Effects of mastitis on milk yield and composition

Department of Agriculture, Western Australia
EVERY DAIRY farmer knows how much he spends on the treatment of cows affected with mastitis, but the actual loss in production is more difficult to estimate.

As part of the current mastitis research programme the Department of Agriculture's Animal and Dairying Divisions surveyed 37 dairy herds with a believed high incidence of mastitis. Twenty-five of these herds, involving 1,335 cows, were subsequently studied in detail, to determine the effect of mastitis on the yield and composition of milk.

All 25 farms involved in the project were required to meet acceptable standards of husbandry, hygiene, and maintenance and operation of milking machines.

Mastitis may be either clinical (showing obvious symptoms) or sub-clinical. Dairymen are aware that clinical mastitis causes a reduction in milk yield and change in milk appearance, as well as an alteration in the chemical composition of the milk. Sub-clinical mastitis can be diagnosed only with the aid of special tests and does not cause obvious changes in milk—but nevertheless may cause loss in yield and quality.

The survey
Milk yield, fat, protein and lactose content, were measured from each quarter of each cow in the selected herds at two consecutive milkings; the solids-not-fat content was also measured in some cases. Each quarter of the udder was also examined for clinical abnormalities and milk samples from each quarter were later examined in the laboratory for the presence of bacteria and cells. A rapid cow-side mastitis test was applied to milk from each quarter.
Measurable losses from mastitis indicated by the survey exceed $800,000 a year. The total loss to the State, when other losses are added, is probably $2 to $2½ million a year.

As a result, quarters which were abnormal either clinically or on the basis of laboratory tests could be identified and their milk yield and composition could be compared with normal quarters. In this way, for example, the yield and composition of milk from a completely normal front quarter could be contrasted with the yield and composition of a matching abnormal front quarter.

Differences in the yield and composition of milk from such comparisons were considered as being due to the effect of mastitis.

Results

Quarters with clinical mastitis (abnormal signs together with organisms and cells) yielded 6.05 lb. less milk per day than their normal neighbours, 0.29 lb. less fat, 0.19 lb. less protein, 0.31 lb. less lactose and 0.50 lb. less solids-not-fat.

For quarters with subclinical mastitis (no abnormal signs but with organisms and cells) and a positive cow-side test the daily reductions were milk, 2.39 lb.; fat, 0.11 lb.; protein, 0.07 lb.; lactose, 0.12 lb.

For quarters with subclinical mastitis and a negative cow-side test the daily reductions were milk, 1.73 lb.; fat, 0.09 lb.; protein, 0.06 lb.; lactose, 0.15 lb.; solids-not-fat, 0.15 lb.

Quarters with “latent” infection (the only abnormality detected being the presence of pathogenic* organisms) showed little variation in milk yield or composition, but the number of quarters in this category was too low to provide valid evidence.

The average milk yield of cows free of mastitis (247 cows) was 28.02 lb. per cow per day; the yield for all cows, both free and mastitis-affected, averaged 27.55 lb. per cow per day. The yield for cows affected with mastitis in any form (1,088 cows) was 27.44 lb. per cow per day.

Explanatory notes

A mastitis infection develops through several stages. When a quarter becomes infected by a pathogenic organism, it may

* A pathogenic organism is an organism capable of causing disease—in this case, mastitis.
continue to secrete the normal amount of milk of the usual composition—but only for a time.

When the organism persists it causes some tissue damage, although manual examination of the udder may not reveal it. Milk yield and composition are likely to decline, in proportion to the amount of tissue damage.

When mastitis is cured, the milk yield and composition from the infected quarter usually does not revert to its previous level, but may do so in the following lactation.

The cell count of milk from a quarter cured of an infection by a pathogenic organism may remain high for several weeks, even months. The result from one rapid cow-side mastitis test, which indicates the number of leucocyte cells present, if it is not supported by other tests, may give a false impression. Furthermore, cells are often present in large numbers in colostrum, and again when the cow is near the end of her lactation, due to causes other than mastitis.

The mere presence of what may appear to be mastitis-causing organisms in milk does not necessarily mean that there is an established infection in the udder. The skin generally, and especially that on the udder and teat canal, may contain bacteria, particularly staphylococci. Some are probably harmless, whereas others certainly are not, but they cannot readily be distinguished by any of the usual laboratory tests. Both kinds may be present in the milk.

Implications
Since cows in the study were in all stages of lactation when examined the above results are taken to represent “entire lactation” averages.

The results are limited to some extent in that they are based on the measurement of one day’s milk production and laboratory examination of only two sets of milk samples. All results are given as averages.

However, keeping these limitations in mind, the average cost of the reduction in yield and composition of milk caused by mastitis can be estimated, using the following assumptions:—

- An average lactation period of 250 days. (This corresponds to the average for cows under herd recording for 1969-70).
- An average price of manufacturing milk at the farm of 20 cents per gallon as milk, or 38 cents per pound of butterfat or cream.
- A general incidence of mastitis similar to that found in the 1964-65 survey in which, for all mammary quarters—
  20.9 per cent. of quarters had evidence of clinical mastitis. About \( \frac{1}{3} \) of these also secreted milk containing both pathogenic organisms and cells; and
  6.3 per cent. of quarters had evidence of subclinical mastitis. More than half of these secreted milk containing both pathogenic organisms and cells.
- Average daily milk loss due to clinical mastitis was 6 lb. per infected quarter, and due to subclinical mastitis 2 lb. per infected quarter.

On this basis the calculated loss for each quarter affected with clinical mastitis amounted to $30 for the entire lactation, and for each quarter affected with subclinical mastitis, $10 for the entire lactation.

When the total number of quarters affected with one or the other of these kinds of mastitis (10.5 per cent.) is weighted proportionately to the incidence of each, it can be shown that the average affected quarter sustains a loss of $23 per lactation.

The true loss must be somewhat greater than this because the total percentage of affected quarters (27.2 per cent.) is considerably greater than the percentage of affected quarters (10.5 per cent.) for which significant data were available and which formed the basis of the present calculations.

Losses other than outlined above include—

(a) For quota milk, the cost would be greater as this is valued at over 40 cents per gallon.
(b) Milk discarded because of abnormal appearance or content of residual antibiotic.
(c) Cost of antibiotics and treatment of infected cows.
(d) Cost of farmer’s time in treating cows.
(e) Reduced length of lactation of severely affected cows.
(f) Excessive herd wastage—and inadequate culling of low producers.
(g) Lowered milk composition and yield as a result of previous mastitis infection; the 1964-65 survey revealed 10.3 per cent. of quarters to be affected in this way.

A conservative estimate of the cost of mastitis to Western Australian dairy farmers, based on the measurable losses revealed by this survey, is more than $800,000 per year. The actual cost, when the non-measurable and incidental losses are added, is probably two or three times this, or from $2 to $2½ million per year—a heavy burden for an industry milking about 85,000 cows each year.

THE MARCH OF MASTITIS . . .

It is interesting to compare some of the results of this survey with those of the 1964-65 survey.

If the data for organisms resistant to antibiotics can be taken to apply generally, it appears that farmers are using more antibiotics, and a greater variety of antibiotics, than in 1964-65.

Figures for the proportion of staphylococci resistant to the antibiotics tested illustrate this point.

<table>
<thead>
<tr>
<th>Survey</th>
<th>Per cent. Staphylococci resistant to</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Penicillin</td>
</tr>
<tr>
<td>1964-65</td>
<td>28.4</td>
</tr>
<tr>
<td>1967-69</td>
<td>61.2</td>
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<tr>
<td>Approximate increase</td>
<td>2-1/5th times</td>
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The increased resistance is a threat to the future control of mastitis and poses problems where public health aspects are concerned.

Only 24 per cent. of nearly 6,000 quarters, normal clinically, gave milk without organisms or cells. In the 1964-65 survey the figure was 38 per cent. of 16,352 quarters.

The proportion of clinically abnormal quarters giving milk with a high cell count and pathogenic organisms was 39 per cent. compared to 29 per cent. in the 1964-65 survey.

Acknowledgment

It is a pleasure to acknowledge the ready assistance of the dairy farmers who participated in this study, often at considerable inconvenience to themselves.