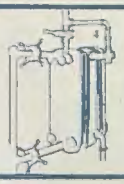
AGRICULTURAL EXTENSION SERVICE · UNIVERSITY OF MINNESOTA

# MINNESOTA DAIRY PRODUCTS PROCESSOR





Editor: V. S. Packard
Extension Specialist, Dairy Products

October 1, 1979; No. 74

This newsletter highlights the results of a University of Minnesota study recently completed on three methods of testing various components in milk.

## METHODS STUDIED

Three routine methods were evaluated--two dye-binding and one infra-red device. One of the dye-binding methods used amido black as dye, the other orange g. These units measure protein only. The infra-red device could analyze protein, fat, lactose, solids-not-fat (SNF), and total solids (TS).

## INFORMATION DESIRED

In the evaluation of any routine method of analysis, three criteria determine how well the test performs. These criteria are termed accuracy, repeatability, and reproducibility and are defined as follows:

Accuracy--how well the test agrees with a reference standard (dye-binding vs. Kjeldahl method of protein determination, for example).

Repeatability--how well the test repeats itself on the same sample of milk.

Reproducibility--the degree to which two or more laboratories using the same method are able to agree on the same sample of milk.

## SOME FINDINGS

We looked at the last measure first. Only one device, the Pro-Milk Mark II, was available in the numbers needed, so results are limited to this one test. Different laboratories were able to reproduce test results on the same samples to within 0.215 percent protein, at 95 percent probability. However, agreement was found to be better at 3.2 percent protein (the average level) than at the extremes of protein content found in milk. This suggests the need to calibrate equipment over a wide range of protein levels, rather than at a single, mid-point level. Other steps necessary to achieve best results include: (1) avoiding sampling errors, (2) avoiding data mis-readings (we spotted a couple of these), (3) using milk control samples to check calibration daily, (4) re-calibrating equipment when new dye is purchased (because amido black purity varies), (5) re-calibrating on a seasonal basis (to account for changes in non-protein-nitrogen content), and (6) centralization of laboratory calibration (when several labs within an organization are using the same method).

## ACCURACY AND REPEATABILITY

Table 1 shows accuracy and repeatability, at 95 percent probability, for the three methods evaluated. All three methods were about equal in these measures of test capability.

Table 1. Accuracy and repeatability of three methods used in the determination of protein in milk.

| Component | Method | Accuracy (%) [1] | Repeatability (%) [1] |
|---|---|---|---|
| Protein | Pro-Milk [2] | ± 0.12 | 0.04 |
| | Udy [3] | ± 0.12 | 0.03 |
| | Milko-Scan | ± 0.13 | 0.03 |

[1] At 95 percent probability

[2] Pro-Milk, Mark II; Foss America, Inc., Fishkill, NY 12524

[3] Udy Analyzer, Tecator-Udy Co., Boulder, CO 80301

[4] Milko-Scan 104 (infra-red), Foss America, Inc., Fishkill, NY 12524

## AVERAGE LEVEL OF VARIOUS COMPONENTS

From November 1978, through April 1979, some 1,435 samples of herd milk (from a wide geographic area in Minnesota, western Wisconsin, and southeastern South Dakota) were analyzed on the Milko-Scan infra-red device. These samples reflect the average composition of milk for the area designated. Table 2 gives results.

Table 2. Average and range of level of various components of 1,435 milk samples taken between November 1978 and April 1979.

| Component | Average (%) | Standard deviation | Range (%) |
|---|---|---|---|
| Fat | 3.81 | 0.323 | 2.84-4.78 |
| Protein | 3.20 | 0.168 | 2.66-3.70 |
| Lactose | 4.90 | 0.116 | 4.55-5.24 |
| SNF | 8.80 | 0.219 | 8.14-9.46 |

TESTING FOR SOLIDS-NOT-FAT

Infra-red units measure solids-not-fat (SNF), among other components. Our research indicated that the unit we tested did so with an accuracy (compared with Mojonnier as reference) of ± 0.14 percent, at 95 percent confidence. The device determined fat to within ± 0.10 at the same level of confidence and against the same reference method.

OTHER FINDINGS

Some other findings follow:

(1) Casein can be estimated from a protein (total nitrogen) determination using a factor of 0.784, that is, the factor times percent protein = casein. The estimated value for casein has an accuracy (compared to the reference test) of ± 0.18 - 0.19 percent.

(2) Level of non-protein-nitrogen (NPN) in the samples tested was 0.15 percent. Nitrogen was distributed: casein 78.4 percent, whey proteins 17.23 percent, and NPN 4.36 percent.

(3) Solids-not-fat (SNF) correlates quite well (r = 0.85) with total protein. That is, 72 percent of the variation in SNF can be explained by variations in protein content. While this is a good correlation, it is not good enough for use in a pricing program. If SNF is to be used, a test will have to be made to determine this component specifically.

(4) When the log somatic cell count goes up by one unit (from 100,000 to 1,000,000 for example), casein may be expected to decrease by 1.85 percent and lactose by 0.235 percent. Whey protein increases by about 2.08 percent. Those are all percentages of the total amount of the component present.

Vernal S. Packard, Jr.

Vernal S. Packard, Jr.
Extension Specialist, Dairy Products