# Better estimation of national ewe and beef cow liveweights

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# Better estimation of national ewe and beef cow liveweights

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**On-Farm Research Ltd.**

**Final Report**

**June 2010**

# Table of Contents

# 1.0 Summary

The project set out to validate the ewe and beef cow data currently used in the New Zealand methane inventory model by comparing the data with all other available information. This report incorporates the data previously published in (MAFPOL 0809-11058).

The estimate of 55.9 kg (2009/10) used for ewe liveweight in the national inventory is based on the national average carcass weights (24.0 kg) collected at slaughter and a dressing out of 43%. Our data (based on 28 mobs of cull ewes) suggests that a more accurate figure for ewe dressing out would be 40.0%. Using this lower figure for dressing out %, the national ewe liveweight used in the model would increase from 55.9 to 60.0 kg in 2009/10. This compares more closely with published data of 60.6 kg (1991-2008), unpublished data of 62.1 kg (1998-2008) and our own survey data of 62.5 kg measured in 21 flocks during 2008/09 and 2009/10. Our recommendation is to continue to use national data on ewe carcass weight back to 1990/91 with liveweight calculated using a dressing out of 40%.

The estimate of 451 kg (2009/10) for beef cow liveweight used in the model is calculated from cow carcass weight after allowing for the weight of dairy cows and using a dressing out of 45%. There are a number of assumptions used which means that the cow liveweight used in the model is significantly different from other data – e.g. 568 kg for unpublished data from 18 herds (2004-2009), 541 kg for our own survey data from 12 farms (2008/09 and 2009/10), 568 kg calculated for cows slaughtered off 59 Landcorp farms in 2007/08 and 537 kg calculated for cows slaughtered off 558 M&WNZ survey farms in 2007/08. These data suggests that the values used in the national inventory model significantly underestimate beef cow liveweights. Our estimates of beef cow liveweight are based on approximately 20,000 cow carcass weights collected throughout NZ and a dressing out of 42.6% collected on 12 mobs of slaughtered beef cows. These data indicate that the beef cow liveweight presently used in the model in 2009/10 should be increased from 451 kg to 547 kg. There are real difficulties in calculating beef cow liveweights back in time. However, Landcorp Farming have made available the carcass weights on 96,176 cull beef cows slaughtered between 1997/98 and 2008/09 and which show a linear increase in beef cow liveweights of 8.5 kg/year. This means that national beef cow liveweights are likely to have increased from 402 kg in 1990/91 to 547 kg in 2009/10. These compare with figures presently used in the model of 378 kg (1990/91) and 451 kg (2009/10). In future, beef cow liveweights could be calculated using carcass weight data from approximately 16,000 cows slaughtered annually by Landcorp Farming Ltd and M&WNZ survey farms.

The model assumes that a weight of a cull ewe or cow provides an estimate of the average liveweight of the animal. For practical reasons, animals tend to be culled at one time - around weaning (for the cull beef cow) and weaning/mating (for the cull ewe). Yet the conceptus free weight of ewes and cows is probably at its highest at this time and animals culled at this time are likely to be heavier than at other times of the year. From the scanty data available, there is a suggestion that the calculation of liveweight from peak summer/autumn liveweight or calculated from average annual

carcass weight will result in an over-estimate of both ewe and breeding cow liveweight. This could be approximately 2 kg for ewes and 5-10 kg for breeding cows. Collection of data of average liveweight is complicated by the large swings in liveweight between seasons and between years. This is particularly the case with the beef cow where feed surpluses and deficits are reflected in the beef cow liveweight. Whilst this might seem a fruitful area for further work, there are challenges in obtaining meaningful data.

### Recommendations

1. That ewe liveweight is calculated from annual slaughter data back to 1990/91 using a dressing out percentage of 40%.

2. That a figure of 547 kg is used for beef cow liveweight in 2009/10 and that this is decreased retrospectively by 8.5 kg/year back to 1990/91. Going forward, better data on annual beef cow liveweights might be available using carcass data from approximately 16,000 cull cows killed annually from Landcorp Farming Ltd and off Meat and Wool NZ survey farms.

# 2.0 Introduction

The model used to calculate New Zealand's agricultural methane emissions (Clark, 2008) is based on estimated energy and feed intakes. The energy required to maintain an animal makes up a large proportion of the total energy and feed consumed by the animal and this is especially marked in breeding animals. For example, 70% of the feed requirements of the breeding cow is the cost of maintaining the animal (Morris and Smeaton, 2009). The review of the agricultural methane model (Muir *et al.,* 2008) suggested that there was limited data on both ewe and cow liveweights and that use of incorrect data on dressing out percentage might lead to significant errors when extrapolated across the national herd.

This project aims to obtain better data on breeding ewe and beef cow liveweights by:

- Reviewing the New Zealand literature on cow and ewe liveweights.
- Obtain current data on ewe and beef cow liveweights by collecting data from flocks and herds throughout New Zealand.
- Evaluating whether the liveweights of the cull animals differ from the remaining breeding stock.
- Comparing the dressing out percentages from ewes and beef cows with the dressing out percentages used in the inventory model (Clark, 2008)
- Determining whether the current timing of the liveweights collected for ewes and breeding cows reflect a true average given the seasonal variation that is likely to occur.

# 3.0 Ewe liveweight

## 3.1. Data used in the methane model

The data on ewe liveweight is based on carcass data collected at slaughter and is published annually by MAF. This indicates that ewe carcass weights have increased over time (Table 1). However, intake and methane production are based on liveweight data so the calculation of liveweight from carcass weight is dependent on the figure used for dressing out %. The figure used in the model is 43% (Clark, 2008) but because it is based on very little data, the review by Muir *et al.,* 2008) suggested that this figure might be too high and might be underestimating the ewe liveweight used in the inventory. Moreover, because ewes are often culled for age or condition, the carcass weight of cull ewes may not be representative of the national flock.

**Table 1: Ewe liveweight data used in the inventory model (Clark, 2008)**

| Year | Carcass weight used in the model (MAF data) | Liveweight calculated for model |
|---|---|---|
| 90-91 | 21.1 | 49.1 |
| 91-92 | 21.2 | 49.3 |
| 92-93 | 21.0 | 48.8 |
| 93-94 | 21.7 | 50.5 |
| 94-95 | 21.0 | 48.8 |
| 95-96 | 21.4 | 49.8 |
| 96-97 | 22.2 | 51.7 |
| 97-98 | 22.5 | 52.4 |
| 98-99 | 22.6 | 52.6 |
| 99-00 | 23.2 | 54.0 |
| 00-01 | 23.9 | 55.6 |
| 01-02 | 23.3 | 54.2 |
| 02-03 | 23.5 | 54.7 |
| 03-04 | 24.2 | 56.3 |
| 04-05 | 24.7 | 57.4 |
| 05-06 | 24.7 | 57.4 |
| 06-07 | 24.7 | 57.4 |
| 07-08 | 24.1 | 56.1 |
| 08-09 | 23.3 | 54.2 |
| 09-10 | 24.0 | 55.9 |

## 3.2. Review of ewe liveweights

The following journals were searched for records of ewe liveweight between 1985 and 2008.

- Proceedings of the New Zealand Society of Animal Production
- Proceedings of the New Zealand Grasslands Society
- New Zealand Veterinary Journal
- New Zealand Journal of Agricultural Research

From 1991, 13 papers were found which reported 20 records of ewe liveweight at or just prior to mating (Table 2). On average, ewe liveweight at tupping was 60.6 kg (61.5 kg when the merino data was excluded). This compares with 57.2 kg used in the methane model for the 2007/08 year (Clark, 2008, Table 1).

An additional four sets of data were also obtained from unpublished sources (Table 3). This data included in excess of 100 flocks with the survey data of Tom Fraser including some 81,000 ewes in the South Canterbury area (FB 2000 report). The average ewe liveweight from these unpublished reports was 62.1 kg (Table 3).

**Table 2: Published literature values on ewe liveweight data at mating (kg)**

| Authors | Ewe liveweight (kg) | Comments |
|---|---|---|
| Smith *et al.* (1991) | 57.1 | 1986-87 Coopworth |
| | 58.2 | 87-88 |
| | 51.7 | 88-89 |
| | 50.9 | 89-90 |
| Betteridge *et al*. (1992) | 64.0 | MA Romney (55-72) |
| Judson and Nicol (1993) | 64.4 | MA Corriedale |
| | 61.3 | MA Romney |
| Dabiri *et al.* (1994) | 58.7 | 1989 MA BL x Rom |
| | 53.5 | 1990 |
| | 53.7 | 1991 |
| Panggabean *et al.* (1995) | 61.0 | |
| Muir *et al*. (1998) | 79.7 | 1997 |
| | 75.5 | 1998 |
| Litherland *et al*. (1999) | 58.1 | |
| Tarbotton and Webby (1999) | 60.4 | 8 farms (range 54-68) |
| McWilliam *et al*. (2002) | 57.0 | Romney |
| Morris *et al*. (2003) | 62.2 | Romney |
| Morris *et al*. (2004) | 66.5 | East Friesian and Rom |
| Thomson *et al*. (2004) | 70.0 | East Friesian x Rom |
| Van Reenen *et al*. (2008) | 43.0 | Merino |
| | | |
| **Mean** | **60.6** | **61.5 without merino** |
| **Standard deviation** | **8.69** | **7.91 without merino** |

**Table 3: Unpublished reports and data on ewe liveweights at mating (kg)**

| Authors | No ewes | Year | Ewe liveweight (kg) | Comments |
|---|---|---|---|---|
| Paul Muir | 500 | 2006 | 62.8 | Romney |
| | | | 65.3 | Romney composite |
| Roy Fraser | | 2007 | 53.6 | 3 different farms |
| | | | 58.1 | |
| | | | 67.6 | |
| Paul Muir | 7,700 | 1998-2008 | 66.7 | |
| Tom Fraser | 250,000 | 1998-2002 | 60.8 | Pre flush -97 mobs |
| | | | 62.8 | Post flush-122 mobs |
| | | | | |
| **Mean** | | | **62.1** | |
| **Standard deviation** | | | **4.66** | |

## 3.3. Collection of current data on ewe liveweights

Data were collected from 22 farms across New Zealand (9 in 2008/09 and 13 in 2009/10). In total data were collected on 28 mobs of ewes as in some cases farms had more than one type of ewe and there were often more than 1 draft of cull ewes (Table 4). Ewe liveweights were collected around the time when ewes were being culled (between weaning and mating i.e. Nov-April each year). Most ewes were being culled for condition or age or because they had failed to rear a lamb. Full liveweights were collected on all cull ewes and a sample of at least 50 flock ewes at the same time. Ewes were weighed as soon as possible after yarding. The farmers supplied the killing sheets or at the very least the average carcass weight for the cull ewes. The average liveweight of the flock ewes differed between years (61.5 kg in 2008/09 and 63.4 kg in 2009/10) and averaged 62.5 kg. However, cull ewes only weighed 94% and 98% of their flock counterparts in 2008/09 and 2009/10, respectively (Table 4). This probably does not reflect the true relationship between cull ewes and flock ewes as although the majority (71%) of ewes are culled between weaning and mating (Nov-April), a number of ewes are slaughtered when diagnosed as dries after scanning or prior to lambing, or as wet dries at docking. It is possible that these ewes may have heavier carcass weights than their flock counterparts who are pregnant or rearing a lamb.

## 3.4. Dressing out percentages of cull ewes

Data was collected on dressing out % (liveweight: carcass weight) on 28 mobs of cull ewes across the 21 properties surveyed. Dressing out % was highly variable with a range from 36.0% to 46.7% (average 40.0%, Table 4) and was affected by ewe feeding level and how much wool they were carrying. This compares with a dressing out of 43% used in the model (Clark, 2008) and a figure of 39.1% from the review by Muir *et al*. (2008) which found only two useful datasets. Changing the dressing out % from 43% to 40.0% would result in an increase in ewe liveweight in the model from 55.9 to 60.0 kg for 2009/10.

There have been breed changes since 1990 as the advent of East Friesian and Finnish Landrace genotypes have led to considerable crossbreeding to produce “composite” ewes. These breeds may have different liveweights but these will have been captured in the national average carcass weights. It is possible that there are differences in dressing out % between breeds and that the ewe dressing out % may have changed since 1990. However, there is no good data on breed differences in dressing out % and it is likely that any differences will be small in comparison to other factors like shearing date and the type and amount of feed the animals had been grazing prior to slaughter.

**Table 4: Liveweights of flock and cull ewes at culling from 22 farms (2008-10)**

| | Location | Breed | Wgt Flock | Wgt culls | Carcass weight | Dressing out % | Comment |
|---|---|---|---|---|---|---|---|
| **2008/2009** | | | | | | | |
| 1 | Hawkes Bay | Romney | 63.2 | 70.5* | 27.3 | 38.7 | Very full |
| 1 | | Romney | 65.8 | 63.0 | 26.5 | 42.1 | |
| 2 | Hawkes Bay | Romney | 59.0 | 59.0 | 23.9 | 40.5 | Shorn |
| 2 | | Romney | 65.5 | 55.0 | 20.4 | 37.1 | Woolly |
| 3 | Fairlie | Coopworth x | 72.6 | 68.2 | 28.1 | 41.2 | |
| 4 | Fairlie | Coopworth | 65.6 | 60.6 | 27.2 | 40.0 | |
| 5 | Hawkes Bay | Highlander | 50.7 | 53.8 | 22.1 | 41.1 | Shorn |
| 5 | | Highlander | | 52.1 | 19.3 | 37.0 | Woolly |
| 6 | Manawatu | Romney | 61.1 | 53.1 | 21.8 | 41.0 | |
| 7 | Canterbury | Coopworth Romney | 58.0 | 53.0 | 26.8 | 46.7 | |
| 8 | Canterbury | Halfbred/merino | 52.0 | 43.6 | 20.1 | 46.1 | |
| 9 | Hawkes Bay | Mixed breed | 63.2 | 60.9 | 23.0 | 37.6 | |
| | | | | | | | |
| **Mean** | | | *61.5* | *57.7* | *23.9* | *40.8* | |
| **SD** | | | *6.36* | *7.50* | *3.18* | *3.14* | |
| | | | | | | | |
| **2009/2010** | | | | | | | |
| 1 | Wairarapa | Romney | 53.9 | 53.7 | 20.2 | 37.6 | |
| 1 | | | | 55.2 | 20.7 | 37.5 | |
| 2 | Hawkes Bay | Coopworth | 65.0 | 66.0 | 26.5 | 40.7 | Shorn |
| 3 | Southland | Composite | 65.5 | 61.3 | 28.4 | 46.3 | Fasted |
| 4 | Hawkes Bay | Romney | 59.5 | 53.0 | 19.8 | 37.4 | |
| 5 | Otago | Coopworth | 67.9 | 64.3 | 26.6 | 41.4 | |
| 5 | Otago | Coopworth | 67.2 | 63.2 | 25.0 | 39.5 | |
| 6 | Manawatu | Romney x | 69.1 | 78.1 | ND | ND | |
| 7 | Hawkes Bay | Composite | 63.0 | 63.0 | 25.0 | 39.7 | |
| 8 | Taurumurui | Coopworth | 57.0 | 59.4 | 21.41 | 36.0 | |
| 9 | Canterbury | | 58.9 | 44.8 | 18.6 | 41.5 | |
| 10 | Hawkes Bay | Composite | 66.5 | 60.8 | 23.5 | 38.7 | |
| 10 | | | | 71.0 | 26.4 | 37.2 | |
| 10 | | | | 68.4 | 25.5 | 37.3 | |
| 10 | | | | 63.8 | 25.6 | 40.1 | |
| 11 | Taihape | Composite | 69.7 | 66.0 | 25.3 | 38.3 | |
| 12 | Hawkes Bay | Composite | 61.3 | 66.8 | 24.8 | 37.1 | |
| | | | | | | | |
| **Mean** | | | *63.4* | *62.3* | *24.0* | *39.1* | |
| **SD** | | | *4.96* | *7.69* | *2.90* | *2.47* | |
| | | | | | | | |
| | | | | | | | |
| **Overall Mean** | | | ***62.5*** | ***60.0*** | ***23.9*** | ***40.0*** | |
| **Model** | | | ***55.0*** | ***55.0*** | ***23.7*** | ***43.0*** | |

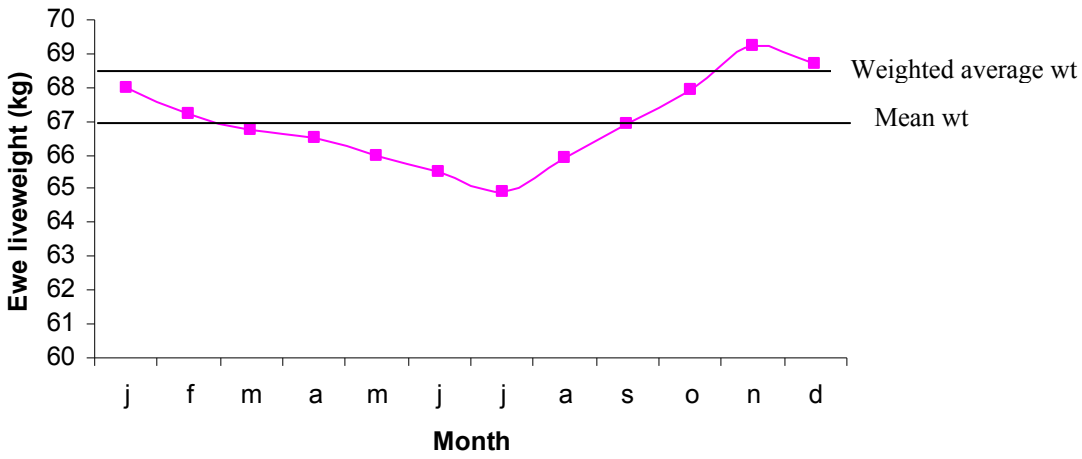
## 3.5. Seasonal variation in ewe liveweight

In the national inventory model, breeding ewes are assumed to have a constant liveweight and maintenance energy requirement to which the energy costs of wool, pregnancy and lactation are added. However, given New Zealand's reliance on a pasture based feeding system, constant ewe liveweights are unlikely. There is very little published data on the seasonal change in liveweight of breeding ewes. Jagusch and Coop (1971) present a very stylized liveweight curve suggesting significant ewe liveweight change but there is no supporting data in the paper. On the other hand, liveweight data (over 7400 ewe records) has been collected from the Poukawa ewe flock for 10 years with ewe liveweights recorded at mating, pre lambing and weaning (Table 5). Whilst these ewes are heavier than most commercial ewes, it is the pattern of liveweight change that is of interest and this seems to be the best data available. The liveweight pattern varies with changes in management, lambing percentage and seasonal effects like drought. Nevertheless, after we allow for the weight of wool and pregnancy and smooth the data between weigh points, there are still modest changes in liveweight (Fig. 1). The average liveweight of the Poukawa ewes over the year weighted by the percentage of ewes killed each month (from national slaughter statistics) is 68.8 kg. This is 1.8 kg heavier than the overall average Poukawa ewe liveweight of 67 kg. These figures may under-estimate commercial reality since the Poukawa flock is a high performance flock which employs supplementary feeding as required. Under commercial conditions where supplementary feeding is difficult, these differences may be even greater.

**Table 5: Pattern of ewe liveweight (kg) from mating to weaning each year in the Poukawa flock from 1998 to 2008 (includes pregnancy weight in pre-lamb weight)**

| | Year | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1998 | 99 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | Mean |
| Mating | 60.2 | 67.4 | 67.7 | 67.0 | 68.5 | 68.9 | 70.5 | 72.3 | 72.3 | 70.7 | 74.3 | **69.0** |
| Prelamb | 69.2 | 72.0 | 76.9 | 77.5 | 78.3 | 81.6 | 77.8 | 74.6 | 74.6 | 72.6 | 74.6 | **76.8** |
| Weaning | 74.6 | 64.8 | 72.5 | 70.3 | 78.3 | 73.2 | 74.0 | 69.4 | 69.4 | 71.3 | 71.1 | **71.8** |

**Figure 1: Estimated patterns of ewe liveweight change after removal of wool and foetal weights using the Poukawa Flock data**




Assumptions: Early August lambing with two thirds of the flock lambing in the first cycle. Loss of 10 kg in lamb and fluid based on a lambing percentage of 160% and an average lamb birth weight of 5.4 kg. Shearing in Dec and May – 5 kg wool total.

# 4.0 Beef cow liveweights

## 4.1. Data used in the methane model

Calculation of the beef cow liveweight from carcass weight is difficult because the carcass weights of dairy and beef cows are not separated in national slaughter statistics. The methane model adopted the following procedure to estimate the weights of breeding beef cows. "The number of beef cows slaughtered was assumed to be 25% of the total beef breeding cow herd and the remaining adult cows slaughtered were assumed to be dairy cows. The carcass weight of the dairy cattle slaughtered was estimated using the adult dairy cow weights and a killing out percentage estimate of 40%. The total weight of dairy cattle slaughtered (number × carcass weight) was then deducted from the national total carcass weight of slaughtered adult cows. This figure was then divided by the number of beef cows slaughtered to obtain an estimate of the carcass weight of adult beef cows. Liveweights were then obtained assuming a killing out percentage of 45%" (Clark, 2008). Using this method of calculation the model estimates that beef cow liveweights have increased from 392.5 kg in the 1989/90 season to 433.1 kg in the 2007/08 season with an overall mean of 416 kg. There are clearly a number of assumptions in this calculation and it is also very dependent on the dressing out % used. Muir *et al*. (2008) suggested that there was very little data on which to base the figure of 45% being used in the model.

## 4.2. Review of beef cow liveweights

As with ewe liveweight, the following journals were searched for records of beef cow liveweight between 1985 and 2008.

- Proceedings of the New Zealand Society of Animal Production

- Proceedings of the New Zealand Grasslands Society
- New Zealand Veterinary Journal
- New Zealand Journal of Agricultural Research

The data on beef cow liveweights available from the literature was very limited and most of the reports in the literature involved nutritional treatments and were therefore not used as they did not represent commercial reality. Most data reported results of Hereford x Friesian cows (Table 6) and it is worth noting that these only represent a small part of the national beef herd. For example, in 2007, it was estimated that the national herd consisted of 23% Angus, 11% Hereford, 11% Hereford x Angus, 36% mixed crosses, 12% Friesian crosses and 7% others (Morris and Smeaton, 2009). The data reported appears to suggest that cow liveweight may have increased over time. For example, the liveweights reported before 2000 averaged 446 kg whereas those reported after 2000 averaged 522 kg.

Unpublished data was obtained on a further 2100 breeding cows (Table 7) with most data collected between 2006 and 2009. The majority of which were Angus or Hereford x Angus crosses and are likely to be more representative of the current New Zealand breeding cow. The average weight of these cows was 568 kg.

**Table 6: Summary of beef cow liveweights at weaning (autumn) reported in the New Zealand scientific literature**

| Authors | Liveweight | Comments |
|---|---|---|
| Smeaton et al. (1986) | 422 | Angus, Hereford x Friesian |
| Montgomery and Davis (1987) | 475 | Angus |
| McCall et al. (1988) | 429 | Angus, Hereford x Friesian |
| McMillan et al. (1993) | 420 | 1991 Hereford x Friesian |
| | 469 | 1992 Hereford x Friesian |
| Smeaton et al. (1995) | 460 | 1991 Hereford x Friesian |
| | 446 | 1992 Hereford x Friesian |
| Smeaton et al. (2004) | 511 | 2001 Hereford x Friesian |
| | 526 | 2002 Hereford x Friesian |
| | 530 | 2003 Hereford x Friesian |
| | | |
| **Mean** | **469** | |
| **Standard deviation** | **41.6** | |

**Table 7: Unpublished data on beef cow liveweights at weaning (autumn)**

| Authors | Liveweight | Number | Comments |
|---|---|---|---|
| Morris *et al.,* 2002 | 503 | 219 | 2001 Hereford x Friesian |
| | 543 | 219 | 2002 Hereford x Friesian |
| MAF SFF 2006/2007 | 499 | 190 | Farm 1 Angus |
| | 568 | 173 | Farm 2 Angus |
| | 573 | 57 | Farm 3 Unknown |
| | 568 | 97 | Farm 4 Unknown |
| | 623 | 26 | Farm 5 Angus |

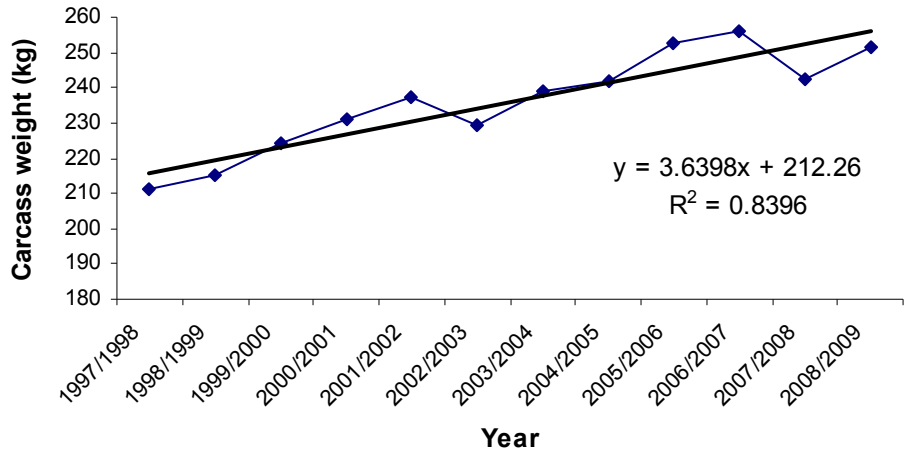
| Authors | Liveweight | Number | Comments |
|---|---|---|---|
| | 606 | 164 | Farm 6 Hereford x Angus |
| | 512 | 66 | Farm 7 Angus |
| | 641 | 177 | Farm 8 Angus |
| | 572 | 11 | Farm 9 Angus |
| | 528 | 37 | Farm 9 Hereford |
| | 488 | 16 | Farm 9 Hereford x Angus |
| | 609 | 36 | Farm 10 Angus |
| | 600 | 3 | Farm 10 Hereford |
| | 619 | 57 | Farm 10 Cross |
| | 635 | 40 | Farm 10 Hereford x Angus |
| Landcorp (2009) | 534 | 629 | Angus |
| | | | |
| **Mean** | **567.7** | **2187** | |
| **Standard deviation** | **49.38** | | |

## 4.3. Collection of current data on beef cow liveweights and dressing out %:

Liveweight data on breeding cow liveweights was collected from 12 farms in 2009 and 2010 (Table 8). It was planned to collect more data but in a number of cases farmers did not follow through with their original intentions. Liveweights were collected at weaning/pregnancy testing and since this was the stage at which culls are identified, liveweights were collected on the cull cows to examine any differences between herd cows and culls. Liveweight was recorded soon after yarding and carcass weights were also collected on cull cows to obtain better data on dressing out %. In contrast to the published literature, most of the herds surveyed were Angus and Angus x and are probably a better representation of the national herd than the Hereford x Friesians reported in the literature. On average, the beef cows averaged 541 kg (Table 8), considerably heavier than the figure of 452 kg used in the methane model over the same years. There was a large difference between years (510 in 2009 and 573 in 2010). Since beef cows are used to harvest and manage surplus grass it is not surprising that their liveweights were reflected in the better summer feeding conditions which occurred over the summer of 2009/2010. During the 2008/09 farm survey, cull cows were heavier than herd cows (527 kg vs 510 kg) but in 2009/10 the cull cows were lighter than their herd mates (566 kg vs 573 kg). These differences probably reflect the feed conditions and culling decisions being made. The dressing out % of the cull cows averaged 42.6% – this compares with a figure of 45% used in the model.

Landcorp Farming Ltd made available carcass data from 96,176 cull beef cows slaughtered between 1997/98 and 2008/09. In 2007/08 the average carcass weight of the 8995 cows slaughtered was 242 kg. Using the dressing out of 42.6% collected in the present study, the liveweight of cows on Landcorp farms would have averaged 568 kg in 2007/08. There is also evidence of a linear trend of increasing beef cow carcass weights, with carcass weights increasing by 3.64 kg a year between 1997/98 and 2008/09 (Fig. 2). After correcting for dressing out percentage and extrapolating back to 1990 we can calculate that beef cow liveweights have been increasing by 8.5 kg/year.

**Figure 2: Changes in carcass weight of cull beef cows (Landcorp Farming Ltd)**




The M&WNZ Economic Service undertake annual surveys of 560 sheep and beef farms and have made data on average beef cow carcass weights available. The only year for which this data has been collected is 2007/08 and the average beef cow carcass weight (8511 beef cows) was 229 kg. Using a dressing out of 42.6% from the present study, the average beef cow liveweight on these farms would have been 537 kg.

Over a 1 week period in March 2010, Silver Fern Farms identified the breed of cows (beef/dairy) arriving for slaughter at their Pacific plant (Hastings) and recorded the carcass weight of each mob. Beef cow carcass weights averaged 255 kg and dairy cow carcass weights averaged 225 kg.

**Table 8: Beef cow liveweights measured on-farm in 2009**

| Farm | Breed | Herd cow weight (kg) | Cull cow weight (kg) | Carcass weight (kg) | Dressing out % |
|---|---|---|---|---|---|
| **2008/09** | | | | | |
| 1 | Angus | 506 | 510 (547.7) | 224.0 | 40.8 |
| 2 | Angus | 474 | 490 | 205.6 | 42.0 |
| 3 | Ang x Friesian | 539 | 539 | 229.3 | 42.5 |
| 4 | Angus | 460 | 480 | 200.4 | 41.7 |
| 5 | Angus/Simm | 544 | 587 | 262.0 | 44.6 |
| 6 | Angus | 534.8 | 554.9 | 203.3 | 36.6 |
| | | | | | |
| **Mean** | | **509.6** | **526.8** | **220.8** | **41.4** |
| **SD** | | **35.8** | **40.96** | **23.38** | **2.66** |
| **Model** | | **455** | **455** | | **45** |
| | | | | | |
| **2009/2010** | | | | | |
| 1 | Ang x Friesian | 515 | 467.4 (515) | 202.8 | 39.4 |
| 2 | HxF | 543 | 626 | 274.9 | 43.9 |
| 3 | Angus | 633 | 570.7 | 265.7 | 46.7 |
| 4 | Angus | 636 | 586 | 265.6 | 45.3 |

| | | | | | |
|---|---|---|---|---|---|
| 5 | Angus | 524 | 534 | 231.2 | 43.3 |
| 6 | HB | 586.7 | 614 (600.1) | 269.7 | 44.9 |
| | | | | | |
| **Mean** | | **573.0** | **566.4** | **251.7** | **43.9** |
| **SD** | | **53.7** | **71.7** | **33.9** | **2.36** |
| **Model** | | **451** | **451** | | **45** |
| | | | | | |
| **Overall Mean** | | **541** | **546.6** | **236.2** | **42.6** |

() Weight prior to slaughter. Culls were farmed on and weights changed prior to slaughter.

## 4.4 Seasonal variation in beef cow liveweight

As with ewes, the methane inventory model assumes that breeding cows have a constant maintenance liveweight to which the energy costs of pregnancy and lactation are added. Although beef cow weights are believed to vary widely over the year and reflect the available feed supply, there is limited data. Morris et al (2002) shows that the cow liveweight fluctuates by up to 100 kg (440 mid winter 2001 to 540 weaning; Fig. 3). As well as this large seasonal fluctuation there is a large year effect, with cow liveweights differing by 40 kg at weaning between the two years.

Even better data is available from a Landcorp Northland farm where liveweights were measured on a random sample of beef cows (Thomson pers comm.). We have amended this data to indicate the weight of the beef minus conceptus (Fig. 4). As with the data of Morris et al (2002) there was significant liveweight change over the year and large differences in cow weight at weaning in 2009 and in 2010. This lower cow weight in March 2010 no doubt resulted from the significant summer drought which occurred in Northland in Jan – May 2010.

Given these variations in liveweight, the challenge is in identifying an average beef cow liveweight, particularly given that almost all cow weights are collected at pregnancy scanning or weaning and which tend to represent a high point in the weight cycle (Fig. 4) as the beef cow usually has the opportunity to build up body reserves over summer. Moreover, most cows are killed over the summer as the dries and culls are identified. It is therefore likely that both the average beef cow carcass weight and the summer liveweight recorded at weaning will over-estimate the average conceptus free cow liveweight (Fig. 4). Gaining a more accurate indication of average beef cow liveweight provides a huge challenge – both from the perspective of the seasonal and yearly effect on cow liveweight and from the logistical challenge involved in capturing cow liveweights at various times of the year.

**Figure 3: Change in cow liveweight over time (Morris *et al.*, 2002)**

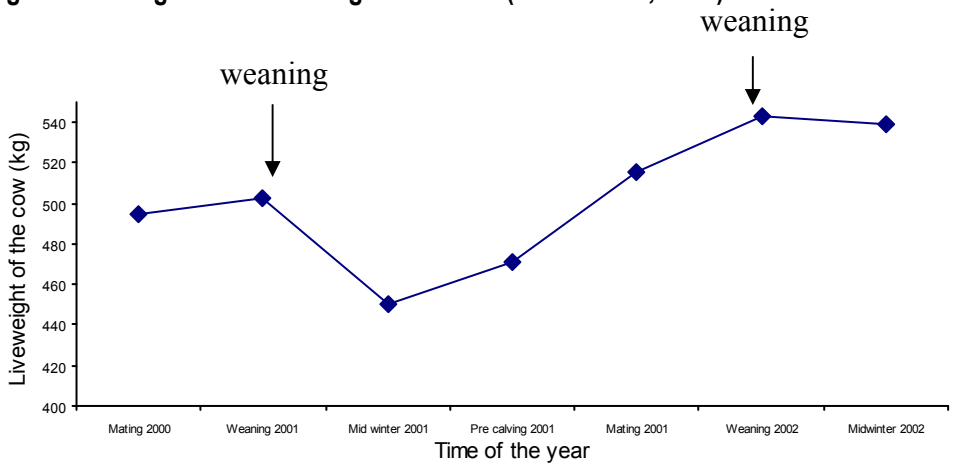
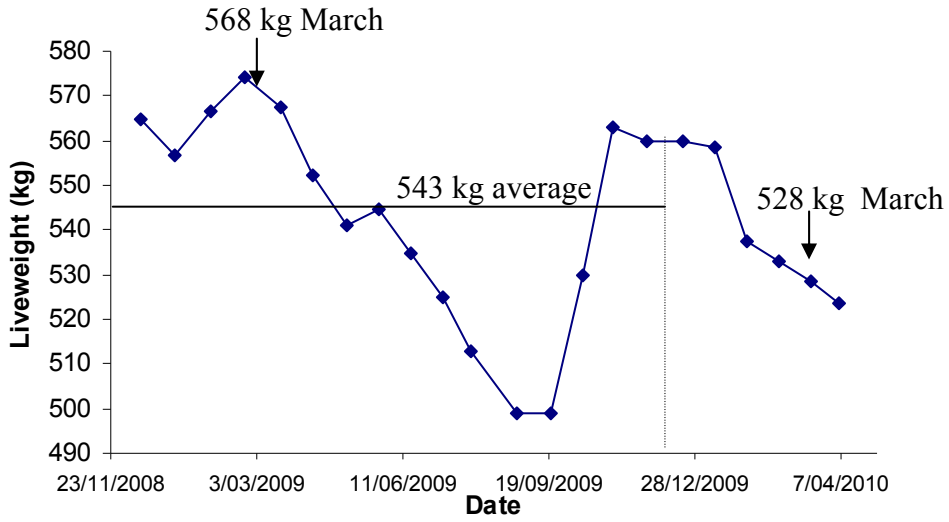



**Figure 4: Liveweights in mixed aged beef cows (n=492) in Northland– excludes weight of pregnancy (Thomson pers comm., 2010)**




Because of the seasonal variation in cow liveweight, data collected in late summer/autumn at the time of highest cow liveweight may overestimate beef cow liveweight. In the data of Thomson (pers comm., 2010) cows were 25 kg heavier in their peak at March 2009 than the average of the 2009 year (Fig. 4). Not all cows are culled in summer and a calculation of a weighted average liveweight based on slaughter data suggests that beef cow liveweight could be over-estimated by 5-10 kg.

## 5.0 Conclusions and recommendations

***Ewe liveweight**:* The estimate of 55.9 kg (2009/10) used for national ewe liveweight in the inventory is based on carcass weights collected at slaughter (24.0 kg) and a dressing out of 43%. From the present study, our estimate of dressing out is 40.0% from 28 mobs of cull ewes. Use of this lower figure for dressing out would increase the 2009/10 ewe liveweights from 55.9 kg to 60.0 kg. This compares with published

data of 60.6 kg (1991-2008), unpublished data of 62.1 kg (1998-2008) and our own survey data of 62.5 kg in 22.flocks collected during 2008/09 and 2009/10 (Table 9).

Our survey data also suggests that the 75% of ewes culled between weaning and mating are actually lighter than flock ewes probably because they are older and often culled on condition. However, the extent of the difference varied between years (6.5% heavier in 2008/09 and 1.9% heavier in 2009/10) and no doubt reflected seasonal feed conditions and the extent to which cull ewes are able to be "fattened" before slaughter (Table 9). Moreover, the 25% of ewes killed from mating through to weaning are likely to be dries and wet dries which well may be heavier than their flock counterparts. Given the apparent variability between years we feel it is inappropriate to correct for differences in carcass weight between cull and flock ewes.

**Table 9: Summary of ewe liveweight data**

| | **Ewes** | | | |
|---|---|---|---|---|
| | Flock ewe LW | Cull ewe LW | Carcass weight | Dressing out % |
| Literature | 61.5* | | | |
| Literature | | | 23.0 | 39.1 |
| Unpublished | 62.1* | | | |
| 2008/09 Farm survey | 61.5 | 57.7 | 23.9 | 40.8 |
| 2009/10 Farm survey | 63.5 | 62.3 | 24.0 | 39.1 |
| Model (2009/10) | 55.9 | | 24.0 | 43 |
| **Revised Model (2009/10)** | **60.0** | | **24.0** | **40.0** |

* Liveweight at mating

***Cow liveweight***: The estimate for beef cow liveweight used in the model (455 kg in 2008/09 and 451 kg in 2009/10) is significantly different from recent data - 568 kg for unpublished data from 18 herds (2004-2009), 541 kg for our own survey data from 12 farms (2008/09 and 2009/10), 568 kg calculated from carcass weights of 8995 beef cows slaughtered off 59 Landcorp farms in 2007/08 and 537 kg calculated for 8511 beef cows slaughtered off 558 M&WNZ survey farms in 2007/08. These figures are all heavier than that used in the model. We believe that the data presented here is representative of New Zealand beef cows and that figure used the beef cow liveweight in 2009/10 should be increased to 547 kg. There appears to be a trend of increasing carcass weights over time, with data from Landcorp Farming Ltd between 1997/98 and 2008/09 suggesting an increase of 8.5 kg/year. An extrapolation using this relationship suggests that beef cows averaging 547 kg in 2007/08 would have averaged 402.5 in 1990/91. This is slightly higher than the 378 kg currently used in the model for 1990/91.

**Table 10: Summary of beef cow data**

| | **Cows** | | | |
|---|---|---|---|---|
| | Herd cow LW (kg) | Cull cow LW (kg) | Carcass Wgt (kg) | DO% |
| Literature | 469 | | | |
| Unpublished | 567 | | | |

| | | | | |
|---|---|---|---|---|
| SFF | | | 255* | |
| Landcorp (2007/08) | 568** | | 242 (8995 cows) | |
| M&WNZ data (2007/08) | 537** | | 229 (8511 cows) | |
| 2008/09 Farm survey | 510 | 526.8 | 220.8 | 41.4 |
| 2009/10 Farm survey | 573 | 555 | 251.7 | 43.9 |
| Model (2009/10) | 451 | | | 45 |
| **Revised model (2009/10)** | **547*** ** | | **235.9** | **42.6** |

* Small dataset. Not included in overall carcass weight average
** Calculated from carcass weight
***Based on liveweight of cows from Landcorp, M&WNZ and Farm surveys

***Seasonal variation in ewe and cow liveweight*:** The model assumes that the weight of the cull ewe and cow provide an estimate of the average liveweight of the animal. However animals tend to be weighed and culled at certain times of the year - around weaning (for the cull beef cow) and weaning/mating (for the cull ewe). At both points animals are near the peak of their conceptus-free weight cycle. Whilst the data is scanty indeed, it does suggest that the calculation of liveweight from an average annual carcass weight (or from summer/autumn liveweight) will result in an over-estimate of ewe and cow liveweight. This could be as much as 2 kg in the case of ewes and 5-10 kg in the case of breeding cows. However, given the limited data we suggest that further work is carried out before any further adjustments are made.

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