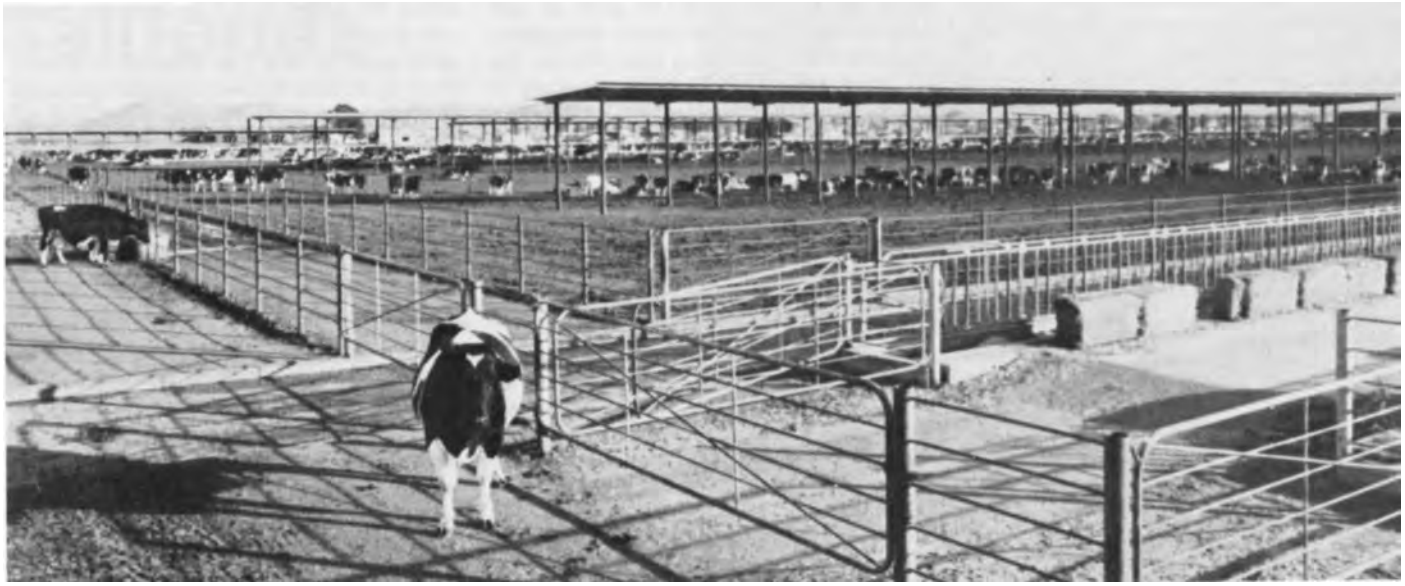


Corral shades.

Heat stress survey

James C. Oliver
Howard M. Hellman
Shirl E. Bishop
C.L. Pelissier
Loren F. Bennett

The cattle and milk-production losses caused by tropical storm Doreen enabled dairymen to evaluate the effectiveness of various heat-stress-reducing devices.

Dairymen in western San Bernardino and Riverside counties suffered a death loss of 725 milk cows and a drastic drop in milk production during the heat wave following tropical storm Doreen in August 1977. Milk and cattle losses totaled approximately one million dollars.

Rain—2.91inches of it—fell almost continuously from 6 p.m. August 16 to 6 a.m. August 18; and for over a week following the storm, relative humidity approached 100 percent each night, dropping to around 50 percent only briefly at midday. (Normal relative humidity for this time of the year is 50 to 55 percent at night and 20 to 25 percent during midday.) That prolonged periods of high humidity, even with only moderately high temperatures, is stressful to dairy cattle is well established. These conditions apparently were reached following storm Doreen. August temperatures were believed to have caused the unusual mortality and drop in milk production. The brief respite periods from the combined effect of temperature and humidity that might have occurred were not sufficient to alleviate abnormally stressful conditions (see figure, page 8).

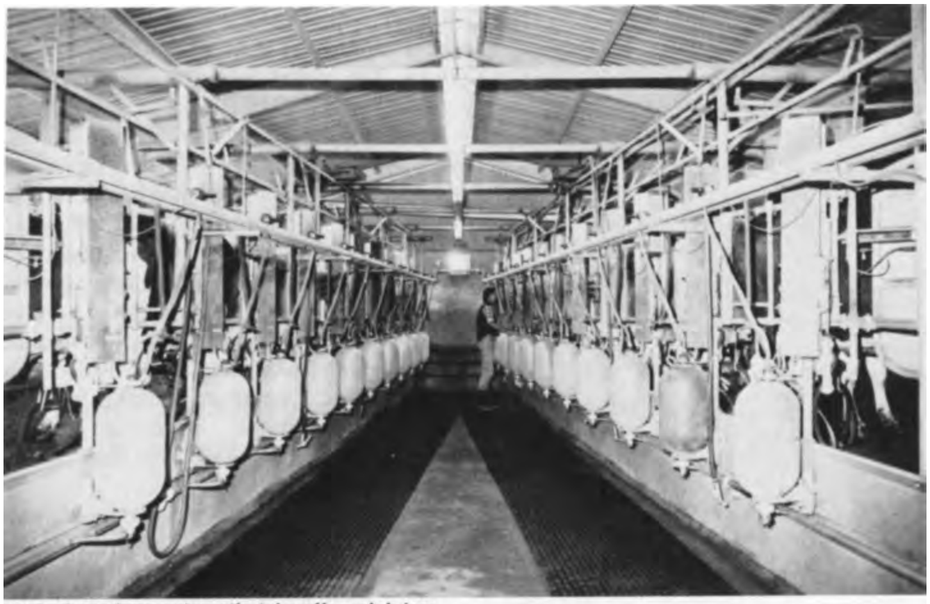
The major period of cow heat stress extended from midday on August 19 to midday August 22. Since the creamery milk weights and fat test are for the evenings followed by the morning milkings, they would primarily reflect the stress of the previous day. The most critical days of stress were reported on the four days of August 20 through 23.

Because wide variations in milk and cattle losses were reported, a survey was conducted to determine the reasons for these variations and to measure their effect for future application. A survey form was drafted to standardize the collection of data and the forms were completed during farm visits by dairy sanitarians, creamery personnel, and farm advisors. Daily milk production data were obtained from the creameries to which the cooperating dairymen shipped their milk. Survey forms were completed for 234 dairies, of which 132 reported losing one or more cows and 102 suffered no death loss. Of 90,519 milking cows, 0.5 percent died; of 21,176 dry cows, 0.1 percent died.

Data from 119 dairies that reported production level of cows that died show that high-producing cows were more vulnerable to heat stress than low producers. Of the cows that died, 71.5 percent were high producers; 19.1 percent were medium producers; and only 9.4 percent were low producers. Classification of production level was left to the discretion of the herd owner and was based on the relative production of the herdmates. Most herdsmen had production records on each cow in the herd on which to base this judgment.

Milk, fat, and solids-not-fat (SNF) losses were calculated by averaging the production of the four days just prior to the stress period (August 15 through 18) and subtracting the subsequent daily production from this base. Daily milk loss per cow decreased from a 52.4 pounds-per-day average, reaching a low of 46.4 pounds per day on the 22nd. The average daily loss over the eight-day stress period was 4.0 pounds, or 7.6 percent.

As might have been expected, percent of loss in fat production was less than percent of milk and SNF losses because the butterfat content of the reduced milk output was higher (by as much as .35 percent on the 21st) during the stress period. Daily fat



Herringbone barn automatic take-offs weigh jars.

Flat barn fire hose wash-up.

Jet cow-washer.

production fell from an average of 1.76 pounds per cow before the stress period to 1.64 pounds on the 23rd—a 4.5 percent average daily loss.

The SNF percentage of the milk decreased only slightly during the stress period—from a pre-stress average of 8.65 percent of the milk to a low of 8.55 percent on the 22nd. SNF production was therefore determined, in the main, by milk production, losing an average of 8.1 percent (.37 pounds) per day, compared with a 7.6 percent-per-day milk loss. SNF production fell from 4.55 pounds pre-stress to 3.87 pounds on the 21st.

The production of milk, fat, and SNF had not yet returned to normal by August 26.

Reasons for stress variations

The survey attempted to determine the effects of shades, foggers, barn types, and wash systems, singly and in combination, on production losses and cow deaths. Data for the four days of greatest stress (August 20 through 23) were compared with an average of the four days that preceded the stress period and the results were analyzed statistically.

Cooling systems. Shades were much more effective than any other method of reducing production and death losses. Dairies with shades averaged only one-half as much production loss as dairies with no shades—3.15 pounds of milk per cow per day.

Foggers were less effective than shades in preventing production losses, but did reduce production losses by 1.5 pounds of milk per cow per day over cows with no protective system.

Dairies with shades reported a production loss that was about one-third less than dairies with foggers. This milk loss difference also amounted to 1.5 pounds per cow per day.

Death loss on dairies that had shades was one-third that of dairies with no shades. Foggers reduced cow deaths by 25 percent compared with dairies with no foggers. Dairies with shades had death losses less than half as great as dairies without foggers.

The survey reports include a considerable volume of feeding data, but the feeding systems reported were surprisingly uniform. Because of this small variation, analyses were of little practical value. The relationship of forage and concentrates, for example, was of keen interest to many, but the forage-to-concentrate ratios provided insufficient variation for analyses. It was consistently reported, however, that

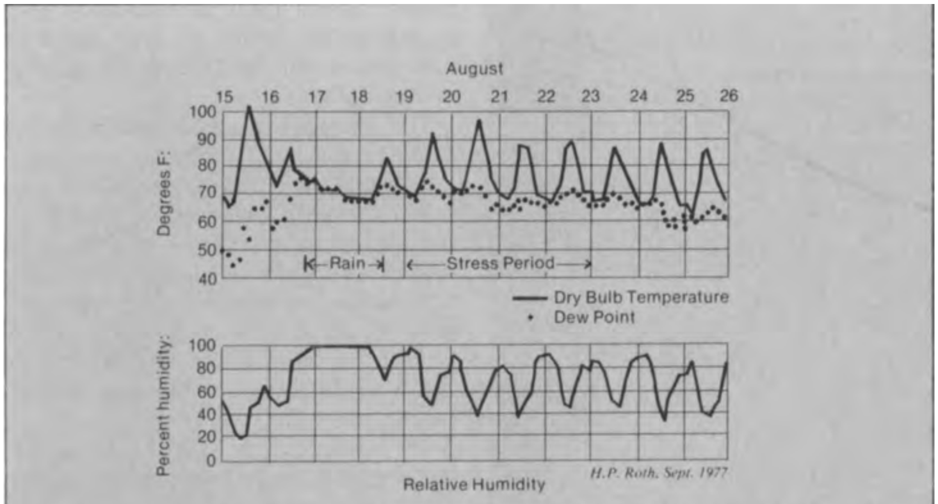


Fig. 1. Temperatures and relative humidity in San Bernardino and Riverside counties during and after tropical storm Doreen.

heat stress reduced appetite and, consequently, feed intake.

Wash systems. Both fire hose and jet-cow wash systems had little effect on production and death losses. In 61 herds using flat barns and fire hose with no shade, average milk production during the stress period was 5.73 pounds per cow per day below the average production during the pre-stress period.

In eight herds using flat barns and jet cow washers, the average production during the stress period was 5.90 pounds less than during the pre-stress period.

There was no significant difference in milk production between wash systems among flat barns with shades.

In dairies with flat barns and no shades, jet washed cows suffered a significantly higher death rate than those with fire-hose wash systems. It is possible, of course, that the fire-hose systems are superior; but the large standard error (.5959) and the fact that two herds in the group accounted for 70.7 percent of the total death loss indicate that other factors might account for the data.

There was no significant difference in death loss between wash systems among flat barns with shades. No comparison of wash systems could be made with herringbone barns, because all were equipped with jet cow washers.

Barn difference. Milk production and death loss were slightly less for cows in flat barns than for cows in herringbone barns.

Dairies with herringbone barns that had shades in the corrals had less than half the production loss of dairies with herringbone barns and no shades. This difference was 4.1 pounds of milk per cow per day.

Production losses on dairies with flat barns and shades was just under two-thirds as much as dairies with flat barns and no shades. This difference in production amounted to 2.25 pounds of milk per cow per day.

The difference in production loss between herringbone and flat barns with no shade was highly significant: in the herringbone barns, daily production loss was 7.73 pounds per day, whereas loss was 5.75 pounds in the flat barns. Yet the difference in barn types with shade was practically nil—.12 pounds per day less in the flat barns.

In dairies with herringbone barns that had shades in the corrals, .1874 percent of the cows died; in herringbone barns with no shade there was a .6425 percent loss. Fewer than one-third as many cows died in herringbone barns with shades.

Dairies with flat barns had just over one-third as many cows die if shades were provided (.3845 percent in flat barns with no shade, .1330 percent in flat barns with shade).

The difference between herringbone and flat barns with no shade in percent of death loss was statistically significant (.2580 percent difference) but the difference in barn types with shade was not significant.

Discussion

The advantage of flat barns on dairies without shades is difficult to reconcile with the absence of barn differences on dairies with shades. As a high skin-surface temperature is characteristic of cows under heat stress, it is likely that cows without corral shades were under more critical stress than those with shades when they entered the milking barn. It is possible that these super-heated cows were provided more relief by the normal washing process before milking. It is also possible that cows washed in flat barns were washed for a longer period than usual or were washed over a greater than usual body surface area. The longer period that cows usually stay under shade in flat barns during milking may have provided additional respite. In contrast, cows in herds with corral shades may not have reached a high enough stress level for barn type to be of influence.

Many dairymen in this study exercised considerable ingenuity in the management of their herds. A considerable number changed their milking schedule to avoid the most stressful periods. Some provided their highest producing strings with the most favorable conditions, including milking hours. Survey data supported their favoritism.

Many dairymen reorganized their feeding schedules so that the cows could do most of their eating during less stressful periods and some provided the best quality hay available and more concentrates than usual. Unfortunately, the lack of controlled data prevented analyses of these practices but they are compatible with available research data.

Summary

Storm Doreen cost milk producers in the Chino Valley area approximately one million dollars in milk production and cattle losses. Milk, fat, and SNF production were significantly reduced. Butterfat percentage in the milk increased during the stress period but the SNF percentage was reduced slightly. Cattle losses were approximately 18 times greater than the normal expected loss of two percent per year.

Shades were more effective in reducing milk production and cattle losses than any other factor studied. Because of their clear-cut advantage under this extreme stress period, the possibility must be recognized that shades may be helpful in maintaining maximum milk production during the less stressful weather of summer months.

Foggers were less effective than shades, possibly because cooling through evaporation may have been impaired by the high humidity. Wash systems apparently had little or no effect on milk and cattle losses. Although flat barns without shade had a significant advantage over herringbone barns without shade in both milk and cattle losses, the possible explanation for this advantage is purely conjecture and does not apply to herds with corral shades.

James C. Oliver is Farm Advisor, San Bernardino County; Howard M. Hellman is Farm Advisor, Los Angeles County; Shirl E. Bishop is Farm Advisor, Riverside County; C.L. Pelissier is Dairy Specialist, UC, Davis; and Loren F. Bennett is Senior Programmer, UC, Davis.