Herd recording's economic contribution to the Victorian dairy industry

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ABARE report to the
National Herd Improvement Association

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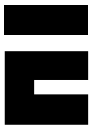

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Key results

- In 1994-95, 63 per cent of Victorian dairy producers used herd recording as a tool for management of their dairy herd.
  - A further 27 per cent, while not using herd recording, used artificial insemination to assist with improving the productivity of their herd.
  - 10 per cent of producers do not use either technique in herd management.
- Farms that use herd recording have higher annual average milk production per cow and milk receipts than non-herd recording farms.
  - There is less variability in average milk production per cow among herd recorders than among either of the other two groups.
- Herd recording farms have higher milk receipts per cow than the other two groups. In addition, there is less variability among herd recording farms in their receipt per cow than is the case for non-herd recorders.
- After accounting for the economic costs associated with operating a dairy farm, herd recording farms had a higher level of profit per cow than farms that don't herd record except in the drought year of 1994–95.
  - In 1993-94, the farm profit of herd recording farms was $252 per cow compared with $230 per cow for farms that use artificial insemination only.
  - Although not directly comparable because of the differences in herd composition, the profit per cow for farms that do not use artificial insemination was $59 in 1993-94.

- Under the assumption that all of the performance differences between farms that herd record and farms that use artificial insemination only is due to herd recording, the net value of herd recording to the Victorian economy is estimated at $16.3 million in 1993-94.
- The industry as a whole also benefits from herd recording activities through the collation of all the herd recording information which permits the assessment of the genetic bloodlines of bulls and cows within the Australian dairy herd.
- The benefits of improved production performance flow through to all sectors of the dairy industry. However, all dairy farms whether they herd record or not pay for these benefits in terms of higher prices for genetic stock.

1. Introduction

The productivity of the Australian dairy industry has improved significantly over the past twenty years largely due to better management practices and the application of new technologies at the farm level. Nevertheless, there is evidence to suggest that the application of certain technologies varies considerably between dairy farms. Among these are techniques employed in dairy herd improvement. Despite the claimed benefits of herd recording, in 1994-95 only 63 per cent of Victorian dairy farmers used herd recording as a management tool.

The National Herd Improvement Association of Australia (NHIA) commissioned ABARE to undertake a study of herd recording in Victoria to assess the net economic benefits to the Victorian dairy industry. This analysis has been undertaken using ABARE farm survey data from the Australian Dairy Industry Survey.

The terms of reference requested that ABARE give specific attention to:

(a) analysis and estimation of any transfer of benefits from herd recording farmers to those who do not herd record, yet use AI, and those who use neither;

(b) analysis, on an individual farm basis, of the difference in performance of farms that herd record and those that do not to assess the benefits of herd recording; and

(c) extrapolation of farm level results to provide an estimate of the overall gains to the Victorian dairy industry from herd recording.

2. Background and issues

Herd recording — what is it?

Herd recording is the measurement and recording of the yield of milk from each cow in the herd, the butterfat and protein content of that milk and the monitoring of cows for early signs of mastitis. Samples are taken at monthly intervals throughout the lactation period which is sufficiently representative to give the approximate annual yield of milk, butterfat and protein from each cow in the herd (Bradbury 1954).

The most practised herd recording system used in Australia is farmer sampling recording. Under this system, milk meters and flasks are delivered to farms by the regional herd recording centre before the evening milking.

Milk meters are placed in each dairy stall. Flasks are inserted into the meter for each cow milked. When full they are matched with cow identification and stored in a crate ready for the flask from the morning milking next day when the procedure is repeated. These samples of milk are then taken to regional herd recording centres for testing.

Farmers receive their herd recording reports normally within a few days after testing — a list of yield estimates for all cows tested, together with a report on information supplied by the farmer on calving and testing dates, and an inventory list describing pedigree details.

The herd recording data are also provided to the Australian Dairy Herd Improvement Scheme (ADHIS). ADHIS provides estimates of the genetic merit of bulls and cows based on the production performance of their progeny. These estimates are known as Australian Breeding Values (ABV). As data have accumulated over the years, it has allowed the systematic

cataloguing of breeding stock, including bulls resident overseas whose semen is imported.

The information generated from herd recording is a particularly valuable tool used in the evaluation of sires and cows in breeding programs run by firms involved in the commercial production of semen. These firms, such as Genetics Australia and Riverina Artificial Breeders Australia, can be considered as working towards producing technological improvements in the genetic material available to the dairy industry. Most of the semen available for AI in Australia is sourced either from these firms or imported from overseas suppliers.

These firms undertake extensive testing of their breeding stock through programs that involve the distribution of semen for testing throughout randomly selected herds within Australia. Arrangements are entered into with the dairy farmers which contract the farmer to milk and herd record the offspring of the bulls being proved. The activities of farmers undertaking bull proving programs provide an important contribution toward the improved production performance within the dairy industry. However, the benefits of these arrangements are not necessarily linked to industry herd recording arrangements. They are also undertaken on a commercial basis where the benefits to the farmers and breeders involved would be expected to equal or exceed the costs. These arrangements are not considered further in this report.

Who benefits from it?

There are two levels of benefits arising from herd recording. Firstly there is the direct benefit to the farmer from the information arising from herd recording. Secondly, there is a wider benefit to the industry through the collation of herd recording information in order to readily identify bulls and cows whose progeny have consistently performed well. That is, there are

benefits from herd recording through an improved genetic standard and production performance of the national dairy herd.

Direct benefits to the farmer

Probably the most useful information to the farmer are the Production Index report and the Individual Somatic Cell Count (SCC) results (Jeffries 1996).

After accounting for mature age equivalent production, the Production Index (PI) allows each cow's yield to be compared to the average for the herd. It provides the dairy farmer with a reliable method of selecting the better milk producers and eliminating unprofitable animals from the herd (Jeffries 1996). As such it allows the farmer to build up a herd of greater uniformity. The PI also allow the farmer to make more informed decisions about feeding programs and when to terminate lactation.

The SCC test provides an efficient check on mastitis and can be used to avoid incurring the price penalties processors impose if the milk from a farm is found to exceed a specified level of SCC. Once a cow is identified to have a high SCC, the farmer can treat the cow, or if the problem persists, consider culling the cow from the herd (Jeffries 1996).

Herd recording and pedigree information is also used in relation to the sale of stock. There is anecdotal evidence that buyers request herd recording information for the dam and grand dam of heifers. While there is no specific price paid for the information, it is likely that the value of the information would be reflected in the sale price of the heifers.

Industry level benefits

A benefit to the industry as a whole is available through the collation of all the herd recording information. The collection of all the herd recording information generated from herd testing centres provides a database on the

performance of over 60 per cent of the dairy herd in Victoria. This information permits the assessment of the genetic bloodlines of bulls and cows within the Australian dairy herd.

The benefits of improved production performance flow through to all sectors of the dairy industry. Dairy farmers, whether they herd record or not, have access to improved genetic stock. Dairy studs and other breeders benefit from working with better stock. The benefits also extend to processors, where the higher production of milk enables a larger processing sector.

There are concerns in some quarters that farmers who do not herd record benefit from the improvements in the dairy herd without contributing through herd recording. However, the concerns appear to be misplaced.

As discussed above, the improvement in genetic material is being undertaken primarily by specialist organisations within the dairy industry. Since these firms are providing a private good in the market place, it is an efficient allocation of the resources within the dairy industry that all those seeking to purchase the newer technology do so at the same price. That is, equal access to the improved genetic material by herd recorders and non–herd recorders alike is not a case of free riding.

To the extent that herd recording adds to the productive performance of cows, milk producers would be prepared to pay a higher price for the cows and for any semen that they purchase. The prices semen producers, breeders and others would be prepared to pay for ABV information would include any higher prices they might receive for their semen and stock sales. Hence, if there were net benefits to the industry from the collation of the herd recording data, it would be possible for the ADHIS to charge clients sufficient to cover the full costs of collating herd recording information and estimating ABVs.

This is not currently the case. The Dairy Research and Development Corporation provides an annual grant for partial funding of ADHIS for the collection of the information, and the calculation of ABVs. Some of these funds may be returned to DRDC by ADHIS subject to the level of income generated by ADHIS. The rest of ADHIS funds are made up by charging clients, predominantly firms involved in the provision of semen in artificial breeding, and for the calculation of ABVs for specific bull proving programmes carried out by these firms.

At the present, the funds provided by the DRDC to ADHIS lowers the costs associated with breeding bulls for work in the AI industry. This lowering of costs to breeders will result in higher returns to breeders and/or cheaper semen to all producers who purchase semen.

It is possible that there are unrealised benefits from more widespread herd recording. There is a jointness in the value of performance testing information obtained from herd recording. The higher the proportion of farmers which herd record, the faster information becomes available on the genetic potential of bulls and the greater the use that can be made of semen from the better bulls. Such benefits may not be realised without some form of cooperative action. This might include direct payments to farmers for provision of herd recording information to reflect the value of the information.

The survey

The data presented in this analysis are drawn from ABARE's *Australian Dairy Industry Survey (ADIS).* ADIS is an annual survey of Australia's dairy farming sector. The survey provides detailed information on the physical and financial characteristics of dairy farms throughout Australia.

ADIS has been conducted by ABARE since 1979 and involves visits to approximately 300 dairy farms in all states. The survey covers

establishments defined by the Australian and New Zealand Standard Industrial Classification class 0130 — those engaged in dairy farming — and with an estimated value of agricultural operations (EVAO) of $22 500 or more. A more detailed description of the survey can be found in ABARE (1996).

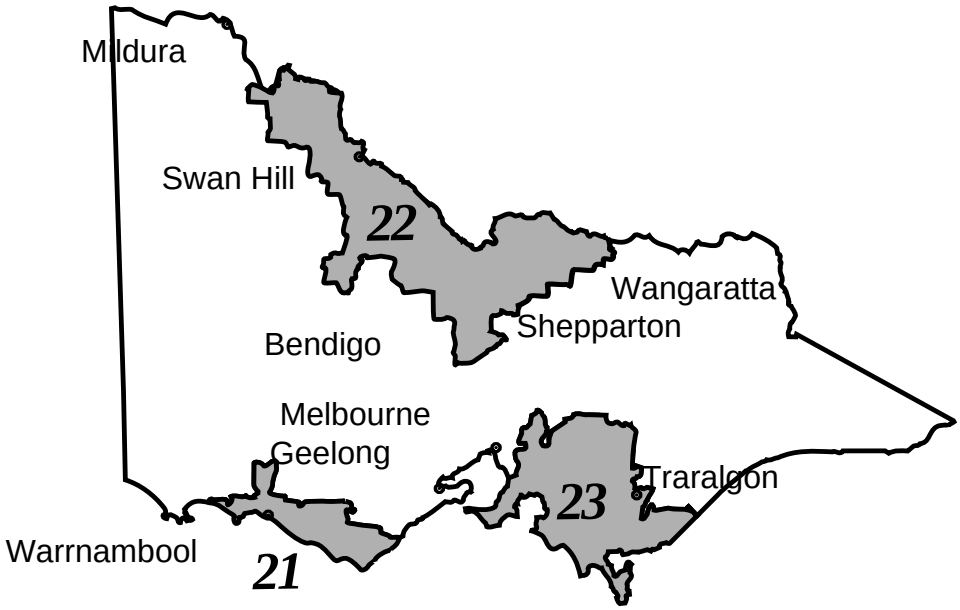
As part of this survey in 1992 and 1994, ABARE was requested by the Dairy Research and Development Corporation to collect additional data on the application of technology in the dairy industry. These additional questions provide data on the use of new technologies on farms, including whether farmers participate in herd recording, and the length of time respondents had been carrying out this practice. The results from the first two of these surveys have been reported in *Farm Management and Technology in the Australian Dairy Industry 1991-92* and *Farm Management and Technology in the Australian Dairy Industry 1993-94*.

Even though the 1994-95 ADIS survey did not include the farm management and technology supplementary survey, questions regarding herd recording and artificial insemination were asked as supplementary questions for this study.

ADIS data are available by regions within states. These regions represent the smallest stratum at which the survey sample is designed and are based on groups of local government areas or shires. In Victoria there are three ADIS regions (see figure 1). The Western Region (region 21) covers the local government areas in the south-west of the state around Warrnambool. The Northern Region (region 22) covers the Goulburn–Murray irrigation district which includes such local government areas as Swan Hill, Echuca, Numurkah and Shepparton. Gippsland (region 23) covers the area east of Melbourne including such local government areas as Packenham, Warragul, Morwell, Traralgon and South Gippsland.

Figure 1: **Australian Dairy Industry Survey Map**

Victorian survey regions



3. Analysing the influence of herd recording

Participation in herd recording

Herd recording was only undertaken on those farms that also used artificial insemination. The analysis separates dairy farmers into three groups, based on their use of herd recording and artificial insemination (AI):

- Group 1: those farmers who herd record and use AI;
- Group 2: those farmers who use AI only; and
- Group 3: those farmers who neither herd record nor use AI.

Table 1 shows the sample sizes and estimated populations for each of the three groups.

Table 1 **Sample and estimated population sizes**

	Sample			Estimated Population		
	1991-92	**1993-94**	**1994-95**	**1991-92**	**1993-94**	**1994-95**
Group 1	47	91	54	4 267	4 968	4 860
Group 2	19	27	22	1 391	1 554	1 938
Group 3	14	15	8	1 901	1 434	850
State average	77	130	81	7 111	7 729	7 368

In 1994-95, 63 per cent of farms practiced herd recording, while 27 per cent of farms used artificial breeding without herd recording (figure 2). The remaining 10 per cent of farms in Victoria used neither herd recording nor artificial breeding as a management tool.

Farms vary regionally as to whether or not they practise herd recording. Herd recording was undertaken by a larger proportion of farmers in the Northern Region than in either the Western Region or Gippsland. The Gippsland area had the next highest rate of participation in herd recording while the Western Region had the largest proportion of farms (22 per cent in 1994-94) which were not using any herd improvement techniques. In 1994-95, all of the sampled farms in the Northern Region were involved in herd recording and/or AI practices.

Figure 2: Participation in herd recording – 1994-95

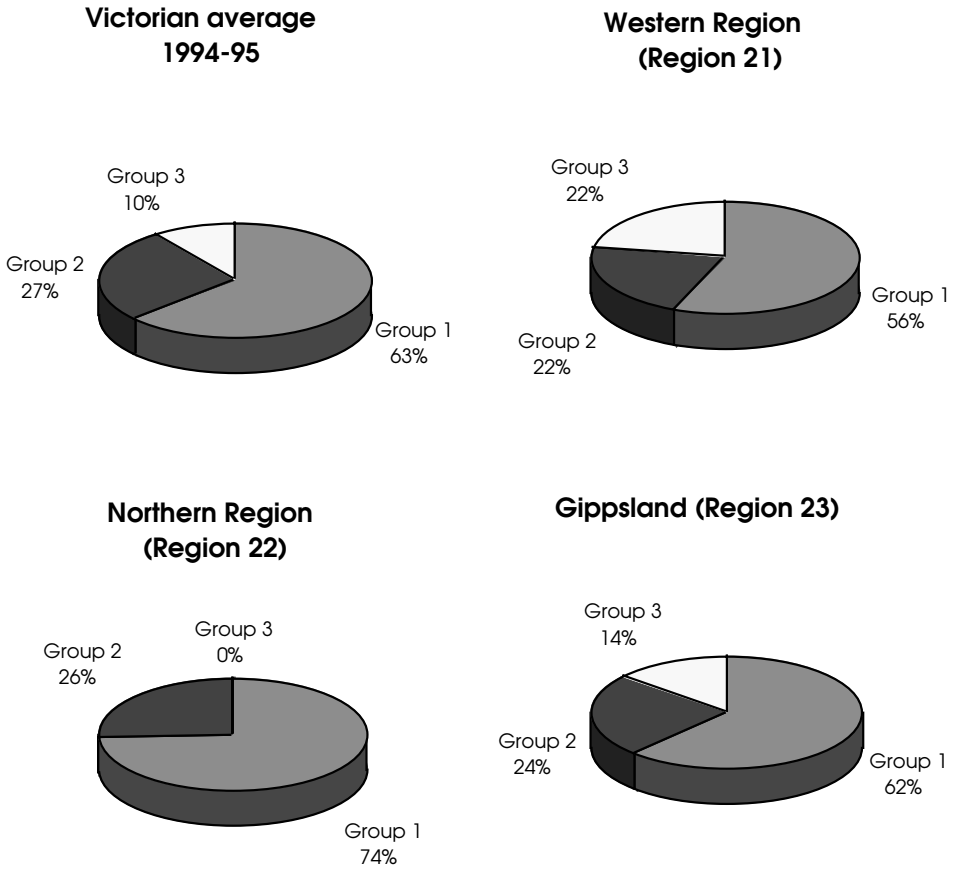


Table 2 shows that almost half of the herd recording farmers surveyed commenced the practice during the 1980s. Only a relatively small number of farmers commenced herd recording more recently.

With only a 63 per cent participation rate in Victoria, there is a substantial number of dairy farmers who do not use herd recording as a management tool. Recent research questioning the high rate of non–participation found that many farmers believed the costs of herd recording — the financial costs of the tests, the extra labour involved, and the organisation required — often outweigh the benefits (Marks 1996). That study concluded that the herd improvement centres involved in herd testing could better tailor their

information to meet farmers' specific needs and this may lead to increased participation.

Table 2: **Year herd recording commenced**

	%
Before 1980	38
Between 1980 and 1989	47
1990 onwards	15

Source: ABARE, Australian Dairy Industry Survey

Farm Characteristics

Herd Composition

- *Friesians account for nearly 75 per cent of the herd of producers who use artificial insemination for herd improvement.*

- *Producers not using artificial insemination have approximately equal numbers of Jerseys and Friesians, which together account for over 80 per cent of their herd.*

There is a clear difference in the composition of the dairy herd of producers who use artificial insemination compared with those producers who do not (table 3). The values presented in the tables are the means or average values for each group in the samples for the survey years 1991-92, 1993-94 and 1994-95. Information regarding the reliability of the estimates is also included in each table. The figures in parentheses are termed 'relative standard errors' (the standard error of the estimated mean divided by the

mean). In general, the smaller the relative standard error, the more reliable the estimate.

Due to the sampling error associated with the estimated means, a statistical test is required to determine whether or not the differences between two sample means is true for the populations as a whole. Comparisons between groups were carried out using a z-text (see Appendix A for a discussion of the statistical tests and the meaning of statistical significance). The results for all the tests are presented in Appendix B.

For group 1 and 2 farms, nearly 75 per cent of the dairy herd on each property consists of Friesians, with a further 11 to 14 per cent being Jersey cows (table 3). This contrasts strongly with group 3 farms, where only approximately 44 per cent of the herd is Friesians and a further 40 per cent consists of Jersey cows.

Herd composition for group 3 farms is significantly different from both group 1 and group 2 farms. These differences have important implications for this study. Since Friesian cows produce higher volumes of milk than Jerseys, it is not possible to draw any conclusions regarding the performance of herd recording (group 1) farms compared to farmers who do not use AI practices in relation to improved production responses (group 3 farms). Such comparisons can only be made between group 1 and group 2 farms.

In addition, the previously discussed differences in the geographic distribution of group 3 farms compared to groups 1 and 2 further hinders drawing sound inferences from any comparisons with group 3 farms. However, group 1 and group 2 farms are similar both in geographic distribution and in the composition of the dairy herd.

Table 3: Herd Composition

	Units	1991-92	1993-94	1994-95
Friesians				
Group 1	%	na	74 (6) #	74 (7) #
Group 2	%	na	73 (13) #	73 (12) #
Group 3	%	na	44 (26)	43 (25)
State average	%	na	70 (6)	71 (6)
Jerseys				
Group 1	%	na	11 (26) #	14 (28) #
Group 2	%	na	11 (78) #	14 (39) #
Group 3	%	na	38 (37)	41 (23)
State average	%	na	15 (22)	17 (19)
Crossbreeds				
Group 1	%	na	13 (26)	11 (28)
Group 2	%	na	14 (39)	12 (42)
Group 3	%	na	13 (51)	9(145)
State average	%	na	13 (20)	11 (25)
Others				
Group 1	%	na	2 (65)	1 (95)
Group 2	%	na	2 (95)	1 (97)
Group 3	%	na	2(118)	1(100)
State average	%	na	2 (60)	1 (89)

na: Not available, Others includes Ayrshires, Shorthorns and Guernseys

Significantly different from group 3 at the 5 per cent level

Figures in parentheses are relative standard errors

Farm Size

In terms of farm size (table 4), there were no significant differences between any of the groups for either area used by the milking herd or total farm area.

Table 4: **Farm size measures**

	Units	1991-92	1993-94	1994-95
Herd size				
Group 1	No. of Cows	143 (4)	143 (4) #	146 (4)
Group 2	No. of Cows	150 (9)	152 (6) #	134 (5)
Group 3	No. of Cows	86 (54)	99 (10)	126 (13)
State average	No. of Cows	130 (9)	137 (13)	141 (3)
Area used by milking herd				
Group 1	Ha	94 (6)	83 (6)	86 (8)
Group 2	Ha	107 (25)	102 (15)	90 (11)
Group 3	Ha	65 (54)	90 (13)	85 (23)
State average	Ha	89 (12)	88 (5)	87 (6)
Total operated farm area				
Group 1	Ha	150 (6)	151 (7)	151 (9)
Group 2	Ha	140 (20)	166 (9)	148 (11)
Group 3	Ha	115 (74)	134 (12)	152 (21)
State average	Ha	140 (16)	151 (5)	150 (7)

Significantly different from group 3 at the 5 per cent level
Figures in parentheses are relative standard errors

The number of cows per farm were only significantly different in 1993-94 when group 3 herd sizes were considerably smaller than either group 1 or group 2 farms.

Other sources of farm income

As a share of total cash receipts, milk receipts account for approximately 88 per cent, 86 per cent and 83 per cent for group 1 farms, group 2 farms and group 3 farms respectively. Other sources of cash receipts can include

income from the sale of dairy and beef cattle as well as income from cropping activities (table 5).

Sales from dairy cattle accounted for the largest share of other receipts, averaging around 8 per cent across all three groups. Beef cattle accounted for a further 4 per cent on average. Crops generally contributed less than 5 per cent of total cash receipts across the three groups, except in 1994-95 when crop receipts for group 3 farms accounted for 7 per cent.

Table 5: Farm receipts other than milk

	Units	1991-92	1993-94	1994-95
Dairy cattle receipts				
Group 1	$	14 102 (13)	14 344 (10)	15 761 (15)
Group 2	$	11 816 (27)	11 615 (10)	11 221 (12)
Group 3	$	9 295 (28)	10 693 (17)	12 133 (21)
State average	$	12 472 (11)	13 153 (7)	14 207 (11)
Beef cattle receipts				
Group 1	$	4 512 (25)	8 565 (22)	7 155 (27)
Group 2	$	7 926 (62)	8 774 (57)	10 943 (40)
Group 3	$	9 032(136)	5 019 (58)	3 818 (73)
State average	$	6277 (52)	7 967 (20)	7 745 (22)
Crop receipts				
Group 1	$	498 (47)	611 (43)	276 (45)
Group 2	$	7 285 (86)	1 093(105)	378 (93)
Group 3	$	159(104)	2 284 (75)	9 697(136)
State average	$	1 662 (70)	1 007 (41)	1 349(109)
Total cash receipts				
Group 1	$	170 563 (5)	199 904 (4) #	192 769 (6) **
Group 2	$	168 301 (14)	178 263 (8) #	164 891 (7)
Group 3	$	97 906 (46)	114 261 (13)	146 363 (11)
State average	$	151 878 (9)	180 226 (3)	180 548 (5)

** Significantly different from both groups 2 and 3 at the 5 per cent level

Significantly different from group 3 at the 5 per cent level

Figures in parentheses are relative standard errors

Other management factors

It can be argued that farmers who manage milking herds through herd recording may also make different use of other management practices. Some other areas of herd management which may influence milk production include the use of concentrates and whether pasture is being assessed for quantity and quality of feed.

The estimated proportion of farmers who fed concentrates or grain to boost milk production 1991-92 was higher for group 1 farms than for either group 2 or group 3 farms. In 1993-94, the estimated proportions were similar for groups 1 and 2 farms, but much lower for group 3 farms (table 6). In that year, only a little over a quarter of group 3 farmers fed concentrates or grain to their dairy cows. This management technique could have been a factor in the performance of group 1 and group 2 farms with respect to milk production in 1993-94.

Table 6 also presents the proportions of farmers who assess their pasture for quantity and quality of feed. Marked increases can be seen in all groups for this attribute.

Table 6: Feed management

	Farmers using concentrates or grain		Farmers assessing pasture for quantity and quality	
	1991-92	**1993-94**	**1991-92**	**1993-94**
	%	%	%	%
Group 1	81	94	20	82
Group 2	68	80	5	75
Group 3	67	27	0	67
State average	75	84	13	79

Physical performance

In order to consider the impact of the practice of herd recording, the following physical performance measures have been calculated for the state level and for each group:

- litres of milk and kilograms of butterfat and protein produced;
- the protein and butterfat content of milk.

Quantity of milk produced

- *Farms that use herd recording have higher annual average milk production per cow than non-herd recording farms.*
- *There is less variability in average milk production per cow among herd recorders than among either of the other two groups.*

The estimates of milk production and milk production per cow in group 1 are higher than for either of the other two groups. In all three survey years, the difference is statistically significant for group 1 farms compared to group 3 farms (table 7). Only in 1994-95 did total milk production for group 1 farms significantly exceed both group 2 and group 3 farms.

Table 7: Milk production performance

	Units	1991-92		1993-94		1994-95	
Total milk production							
Group 1	L	581 063	(5) #	648 300	(4) #	644 440	(7) **
Group 2	L	566 012	(12)	582 136	(8) #	504 510	(7)
Group 3	L	286 581	(44)	329 835	(18)	436 883	(19)
State average	L	505 402	(8)	575 738	(4)	583 467	(6)
Milk produced per cow							
Group 1	L	4 067	(2)	4 533	(2) **	4 417	(4) **
Group 2	L	3 781	(7)	3 832	(7)	3 778	(5)
Group 3	L	3 315	(15)	3 333	(9)	3 458	(13)
State average	L	3 823	(4)	4 212	(2)	4 153	(3)

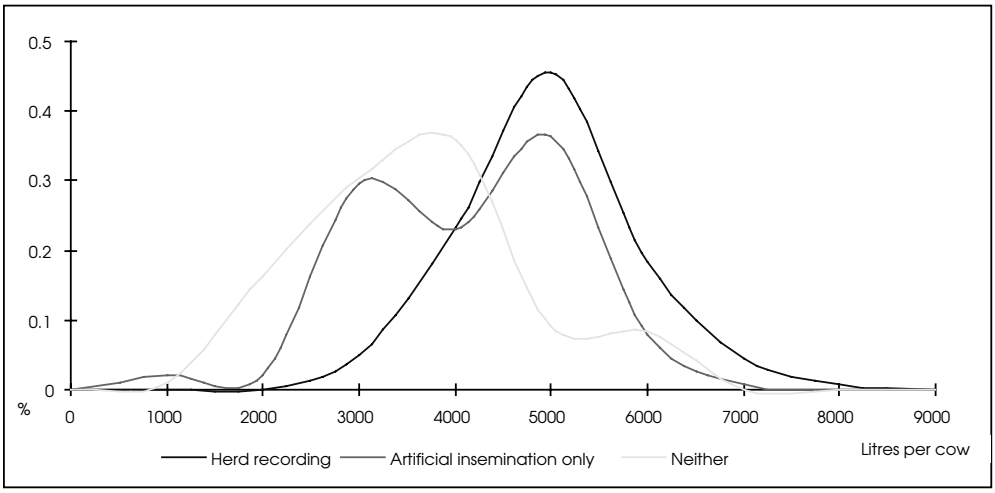
** Significantly different from both groups 2 and 3 at the 5 per cent level
# Significantly different from group 3 at the 5 per cent level
Figures in parentheses are relative standard errors

A second factor also emerges when considering milk yield — the variability in average milk produced per cow is lower for herd recording farms than it is for farms that don't herd record.

Although there is no accurate method of statistically testing for differences in the population variances, some inferences can be drawn from the distribution of the estimated population (figure 3). Each line represents the estimated dispersion of milk yield across the population for each of the groups. The "narrower" the distribution, the lower the variability associated with that distribution.

The bi-modal distribution of group 2 farms suggests that in 1993-94, some 60 per cent of group 2 farms had significantly lower milk yields than group 1 farms. Conversely, around 40 per cent of group 2 farms were able to obtain yields similar to group 1 farms without the use of herd recording.

Figure 3: **Estimated distribution of milk yields in 1993-94**



Milk quality

- *Farms that use herd recording produce more protein and butterfat per cow.*

As farmers receive a compositional payment for milk produced for the manufacturing sector (91 per cent of Victorian milk was allocated to this sector in 1994–95) based on butterfat and protein content, milk quality is a major factor in a farmers' milk returns.

There was little difference between groups 1 and 2 in the estimated average butterfat and protein content of milk. Hence differences in the production of butterfat and protein per cow reflected differences in milk yields, with production for group 1 farms being significantly higher than the group 2 farms in 1993-94 and 1994-95 (table 8).

Table 8: **Milk quality performance**

	Units	1991-92	1993-94	1994-95
Butterfat content of milk				
Group 1	%	4.43 (1)	4.31 (1) #	4.22 (1) #
Group 2	%	4.35 (2)	4.33 (2) #	4.23 (2) #
Group 3	%	4.35 (5)	4.56 (4)	4.50 (5)
State average	%	4.40 (1)	4.34 (1)	4.24 (1)
Protein content of milk				
Group 1	%	3.31 (1)	3.29 (0) #	3.24 (1) #
Group 2	%	3.34 (1)	3.27 (1) #	3.25 (1) #
Group 3	%	3.49 (8)	3.41 (2)	3.43 (2)
State average	%	3.35 (1)	3.30 (0)	3.26 (1)
Butterfat production per cow				
Group 1	kg	180 (2)	195 (2) **	186 (3) **
Group 2	kg	165 (7)	166 (7)	160 (5)
Group 3	kg	144 (18)	152 (7)	156 (9)
State average	kg	173 (8)	184 (2)	173 (8)
Protein production per cow				
Group 1	kg	135 (2)	149 (2) **	143 (4) **
Group 2	kg	126 (7)	126 (7)	123 (4)
Group 3	kg	116 (20)	114 (8)	118 (11)
State average	kg	132 (5)	140 (2)	133 (8)

** Significantly different from both groups 2 and 3 at the 5 per cent level

Significantly different from group 3 at the 5 per cent level

Figures in parentheses are relative standard errors

Financial performance

The following financial performance measures have been calculated for the state level and for each group:

- the average price per litre received;
- milk receipts per cow;
- production costs;
- farm business profit per cow.

Milk receipts

- *Herd recording farms have higher milk receipts per cow than the other two groups. In addition, there is less variability among herd recording farms in their receipts per cow than is the case for non-herd recorders.*

- *There is no difference in the average price per litre received by farms that herd record and farms that use AI practises only. However, the higher proportion of Jersey cows in group 3 resulted in higher prices received by this group.*

The average price per litre received by farmers in groups 1 and 2 was similar in each of the 3 years (table 9). Group 3 farms received significantly higher prices in 1993-94 and 1994-95, reflecting the higher protein and butterfat content of milk achieved by the farms in this group.

The higher milk yields of group 1 farms translates into milk receipts per cow for group 1 farms being significantly higher than for farms in either group 2 or group 3.

Although group 3 farms receive a significantly higher price per litre of milk than group 2 farms, the higher yields from group 2 more than compensate for the lower price, resulting in group 2 receipts per cow exceeding group 3 milk receipts per cow.

Table 9: **Milk receipts performance**

	Units	1991-92	1993-94	1994-95
¢ per litre				
Group 1	$	24.9 (1)	26.3 (1) #	25.5 (1) #
Group 2	$	24.6 (3)	26.3 (2) #	25.7 (2) #
Group 3	$	24.8 (2)	27.8 (3)	26.9 (3)
State average	$	24.8 (1)	26.4 (1)	25.6 (1)
Milk receipts per cow				
Group 1	$	1 012 (4)	1 195 (2) **	1 130 (4) **
Group 2	$	933 (6)	1 009 (7)	969 (5)
Group 3	$	872 (24)	926 (9)	929 (9)
State average	$	975 (5)	1 119 (2)	1 071 (3)
Total milk receipts				
Group 1	$	144 710 (6) #	170 060 (4) #	164 463 (7) **
Group 2	$	138 894 (21)	152 850 (14) #	129 464 (8)
Group 3	$	76 834 (50)	91 633 (17)	117 407 (8)
State average	$	129 200 (9)	152 444 (4)	150 266 (5)

** Significantly different from both groups 2 and 3 at the 5 per cent level
# Significantly different from group 3 at the 5 per cent level
Figures in parentheses are relative standard errors

Significantly higher receipts per cow do not necessarily translate into significantly higher milk receipts per farm due to the influence of herd size. Although farm size has been shown to not be a significant factor by itself, the combination of herd size with receipts per cow combines to leave group 1 farms having a significantly higher total level of receipts than group 2 farms only in 1994-95. In 1993-94, both group 1 and group 2 farms had significantly higher levels of total milk receipts than group 3 farms, but not between each other.

Production costs

- *Farms that herd record spend significantly more on fodder per cow than other farms.*

- *Herd recording service costs are approximately $9 per cow.*

Herd recording provides dairy producers with information on the efficacy of feed regimes. As such, it is likely that feed costs per cow for group 1 farms will be different from the other groups. Table 10 bears out this supposition with fodder costs for group 1 exceeding both the other groups in 1993-94 and 1994-95. In 1991-92, although group 1 farms spent significantly more on feed than group 2 farms, the much larger variability in the estimates of fodder costs of group 3 farms in that year means that no firm conclusion could be drawn on differences between group 1 and group 3 farms in that year.

The ADIS survey does not collect information on the quantity of feed consumed on each farm. However under the assumption that each farm faces similar prices for feed, the difference in feed costs can be translated directly into differences in feed quantities within a given year. It is not possible to make comparisons across years since the price of fodder will fluctuate with changes in the supply and demand conditions for fodder.

From the information in table 10, it can be inferred that in 1991-92 and 1992-93, group 1 farms were fed more than 50 per cent more fodder than group 2 farms, and nearly twice as much in the drought affected 1994-95.

Table 10: **Farm Costs**

	Units	1991-92	1993-94	1994-95
Fodder costs per cow				
Group 1	$	109 (14) *	151 (6) **	205 (10) **
Group 2	$	71 (22)	100 (16) #	112 (20)
Group 3	$	77 (50)	40 (39)	104 (40)
State average	$	96 (8)	125 (6)	173 (7)
Other materials costs per cow				
Group 1	$	247 (5)	306 (4) *	284 (6) #
Group 2	$	251 (13)	244 (7)	272 (9)
Group 3	$	272 (21)	265 (10)	205 (19)
State average	$	253 (5)	287 (3)	273 (5)
Herd test/AI/stud costs per cow				
Group 1	$	21 (10) **	21 (9) **	20 (12) #
Group 2	$	12 (29) #	12 (15) #	14 (22) #
Group 3	$	1(158)	0(133)	0(142)
State average	$	16 (13)	16 (8)	16 (11)
Total operating costs per cow				
Group 1	$	929 (4) **	1 109 (2) **	1 138 (12) #
Group 2	$	952 (8) #	922 (3) #	1 024 (7) #
Group 3	$	975 (11)	934 (8)	930 (10)
State average	$	942 (3)	1 046 (2)	1 090 (3)

* Significantly different from group 2 at the 5 per cent level

** Significantly different from both groups 2 and 3 at the 5 per cent level

Significantly different from group 3 at the 5 per cent level

Figures in parentheses are relative standard errors

Consumption of other inputs such as dairy supplies are included together in other materials costs. Except in 1991-92, these costs per cow for group 1 farms exceeded that for group 2 farms, and the difference in 1993-94 was significant.

The costs of herd recording tests, AI services and stud costs are only included in a single data item in the survey. This item does not include the labour costs of the producer or the producer's family. However, under the assumption that AI costs per cow do not differ between groups 1 and 2, the

direct costs associated with herd recording activities are estimated to be $9 per cow in 1991-92 and 1992-93. Although the cost of herd recording appeared to fall in 1994-95, the lack of any significant difference for this data item in 1994-95 between group 1 and group 2 farms does not permit a firm conclusion concerning the cost of herd recording in 1994-95.

Farm cash surplus

- *After deducting operating costs from revenue from farm activities, herd recording farms had a higher level of farm cash surplus than the other two groups except in the drought year of 1994-95.*

Farm cash surplus is the difference between total cash receipts and total cash costs, excluding interest costs and changes in the level of trading stocks. Interest costs are excluded so that the debt and ownership structure of farms do not influence results concerning measurement of the financial performance of farms.

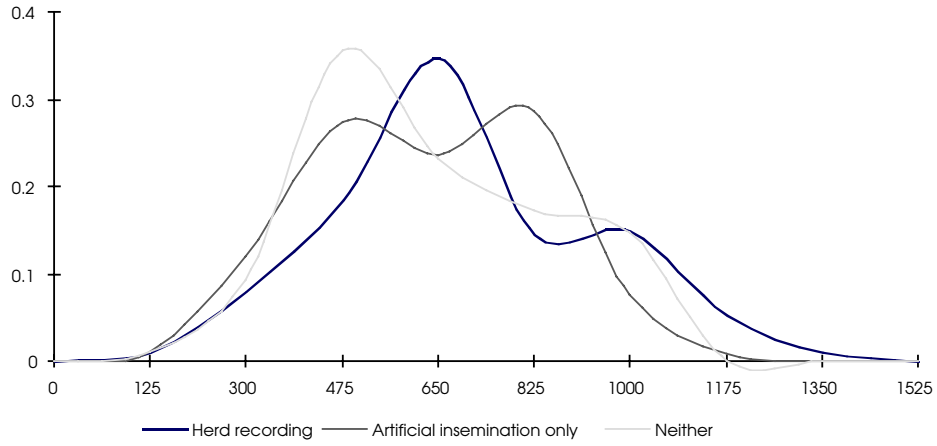
Table 11**: Farm cash surplus per cow**

	Units	1991-92	1993-94	1994-95
Farm cash surplus				
Group 1	$	591 (5)	618 (4)	469 (6)
Group 2	$	495 (12)	588 (6)	517 (10)
Group 3	$	503 (13)	529 (16)	548 (11)
State average	$	556 (4)	600 (3)	488 (5)

Except in the drought year of 1994-95, the farm cash surplus per cow of group 1 farms exceeds that of group 2 and 3 farms and of group 3 farms. There is no clear ranking between farms in groups 2 and 3. However the lack of any statistical significance in the rankings does not allow any firm conclusions to be drawn regarding the rankings.

Although there only limited differences in the average level of farm cash surplus between group 1 and group 2 farms, the variability of the surplus was generally lower for group 1 farms (figure 4). From figure 4, it can be seen that there are two separate groups of farmers within group 2 farms. Approximately 50 per cent of group 2 farms in 1993-94 had a lower farm cash income than group 1 farms. Conversely, some 50 per cent of group 2 farms performed at least as well as group 1 farm in 1993-94.

Figure 4: **Estimated sample distribution of Farm cash surplus**



The increase in performance of milk yield and milk receipts for herd recording farms against group 2 farms does not translate into higher total levels of farm cash surplus when compared to producers who use AI management practices only. That is, the additional expenditure on inputs, particularly fodder costs, erodes the additional income arising from the increased in yields of group 1 farms.

Profit at full equity

- *Herd recording farms generally have a higher level of profit per cow than farms that don't herd record.*

Operating surplus represents the cash available to the farmer after accounting for operating costs. It is not a true measure of the economic value of dairy operation since it excludes depreciation and the imputed value of operator and family labour. Accounting for these items gives an economic measure defined as Farm Business Profit at full equity (since interest payments are excluded).

The differences between groups in the imputed value of both family labour and changes in trading stocks were major contributors to the variations in farm business profit between the groups in each of the years.

Table 12: Farm business profit at full equity per cow

	Units	1991-92	1993-94	1994-95
Farm business profit				
Group 1	$	207 (14) #	252 (11) #	62 (56)
Group 2	$	152 (36)	230 (18)	81 (70)
Group 3	$	-44(275)	59(179)	166 (48)
State average	$	154 (19)	222 (11)	77 (36)

Significantly different from group 3 at the 5 per cent level
Figures in parentheses are relative standard errors

Except in the drought year of 1994-95, the profit per cow of group 1 farms exceeded that of group 2 farms and group 2 farms exceeded that of group 3 farms. However, the variability of profit across the three groups means that no firm conclusions can be drawn except that group 1 farms were definitely more profitable than group 3 farms in 1991-92 and 1993-94.

4. Herd recording's contribution to financial performance

The composition of dairy cows in the herd on farms that use AI practices is different from farms which don't use AI. For farms that use AI, a little over 10 per cent of their herd are of Jersey cows with nearly 75 per cent of the herd being Friesians. For farms that do not use AI practices, approximately 40 per cent of the dairy herd are Jersey cows, and a further 40 per cent are Friesians.

Due to the higher yield associated with Friesians compared to Jersey cows, no strong conclusions can be drawn from farm level data between farms that use herd recording or AI practices and farms that don't. As a result, farms that don't use AI practices are ignored in this chapter.

From the results of chapter 3, farms that use herd recording have significantly higher yields than farms that use AI practices only. Since there is virtually no difference in the average price received per litre between these farms, the higher yields translate directly into higher milk receipts per cow for farms that herd record. Since these results were statistically significant, it can be clearly stated that farms that herd record have definite advantages in the production of milk.

Another factor that also separated herd recording farms from those that don't was the significantly higher level of fodder fed to the dairy herd. In 1993-94, fodder used per cow was nearly 50 per cent higher than that for farms that used only AI practices in herd improvement. It is not clear whether farms that use a high level of feed inputs use herd recording to manage these costs, or whether herd recording itself leads to a higher level of feed inputs.

Nonetheless, despite the higher level of costs by farms that herd record, the farm business profit per cow was higher for herd recording farms in the sample for both 1991-92 and 1993-94. In the drought year of 1994-95, profit per cow for herd recorders was less than that of those who did not herd record.

Assuming that the increased use of grain is directly attributable to herd recording, the net value of herd recording can be estimated by taking the difference in farm business profit between groups 1 and 2 (table 13). In 1993-94, it is estimated that the value of using herd recording to an individual farmer was $23 per cow. Taking account of all farms that used herd recording in Victoria, it is estimated that herd recording contributed $16.3 million dollars to the Australian economy in 1993-94. While the gains were even bigger in 1991-92, the high level of fodder expenditure in the 1994-95 drought resulted in farmers that use herd recording being worse off. However, on average, over the three survey years, it is estimated that herd recording in Victoria contributed $12.2 million per year to the economy.

Table 13: The value of herd recording 1

Units	1991-92	1993-94	1994-95
$/cow	55	23	-19
$m	33.7	16.3	-13.3

1: Calculated as the difference between farm business profit at full equity per cow of group 1 and group 2 farms.

Appendix A: Statistical significance

The method of hypothesis–testing used in this analysis for comparing sample means for differences is a z-test, which involves checking whether the reported means (or average values) are statistically different in the population.

In using a z-test to compare two sample means, it is assumed that each sample is normally distributed, that the samples are independent and that the combined sample sizes are sufficient for the law of large numbers to hold.

The test statistic z is computed using the following equation:

$$z = \frac{\overline{X_1} - \overline{X_2}}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

Under the *a priori* assumption that group 1 farms outperformed group 2 farms, a one-tailed test was used to establish whether the estimated differences between the groups were statistically significant. For differences in farm characteristics, where there was no *a priori* assumption regarding direction of the variables, a two tailed test was used.

The hypotheses are stated as:

H_o: $\mu_1=\mu_2$	and	H_o: $\mu_1=\mu_2$
H_a: $\mu_1>\mu_2$		H_a: $\mu_1 \bullet \mu_2$

for farm performance and farm characteristics respectively, where μ_1 is the average value for the first group in the comparison and μ_2 is the average value in the second group.

The level of significance chosen in this analysis is the 0.05 level — a 95 per cent confidence interval. Using the 0.05 level of significance, the critical value is 1.645 for a one-tailed test and 1.96 for a two tailed test. The hypothesis that the two groups were equal was rejected where the absolute value of z-statistic was greater than the critical value.

Appendix B: Statistical test results

Table A1: **Z statistics**

	1994-95			1993-94			1991-92		
	1 vs 2	**1 vs 3**	**2 vs 3**	**1 vs 2**	**1 vs 3**	**2 vs 3**	**1 vs 2**	**1 vs 3**	**2 vs 3**
Scale									
Mean no. of cows	1.300	1.127	0.415	–0.741	**3.796**	**3.652**	–0.451	1.186	1.287
Area used by milking herd	–0.327	0.037	0.220	–1.136	–0.542	0.593	–0.449	–0.825	0.946
Total farm area	0.105	–0.040	–0.102	–0.764	–0.832	1.362	–0.350	0.411	0.273
Area per cow	–1.147	–0.910	0.000	–1.169	**–1.822**	–1.116	0.000	–0.523	–0.430
Financial performance									
Total milk receipts	**2.580**	**2.220**	0.629	1.234	**4.416**	**2.889**	0.386	**2.341**	**1.869**
Dairy cattle receipts	**1.982**	1.151	–0.269	1.487	1.583	0.420	0.629	1.503	0.618
Beef receipts	–0.822	1.425	1.036	–0.039	1.023	0.650	–0.681	–0.367	–0.084
Crops receipts	–0.223	–0.714	–0.707	–0.409	–0.970	–0.580	–1.086	1.184	1.141
Total cash receipts	**1.675**	**1.837**	0.723	1.339	**5.109**	**3.100**	0.089	1.596	1.386
Total cash costs	1.545	**1.759**	0.671	**2.068**	**4.979**	**3.393**	–0.470	1.088	**1.221**
AI/stud/herd test costs	1.394	**7.388**	**3.403**	**2.074**	**10.175**	**5.925**	**2.025**	**3.114**	**8.678**
Total materials expenditure	**2.795**	**3.162**	1.244	**2.619**	**5.681**	**3.356**	0.306	**1.751**	1.353
Farm cash income	0.538	1.152	0.389	0.182	**2.411**	1.492	1.098	**4.043**	1.191
Farm business profit	0.819	–0.765	–1.299	1.080	**2.626**	1.541	1.058	**3.520**	0.890
Costs/receipts ratio	**2.093**	**2.481**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Buildup in trading stocks	0.439	–1.008	–1.151	0.732	**2.110**	1.105	0.864	**2.281**	0.415
Depreciation	–2.734	0.601	–0.549	–1.231	0.879	1.601	0.609	0.597	0.294
Labour	1.392	0.792	**1.832**	–0.140	0.560	0.473	0.250	0.742	0.416
Physical performance									
Milk production	**2.554**	**2.280**	0.767	1.190	**4.946**	**3.368**	0.199	**1.940**	**2.285**
Butterfat production	**2.719**	**2.217**	0.512	1.150	**4.964**	**3.218**	0.332	**2.571**	**2.056**
Protein production	**2.619**	**2.086**	0.527	1.235	**4.838**	**3.190**	0.141	**2.156**	**1.854**
Milk per cow	**2.615**	**2.026**	0.671	**2.407**	**3.704**	1.216	0.999	1.447	0.809
Butterfat per cow	**2.801**	**2.030**	0.258	**2.481**	**3.818**	0.883	1.327	1.388	0.724
Protein per cow	**2.762**	**1.736**	0.313	**2.534**	**3.642**	0.940	0.892	0.810	0.420
Milk receipts per cow	**2.538**	**1.934**	0.450	**2.503**	**3.011**	0.683	1.369	1.430	0.645
Butterfat content	0.000	–1.386	–1.327	0.000	–1.642	–1.549	0.000	0.000	0.000
Protein content	**–2.128**	**–3.118**	–1.338	0.000	**–1.687**	–1.502	0.000	–0.686	–0.682

Bolded zstat is significant at 0.05 level (i.e. zstat<–1.645 or zstat>1.645)

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