TABLE III
FORAGE COMPOSITION CHANGES AFTER EPTC TREATMENT

	Per cent composition								
	Vasser E.			Lower strip			Other untreated pastures		
	1961	1960*	1959	1961*	1960	1959	1961	1960	1959
Annual grass	21.0	8.6	49.7	9.4	28.6	49.0	41.3	43.0	40.8
Subclover	36.0	16.0	9.0	21.6	6.0	7.0	20.5	8.9	9.8
Resident clovers	17.7	18.3	6.6	29.3	5.4	9.0	16.0	13.7	11.1
Other forbs	25.0	57.0	33.7	33.7	51.7	26.0	11.8	24.0	27.9
Perennial grass	.3	.1	1.0	6.0	8.3	9.0	10.4	10.4	10.4

*First growing season after EPTC application.

Other counties

In San Benito County, with approximately 13 inches of annual rainfall, three rates of EPTC were tested. EPTC applied in March resulted in a reduction of competition for seeded annual clovers, and the following ground cover estimates were recorded: check, 45.5 per cent; two pounds per acre EPTC, 19.5 per cent; four pounds per acre, 8.5 per cent; and six pounds per acre, 6.1 per cent.

The clover was evaluated near the conclusion of the growing season and the percentage of clover stand recorded (assuming one plant for each 3 inches of row constituted a 100 per cent stand): check, 11 per cent; two pounds EPTC 22 per cent; four pounds, 24.5 per cent; six pounds, 24.5 per cent. In this test even the lowest rate of EPTC significantly increased the clover stand over the check while no increase in clover stand resulted from rates higher than two pounds per acre.

In the Mariposa County plot the principal competing plant was filaree and was not affected by EPTC. Seedling establishment differences for clovers were small. At the Santa Barbara County location a heavy stand of mustard overshadowed any effect of the chemical. The combined effects of the mustard and a short growing season, with limited moisture, appeared to be more critical to clover seedling establishment than the action of EPTC to decrease grass competition.

This study also showed that EPTC is effective without soil incorporation when applied to dry ranges, thus it also might be used to control weedy range grasses, such as medusahead, in certain situations. However, the use of EPTC on forage grazed by livestock is not currently a University of California recommendation because residue information has not been developed.

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The EPTC used in the study was supplied by Stauffer Chemical Company. Assisting with some of the field work were Rocky Lydon, San Benito County; Ray Greberger, Santa Barbara County; and John Anderson, Mariposa County—Farm Advisors, Agricultural Extension Service.

Improper pipe size is a common fault of vacuum supply systems on California dairies. Data presented in this study indicate that a minimum vacuum supply pipe diameter of 1¼ inches is needed to handle four or five milking units and 2-inch pipe is the minimum size required for 7 to 12 units.

PIPE SIZE *and Milking Machine Airflow*

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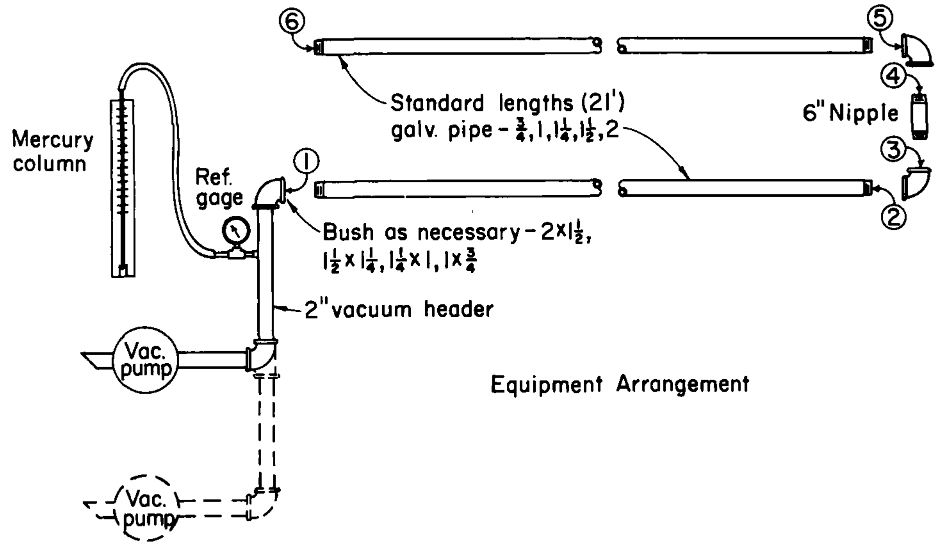
THE MOST COMMON FAULT still observed in pipeline milking machine installations on California dairies is an inadequate vacuum supply system. This includes the vacuum pump, controller and piping up to the sanitary trap just ahead of the milk receiver and to the pulsator pipe. Equipment checks of over 300 dairies showed that quite often the vacuum pump capacity was adequate for the number of milking units in use, but there was a significant airflow loss between the pump and the milking system due to pipe friction. This loss is the difference between the airflow capacity measured at the vacuum pump inlet and the airflow measured into the system at the sanitary trap, which is properly installed close to the milk receiver.

Experience gained from the California Mastitis Test program has established certain quantitative standards for milking machine improvement—including the desirability of providing a vacuum supply of at least 8 to 10 cubic feet of air at 15 inches of mercury, vacuum, per minute per pipeline milking unit. It is acknowledged that the conventional pipeline milking units of either the claw type or the suspension cup type do not normally require more than 4 cfm each for both pulsator and air bleed.

It is more difficult to define air leak losses that frequently occur—especially when milking units fall onto the floor during the milking process. Some manufacturers of milking equipment may not agree that such arbitrary values are necessary to meet the requirements of their units. Others may specify airflow values in terms of "free air" which has one half the volume of "15-inch air." These factors notwithstanding, 8 to 10 cfm per pipeline unit appears the logical vacuum supply figure based on present field experience.

Engineering texts which treat airflow in pipelines are common, but few discuss negative pressure (vacuum) situations of extreme variation such as commonly occur in milking machine systems. The mathematics of calculation are quite involved and would always remain highly presumptive. Such a treatment would certainly be beyond the interest of all who are more immediately concerned with efficient milking and maximum convenience for both cow and milker. This study involved setting up a practical demonstration of the effect pipe size has upon airflow in these systems and presents data meaningful to persons in daily contact with milking machine installation.



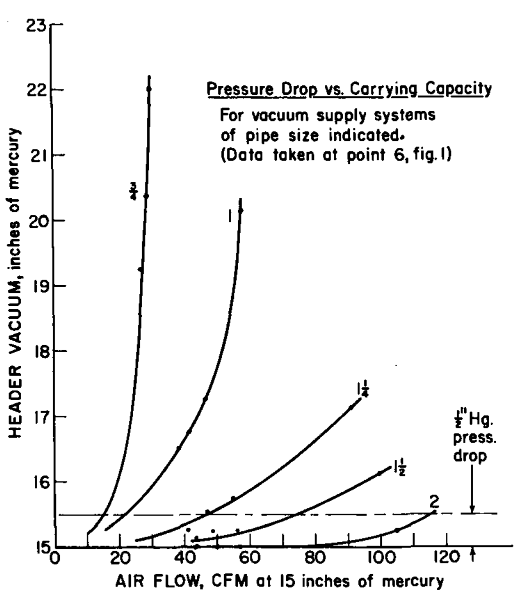
Vacuum supply

Vacuum supply systems usually contain at least two elbows and about 15 to 40 feet of straight pipe. To approximate this condition, the pipe was arranged as shown in the pipe system drawing. Data were taken at points 1 through 6 as the assembly of the six pieces progressed. Each of the five commonly used standard pipe sizes was tested. Three different rotary vacuum pumps were used singly, and one trial was made with two high-speed pumps manifolded in parallel (common header).

All airflow measures were made with a Bou-Matic airflow meter calibrated 0 to 99 cubic feet of air per minute (the air being at 15 inches of mercury, vacuum). All meters and calibrations were cross checked to allow comparison of the flow characteristics of each pipe size, so instrument error of a uniform nature was not a significant factor.

A utility company agricultural engineer recorded electrical load data to check any significant vacuum pump deviations. Dry bulb temperature ranged from 75° to 84° F and wet bulb temperature from 63° to 69° F. Relative humidity varied from 40 to 50 per cent. Elevation at the test area was about 287 feet. These conditions are all typical of California's Central Valley area and are included here to describe more fully the air measured.

The data proved that standard pipe tables giving the restrictive effect of fittings in terms of equivalent straight pipe can be used for milking machine considerations. The meter readings taken at elbows (points 3 and 5) were usually lower than readings taken at the end of a straight pipe or nipple. This would suggest that the nozzle effect of the airflow-meter rubber adapter, when inserted into an elbow, aggravates the turbulence loss caused by such a fitting.



The graph illustrates the limitation of small vacuum supply pipes. The equipment used in these tests did not allow clear definition of the upper limits of the larger pipe sizes, but this area would be of interest to only a small percentage of very large milking operations.

Optimum performance

To obtain optimum vacuum pump performance it is desirable to hold the pump inlet vacuum to the lowest practical level. This suggested that the total pressure drop in this demonstration should not exceed one half inch of mercury measured as the difference between the vacuum level in the header and the vacuum level at point 6. A broken line was therefore scribed across the curves at the one-half inch level, below which the pipe size might be considered adequate and above which severe friction could cause loss of usable pump capacity.

This study was concerned only with airflow under steady conditions through clean, galvanized pipe. The curves presented may be used for comparisons of the common pipe sizes (when new) used for such dairy barn service. This study should not be used as the sole basis for selection of vacuum-supply piping, since no consideration is given dirty conditions, erratic air admission, changes in elevation, methods of pipeline fabrication, and many other field conditions, most of which would favor a larger pipe size.

Conclusions

The data presented in this study indicate:

1. ¾-inch pipe is too small to be considered for vacuum supply
2. 1-inch pipe can be used (questionably) for two pipeline units
3. 1¼-inch pipe is minimum size for 4 to 5 units
4. 1½-inch pipe is minimum size for 5 to 7 units
5. 2-inch pipe is minimum size for 7 to 12 units
6. A pump rated 40–45 cfm (air at 15 inches) should have 1¼-inch pipe for up to 21 feet effective pipe length; 1½-inch for longer than 21 feet
7. A pump rated 50–60 cfm (air at 15 inches) should have 1½-inch pipe (minimum)
8. A pump (or pumps) rated 100 cfm (air at 15 inches) should have 2-inch pipe (minimum).

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