associated with fine-grained mudrocks and, consequently, Cantua Creek sediments contain a much higher portion of organic nitrogen. This form of nitrogen can be mineralized as a part of the natural weathering of the sediments.

The ultimate source of nitrogen in geologic sediments from the Cantua Creek Basin may be attributed to organic nitrogen compounds in the older shale formations that crop out along the upper reaches of the creek. The weathering and transport (by mudflow) of organic nitrogen compounds from these older rocks would facilitate nitrification and explain the observed increase in nitrogen concentrations downstream. A secondary enrichment of nitrate by transport and deposition thus would take place towards the mouth of Cantua Creek through progressively younger geologic sediments (see inset in graph of nitrogen concentrations). This mechanism could account for the exceedingly high concentration of nitrate in the younger sediments, which crop out at the mouth of Cantua Creek (for example, the Tulare Formation).

The congruence of decreasing sediment age and decreasing surface elevation thus has produced a major source of nitrate nitrogen for the soils that formed on the alluvial fan at the mouth of Cantua Creek. In the Ortigalita Creek Basin, on the other hand, the absence of the older, organic-rich geologic formations means that no important source of nitrate nitrogen is available for downstream transport. Consequently, this species does not attain the high concentrations observed at Cantua Creek.

The possibility of geologic sediments contributing naturally occurring nitrogen to the soil system has been demonstrated in a study of two drainage basins from the San Joaquin Valley. The data indicate that a nitrate hazard may result in association with soils that have developed from parent materials originating in nitrogen-rich sedimentary units. This potential problem is likely to be encountered in many regions of the San Joaquin Valley that have basins with suites of geologic sediments similar to those in the Cantua Creek Basin. The problem may be compounded further where these naturally high-nitrate soils are used for irrigated agriculture. Attempts to regulate the concentration of nitrate in leachate waters reaching the groundwater zone would have to take into account the significant contribution of native nitrate predating the application of fertilizer nitrate to these soils.

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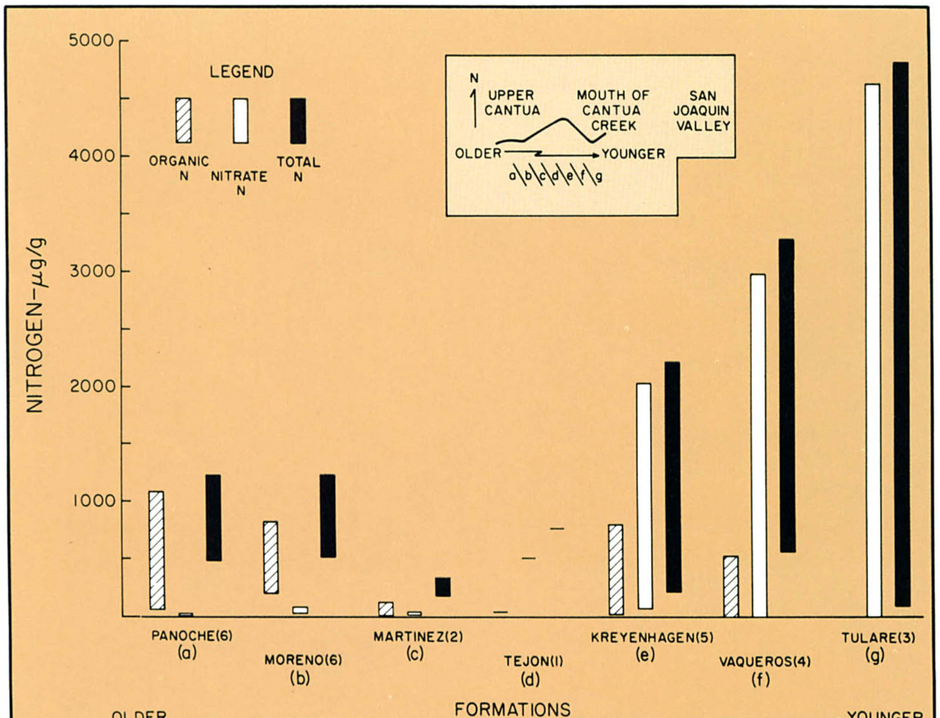

Organic nitrogen, nitrate, and total nitrogen concentrations found in geologic sediments from the Cantua Creek Basin, arranged according to decreasing age.

New "glance" measures dairy

The California dairy industry is characterized by large, high-producing herds. Dairy studies conducted outside the state are sometimes not applicable, particularly with regard to milking parlors because of the wide variety of types and sizes in California. Therefore, a reliable method of estimating cow flow and milker performance in California dairy facilities is being developed to provide data enabling Cooperative Extension workers and farmers to make sound decisions on remodeling or building parlors.

Preliminary trials were initiated to compare a new method of conducting time-and-motion studies with a more conventional method. This new "glance" technique was evaluated in 21 central California dairies—two with floor-level and 19 with elevated herringbone parlors.

The glance technique

The glance technique is a continuing spot-checking method for estimating time used in performing various chores. The investigator glances at the milker(s) and records an impression of the chore. Four random glances per minute for 100 minutes were found to be satisfactory and could easily be converted to percentage of time, seconds per cow, or other parameters.

The technique was first tested to determine its value for spot-checking milker routines and cow traffic patterns at the University of California milking facility in Davis. One technician recorded milker activity by the glance technique, and a second technician made a tape recording of the activity. Later, the tape was timed with a stopwatch for comparative analysis. Uniform chore classifications were developed, so that glance chores were the same as tape-recorded chores.

Observers attended two milkings to be-

technique efficiency

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Mean Statistics for Four Groups of Parlors	Single operator		Multiple operators		
	Manual detachers	Automatic detachers	Manual detachers	Automatic detachers	Mean for all barns
Number of barns studied	2	7	6	6	21
Stalls, 2x	5.0	8.6	8.5	10.0	8.6
Clusters	8.0	17.1	9.8	20.0	15.0
Milkers	1.0	1.0	2.2	2.3	1.7
Stalls per man	5.0	8.6	3.9	4.3	6.7
Cows milked per hour	47.6	62.4	100.1	103.4	83.5
Cows milked per man per hour	47.6	62.4	45.7	44.7	51.2
Cows milked per stall per hour	9.5	7.5	11.8	10.4	9.4
Pounds milk harvested per hour	935.1	1,877.3	2,080.8	2,654.0	2,067.7
Pounds milk harvested per man per hour	935.1	1,877.3	1,149.3	1,140.8	1,369.1
Udder preparation, seconds per cow	12.0	9.4	12.4	11.3	11.0
Cluster handling, seconds per cow	20.2	14.8	19.9	13.7	16.6
Percent time spent productively	89.4	85.1	72.7	75.6	79.2
Percent time spent moving cows	19.3	19.6	15.2	23.0	18.7
Time required per cow to enter barn (seconds)	11.0	10.4	4.5	5.3	7.3
Assistance time: man-seconds per cow for cows to enter barn.	7.4	5.7	4.7	7.6	6.1
Time required per cow to leave barn (seconds)	6.1	6.1	4.8	5.1	5.4
Assistance time: man-seconds per cow for cows to leave the barn	7.0	3.4	3.5	5.6	4.4

NOTE: Data are conclusive only for 21 dairies observed in this study in Sacramento, San Joaquin, Sonoma, and Yuba counties during January and February 1979.

come familiar with techniques and to compare results. Comparison was based on percentage of time engaged in each chore. The first test indicated a mean difference of 1.26 percent between the glance and recorder techniques. Two basic changes were made, reducing the difference to 0.46 percent in the second test: first, the chores were more clearly defined, and second, the observer eliminated the tendency to watch the milker and concentrated only on the glance impression. By glancing, an investigator could easily document the activity of several milkers, the cow flow, and the cow-flow rate.

Herringbone parlor studies

After the initial tests, 21 dairy parlors were studied to develop guidelines for further analyses. Four sets of data were collected:

1. Background: (a) facilities and layout; (b) milkers and performance; (c) milking routine; and (d) cow statistics, including numbers, production, and strings. The statistics were recorded on a three-part checksheet: parlor observations before milking; parlor observations during milking; and information from the dairyman.

2. Milker activity. The activity of each milker was determined by a 100-minute period of "glancing." If more than one milker was involved, each was scored separately but during the same time interval. Chores were classified carefully and recorded at predetermined times.

3. Cow movement data. The time required to move cows into and out of the parlor was recorded. This time was later related to parlor and corral layout, number of stalls, and effort required to move the cows as determined by milker activity, pusher gate, cow pushers, and dogs.

4. Cow throughput data. The parlor throughput in terms of cows per hour, cows per worker per hour, cows per stall hour, milk production per hour, and milk production per man-hour, was determined. These data were collected during the 100-minute glance time used for milker routines and based from the time the front gate was opened on each row of the herringbone parlor.

The raw data were used to determine parlor performance for facilities, cow-milker in action, labor input, and cow flow. These measurements were made simultaneously and gave a good insight into operating performance.

Results

Some interesting facts were observed:

The number of units handled per worker varied from 2.5 to 24, and idle time varied from 10 to 27 percent.

Any parlor type may have widely ranging cow-flow rates. For example, an 8x8-stall, 16-unit, low-line parlor with automatic detachers was credited with an average rate of 55.4 cows per hour, with one milker and average production of 45 pounds per day per cow, and 93.5 cows per hour, with two milkers and average production of 32.5 pounds per day per cow.

Mean udder preparation time per cow varied from 0.112 to 24.03 seconds (time spent per cow handling, or cleaning the udder and/or teats before milking).

The most significant factors are shown in the table, which compares the averages for four parlor groups, giving an overall picture of the dairies visited in the study.

Discussion

The purpose of this survey was to develop guidelines to better understand the design needs of large commercial dairies for efficient cow movement and improved labor training methods.

The glance technique is a simple, versatile means for one investigator to observe several milkers, cow throughput, and cow-flow rate simultaneously in a minimum amount of time, when compared with other methods. More data are required to determine precision of the technique, but for the examination of routines and cow movement, it suffices as a basis for recommendations.

This study illustrates the range of milking conditions and barn performance found in herringbone parlors and indicates the performance that may be expected in an average herringbone parlor. However, experience suggests that wide variations exist between milkers and milking routines. These variables are frequently related to fatigue and other factors affecting the milker's well-being. Studies are under way to compare 100-minute continuous observation with five randomly selected 20-minute time periods during each shift.

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