University of Reading
Department of Agriculture and Horticulture

THE MELBREAD DAIRY HERD HEALTH RECORDING SCHEME

A report on the Economic, Reproductive and Husbandry Changes in 22 Herds over three seasons

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A report on the Economic, Reproductive and Husbandry Changes in 22 Herds over three seasons

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The work described is of a co-operative nature, involving many practitioners, farmers and their staff in keeping information flowing. We gratefully acknowledge their help and also pay tribute to the work of Miss Rachel Miller and Mrs Ann Gibbs who are responsible for all the processing of the data at Reading.

Initial work on the development of the Melbread Scheme was financed by the Milk Marketing Board. It expansion and current use as a basis for epidemiological research was made possible; and will continue for a further period, with support from the Agricultural Research Council.

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1 INTRODUCTION

Many organisations are using computers to process records from dairy herds in widely differing ways. The objectives of each recording scheme are usually limited. Some like the British Milk Marketing Board's Monthly Recording by Statement, are designed to monitor the yields of cows. Others, usually sponsored by Artificial Insemination Organisations, provide evidence of the efficiency of bulls and inseminators. Feed recording schemes and systems for assessing physical and financial productivity are also firmly established.

To a more limited extent, health and fertility records are now being computer processed, sometimes on their own and occasionally in conjunction with productivity data. Interest is mounting for a variety of reasons. The greatly increased size achieved by many herds over the past two decades has made it more difficult for staff to keep track of events and treatments to individual cows. Over the same period, economic pressures have reduced the hours of labour supplied per cow by 50% (Smith, 1969). This has been compensated to some extent by technological developments in the design of parlours and other mechanical aids but further complicated by trends towards a shorter working week and more leisure time allowed for the staff that operate them.

In the face of these difficulties highest priority has been placed on improvement of the rate and efficiency of milking and too little attention has been given to the essential art of stockmanship required for the remaining components of effective dairy cow management. Many important herd management 'inputs' can no longer be fitted into the very limited time available for each cow. It has, therefore, become essential to be able to select the cows which need the extra attention and to determine times when it is most needed. Under current conditions mechanical recording schemes may be the only means open to management of the larger dairy herd for monitoring the state of health and fertility and fulfilling these needs.

While a number of conditions like mastitis and lameness can be seen and dealt with, reproductive failure has more insidious repercussions. Almost all herds fail to achieve optimum reproductive rates and they need assistance in adjusting their reproductive pattern so that peak milk flow is achieved at times when it is most profitable as well as in attempting to maximise annual milk flow on a herd and cow basis. More calves should then be available as replacements or for sale and more selective culling can be practised.

The two most important features of a fertility control scheme are high quality individual cow records and routine pregnancy diagnosis for all cows. The latter technique can be provided by the veterinarian, but the former is inevitably the one which always depends mainly on the initiative and efficiency of the farmer.

Most of the recording schemes in use around the world have been set up by a central agency. In the USA many schemes exist. Among the most sophisticated are those at Cornell University (Ainslie, Everitt, Wadell, 1972) and those of the Dairy Herd Improvement Association Computing Laboratory, Utah (Anon, 1971). Such schemes have been adapted for use in Mexico and countries in South America (Ulberg, 1968). In Australia, Morris (1970) and his colleagues at Melbourne University are continuously developing State Health and Productivity Recording Schemes designed to help the veterinary practitioner and the extension officer as much as the farmer. In New Zealand developments are underway (Moller, 1973) for the introduction of a farm recording scheme designed for their particular needs. The same applies to programming underway in Canada (Meek, 1973) and Holland (de Kruif, 1973). Perhaps the greatest advances have been made in Scandinavia where, because of their unique Farmer Co-operatives, the collation of input, output and health data can be combined into one recording scheme for physical and financial data (Swennsen, 1974; Jeppersen, 1974). Specific fertility schemes are known to exist in Sweden (Roos, 1972) and Israel (where the records are kept and collected by the inseminator) (Bar Anan, 1973) and in the United States (Britt and Ulberg, 1970).

Interest, so far, in the UK has been research based. Fertility recording schemes have been developed for 20 to 50 herds around each of three Universities. At Glasgow the scheme allows detailed examination of the factors affecting anoestrus (Boyd, 1973; Tolley, 1974) while at Aberdeen (MacDonald, 1973) attempts are being made to develop a programme to establish the relationship between such factors as feeding levels, blood metabolism and fertility. At Reading (Esslemont, 1973; Eddy and Esslemont, 1974; Ellis, 1974) the Melbourne programme has been adapted and expanded for use on 49 herds as will be described later.

Many of these schemes allow copies of a computer report to be made available not only to the farmer but also the herdsmen, the local advisory officer and the veterinarian. The information collected by these schemes also can be used by geneticists and those interested in the economic analyses of animal health improvements.

The U.S. schemes favour a single index of a herd's fertility management. In their case it is the Herd Reproductive Status (HRS) which allows the inclusion of cows not yet pregnant (i.e. are 'open'):

$$HRS = 100 - \frac{\text{(Total days open for problem cows)}}{\text{(Total number of cows in the herd)}} \times 1.75$$

Problem cows in their case are those which are 'open' for more than 100 days postpartum (Johnson, 1965). This index takes into account cows culled from the herd after inefficient or inadequate attempts to get them into calf. When using the calving to conception interval as an index such cows are excluded, which makes the interval lower. In the UK it is this interval or its equivalent, the calving interval (which is the interval between successive calvings in a herd) which needs changing to a more comprehensive index.

Some of the more sophisticated schemes allow the farmer to select only the parts of the reporting service that are of interest to him. Tear-off sections containing lists of relevant cows are supplied for the herdsman. In some cases the computer even prints cow numbers in 2" lettering so that the lists can be conveniently read from a distance (e.g. in the parlour).

2 DEVELOPMENT OF THE MELBREAD SCHEME

Introduction

For the past two years the Department of Agriculture at Reading University has been developing the 'Melbread' computerised recording scheme and is now using it on 49 dairy herds mainly in Southern England. R.J. Esslemont, a farm management specialist, who joined the animal health team from 1973 to 1975, has been mainly responsible for this work. The scheme had been devised by Dr. R.S. Morris of Melbourne University for farms served by its veterinary clinic and was brought to Britain when he came for study leave at Reading in 1972. Up to now, the main emphasis has been placed on its use in fertility control but much wider applications have become obvious as the scheme has developed.

The aims and characteristics of the scheme

Preventive medicine in dairy herd management relies on a rapid feedback of information to the veterinary surgeon. Further advice is only as good as the information on which it is based. The fundamental requirements of such an information system are that it should be:-

a Accurate:

Dairy herd records are only satisfactory when each cow has a separate card. Accuracy is dependent on regular entry with monthly scrutiny by the veterinarian.

b Current:

To ensure that the information is current there must be rapid assimilation and processing of the records on a monthly basis, with summaries and indices calculated to allow discussion of tactics by the veterinarian and the farmer within five days of the last recorded event.

c Comprehensive:

Because there are many factors influencing levels of production, the records must include a wide range of information. For example, indices should be calculated for all the cows in the herd and not only those conceiving.

d Highly Efficient:

Calculations made 'by hand' can be inaccurate but are also time-consuming. A relatively cheap and rapid mechanical system is, therefore, needed. Analysis of this type of information is suitable for computer processing by a central agency and, with adequate organisation, results can be returned to the user in a matter of days.

Data Collection and Processing

The computer based programme developed by Morris in Melbourne and adapted as the Melbread Scheme at Reading is an attempt to meet these requirements.

The starting point is a simple system of on-farm recording. Each cow is allocated an individual card (see Fig. 1a) on one side of which is a lifetime summary of the cow and on the reverse is listed every event involving the cow in chronological order. Where appropriate the information is recorded by the herdsman and he needs to spend about ten minutes at the same time each day doing this. Veterinary attention is written in by the veterinarian at the time of his visit, when other records can also be inspected.

In addition to the usual on-farm cow identification each cow is allocated a unique i-cow three-digit number for identification by the computer.

At an agreed time all the events of the month are added to a transcription sheet (Fig. 1b.) in the form of a six digit date and a two digit code for the particular event. A list of codes appears as Appendix 1a. Each sheet can accommodate information on 12 cows and this is sent by post to Reading University where the data are transferred to punch cards added to the existing bank of information on the herd and processed by the computer. Unskilled staff rapidly become proficient at the transcription and coding process and farmers as well as veterinarians are able to use the computer printout. The scheme supplies the veterinarian and the farmer with a printed report containing detailed information on the fertility status of the herd each month. The veterinarian can, of course, add his written comments.

FIGURE 1a

HERD	COW 12 11 10 9 8 7 6 5 4 3 2 1 COW NAME:					
Lact	Ev	Date	Event	Details	Comments	Genital Tract

Individual cow record card — event list

	1 2 3 4 5 6 7 8 9 10 11 12
HERD:	COW NAME:
BREED	DESCRIPTION:
SIRE:	
DAM:	DAM'S RECORD:
REARING RECORD:	
DATE OF BIRTH:	

LACT No.	LACTATION						Number Dry Days	Calving Index	Milk lbs	BF	
	Calved	Conceived	D. Off	Serves	Days Open	Lact Length					

MASTITIS												
DATE												
EXAM												
LF												
LH												
RF												
RH												

Individual cow record card - lifetime summary

Transcription sheet

COW				COW				COW				COW				HERD NO		PAGE NO	
I. COW				I. COW				I. COW				I. COW				COW			
Lact No	Code	Date	Event	Lact No	Code	Date	Event	Lact No	Code	Date	Event	Lact No	Code	Date	Event	Lact No	Code	Date	Event

FIGURE 1b

The monthly report covers:-

1 Number of cows culled with reasons for disposal.

2 *a* Herd size; dry; pregnant and milking, not pregnant and milking — expressed as a percentage;
b Results of pregnancy diagnosis for the month, with the number of services per conception and the average calving/conception intervals calculated for these cows;
c Percentage of cows showing oestrus by 60 days postpartum;
d First-service conception rate for cows proved to be pregnant.

3 Productivity, including calving/conception interval, stage of pregnancy, and lactation length for cows dried-off during the month.

4 A list of all cows receiving examination of the reproductive tract during the month with the results of the examination and treatment.

5 A list of cows which calved during the previous month and the date on which these cows will be 45 days postpartum.

6 A list of cows which will be due for service during the following month and indicating any cows which have passed the time for service and need to be examined, because there have been no visible signs of oestrus.

When the annual breeding cycle is near completion a more comprehensive annual report is produced. It provides an analysis and summaries of events over the year.

The Annual Report Covers:-

1 The fertility of the herd; including calving to conception; services per conception; interoestral intervals.

2 Results of fertility treatments.

3 The mastitis status of the herd.

4 Incidence of certain diseases, including cases treated by the farmer as well as the veterinarian.

5 Reasons for culling.

The annual report is proving helpful both in planning the breeding programme for the ensuing year and in formulating preventive medical advice for the farmers while presenting them with a permanent record of the herd health status for the previous year. As reports have accumulated it has become increasingly obvious that they can throw new light on the causes of infertility and the epidemiology of other health problems and sub-optimal productivity. These broader implications of the scheme will be discussed in a later section.

Description of the Herds

The first herds to be recorded by the Melbread Scheme were introduced by a group of veterinary surgeons who attended a course in cattle health at the University of Reading in July 1972. They were ten in number and each provided data dating from July 1971. These herds continue to be visited monthly by a recorder from Reading. In October 1972 fifteen more herds were accepted into the scheme and have been posting records to Reading, on a monthly basis, ever since. These herds could not supply any historical data. In January, 1974 participation was increased to forty-nine herds and the extra twenty-four herds were only accepted on condition that they provided at least twelve months' historical reproductive data. Another condition was that they had to be taking part in one or other of the physical and financial recording schemes, such as Dairy Management Scheme (MMB), Dairymaid (ICI), Dairy Enterprise Plan (BOCM-Silcock).

Husbandry Practices

The 49 herds currently participating range in size from 40 to 340 cows with the predominant breed being Friesian. Their characteristics are summarised in Table 1.

Table 1

a Herd Size Distribution

Size (cows)	40-79	80-119	120-199	200-299	300-399	Total
No.	7	15	11	14	2	49

Average size 156; total 7655 cows.

b Herd distributed by breed:

37 Friesian
2 Ayrshire
2 Friesian X Guernsey
1 Guernsey and Jersey
5 Friesian X Ayrshire
1 Jersey

All the herds use Artificial Insemination (AI) but an entire bull is kept as well on 38 (78%) of the herds. The interva from calving to first possible service ranges from less than 40 days in one case to 80 days at th opposite extreme. This interval is extended in many herds by the adoption of a close season of two or three months when no services are carried out. This is commonly during the summer and means that some cows, such as early August calvers in an autumn calving herd, are not served until 90 days postpartum. Depending on the intensity of seasonal calving this effect can lead to the addition of eight to ten days to the mean calving to conception interval.

Kamar Heat Mount Detectors have become more popular and are now used on 32 of the herds (65%). Fifteen (30%) of the herds are not registered brucella-free.

For eleven of the herds the records are, in fact, kept by the practitioner. In other cases they are kept by the herdsman (14), herdsman's wife (1), herd's manager (5), secretary (6) and Melbread recorder (12). On three of the farms the herdsman does not see the printout of the monthly or annual reports.

A summary of the characteristics of the 22 herds from which information is used for this report is shown in Appendix 1b.

Each herd operator was asked to indicate the most convenient time of year for the annual analysis of data. For autumn calving herds the suggested year from June to May was generally preferred.

Measurement of Improvement in Fertility

The indices used to assess whether a herd has improved in fertility management over a 12 month season, have been extended to include:-

1 Number of cows calving;
2 Percentage of calved cows that are subsequently served;
3 Mean calving to first service interval in days;
4 Percentage of cows served that conceive eventually;
5 Mean calving to conception interval in days;
6 Serves per conception for cows that conceive;
7 Percentage of cows that conceive among those that calve (product of (2) and (4));
8 First service conception rate, percentage based on PD;
9 Overall conception rate to all services;
10 Percentage of cows that are sold or die after calving.

Where data have been or can be gathered in sufficient detail, can they be combined to give a true score of overall fertility and management in one index? Recently de Kruif (1975) has developed a herd fertility index (F.S.I) which takes account of first service conception rate, repeat services required and calving to conception interval

$$\text{F.S.I.} = \frac{\text{C.R. to 1st service}}{\text{Services/conception for cows conceiving}} - ((\text{Calving to conception interval}) - 125)$$

De Kruif considers that if a herd is normal, by Dutch standards, pregnancy rate after first insemination is 60, the number of inseminations per conception is 1.5 and the interval from calving to conception is 105 days. These give an F.S.I. for the herd of 60. If fertility management is less efficient, the F.S.I. will be lower. The F.S.I. normally ranges between 0 and 100. Only in extraordinary situations is it possible for the F.S.I to become negative or greater than 100.

De Kruif did not obtain satisfactory results with the American index of the Herd Reproductive Status (HRS) developed by Johnson (1965) and reviewed above. Wide discrepancies were noted between F.S.I and the HRS findings, probably because the latter is based on only one of the three criteria that determine fertility whereas F.S.I uses all three.

However, herds can still have high scores of the F.S.I even with high culling rates so the F.S.I has been modified for use with the Melbread herds to become;

$$F.S.I = \frac{\text{CR to 1st Service} - ((C_a \text{ to } C_o) - 125) - ((\text{Culling rate \%}) - 25)}{\text{Service/Conception}}$$

Key CR = Conception Rate
C_a to C_o = Calving to Conception

The extra component penalises those herds which cull more than 25% and improves the index of those that cull less than this proportion.

The acceptance of a standard for calving to conception intervals as high as 105 days is not satisfactory under UK conditions and 80 to 85 days is considered the general aim. In the light of these considerations F.S.I has been adopted as a key index in subsequent analyses.

Components of Infertility

Three main factors affect delays to conception:-

1 The detection of oestrus and consequent service at the appropriate time;

2 Herd breeding policy that may prescribe a period in which no services are carried out; and

3 The rate at which cows conceive at first and successive services.

Relationships between these and other factors have been discussed at length by Esslemont and Ellis (1974).

At present is is not possible to produce the ideal mean 365-day calving index (85 days calving-conception) in an autumn calving herd however efficient the detection of oestrus is, unless an average 60% conception rate is achieved. This must be coupled with an 80% detection rate and a (maximum) *mean* interval to first service of 65 days postpartum. Tables of the relationship between these indices have been produced to allow the selection of the most profitable strategy likely to improve calving to conception intervals (Table 2). Using this table and basic data from dairy herd records, the components of the problem can be identified and then placed and tackled in the correct order of importance.

The mean interval to first service is understood in this table to be already determined. This table thus shows the effect of detection rate and conception rate on the interval from first service to conception. The result is shown in terms of interval from calving to conception. For example a herd with a calving to first service of 70 days and a conception rate of 50% (on average, to all serves) and which has a calving to conception interval of 96 days can be assumed to have a detection rate of 80%. This table assumes all cows served originally are repeatedly served until they eventually conceive. This must not operate in practice as some cows (5% - 20%) are sold before they conceive. In practice many herds may appear to have higher rates of detection because of this.

Table 2

The effect of mean interval to first service (50 to 95 days); conception rate (40 to 60 per cent) and oestrus detection rate (50 to 80 per cent) on mean calving to conception intervals

Mean interval from calving to first service (days)	At 80 per cent Oestrus Detection Rate					At 70 per cent Oestrus Detection Rate				
	Average Conception Rate					Average Conception Rate				
	40	45	50	55	60	40	45	50	55	60
	Calving to Conception Interval					Calving to Conception Interval				
50	87	80	76	71	67	92	84	80	74	70
55	92	85	81	76	72	97	89	85	79	75
60	97	90	86	81	77	102	94	90	84	80
65	102	95	91	86	82	107	99	95	89	85
70	107	100	96	91	87	112	104	100	94	90
75	112	105	101	96	92	117	109	105	99	95
80	117	110	106	101	97	122	114	110	104	100
85	122	115	111	106	102	127	119	115	109	105
90	127	120	116	111	107	132	124	120	114	110
95	132	125	121	116	112	137	129	125	119	115

	At 50 per cent Oestrus Detection Rate					60 per cent Oestrus Detection Rate				
	Average Conception Rate					Average Conception Rate				
	40	45	50	55	60	40	45	50	55	60
	Calving to Conception Interval					Calving to Conception Interval				
50	110	98	92	84	78	100	90	85	80	75
55	115	103	97	89	83	105	95	90	85	80
60	120	108	102	94	88	110	100	95	90	85
65	125	113	107	99	93	115	105	100	95	90
70	130	118	112	104	98	120	110	105	100	95
75	135	123	117	109	103	125	115	110	105	100
80	140	128	122	114	108	130	120	115	110	105
85	145	133	127	119	113	135	125	120	115	110
90	150	138	132	124	118	140	130	125	120	115
95	155	143	137	129	123	145	135	130	125	120

3 DESCRIPTION OF RESULTS IN 22 HERDS

The results are available for three seasons for 10 herds and two seasons for 12 herds. In the case of the 10 herds the data for the first season (1971-72) are for the season before monthly visits were made. In the case of the 12 herds in some cases the data are for an 'historic' season (22,44,45). In the remainder of cases the herds provided these data for the first time. Hence they may have been making improvements in their husbandry as they went along, so the 'historic' position for these herds is not known (Table 3).

Fertility Performance Original 10 Herds over three seasons. (1971-72, 1972-73 and 1973-74).

Table 3
Summary of the Main Fertility Indices
For Three Seasons

	1971-72 (9 herds)	1972-73 (10 herds)	1973-74 (10 herds)
No. of cows in the herds	1902	2147	2257
No. calving (Average)	211	214	225
% Served	92.5*	91.7	89.8
Calving to first service	74.2	72.1	72.6
% Conceived of served	90.5	87.9	88.4
No. of cows conceiving	1594	1730	1742
Calving to conception interval	101.6	99.1	96.1
Serves per conception	1.78	1.75	1.67
% conceiving of those ** calved	85.0	80.6	79.4
First service conception rate	52.0	52.4	53.4
Overall conception rate (all serves)	48.1	48.6	49.9
% culled of those calved	*15.2	18.7	21.9
Interval from first service to conception	25.3	26.7	23.7
Estimated detection rate (unweighted av.) %	72.2	77.5	77.5
Unweighted F.S.I	61.2	63.3	65.5
% served by target	77.3	89.6	–

* 7 herds only. ** excludes some cows pregnant to unknown service.

The average herd position in 1973-74 (Table 3) showed that the herd size had increased by 14 cows per herd. The percentage served after calving had declined and so had the interval to first service by two days. One would have hoped for a greater improvement in this factor. In fact any further improvement might have been masked by the extra time that five of the herds (6 to 10) were forced to wait before heifers purchased in July 1972 could be served. Furthermore all but three are seasonally calving herds and in these an improvement in calving to conception in one year can increase the proportion of August and September calvers in the next.

For some of these early calvers the interval to first service may be intentionally lengthened.

The percentage of cows conceiving (of those served) declined but, fortunately, so did the calving to conception interval which reached 96.1 days in 1973-74. Despite a constant conception rate the numbers of serves per conception, for cows conceiving, were lower. As this might be an indication of the reduced persistence of farmers with 'problem' cows, it is not surprising that culling rates have increased each season.

A very useful index is the average interval from first service to conception. It reflects detection rates and conception rates to second and further services. Despite an improvement in interval to first service in 1972-73 the first service to conception interval lengthens slightly but improves overall by 1973-74. This is because the estimated detection rate derived from Table 2 remains low in 1972-73, but improves to 77.5% (average) in 1973-74.

In the first season the Fertility Status Index of the average herd declines (due to culling rate) but shows an overall improvement by 1973-74.

CHANGES IN THE FERTILITY STATUS INDEX

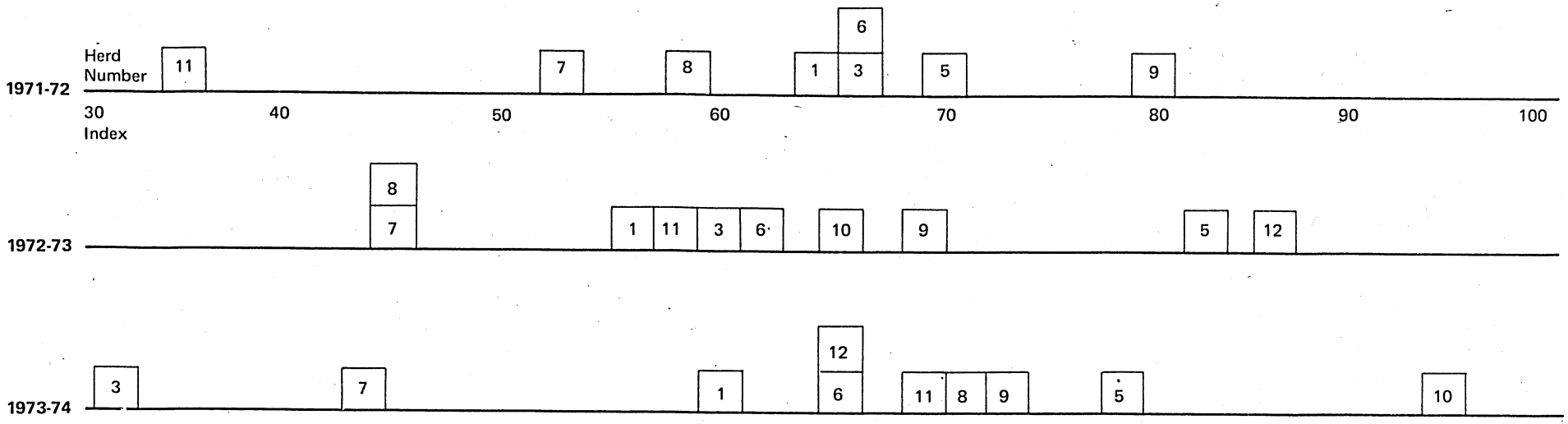


FIGURE 2

PERCENTAGE COWS SERVED

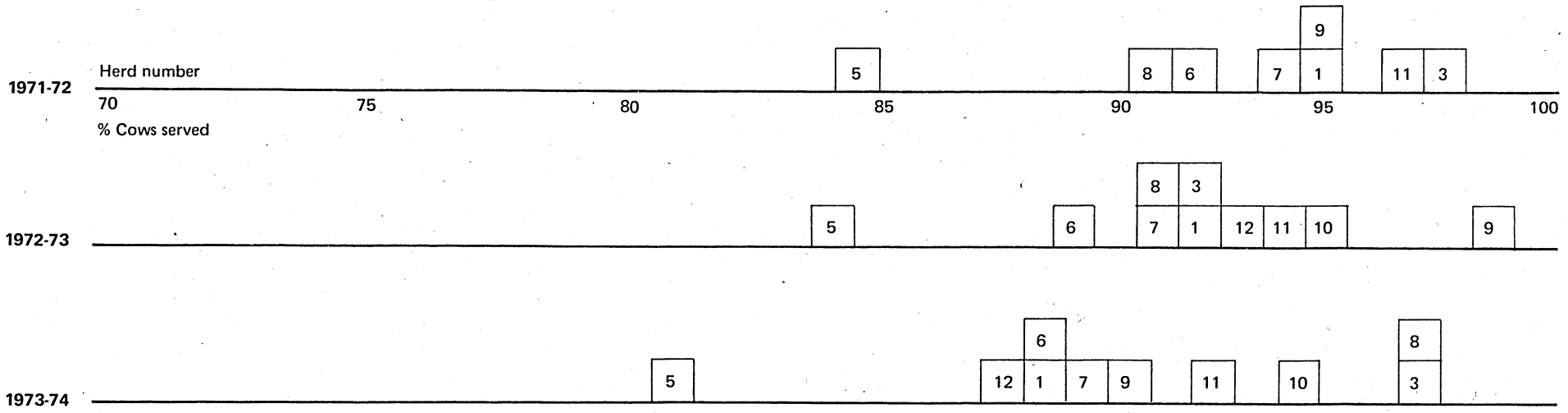


FIGURE 3

INTERVAL FROM CALVING TO FIRST SERVICE

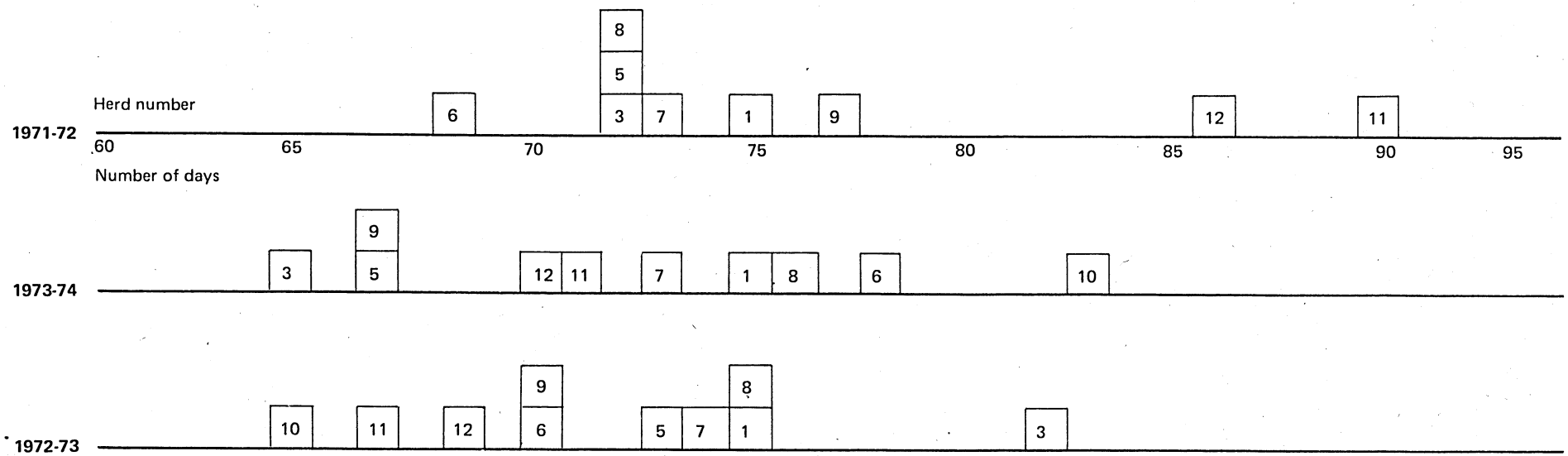


FIGURE 4

PERCENTAGE OF COWS SERVED THAT EVENTUALLY CONCEIVE

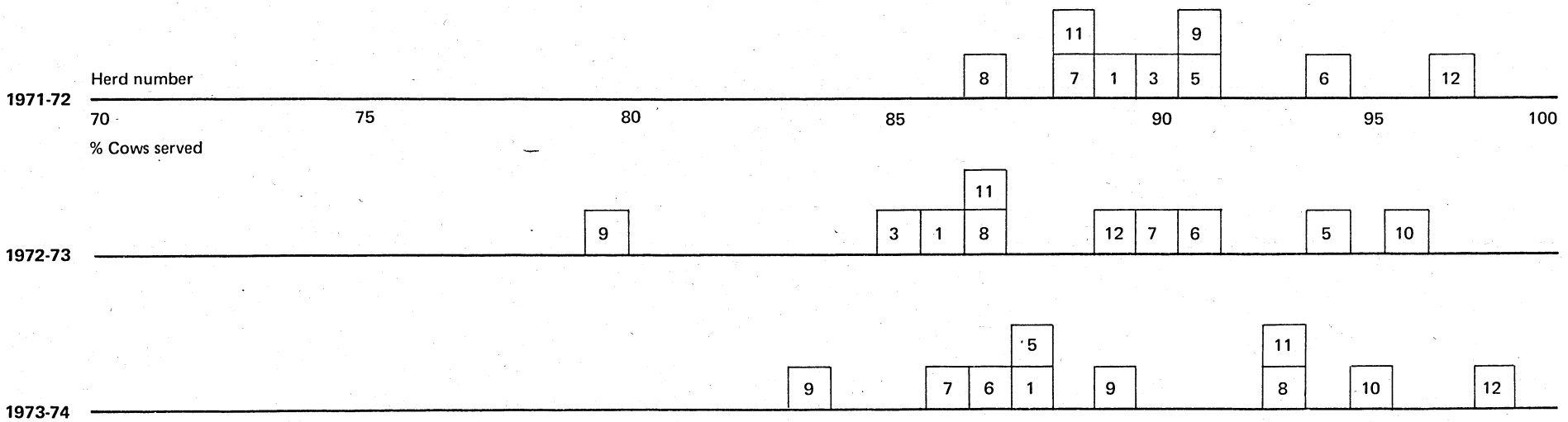


FIGURE 5

CALVING TO CONCEPTION INTERVALS

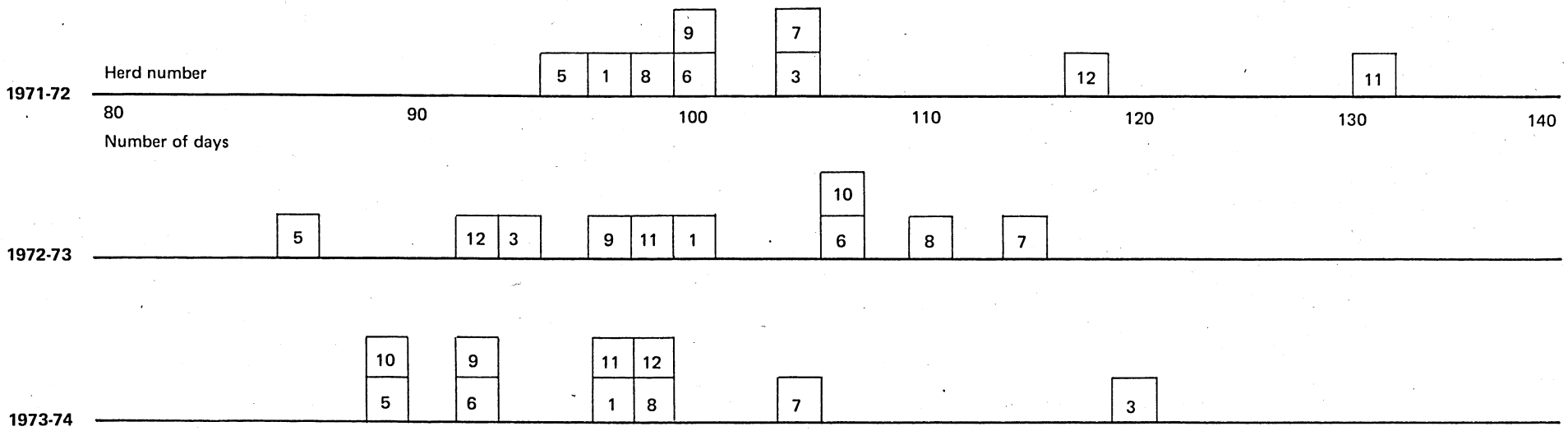


FIGURE 6

PERCENTAGE OF COWS CONCEIVING EVENTUALLY

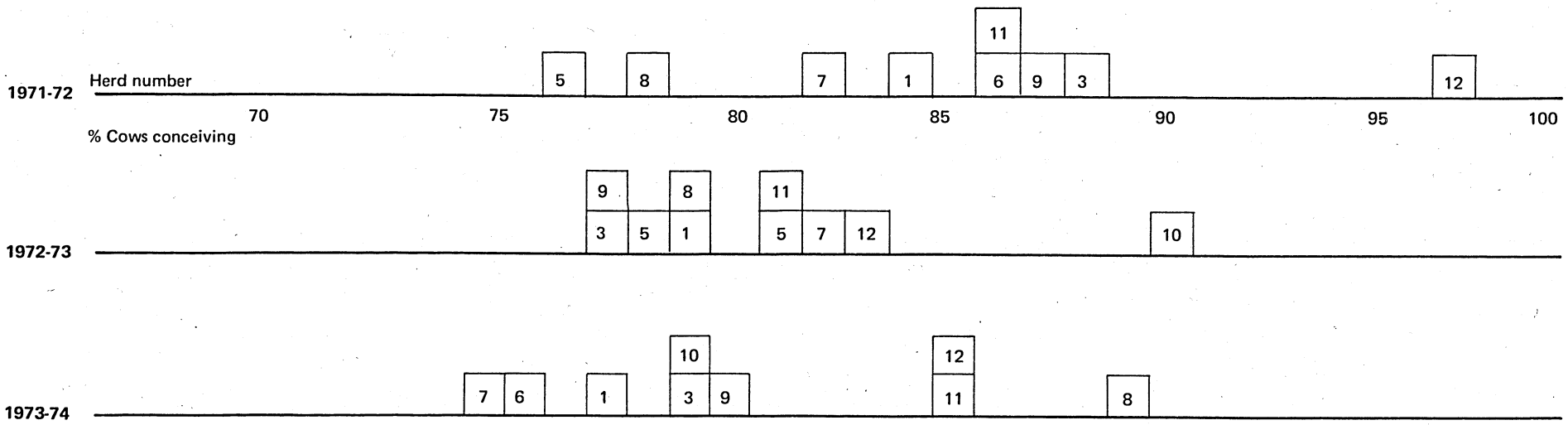


FIGURE 7

FIRST SERVICE CONCEPTION RATES

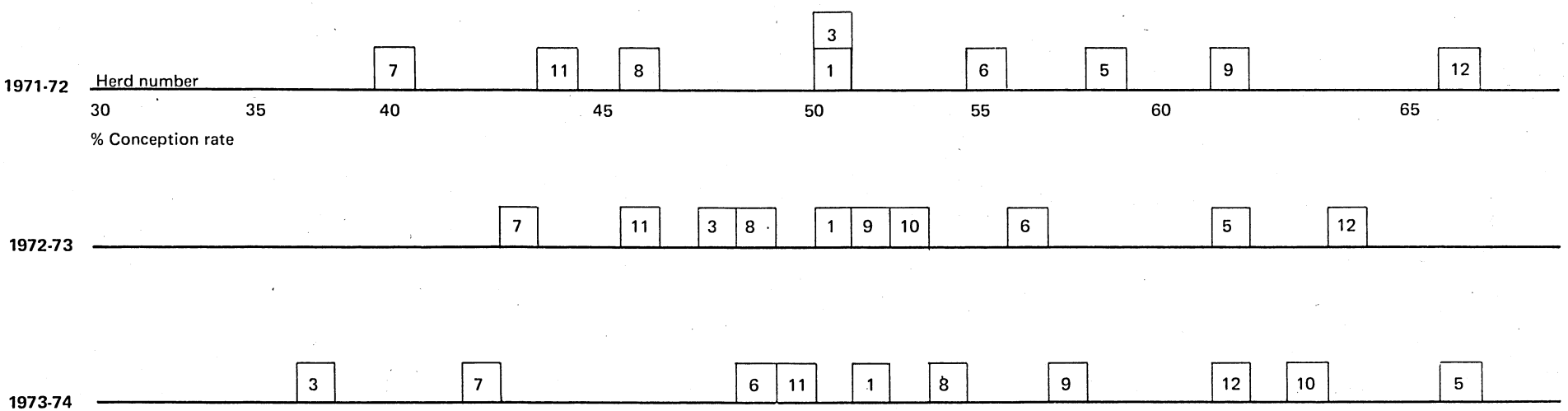


FIGURE 8

PERCENTAGE OF COWS CULLED OF THOSE THAT CALVED

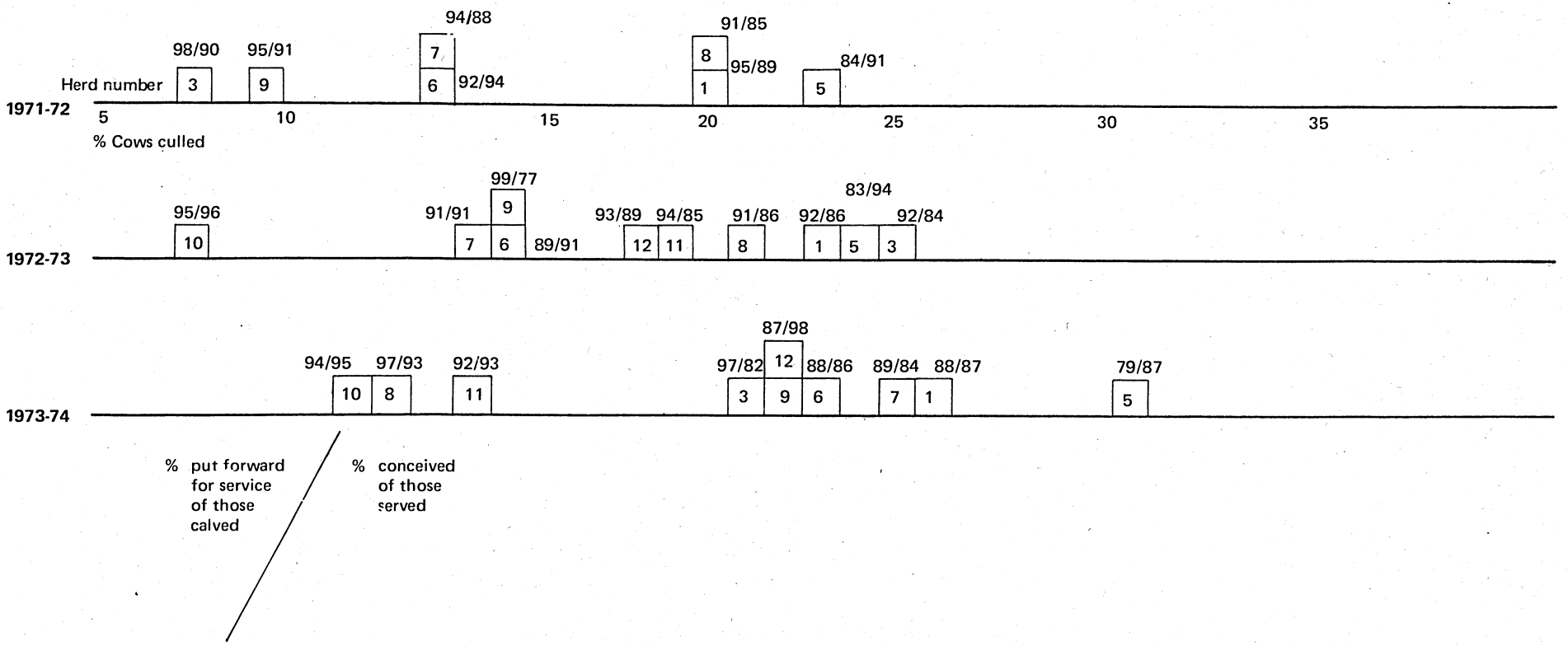


FIGURE 9

A figure calculated by hand for the 1971-72 and 1972-73 seasons only but which should be incorporated into the monthly and annual reports is the proportion of the cows served, that were served by the target day. Target day is the interval after calving which it is reasonable to expect that each cow should have received its first service. A sufficient delay is allowed so that generally 100% of cows should be served by target. For instance the target for *July* heifers introduced in an autumn calving herd was chosen as 140 days, for August calvers 120 days, for September 100 and for all remaining months as 80 days (this latter figure was chosen for all months in year round calving herds). The figure for percentage served by target increased in 1972-73 to 89.6%.

Changes in the first Season on Melbread Scheme (1972-73)

By relating other indices to the F.S.I with the aid of Figs 2 to 9 and Appendix 2a it is possible to draw conclusions on the nature of problems and progress made by individual herds.

Some confusion arises in the cases of Herds 6 to 10, which purchase all replacements. Heifers were added to the herd in July in the second season instead of in August. Since no *cow* was scheduled to calve before August 15th in these herds these introductions lengthened the average calving to first service and calving to conception interval for these herds by 5 or 6 days.

In terms of the F.S. index, Herds 7 and 8 remained at the lower end of the scale, while Herd 11 made a considerable improvement. Herds 11 and 1 are the other two herds that are below a score of 60, Herd 1 because of an unimproved interval to first service, a mediocre first service conception rate (50.8%) and relatively high culling rate (23.3%). Though not given an F.S. score the first season (because of poor culling data), Herd 12 made remarkable progress in 1972-73 in terms of calving to conception, reducing it from 118 days to 90 days. This was partly due to reductions in calving to first service (70.4 *v* 86.3 days) and partly to shortening the interval between first service and conception (19.3 *v* 31.7 days). Improved oestrus detection was responsible in both cases, the conception rate having remained the same.

The herds which gave cause for concern were numbers 1,3,7,8. Herd 7's only major problem was its conception rate which remained at 42.5% overall. Because of persistently repeated services associated with a low culling rate and a reasonable detection rate (70%) for returns to service later in the season, this herd had an interval from first service to conception of 31 days. This could only have been improved to 17 days if the detection rate had improved to 80%. Herd 8 had a slightly longer interval to first service than Herd 7 (75.9 days), and spoilt a better first service conception rate (78.7%) with poorer rates to later serves (overall 42.3%). Management was also less persistent with serving (1.87 serves per conception) and hence culled more (21.5%) giving an equal F.S. Index. Herd 3 (which calved around the year) lowered the calving to first service interval (from 71.7 days to 63.6) and the interval to conception by an even greater amount (from 103.8 days to 91.1 days) because of improved oestrus detection and despite a slight decline in conception rates (45.9 to 42.0). This poor conception rate and higher culling rate (for a very young herd) coupled with the particular decline in standards during the last two or three months of the season, when the manager left, gave cause for concern. Herd 1 was remarkable if only because of the lack of significant change that occurred in the herd performance. Each of the indices worsened slightly to give a lower F.S. score (from 63.7 to 56.6).

The high fertility herds, 5 and 9, retained their status in the second year. Herd 5 served a lower percentage of cows after calving in both seasons (83.6 and 83.4) but despite a seasonal calving pattern reduced the interval to calving to a minimum (65.8 days *v* 71.6 days). Improved conception rates (overall 57.1 *v* 49,4%) helped reduced the intervals to conception to 81.2 days from 90.6 days. This herd's weakness was its high culling rate (23.1 and 24.2) which it could afford because of its very high fertility.

However, the price of such culling rates is low herd age and hence reduced potential milk production per cow per year. The reasons for such a policy need to be closely examined to see if the rate is really justified.

Herd 9 also appears to have made a remarkable effort in the second seasons, despite having the heifers introduced a month early, and served cows on average by 65.8 days. However, this herd also serves cows too early far too often (less than 42 days postpartum). Maybe because of this the conception rate declined from 54.2% to 48.9%. The calving to conception interval only declined by 3.5 days (to 96.5).

Generally the first season saw a slight improvement in overall fertility in the herds taking part in the recording scheme. The really poor herds were improved and the next layer of herds was exposed as unresponsive to advice at this stage. The improvement in the case of herds 6,7,8,9 would have been more marked, to the extent of 5 or 6 more points on the F.S. Index, if the heifer introductions had been in August again.

The Second Season in Melbread Scheme (1973-74) (Figures 2 and 9 and Appendix 11 (a))

In this period it could be seen that sustained effort brings rewards. The herds, except for herds 3 and 7, had F.S. Indices all above 60 at the end of the 1973-74 season. Unfortunately, efficiency waned in herd 3 as measured in the closing months of the 1972-73 season. The calving to first service interval dropped sharply to 82.3 days, from 63.6. Conception rates declined even further to 38.9%, from 42.0%, but because of persistent re-serving of cows, serves per conception being up to 2.02 from 1.79, the culling rate eased from 24.9% to 19.8%. This herd fortunately serves a high percentage of its cows (96.6%) after calving, which means that even if infertility culls are a high proportion of the total, the actual total is kept below 25%. Nevertheless it does mean that such a herd cannot cull for low yield to any extent. Oestrus detection has returned as the major problem in Herd 3.

Herd 7, despite an improved calving to conception interval (104.3 days *v* 113.3) had a slightly lower F.S. Index 42.2 *v* 43.4, because rather fewer cows were served (88.8% *v* 90.9%.) Services were not repeated to the same degree (services per conception, 1.90 *v* 2.06) and with a similar conception rate (42%) the culling rate was much higher (25.4% *v* 14.1%). This herd's problem is primarily associated with conception rate, its detection rate having reached 80% (interval from first service to conception of 30 days for 42% CR (see Table 2)).

All the other herds achieved a score of more than 59 on the F.S. Index. Indices for Herd 1 changed very little and Herd 6 remained static around the mid-60s on the F.S. Index. Herd 12 which suffered changes in farm ownership, buildings and dairy herdsmen during late 1972-73 and early 1973-74 suffered a decline in all component indices except the interval to first service. In this herd's case Kamer Heat Mount Detectors were used by the herdsman rather than the veterinary surgeon, and were placed on all cows at 45 days postpartum. The oestrus detection rate was thus relatively high for first insemination but appeared to be only 50% for the returns (see Table 2 for calculation).

Herd 8 made remarkable improvements in the 1973-74 season by serving more cows (97.0% *v* 91.1%), culling remarkably fewer (11.9% *v* 21.5%), improving conception rate (49.7% overall *v* 42.3%) and hence lowering calving to conception intervals (to 97.8 from 110.5 days). Most of the improvement (10 of the 12 days) comes from an improvement in conception rate. The oestrus detection rate was already at nearly 80% (in 1972-73) but improved a few points to over 80% (see Table 2).

Herd 9 stayed in the 70 to 80 range in the F.S. Index because of improvements in calving to conception (89.8 *v* 96.5 days) intervals and despite a decline in culling rate (to 22.4% from 14.6%). The conception rate improved by 4% to 52.0%. The detection rate improved from 70% to 90%. The good culling an conception rates were spoiled by the failure of 18 cows, run with the bull from April to June, to conceive. The bull, who was known to be lame, was seen to mount the cows but one can only assume that he was not serving them. All these 18 cows were culled following negative pregnancy diagnosis in August.

Herd 5 maintained a remarkably high level of fertility management but only served 79.2% (instead of 83.4%) of the cows that calved. The culling rate worsened to an excessive 31.4% (from 24.2%) partly due to a decrease in the percentage of those served conceiving, to 87.4% from 93.6%.

Herd 10 emerges as the leader of the group of 10 herds and produces near to ideal levels of fertility: 93.7% of cows served after calving, interval to conception 64.3 days, 95% of the cows served eventually conceive, calving to conception interval 85.9 days, overall conception rate 62.2% and a culling rate of 11.2%. It is the culling rate, if anything, which needs examination. Despite the fact that is was only the third season of existence for this herd, there may be a case for culling such a fertile herd more on the basis of yield. However, individual cow yield records are not kept and the replacements consist, in any case, of heifers brought in from outside.

Fertility Performance of group of 12 Herds joining later (1972-73) (Figures 10.11) and Appendix II (b))

These herds provided the data by monthly record sheets posted to the department. However, they consisted of more volunteers than the other group, who tended in the 1972-73 season to be pressed into joining for the purpose of research.

Table 4
Summary of Main Fertility Indices
for 12 herds for two seasons

	1972-73	1973-74
No. of cows (total)	1484	1702
No. calving (average)	123.6	141.8
% served	91.0	91.0
Calving to first service (days)	73.1	70.4
% conceived of served	87.9	90.0
No. of cows conceiving	1187	1395
Calving to conception interval	102.1	95.7
Serves per conception	1.72	1.75
% conceived of calved	79.9	82.0
First service conception rate	52.1	50.7
Overall conception rate	46.7	48.5
% culled of those calved	16.1	19.5
Interval from first service to conception	29.0	25.5
Estimated detection rate (unweighted)	72.9	79.1
Fertility Status Index	62.1	63.6

The overall mean herd size rose from 124 cows to 142 (Table 4). The calving to first service interval was reduced by 2.7 days to a mean for the 12 herds of 70.4 days. The proportion conveiving eventually of those served rose to 90%, and the calving to conception interval dropped, for the 1,395 cows conceiving, to 95.7 days. Happily the proportion conceiving of those calved rose to 82.0%. The first service conception rates dropped 1.6% to 50.7%, though the overall conception rate rose to 48.5%. The culling rate increased by 3.4% to 19.5% of those calving. One hopes that greater vigilance led to part of the improvement in the interval from first service to conception, which was lowered to 25.5 days. The estimated Detection Rate for services subsequent to the first was increased to 79.1% from 72.9%. The overall Fertility Status rose by 1.5 points to 63.6.

The main change in the first season of routine recording (1973-74) was a reduction of all the calving to conception intervals to below 105 days. Conception rates, measured by first service CR, did not suffer adversely (below 40%) except in herds 22 and 70 which tended to serve many individuals at less than 42 days postpartum. The net effect remained beneficial.

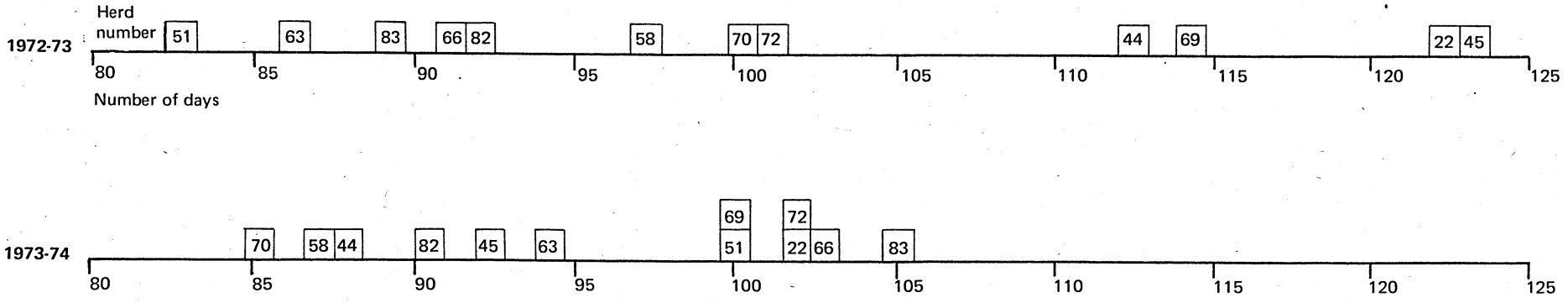
Three herds (22, 45, 72) had high culling rates in the second season for different reasons. Herd 22 suffered from a low conception rate, Herd 45 served a low percentage of cows in the first place (as did Herd 72) which it could afford to do (with high conception rates) and which Herd 72 could not.

Seven of the herds improved their scores in the F.S. Index in 1973-74. These same seven herds also improved in their calving to conception intervals (22, 44, 45, 58, 69, 70, 82). The remaining herds slipped down the scale for a variety of reasons. In the case of Herd 51 it was caused by a decline in overall conception rate from 61.0% to 51.0%. Herd 63 had had a remarkably high first service conception rate of 70% in 1972-73 which slipped to 57.5% in the second season. This, together with a four day increase in delay to first service in 1973-74, plus a higher culling rate accumulated to give a lower standard in the second season, but still an F.S. Index of 76.0. Herd 66 shows a drop in conception rate from 48.3% to 39.7%, which because of persistent serving leads to a decline in calving to conception; and also an increase in culling rate.

This is a more serious decline generally than that of Herd 63 and Herd 66 ended the second season with a F.S Index of only 46.7. Herd 83 seemed to suffer badly in the second season from a change in management and the interval to first service extends 20 days from 66.7 days in 1972-73 to 86.1 days in 1973-74. This delay is critical but it can be partly made up so that by the time calving to conception is calculated 17 days only are added.

It appears that the impact of the recording scheme was largely dependent on the manager's and herdsman's attitude. In the first season, with changed and keen management the really poor herds can eliminate 20 days of their calving to conception interval without affecting the other indices. This is simply brought about by an earlier first service due to a change of policy and/or improved oestrus detection.

CALVING TO CONCEPTION INTERVAL



FIRST SERVICE CONCEPTION RATE

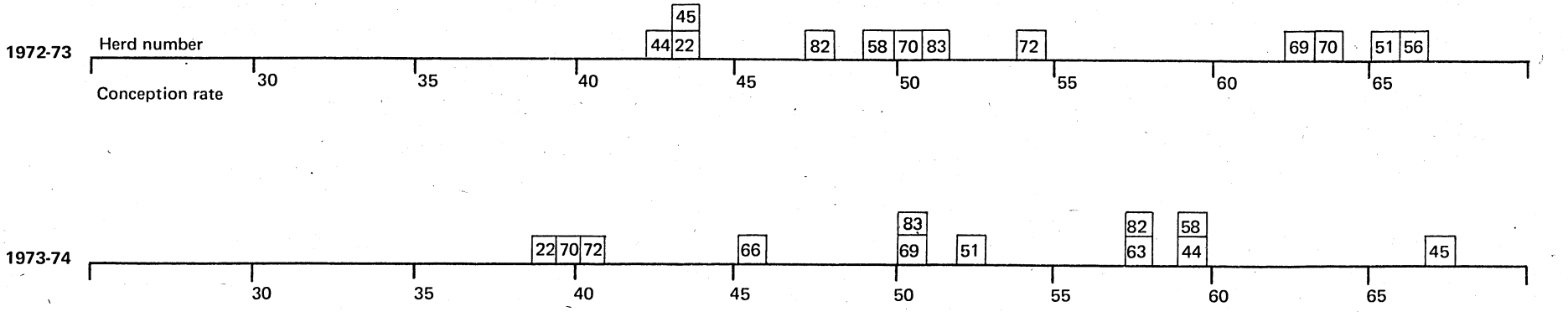
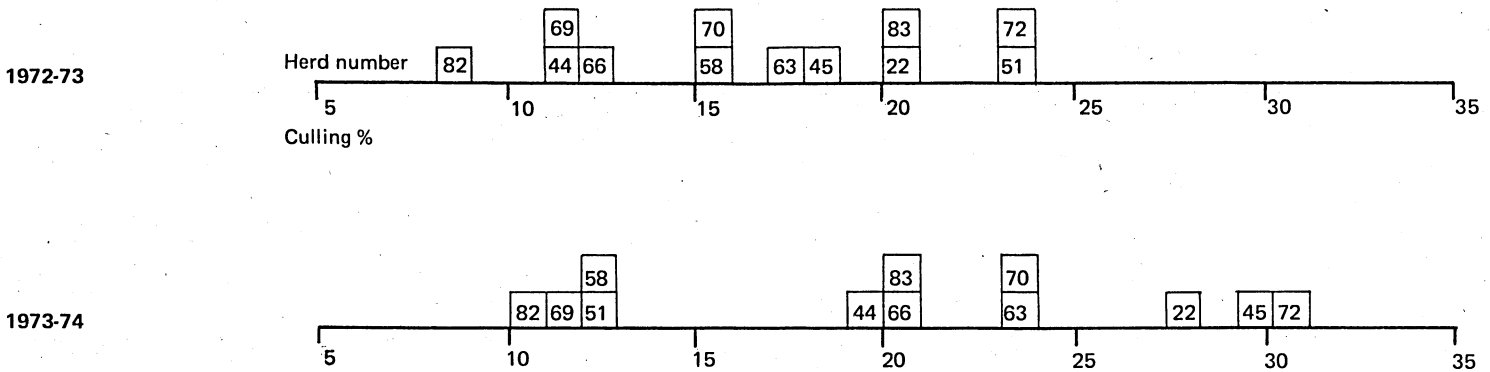


FIGURE 10

CULLING RATE



FERTILITY STATUS

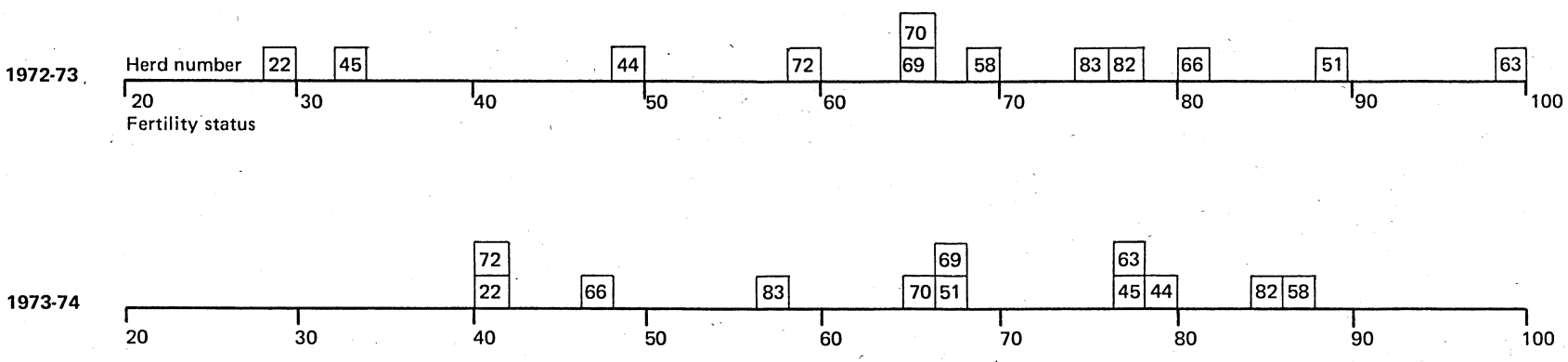


FIGURE 11

From this level, when calving to conception intervals reach 95 to 105 days, any improvements depend on conception rate improving to over 55%. Less is knwon about the factors affecting conception othe than oestrus detection and a considerable amount of basic research needs to be done quickly to clarify the problems so that appropriate advice can be given.

With a mean interval to first service to 65 days, a conception rate of 55% and a detection rate of 80% the interval from calving to conception is 86 days. It should also be policy to serve 90 to 95% of cows after calving and for 85% to 90% of the cows that calve eventually to conceive. This means that 95% of cows served should eventually conceive and that culling rates for failure to, or difficulty in conceiving are limited to 5-8%. The remaining culls, normally between 15-20% maximum, can then be drawn from cows in poor health and those showing poor performance in terms of yield for age.

4 ECONOMIC IMPLICATIONS OF CHANGES IN FERTILITY INDICES

For 13 of the 22 herds, sufficient economic data have been collected for an indication to be gained of the effect of changes in calving to conception intervals on milk output per cow per year.

There are, of course, many factors affecting such a productivity index apart from the interval between calving of the cows. Change occurs in all sorts of herd management components for all sorts of reasons. Such components include feeding levels (forage, concentrates and other purchased feeds), the age of the herd (due to herds starting with only heifers, or due to growth in the size of the herd by extra purchases of heifers or cows). In some cases performance per cow improves because the herd is allowed to contract in size (with considerable adverse effects on total margins) when extra cows are culled.

Convincing, modelled evidence already exists for the firm belief that (with present day margins over concentrates per cow around £240) every day's delay in calving to conception beyond 80 days leads to 60 pence less *profit* per cow per year. This figure does not take account of the extra losses due to extra herd depreciation costs if extra culls arise out of the delays.

The data collected each month from the thirteen herds allow rolling 12 month indices to be calculated. The use of a rolling 12 month average lessens the effect of seasonal variation. The relevant factor is calculated for 12 months data at a time and then the earliest month's information is omitted and the latest month's is added. Changes and implications can be seen most easily in graphic form and factors that have proved most useful are:-

Rolling 12 month indices

Calving to conception interval (A)
Gallons per cow per year
lbs. concentrate/gall
% of cows calving which eventually reconceive (A)
No. of cows which calve

The effects which we are looking for in each of these herds is to see if, when calving to conception reaches a low figure, the gallons per cow per year, 10-12 months later, rise to a higher figure. We need to look 10-12 months later because improved calving-to-conception leads to a faster onset of the beginning of fresh locations. The calving to conception intervals relate to the cows calving in the 12 months in question (as do the number of cows and the % which reconceive) while the gallons per cow and lbs/gallon relate to the months in which they were produced. Normally it is as well to wait 9-12 months before working out A-Type indices for all cows to conceive that are going to.

The other indices can be calculated immediately. Hence the A-Type indices are only calculated for these graphs till mid-1974 and the remainder to April 1975.

As an example of how such a graph can be interpreted Fig. 12 depicting trends in Herd 1 may be helpful.

This herd could supply data for a longer period than most of the herds. The main improvement in calving to conception occurred by R-12-M October 1972. Unfortunately, after R-12-M August 1972 there is a decline in the percentage of cows reconceiving at the same time as the herd expands. The lbs of concentrate per gallon increased until a conscious policy change occurred in May 1974 to cut-back slightly. It may not be direct cause and effect (one says that a great deal in these circumstances) but when R-12-M calving to conception is at its lowest (91 days) the R-12-M gallons per cow is at a peak (just under 1100 gallons) 12 months later (May 1974). An extra index is included on this herd's graph of R-12-M age of cows calving measured in lactations. From it, it appears that yield per cow mirrors the age of the herd quite closely. It is a factor to take into account in a herd where the heifers calve down in different patterns each year. Improvements in R-12-M gallons per cow any particular month may simply be due to the fact that more older cows calved that month than the year before, and the yield will decline when the heifers, if they are delayed, for instance, do appear.

Management must beware that the proportion of cows put forward for service, and the proportion failing ever to conceive do not decline too far. The danger is that the culling rate will become excessive (more than 30%) and the age of the herd will be unnecessarily low, without any benefit from culling for yield. The size of the herd (360 cows)

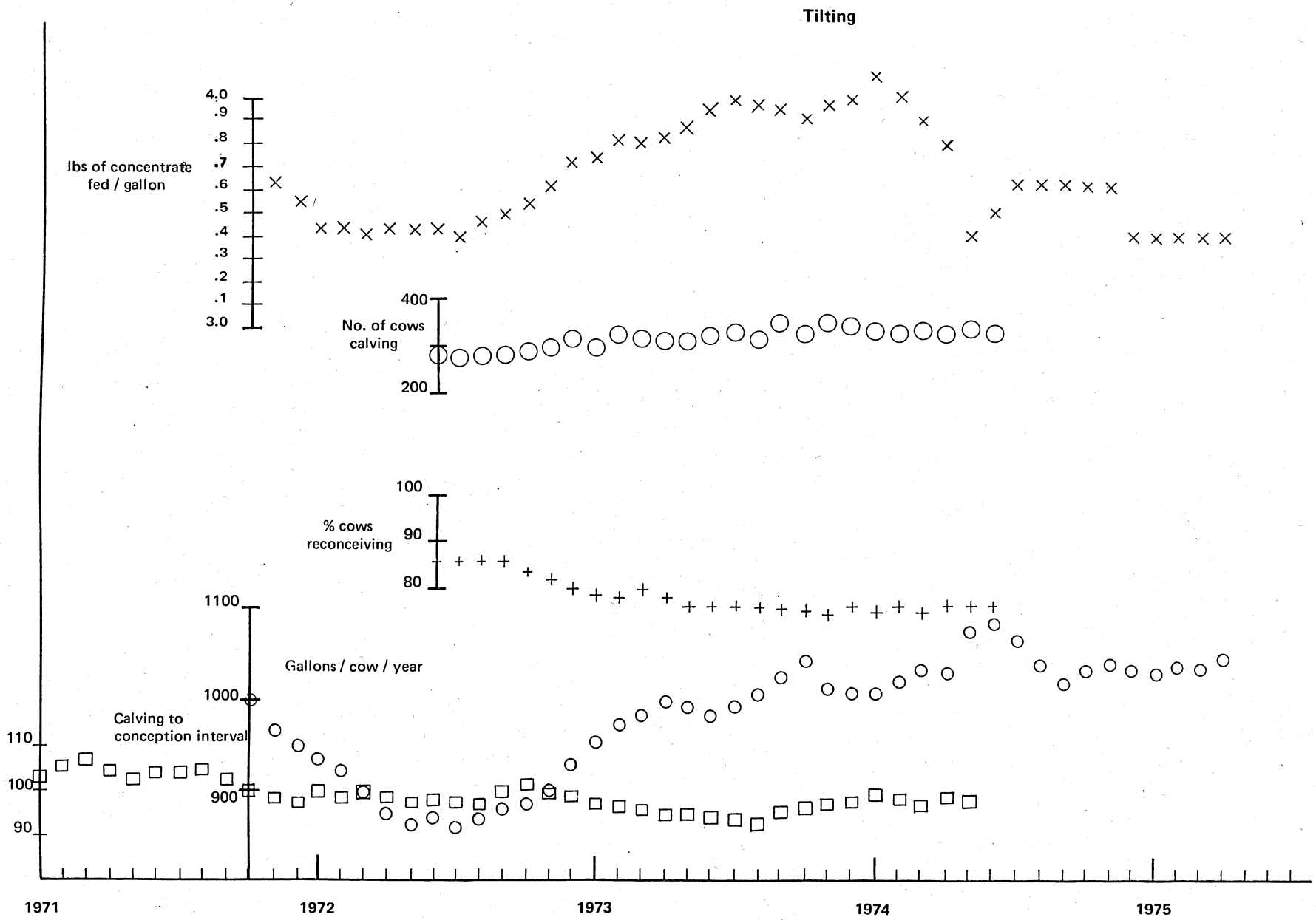
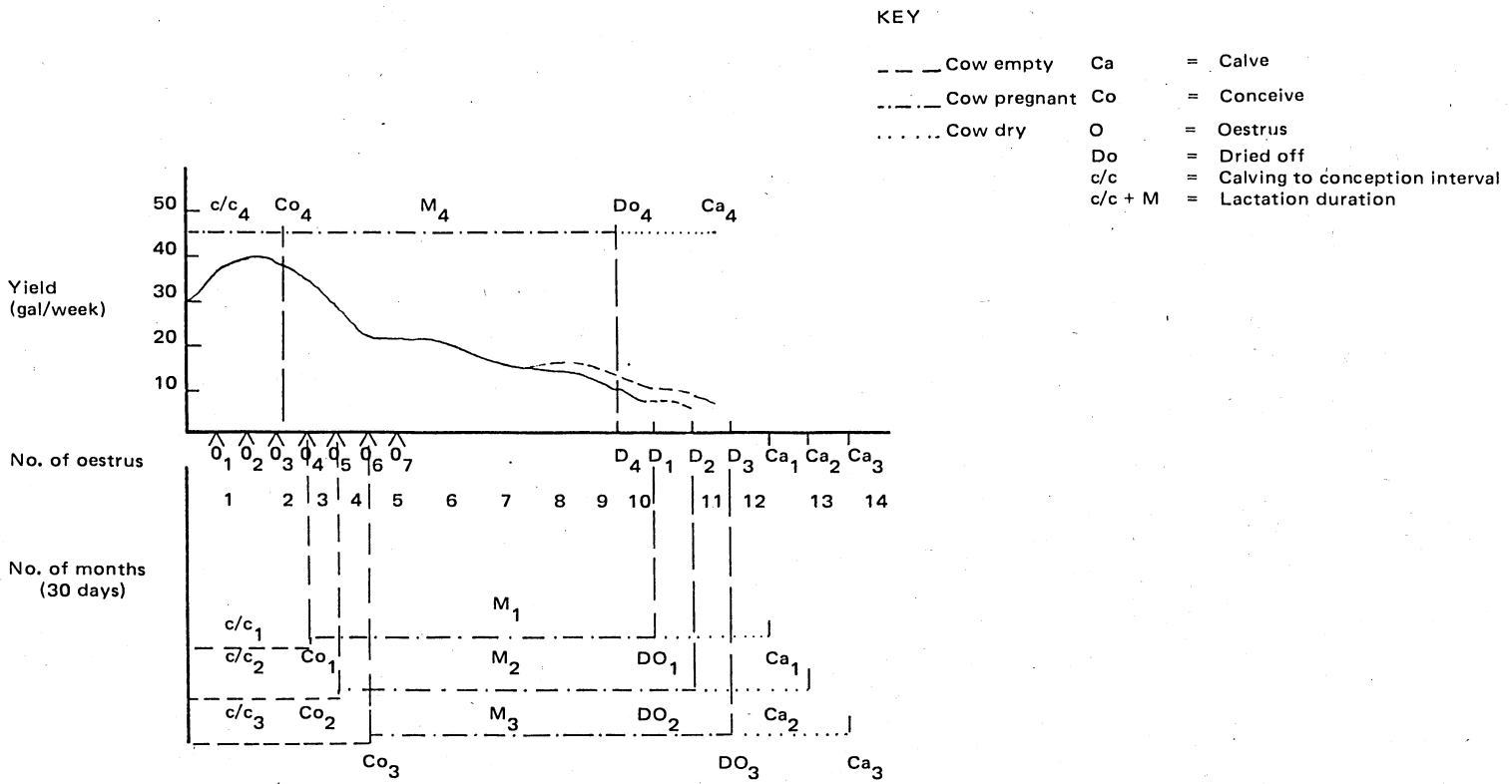


FIGURE 12

Fig 12. Examples of Rolling 12 month Indices for one herd.



Stylized lactation curve with oestruses available for service showing effect on calving to conception interval, calving interval and lactation length

FIGURE 13

is in danger of being below target. This factor, above all, is the most important factor affecting total margins and profits. The gallons per cow figure is being maintained to some extent by culling the extra cows as soon as their lactations are finished. This is one of the effects of reduced fertility and is likely to affect the viability of this particular enterprise critically.

The Economic Importance of Fertility Control Introduction

Any delay in conception beyond 80 days postpartum leads to lower annual productivity of milk. Delays in conception can occur through several causes. In the first case the farm policy of delays before service is allowed after calving can mean excessive intervals to first service. Part of this first case is the common policy of leaving 3 months or so when no serving is carried out. This means that whatever the policy concerning interval to first service some cows do not get served for at least 90 days simply because they calve in a particular month. Fears of adversely affecting conception rates by serving cows early are only justified when the interval is less than 50 days and even then, provided the service is not earlier than 40 days, the net effect of earlier services is beneficial. For every 10 days earlier first service down to 40 days the calving to conception interval benefits by 8 days.

In the second case poor conception rate leads to delays in conception. A rule-of-thumb which can be applied is that every 1% difference in average conception rate leads to one day's delay in conception. Many people are confused by conception rate and non-return rate (NRR). The AI service uses 60-90 day non-return rate as its index of the bull's fertility and the insemination efficiency. Conception rate is normally 20% less than NRR with the latter index being about 75% on average. There are many factors affecting conception rate in a herd and it is not within the scope of this particular report to discuss these in any detail.

The third factor affecting delays in conception is oestrus detection. This appears, together with the question of policy discussed as the first case, to be the area which can be concentrated on and improved immediately by farmers. What is required on any farm is an examination of the policies and levels operating, a plan of attack formulated as required in the circumstances, a regular monitoring of the levels being achieved and a measurement of the economic benefits obtained so other farmers can be encouraged.

The Delay Process: Its Components

A calving interval of 355 and 365 days is suggested (Anon, 1969) as the ideal average herd index. Some consideration must be given to the spread of individual calving indices around this mean (Morris, 1972).

A stylised lactation curve helps to illustrate the economic importance of a delay in conception (Fig. 13). To achieve a 12 month calving interval, conception should take place at 12 weeks (84 days) (Co_1) and drying off (giving two months dry) at DO_1. If a heat period is not observed or if the cow does not conceive to that service she commonly returns three weeks later and provided oestrus is observed she can then be served again. If the cow conceives at this service, Co_2, she may remain in milk until DO_2. Similarly, if she conceived at 18 weeks (Co_3), she may remain in milk until DO_3 giving a calving interval of over 13 months. A cow conceiving at nine weeks (Co_4) is dried off at DO_4 and calves again at Ca_4, with an interval of just over 11 months. This latter practice may lead to cows being difficult to dry off and having a short dry period, which may affect production in the subsequent lactation. Serving at oestruses observed earlier than 6 (or 7) weeks postpartum may lead to other serious physiological and production problems.

The shape of the lactation curve is affected by a large number of factors. The annual output of milk, due to the characteristics of the curve, is maximised by a cow calving every 355 to 365 days. Delaying intervals for longer than this means that low production days (1-1½ gallons or less per day) replace high production days (giving 2-4 or more gallons). In addition extra dry days occur when the calving interval extends beyond 365 days.

Efficiency of Oestrus Detection: A comparison of Two levels

Wide variation is observed between herds in the efficiency of oestrus detection, (Esslemont, 1973) and it is important therefore, to measure the effect of poor detection in economic terms. The character of oestrus manifestation and problems of detection, under a range of conditions, are reviewed elsewhere (Esslemont 1974). It would appear that only 50% detection of oestrus is generally achieved whereas a target of 80% should be the aim.

The effect of 50% compared with 80% detection was modelled with real farm data (Table 5). A typical predominantly autumn calving pattern was assumed for a large (320) cow diary herd. Oestrus cycles were expected to occur at 21 day intervals in 85% of cases, including returns to service; the remaining 15% being at 7, 14 or 28 day

intervals. No insemination took place between August 10 and October 31. Conception rates (based on MMB non-return) varied from 55% to inseminations at 50 days, to 70% at 140 days postpartum (Anon, 1969). These may be higher than conception rates normally found in practice, but their absolute level does not materially affect the comparison between herds. The rate of culling of cows for reasons other than managemental infertility was put at 8.4% (27 per 320). Any cows which did not conceive to a service within six months of calving were assumed to be culled at the end of their lactation. Replacements were assumed to be available at a faster relative rate in the 80% detection herd than in the 50% detection herd. The effect of 50% detection was a higher total culling rate and a slightly higher conception rate due to the delay in the interval to insemination postpartum.

Table 5
Some differences in fertility indices due to 50% oestrus detection instead of 80% detection

	Detection Rate	
	80%	**50%**
Calving to conception interval (days)	85	107
Total culls (cows)	28	56
Total culls as proportion of cows calving (%)	8.75%	17.5%
Conception rate (all services)	62.7%	66.8%
Interval before all 1st. service carried out (weeks)	20	30
Percentage of cows to conceive by 15 weeks postpartum	87.4%	66.1%
Oestrus by 60 days postpartum	96.0%	73.5%
Interoestral interval (mean) (days)	26.4%	43.4

The lower rate of detection increases the calving to conception interval by 22 days per cow. The culling rate rises by 9.7% due to unobserved oestruses, delaying inseminations to such an extent that by the 4th or subsequent service it is more rational to cull a cow than to keep her dry for a long period.

The economic effect of the poorer detection rate is to produce, under a strictly defined but typical feeding regime and using standard lactation curves, a reduction of 60 gallons of milk produced per cow per year, a higher depreciation charge, and fewer calves available for sale. Minor adjustments could be made for differences between true and standard lactation curves and for changed rates of cow depreciation but are to be ignored in this case. Over the first two years the economic loss at 1972-73 prices is £11 per cow per year. This figure is likely to increase in the third and fourth years to about £15/cow/year, (constant prices (Esslemont, 1973)).

The cost of a three week delay in conception due to poor detection increases with the distance in time from parturition. Using the above assumptions the value of three weeks delay rises from £6.68 for the three weeks from 7 to 10 weeks postpartum up to £12.2 for the period 13 to 16 weeks. The loss is maintained at £12 per three weeks beyond 28 weeks postpartum the average cost of an unnecessary day's delay in achieving conception could be assessed at 40 pence in 1973 which is equivalent to about 60 pence with the inflated margin over concentrates available in 1975.

Although these calculations were made, originally, with respect to oestrus detection the loss from low conception rates and early embryonic death or abortion can be represented in the same way. Indeed it can be said that the cost of an extra day in calving to conception interval beyond 84 days from any cause — managerial, nutritional or infections is about 60 pence.

This modelling approach, in physical as well as financial terms, has provided reliable evidence on which to base advice to farmers. Where farmers appreciate the economic importance of fertility they respond to advice to improve fertility management. It would not have been possible without a system which monitors, records and analyses all the relevant events. Such recording systems need to satisfy the many demands of interested farmers, veterinarians and research workers. Apart from improvements in interval to conception, consideration must also be given to the consequent effect on herd milk yield. There are many other factors affecting this latter item so in real herd situations it may not be easy to ascribe cause and effect. This may be more likely over a large sample of herds.

A useful estimate of the effect of reductions in calving to conception intervals on subsequent milk yield can be gained by grouping the data from the 13 herds. Where possible more than one year's set of figures are used from one herd (Table 6).

Even negative effects are included, as are the effects in herds where the age structure was known to change. In fact the overall estimate of 2.25 extra gallons for every day's improvement in calving to conception masked all the other factors affecting herd productivity (in the modelled situation described the 22 fewer days in calving to conception produced 60 extra gallons, equivalent to a rate per day of 2.72 gallons). If anything it is an underestimate, though both groups of herds increased culling rates in the later seasons. The effect of herd depreciation and of calf output have to be added to the effect on the yield.

Economically the extra 2.25 gallons per day at 36 pence per gallon (estimated 1975-76 milk price) would be worth 79.6 pence. The extra concentrate costs incurred at, say, a rate of 3.6 lbs/gallon and 4p. per lb. are 14.4p per gallon. This means an extra 31.8 pence cost in concentrates for the 79 pence extra income from milk, leaving a net 47.8 pence per day of reduced interval. (In the case of the modelled situation using the same rates of concentrate usuage the equivalent figures are 97.9 pence extra income from milk and 39.1p. extra concentrate costs a net figure per day of 58.8 pence).

For the current season the charges for the Melbread Scheme are 40 pence per cow per year. Discounting any other changes in costs associated with the Scheme, and increased efforts at oestrus detection (if, indeed, there are any net increases in costs) then one day's improvement in the herd calving to conception interval should, on average, pay for the Scheme. Based on this benefit cost ratio, 13 of the 22 herds have made their investment worthwhile (Herds 5,6,9,10,11,12,22,44,45,58,69,70,82.)

Table 6

Summary of effect of improvements (or otherwise) in R-12-M calving to conception interval on R-12-M gallons per cow per year 10 months later (13 herds, 17 occasions)

Herd. No.	Calving-conception (A)	R-12-M Galls (A)	Calving-conception (B)	R-12-M Galls (B)	Difference Galls	Days	(B-A (C-C Ratio Galls/Day
1	92	1080	95	1070	-10	-3	3.33
3	90	1012	121	990	-22	-31	0.70
5(i)	92	993	82	1025	32	10	3.2
(ii)	82	1025	85	1025	0	-3	-0.33
6	105	1062	88	1025	-37	-17	-2.18
7(i)	98	1107	115	1030	77	17	4.52
(ii)	115	1030	103	992	-38	12	-3.16
8(i)	105	970	110	937	-33	-5	6.6
(ii)	110	937	96	920	-17	14	-1.21
9(i)	95	955	96	1000	(45	-1)	
(ii)	96	1000	88	1012	12	8	1.15
10	96	990	84	1055	65	12	5.41
11	131	795	98	945	150	33	4.54
22	124	980	105	1050	70	19	3.68
44/45	118	1000	88	1100	100	20	5.0
69	115	1000	96	1055	55	19	2.89
70	114	1080	86	1120	40	28	1.43

Net Ratio of 2.25 gallons per day.

5 THE PRESENT AND FUTURE IMPLICATIONS OF THE MELBREAD SCHEME

Although the output of scientific information from the Melbread Scheme to date has been rather limited, it has demonstrated the possibilities and advantages of collecting data from individual animals on a continuing basis. It has shown that the interests of the farmer can be served while securing fundamental information for preventive medicine programming and for scientific purposes, which cannot be gathered in any other way. The capacity of the scheme to contribute to specific research projects at minimal additional cost has also been explored, with promising results.

It soon became evident that the most effective use of the scheme was only possible through a co-operative effort on the part of the farmers, herdsmen and their veterinarians. This involved a substantial amount of educational and extension work via newsletters, bulletins and personal contact. A major contribution has been made, too, by a series of annual meetings at which farm staff and veterinarians could report experiences for the benefit of newcomers to the scheme and contribute to its wider applications.

The main theme of work in the 1972-73 season was the detection of oestrus. The scheme helped farmers to identify weaknesses in their systems and to recognise the benefits of improvements. Where improved oestrus detection could be coupled with a reduction in the interval to first service results were impressive. As reported elsewhere (Esslemont, 1973), an average gain in the second year was 6 days in the calving to conception interval, representing an increase in profit per cow of £3.6 for the year.

By the beginning of the 1973-74 season the more progressive herd operators had become concerned as much with conception rate as with oestrus detection. This component of fertility is, however, much more complex and harder to improve because it involves a mixture of management, nutrition, physiological and, possibly, disease factors. In contrast, the improvement of oestrus detection normally requires only a few hours training for the willing herdsmen and the judicious use of aids such as Kamar Heat Detectors by the practitioner.

With the aim of contributing to a fuller understanding of the factors affecting conception rate several co-operative long term projects have been started:-

Conception Rate and Metabolic Status

In co-operation with the Institute for Research in Animal Diseases (at Compton, Berkshire), a study of the relationship between feeding, yield, blood metabolites and conception rate has begun. A veterinarian from IRAD and local veterinary surgeons alternate in visiting eight herds once every month to take blood samples from 20 cows in each herd. Milk yield and feeding data are also collected and the Melbread Scheme supplies IRAD with all the health and fertility information for each cow sampled. The blood is assayed, using the Compton Metabolic Profile Test, for up to 20 components. This detailed information should shed further light on nutritional factors affecting conception rate.

Genetics and Longevity

In co-operation with the Blood Type Testing Service of the Animal Breeding Research Organisation, a number of Melbread Herds and one heifer rearing unit, are supplying blood samples for gene typing. Workers at ABRO are hoping, with the aid of herd records, to relate mortality and culling to changes in the homozygous to heterozygous ratio at the amylase gene locus of bovine chromosome (Spooner, 1973). The ratio appears to change in a herd as the herd ages and it is thought there may be some relationship between homozygosity and early culling of cattle.

While the information gained on cull cows will be useful, the opportunity to follow events in the life of heifers from birth in the light of their amylase gene status will be particularly interesting. All heifer calves produced by the co-operating Melbread herd of 340 cows are being block sampled within a few weeks of birth and they are each given a record card so that full details of farmer and veterinary treatments and, in due course, fertility events may be recorded. The Melbread codes have been modified so that more pertinent heifer events can be transferred to punch cards and analysed in monthly and annual reports.

Nutrition and Fertility

In conjunction with ADAS (Ministry of Agriculture), additional work is in progress on five herds where analyses are carried out each month on forage and concentrate rations. For these herds the silage clamp is also measured

each month during the winter to estimate the amounts of silage consumed by the milking cows and a diary is kept of feed and other management changes.

Preliminary results of this work indicate the importance of the level of feeding on the day of service. Many farmers may be underfeeding forage to stock and may be lowering conception rates by as much as 20%. During the service season it appears to be most important to allow access to sufficient feed either by enlarging the silage face area or by ensuring that forage is available in troughs throughout the day.

In this connection the Melbread annual report has been changed to allow measurement of the conception rate by month of calving for cows and heifers separately. Thus it should be possible to assess whether heifers are underfed because they are unable to compete with maturer cows for limited forage supplies. The study could indicate the desirability of establishing a separate group for heifers in large herds to overcome this problem.

It is, therefore, evident that the Melbread Scheme serves several needs in the fields of hered management and veterinary preventive medicine. The fact that:-

1 veterinarians and farmers volunteered all the herds for participation;
2 only 3 herds have dropped out the scheme (and all for reasons other than dissatisfaction with its operation) while newcomers have raised the total to 50 and;
3 participants are prepared to cover the variable costs of the records system while meeting all on-farm veterinary costs;

suggests that there is scope for a much larger scheme which could be a catalytic factor in the development of a broader animal health and productivity improvement programme.

Epidemiological Implications

There are also encouraging indications that through the recording of events in the lives of individual animals, against a background of management, nutritional and productivity information it is possible to throw new light on the epidemiology of health problems. Although findings, to date, have only been presented in the form of student dissertations it is obvious that the approach can give us a much clearer understanding of the nature and importance of such undramatic problems as lameness and abortion. A study now in preparation for a scientific journal, should produce more conclusive evidence on the patterns, relationships, effects and responses to treatment in clinical mastitis. A detailed study of veterinary costs is also in progress.

There is, of course, a low limit to the amount of information that can be recorded on a routine basis so it is impractical to go into great detail on individual disease problems. However, additions could be made to the present, limited, list of disease and treatment items without jeopardising the routine efficiency of the scheme. These could produce a large volume of findings from special surveys conducted on appropriate samples of herds from time to time. Furthermore, herds in such a scheme could be used as part of periodic national surveys to assess changes in less common disease patterns. In every case historic information and details of the characteristics of the herd would be available automatically. Year to year differences within the same herd, differences in herd size and lactation, housing and management patterns and geographical factors are often more important in the development of a disease problem than are variations in the characteristics of the agents which eventually cause the damage.

Operational Problems

In such an appraisal it is essential to point out the deficiencies and drawbacks of the scheme in its present form. Many herdsmen, farmers and veterinarians could not cope with the present Melbread procedures. In the current economic climate special visits to farms to collect data are not viable and postal communication is proving increasingly expensive. The current punch card record and means of access to the computer are subject to error and sometimes delay the return of reports to participants. The "print-out" too is somewhat cumbersome and requires practice in interpretation. Never the less it appears possible to overcome these problems to a substantial extent.

Integrated Recording Services

Ideally the components of the present scheme should be integrated into a comprehensive service. At present, a bewildering choice of recording schemes serving specialised objectives is available to the farmer. Among the best known are the Milk Recording by Statement (MRS), Herd Management Control (HMC) concerned with milk

production forecasts for individual herds and the Dairy Management Scheme (DMS) which covers physical and financial data. All of these are offered by the Milk Marketing Board. Meanwhile, the Ministry of Agriculture and private organisations such as feed manufacturers, offer other management and financial control systems as well as specialised services including feed analysis.

As yet all the above schemes lack essential information on fertility. Co-operative work has, therefore, begun with the Milk Marketing Board and other organisations to see how this additional information could be incorporated. If regular pregnancy diagnosis results could be included in the MRS, which is used by a large proportion of British herds, it could provide an effective fertility management aid. The MRS monthly report could be modified to identify problem cows and the annual report could be changed so that much more summary information is included. The overall aim of this and any other scheme is to focus attention on cows failing to achieve agreed standards.

For the longer-term, consideration is being given to even broader schemes, which will serve as a basis for comprehensive advisory and preventive medicine schemes for various species of livestock. The forward work plan for the Melbread Scheme, therefore, includes:-

a A feasibility test of a carbon copy diary sheet for mailing from farms or by veterinary surgeons to replace the current transcription sheets;

b Quicker and more reliable input of data to the computer using new equipment now being installed;

c A new computer programme providing additional health and treatment data codes for routine use, with a capacity for handling larger bodies of detailed information when special investigations are undertaken;

d Improved data storage and access;

e Simpler computer output documents reducing the amount of numerical material and increasing graphic presentations;

f Regular summary findings from all herds on management, fertility and disease data;

g Exploration of schemes of a similar nature for other species and production systems.

The Reading group hopes to continue a research and development role in these fields and is anxious to enjoy further close collaboration with all groups and agencies. A multidisciplinary co-operative effort is needed to formulate national and regional schemes which minimise the paper work involved yet improve the efficiency of production systems and supply information for policy making, advisory and research purposes that has not, hitherto, been available. Computer technology is improving at such a pace that all these objectives can be achieved at surprisingly low cost.

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UNIVERSITY OF READING – MELBREAD RECORDING SCHEME

APPENDIX Ia

Coding Sheet – November 1973

01 Calving
02 Abortion in or after sixth month
03 Abortion up to end of fifth month
04 Post natal check by practitioner
05 Rearing calves
06 Drying off examination
07 Drying off (without treatment)
08 Drying off (with treatment)
09 Oestrus without service (BNS)

10 Oestrus with AI (unknown bull)
11 AI Other
12 AI Guernsey
13 AI Jersey
14 AI Friesian
15 AI
16 AI
17 AI
18 AI
19 AI

20 Natural service (unknown bull)
21 Natural service - Bull 1
22 Natural service - Bull 2
23 Natural service - Bull 3
24 Pregnancy check – recheck required
25 -ditto- pregnant to last service
26 -ditto- pregnant to last service but one
27 -ditto- pregnant to last service but two
28 -ditto- pregnant to last service but three
29 -ditto- pregnant to unrecorded service

30 Pregnancy check – not pregnant – no treatment
31 -ditto- placebo
32 -ditto- CL removed
33 -ditto- CL squeezed
34 -ditto- Oestrogen
35 -ditto- unspecified treatment
36 -ditto- Nymfalon
37 -ditto- Kamar Heat Detector
38 -ditto- progesterone
39 -ditto- Luteinizing hormone

40 No visible oestrus – no treatment
41 -ditto- placebo
42 -ditto- CL removed
43 -ditto- CL squeezed
44 -ditto- Oestrogen
45 -ditto- unspecified treatment
46 -ditto- Nymfalon
47 -ditto- Kamar Heat Detector
48 -ditto- progesterone
49 -ditto- Luteinizing hormone
50 Failure to conceive – no treatment
51 -ditto- no treatment – recommend cull
52 -ditto- treated
53 Endometritis – no treatment
54 -ditto- unspecified treatment
55 Endometritis – treatment 2
59 -ditto- unspecified treatment
60 Farmer treatment – Preventive or diagnostic measure
61 -ditto- injury or lameness
62 -ditto- dystocia
63 -ditto- retained placenta or endometritis
64 -ditto- bloat
65 -ditto- metabolic disorder
66 -ditto- parasitic disease
67 -ditto- mastitis
68 -ditto- other infectious disease
69 -ditto- non?infectious disease
70 Vet. treatment – preventive or diagnostic measure
71 -ditto- injury or lameness
72 -ditto- dystocia
73 -ditto- retained placenta
74 -ditto- repeat breeder or endometritis
75 -ditto- metabolic disorder
76 -ditto- parasitic disease
77 -ditto- mastitis
78 -ditto- other infectious disease
79 -ditto- non-infectious disease

80 Sold – reason unknown
81 Sold – injury or lameness
82 Sold – miscellaneous
83 Sold – Old age
84 Sold – infertility
85 Sold – behavioural faults
86 Sold – low production
87 Sold – mastitis
88 Sold – other infectious disease
89 Sold – non?infectious disease

90 Died – reason unknown
91 Died – injury or lameness
92 Died – miscellaneous
93 Died – old age
94 Died – bloat
95 Died – metabolic disorder
96 Died – parasitic disease
97 Died – mastitis
98 Died – other infectious disease
99 Died – non-infectious disease

1. HHV – Herd Health Visit

2. Practitioners are invited to use the codes for 'other unspecified treatments' for treatments which they themselves themselves instigate. It is suggested that a code is made on this sheet as to the treatments so coded.

3. Any questions concerning the coding to:

R.J. Esslemont, Department of Agriculture,
University of Reading,
Reading, Berks.

SUMMARY OF THE MAIN FACTORS OF MANAGEMENT AFFECTING 22 HERDS ON MELBREAD SCHEME (JAN. 1965)

Herd No.	No. in Herd	Housing	Parlour	Grazing	Conservation	Men in Parlour	No. Men Total	Weigher on farm?	Months no serving is practised	Int. to PD (days)	Calv. to AI days	AI used	Bull used	Kamar used	Bruc. free
1 F	350	C	H	P	M&GR/Sil	1	1	Y	8, 9, 10	35	42	Y	Y	N	Y
3 F	280	C/LH	H	SS	Sil	2	3	Y	None	+60	42	Y	Y	Y	Y
5 F	300	C	H	P	GR/Sil	2	3	N	9, 10, 11	+60	42	Y	N	N	Y
6 F	205	C	H	SG	GR/Sil	2	3	N	8, 9, 10	50	42	Y	N	Y	N
7 F	200	C	H	SG	GR/Sil	2	3	N	8, 9, 10	50	42	Y	Y	Y	N
8 F	204	C	H	SG	GR/Sil	2	3	N	8, 9, 10	50	42	Y	N	Y	N
9 F	245	C	H	SG	GR/Sil	2	3	N	8, 9, 10	50	42	Y	N	Y	N
10 F	248	C	H	SG	GR/Sil	2	3	N	8, 9, 10	50	42	Y	N	Y	N
11 F/A	100	C	H	SG	GR/Sil	2	3	N	9, 10	50	42	Y	Y	Y	Y
12 A	65	C	H	SG	GR/Sil	2	3	N	None	50	42	Y	N	Y	
22 F	298	C	H	P	M&GR/Sil	2	4	Y	8, 9, 10	56	56	Y	Y	N	Y
44 F	122	C	R	P	S/H	2	3	N	8, 9, 10	42	45	Y	Y	Y	Y
45 F	126	C	R	P	S/H	2	3	N	8, 9, 10	42	45	Y	Y	Y	Y
51 F	152	C	H	P	Sil	1	1+	N		40/54	50	Y	Y	Y	Y
58 F/A	113	C	H	P	Sil	1	1	N		42	60	Y	N	Y	Y
63 F	151	LH	H	P	S/H	2	2+	N		42	60	Y	Y	N	Y
66 J	95	LH	AB		S/H	1	1	N		50	40	Y	Y	Y	Y
69 F	133	C	H	SG	S/H	1	1	N		42	60	Y	Y	Y	Y
70 F	88	LH	H	P	S/H	1+	1+	N		56	60	Y	Y	Y	Y
72 A	49	BYRE	BYRE	P	Sil	2	2	Y		45	56	Y	Y	N	Y
82 F/A	260	C	R		Sil							Y	Y	Y	
83	164	C										Y	Y	Y	

KEY

AB = Abreast
C = Cubicle
GR = Grass
H = Herringbone
P = Paddocks
R = Rotary
SG = Strip grazing
SS = Set Stocking
K = Kennel
LH = Loose Housing
M = Maize
N = No
Y = Yes

APPENDIX Ib

APPENDIX 2a

10 Herds over Three Seasons. Main Indices

	No. Calving			% Served		
Herd No.	71-72	72-73	73-74	71-72	72-73	73-74
1	322	338	363	94.7	92.0	88.1
3	295	241	267	97.6	92.1	96.6
5	294	301	312	83.6	83.4	79.2
6	202	205	212	92.1	89.2	88.2
7	195	198	216	93.8	90.9	88.8
8	205	204	202	90.7	91.1	97.0
9	224	233	236	95.1	99.6	90.2
10	-	240	258	-	95.4	93.7
11	99	115	111	97.0	93.9	91.9
12	66	72	80	100.0	93.0	87.5

	Calving to 1st Service Interval			% Conceiving of those Served		
	71-72	72-73	73-74	71-72	72-73	73-74
1	74.7	75.1	74.6	89.1	85.5	87.2
3	71.7	63.6	82.3	89.9	83.8	81.7
5	71.6	65.8	73.3	90.6	93.6	87.4
6	68.3	77.7	70.1	94.1	91.2	85.6
7	73.1	72.6	74.4	88.0	90.5	83.8
8	71.9	75.9	75.1	86.5	86.5	92.8
9	76.9	65.8	69.8	91.1	77.5	88.7
10	-	83.1	64.3	-	95.6	95.0
11	90.3	71.0	65.7	88.5	86.1	93.1
12	86.3	70.4	67.6	96.9	89.5	98.5

Herd No.	Calving to Conception			Serves per Conception			% Conceiving of Calved		
	71-72	72-73	73-74	71-72	72-73	73-74	71-72	72-73	73-74
1	96.2	98.6	95.8	1.72	1.78	1.68	84.5	78.6	76.8
3	103.8	91.1	121.4	1.87	1.79	2.02	87.7	77.1	79.0
5	93.4	81.2	85.6	1.66	1.55	1.38	75.8	78.1	69.2
6	100.0	105.0	90.1	1.89	1.74	1.68	86.6	81.4	75.5
7	103.1	113.3	104.3	2.13	2.06	1.90	82.5	82.3	74.5
8	98.6	110.5	97.8	1.75	1.87	1.74	78.5	78.9	90.1
9	100.0	96.5	89.8	1.57	1.64	1.54	86.6	77.2	80.1
10	-	107.4	85.9	-	1.73	1.49	-	91.2	89.1
11	131.0	98.2	94.8	1.84	1.84	1.71	85.8	80.9	85.6
12	118.0	89.7	96.7	1.50	1.41	1.74	96.9	83.3	86.2

	First Service Conc. Rate			Overall Conc. Rate			% Culled of Calved		
	71-72	72-73	73-74	71-72	72-73	73-74	71-72	72-73	73-74
1	50.8	50.8	52.5	50.1	49.3	52.3	19.6	23.3	25.9
3	51.4	48.2	37.6	45.9	42.0	38.9	6.7	24.9	19.8
5	58.5	61.3	66.8	49.4	57.1	58.1	23.1	24.2	31.4
6	55.4	56.2	49.7	44.0	51.5	45.1	13.4	15.1	23.1
7	40.5	42.8	41.7	37.9	42.5	42.4	13.3	14.1	24.1
8	46.2	48.7	54.1	48.9	42.3	49.7	20.0	21.5	11.4
9	60.6	52.3	56.8	54.2	48.9	52.0	8.9	14.6	21.2
10	-	53.3	63.2	-	54.9	62.2	-	7.5	11.2
11	43.7	46.3	50.0	42.4	44.3	53.4	8.1	19.1	14.4
12	67.2	64.1	61.4	64.4	61.6	57.0	(3.0)	18.1	22.5

APPENDIX 2a

Herd No.	Interval from 1st Service to Conception			Estimated Detection Rate			Estimated Fertility Status		
	71-72	72-73	73-74	71-72	72-73	73-74	71-72	72-73	73-74
1	21.5	23.5	21.2	80	80	80	63.7	56.6	59.2
3	32.1	27.5	39.1	70	85	70	67.0	60.9	28.6
5	21.8	15.4	12.3	80	85	90	68.7	84.1	81.4
6	31.7	27.3	20.1	80	70	90	65.9	62.2	66.0
7	30.0	40.7	29.9	85	70	80	52.6	43.4	42.2
8	26.7	34.6	22.7	80	70	90	57.8	44.0	71.4
9	23.1	30.7	20.0	70	70	90	79.7	70.8	74.7
10	-	24.3	21.6	-	80	70	34.5	65.9	95.3
11	40.7	27.2	29.1	70	85	60	-	57.8	70.0
12	31.7	19.2	29.1	40	80	55	61.2	87.7	66.1

	% Served by Target	
	71-72	72-73
1	77.7	83.8
3	74.6	86.0
5	77.6	92.5
6	93.6	95.0
7	91.3	94.0
8	84.9	93.5
9	83.3	94.0
10		94.7
11	31.2	72.4
12	54.6	77.6

12 Herds over Two Seasons

Herd No.	Number Calving		% of those calved, served		Calving to first service interval	
	72-73	73-74	72-73	73-74	72-73	73-74
22	279	334	94.2	92.5	80.6	67.0
44	74	114	95.9	92.9	75.5	64.0
45	112	110	89.2	82.7	84.9	73.0
51	119	131	85.7	93.8	69.5	74.1
58	115	108	91.3	90.7	73.7	67.8
63	174	183	87.3	87.4	74.4	78.8
66	67	95	91.0	86.3	73.3	69.8
69	100	104	89.0	91.3	60.7	71.1
70	81	93	93.9	87.1	72.2	49.7
72	43	54	95.3	74.1	79.6	75.0
82	186	219	93.5	97.7	64.7	66.2
83	134	157	86.6	95.5	66.7	86.1

	% Conceiving of those Served		Calving to Conception interval		Serves per Conception	
	72-73	73-74	72-73	73-74	72-73	73-74
22	85.9	82.2	122.0	101.8	2.04	2.07
44	91.5	94.3	112.2	88.4	1.98	1.64
45	89.0	90.1	123.2	91.9	1.93	1.40
51	93.1	94.3	83.2	99.9	1.48	1.83
58	87.6	96.9	97.3	86.7	1.64	1.65
63	94.1	89.3	85.9	94.2	1.41	1.38
66	90.1	90.2	90.8	103.3	1.65	2.15
69	92.1	96.8	114.4	99.8	1.58	1.85
70	92.1	79.1	100.4	85.0	1.71	1.74
72	82.9	90.0	100.8	101.6	1.62	1.86
82	83.9	95.3	92.4	89.9	1.77	1.71
83	77.6	84.6	88.6	105.3	1.50	1.63

APPENDIX 2b

	% Conceiving of Calved		First Service Conc. Rate		Overall Conc. Rate	
Herd No.	72-73	73-74	72-73	73-74	72-73	73-74
22	81.0	76.0	43.3	38.2	38.4	38.0
44	87.8	87.7	42.2	59.4	44.5	55.2
45	79.5	74.5	43.6	67.9	43.0	60.9
51	79.8	88.5	65.6	52.0	61.0	51.3
58	80.0	87.9	49.5	59.2	48.7	55.9
63	82.2	78.1	70.4	57.5	61.9	62.8
66	82.1	77.8	55.7	45.1	48.3	39.7
69	82.0	88.4	61.8	50.5	59.6	50.5
70	86.4	77.4	50.0	39.5	53.8	49.3
72	79.1	66.6	53.6	40.0	45.9	50.7
82	83.9	93.1	47.1	57.0	43.3	51.8
83	77.6	80.9	50.8	49.7	45.6	47.4

	% Culled of Calved		Interval from first service to Conception		Estimated Detection Rate	
	72-73	73-74	72-73	73-74	72-73	73-74
22	19.7	26.6	41.4	34.8	70	80
44	10.8	19.3	36.7	24.4	65	80
45	17.8	29.1	38.3	18.9	80	80
51	22.7	12.2	13.7	25.8	80	80
58	14.8	12.0	23.6	19.1	80	85
63	16.7	21.8	11.5	15.4	80	80
66	11.9	20.0	17.5	17.0	80	85
69	11.0	10.6	53.4	8.5	30	70
70	14.8	22.5	28.2	35.3	70	60
72	23.2	29.6	21.2	26.6	80	80
82	8.1	10.0	27.7	23.7	80	85
83	20.1	19.7	21.9	19.2	80	85

	Estimated Fertility Status	
	72-73	73-74
22	29.5	40.0
44	47.8	78.5
45	31.6	76.8
51	88.4	66.3
58	67.7	87.0
63	97.3	75.5
66	81.0	46.7
69	63.7	66.9
70	64.0	65.2
72	59.1	40.3
82	76.1	83.4
83	75.2	55.5