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A SURVEY OF THE ACCURACY AND USE OF THREE MILK METERS

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SUMMARY

Milk yields of 59, 15 and 31 cows were measured with the Milky Weigh, Bodmin and Johnson milk meters respectively, and comparisons were made with scale weights. Meters were accurate in one-third of readings. Most readings with the Milky Weigh meter were higher than weights (positive). Both high and low readings were noted on the Bodmin while most readings were lower than weights (negative) in the case of the Johnson. Of all readings, 83% (Milky Weigh), 74% (Bodmin) and 75% (Johnson) did not deviate more than $\mp$ 5% from weights. Correlation coefficients of 0·9 were derived in the case of each meter. Regression coefficients were calculated and equations for regression lines prepared.

The Milky Weigh was most convenient to use, as it had little effect on milking machine operation. Milking machines with a low reserve of air could be affected by the Johnson, while a loss of 1 cu ft of air occurred at 15 in. of vacuum when the Bodmin was being used.

I. INTRODUCTION

Where milking installations utilize pipeline systems, there are problems associated with the weighing and sampling of milk from individual cows. Herd recording operations are based on the collection of milk in vacuum buckets prior to weighing and sampling. This requires amendment to the milking routine and necessitates the employment of a person to do the extra work in the shed.

A simple method of measuring the milk production of individual cows in an economical, convenient and accurate manner would entail the installation of a measuring device which would eliminate the need for collecting and weighing. The search for a suitable instrument has led to a survey of the accuracy and use of the "Milky Weigh", "Bodmin" and "Johnson" milk meters.

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II. METHODS AND MATERIALS

The milk meters examined were constructed chiefly of plastic material. In both the Bodmin and the Johnson meters, interior fittings contained stainless steel and/or tin-plated brass. There were no moving parts incorporated in the designs. As milk flowed through the meters a small quantity was diverted into their graduated containers, from which weights were read directly. The Milky Weigh and the Johnson containers were graduated in divisions of 1 lb, while the Bodmin was graduated with ½ lb divisions.

Meters were set up in milking sheds in accordance with the directions provided by the manufacturers. They were located in the milk line between teat-cups and vacuum buckets. Cows were milked normally (by the owner of each herd), and milk was passed through meters to be collected in vacuum buckets of the type used by Herd Recorders.

Samples of milk were taken in the case of the Milky Weigh meter in order to calculate fat contents. Containers of the Milky Weigh and the Bodmin meters were easily emptied after each reading was made (or sample taken) by inverting them and allowing air to enter through the teat-cups. Inversion was not necessary with the Johnson meter, as air was allowed to enter through a valve provided on the bottom of the container.

The accuracy of meters was determined by comparison with readings (to the nearest ½ lb) on standard scales. Testing was carried out in six different herds. The Australian Illawarra Shorthorn breed was predominant in three herds, Friesian in one and Jersey in one, while the remaining herd contained animals of mixed breeds. Although the milking rates of individual cows were not measured accurately, an attempt was made to include slow (less than 2 lb/min) and fast milkers (exceeding 5 lb/min). Low-yielding and high-yielding cows were included in the survey—the productions ranged from 3·0 to 22·5 lb per milking.

III. RESULTS AND DISCUSSION

(a) Milky Weigh Meter

Meter readings of 59 cows were compared with actual weights. Weights ranged from 3·0 to 22·5 lb and averaged 10·8 lb. In five cases milk was produced at less than 2 lb/min, and in nine cases the rate of milking exceeded 5 lb/min.

Although no variations between readings and weights were noted in 32·2% of comparisons, the remaining 67·8% showed differences ranging from 0·5 to 2·0 lb. When all readings were considered, 83% did not deviate more than ± 5%, or 0·5 lb, from weights. There were no negative differences greater than 0·5 lb.

Regression coefficients of 1·01 and 0·98 respectively were derived from meter and weight comparisons. If M = meter reading and M^1 = weight from scales, then the regression line for the set of readings is given by the equation—

$$M^1 = 1{\cdot}01\,M - 0{\cdot}6 \qquad (r = 0{\cdot}9)$$

Milking machine operation did not appear to be affected when the meter was being used.

Frothing in the cylinder was noted, but did not present a serious problem when readings were made.

(b) **Bodmin Meter**

Fifteen comparisons of the Bodmin meter were made in two herds. Weights of milk ranged from 4·5 to 20·0 lb, with an average of 12·2 lb. The rates of milking of individual cows varied from approximately 2 to 6 lb/min.

No differences between readings and weights were noted in 33·3% of comparisons. The remaining 66·6% showed variations of 1·0 lb or less: 74% of all readings did not deviate more than ± 5%, or 0·5 lb, from weights. Both negative and positive differences occurred.

Regression coefficients of 1·07 and 0·92 respectively were derived from meter and weight comparisons. Using M = meter and M^1 = weight, the regression line for the set of readings is given by the equation—

$$M^1 = 1{\cdot}07\ M - 0{\cdot}9 \quad (r = 0{\cdot}9)$$

It was apparent that milking machine operation was affected by this meter. Measurements indicated that a loss of 1 cu ft of air per minute occurred at 15 in. of vacuum.

In making readings it was necessary to allow for a layer of froth in the cylinder. The froth could not be dispersed by shaking the meter in accordance with the instructions provided.

(c) **Johnson Meter**

The survey on this meter involved 31 comparisons in three herds. Weights of milk and milking rates were similar to those described above.

Differences between readings and weights were observed in 68·0% of comparisons. Of the readings noted, 75% did not deviate more than ± 5%, 0·5 lb, from weights. Differences were chiefly negative, with a maximum of 3·5 lb. Using M = meter and M^1 = weight, the regression line for the set of readings is given by the equation—

$$M^1 = 0{\cdot}96\ M + 1{\cdot}19 \quad (r = 0{\cdot}9)$$

No adverse effects were noted with regard to milking machine operation. As the emptying procedure depends on intake of air through a valve, the efficiency of machines with a low reserve of air could be affected.

While frothing was present in the cylinder, it did not present a serious problem when readings were made.

(d) **Comparisons**

Results are summarized in Table 1, which compares the accuracy of the three meters.

TABLE 1

ACCURACY OF MILK METERS IN SURVEY

Meter	Percentage of Accurate Readings	Regression Equation (M = meter; M^1 = weight)
Milky Weigh ..	32·2	$M^1 = 1{\cdot}01M - 0{\cdot}6$
Bodmin	33·3	$M^1 = 1{\cdot}07M - 0{\cdot}9$
Johnson	32·0	$M^1 = 0{\cdot}96M + 1{\cdot}19$

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