61-70g/d) was small.

This liveweight gain data reflects the natural inappetence of deer during the winter. Although no observation was made of the feed source and level offered to weaners during winter, previous authors (Judson and Nicol, 1997) have shown red deer and red x elk hybrids do not show a large response to increasing feeding level during winter.

**Table 3.3. Winter liveweight gain of mixed sex weaner red deer.**

<table>
<thead>
<tr>
<th>Farm</th>
<th>Year</th>
<th>Period</th>
<th>n</th>
<th>LWG (g/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fraser</td>
<td>97</td>
<td>26 June-30 Sept</td>
<td>308</td>
<td>73</td>
</tr>
<tr>
<td>Sagar</td>
<td>97</td>
<td>26 July-9 Sept</td>
<td>307</td>
<td>43</td>
</tr>
<tr>
<td>Shepherds Bush</td>
<td>97</td>
<td>29 July-1 Sept</td>
<td>274</td>
<td>70</td>
</tr>
<tr>
<td>Shepherds Bush</td>
<td>98</td>
<td>27 May-7 Oct</td>
<td>166</td>
<td>44</td>
</tr>
<tr>
<td>Steven</td>
<td>98</td>
<td>2 June-22 July</td>
<td>270</td>
<td>75</td>
</tr>
<tr>
<td>Ashworth</td>
<td>99</td>
<td>7 June-22 Sept</td>
<td>186</td>
<td>70</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>63.2</strong></td>
</tr>
</tbody>
</table>

Most of the limitation to growth at this time of the year is due to limitations to energy intake of the animal, regulated by daylength. This means that the overall response is mainly driven by the climatic conditions for which the animal has to use energy to maintain body heat. Therefore the provision of high quality feed at this time tends to replace other available feed, rather than increase liveweight gain (Nicol & Stevens 1999). Although some small increases above this level of liveweight gain may be possible by providing generous allowances of high quality feed, this is unlikely to be efficient in terms of liveweight gain when compared to feeding the same feed at other times of the year, especially late lactation or spring.
A reduction in appetite and consequently a reduction in liveweight gain during winter may not be the case for all deer. Data exists (Figure 3.4) which indicates elk type weaners may not exhibit such a pronounced seasonal decline in liveweight gain and may continue to increase liveweight a similar rates to autumn (Beatson, unpublished data).

**Table 3.4. Autumn and winter liveweight gain (g/d) and winter liveweight as a proportion of autumn gain for deer differing in the proportion of elk genes.**

<table>
<thead>
<tr>
<th>Deer Type</th>
<th>Autumn LWG</th>
<th>Winter LWG</th>
<th>W:A ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>171</td>
<td>29</td>
<td>0.17</td>
</tr>
<tr>
<td>Hybrid</td>
<td>269</td>
<td>95</td>
<td>0.35</td>
</tr>
<tr>
<td>F1’s</td>
<td>285</td>
<td>54</td>
<td>0.19</td>
</tr>
<tr>
<td>¾ Elk</td>
<td>397</td>
<td>168</td>
<td>0.42</td>
</tr>
<tr>
<td>Elk</td>
<td>391</td>
<td>345</td>
<td>0.88</td>
</tr>
</tbody>
</table>

Autumn liveweight gain was greater in weaners that had a high proportion of elk genes compared to those who did not. Liveweight gain was 2.3 times greater in autumn for elk than for red deer. Liveweight gain during winter showed a similar trend between deer types but the difference between red deer and elk increased. Elk achieved a winter liveweight gain almost 12 times greater than red deer. This effect was further illustrated by examining the reduction in winter liveweight. For red deer, winter liveweight gain was 17% of autumn liveweight gain compared with elk where winter liveweight gain only slowed to 88% of autumn liveweight gain.

This data suggests the seasonal decline in intake and liveweight gain normal associated with deer is much more marked for red deer compared with elk. Hybrids which contained about 35% elk genes grew no faster than red deer during winter (Judson and Nicol, 1997) While there is little benefit in terms of liveweight gain in providing red deer and hybrids with high allowances, the implications of this data are that this is not the case for elk which may respond to feed supply in a similar way to autumn.
Summary

- Overall average weaning weight was 46.0kg and 56.3kg for mixed sex red and hybrid fawns respectively.

- Drought conditions had a major effect on weaning weights, though could be offset with the use of high quality supplements.

- Dam age had a significant effect on weaning weight through average birth date and growth rate to weaning. R2YO dams produced fawns which weaned 11.2kg lighter than those from MA hinds.

- Average liveweight gain from birth to weaning was 378 g/d, slowing considerably in late lactation.

- Pasture quality was very important to maximise fawn growth in late lactation and during the post-weaning period.

- Fawn liveweight gains of over 400 g/d in late lactation were achieved on pastures with more than 60% green leaf, an energy value over 10.5 MJME/kgDM, and a pasture mass of over 2500 kgDM/ha.

- Weaning management was important to ensure the continuation of high growth rates.

- Given sufficient mass, post-weaning growth was improved by good quality pasture.

- Maximising fawn growth rates in lactation and in the March/April period was the most efficient way to use high quality feeds, as winter liveweight gain was low regardless of the circumstances.
Liveweight gain of elk and hybrid weaners

Figure 3.6. Liveweight gain of red, hybrid and elk weaners between weaning and 12 months.

This data indicates

- Much of the difference in weaning weight between R2YO and MA red deer stems from birth date.

- Hybrids and elk have the potential to accumulate liveweight quicker than red deer during all periods (but need to be fed more, Judson and Nicol 1997).

- The reduction in liveweight gain over winter is much less pronounced in elk than in red deer.

- Elk genes are required for early (October) venison production
1996
1997
1998
1999
10-year average

$4.00
$5.00
$6.00
$7.00
$8.00
$9.00
$10.00

1/01/00 1/02/00 1/03/00 1/04/00 1/05/00 1/06/00 1/07/00 1/08/00 1/09/00 1/10/00 1/11/00 1/12/00

1/01/00 1/02/00 1/03/00 1/04/00 1/05/00 1/06/00 1/07/00 1/08/00 1/09/00 1/10/00 1/11/00 1/12/00

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Total number slaughtered

Average carcass weight (kg)

1996
1997
1998
1999
10-year average

$4.00
$5.00
$6.00
$7.00
$8.00
$9.00
$10.00

1/01/00 1/02/00 1/03/00 1/04/00 1/05/00 1/06/00 1/07/00 1/08/00 1/09/00 1/10/00 1/11/00 1/12/00

1/01/00 1/02/00 1/03/00 1/04/00 1/05/00 1/06/00 1/07/00 1/08/00 1/09/00 1/10/00 1/11/00 1/12/00

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Total number slaughtered

Average carcass weight (kg)