HOARD'S DAIRYMAN

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Hoard's West inside

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HEAT STRESS HAS IMPACTS that extend well beyond just the amount of milk produced, hampering milk components, reproduction and animal health. Its reach may be even greater as improvements in genetics and management increase the baseline production level of lactating cows.

Whom will heat stress hit hardest?

Climate prediction models can help farmers plan ahead and work to reduce the potential impacts a changing environment will have on the dairy industry.

by Tamilee Nennich, Guillaume Mauger, Yoram Bauman and Eric Salathe

HEAT stress has significant impacts on milk production. As weather patterns change, temperatures can rise enough to cause heat stress in cattle, with impacts on both individual farms and the industry as a whole. Regardless of the cause of climate change, there is evidence that weather patterns are shifting in different areas around the U.S. Understanding the projected changes in climate can help farmers be more proactive in planning for the future needs of their herd.

Complex models are currently available to help predict changes in weather patterns. Researchers at the University of Washington have been working with a model that allows them to predict changes in temperature in various locations across the U.S.

Higher temperatures, less milk

Daily temperatures, and particularly the temperature-humidity index (THI), have an impact on production, reproduction and the health of lactating cows. As the temperature-humidity index rises above 70, cows become heat stressed. A THI of 70 would correspond to a temperature of 70°F and extreme humidity (100 percent relative humidity), or to a temperature of 84.7°F with no humidity (0 percent RH). Recent research from the University of Arizona even suggests that high-producing cows may experience heat stress starting at a THI of 68 or lower. In the absence of heat abatement strategies, research has identified a clear relationship between the THI and milk production, with dry matter intake and milk production shrinking as the THI goes up.

Researchers from the University of Washington have used climate models to estimate both the potential milk production losses and the resulting financial implications that could result from escalating heat stress. The models show that the potential impacts on milk production vary by location across the U.S. Some areas are expected to be impacted more by rising temperatures than others.

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Calculating production losses

The model for this project was based on historic minimum and maximum temperatures from the National Oceanic and Atmospheric Administration (NOAA) going back to 1950. To estimate daily temperatures for the 2050s and 2080s, the model combined both historic data and global climate model output. A moderate global climate model, indicating a 5°F temperature gain globally over the next century, was selected for the development of the temperature estimates.

Additional inputs to the model included the number of cows per square kilometer across the U.S. An average milk production of 66 pounds per cow and a milk price of $15.90 per hundredweight were used to conservatively estimate additional financial losses.

Future climate predictions were obtained from global model output for the 2050s and 2080s using a middle-of-the road projection of future greenhouse gas emissions. The model calculated potential milk production losses on a daily basis according to projected minimum and maximum temperatures and morning and afternoon humidity. Apart from the wide geographic coverage, a key improvement over previous studies is the use of daily data for calculations — studies using only monthly data may discount important short-term heat events that are not present in the long-term average.

South takes hardest hit

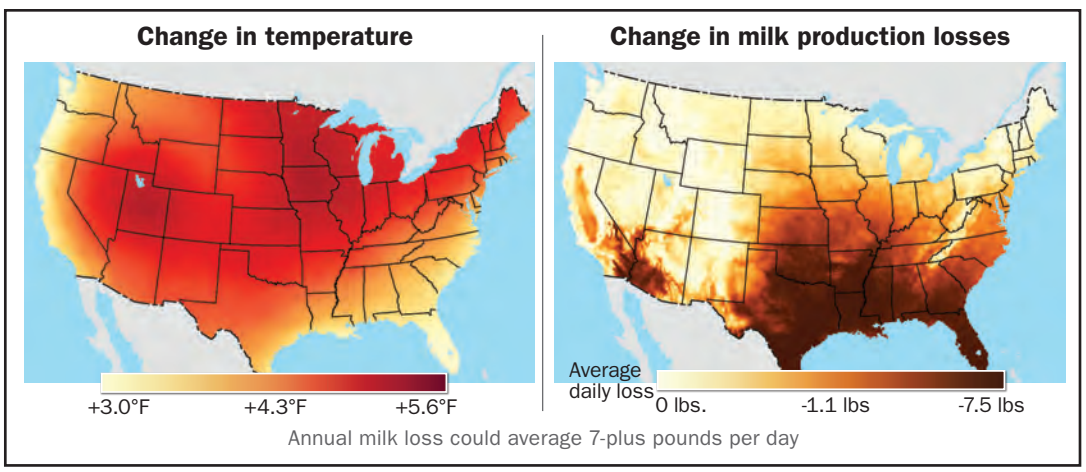
The calculations showed that estimates of climate change led to noticeable milk production losses, and that these losses varied by location, with some areas much more sensitive to warming than others. Added heat could further compound summer production losses that these areas already see by another 10 to 15 pounds per day. Some locations, such as Okeechobee County, Fla., and Maricopa County, Ariz., are already frequently in excess of the THI threshold of 70°F. In such locations, future warming will dramatically raise the duration and severity of heat exposure. In other regions, such as Tillamook County, Ore., temperatures are cool enough that additional warming doesn't substantially tip the scales towards greater heat stress.

Annual milk loss estimates across the entire U.S. are shown in the figure below. Note that these losses in milk production are averaged over the year and would be expected to be much greater (about three to four times greater) during the summer months.

Estimates of economic loss due to reduced milk production indicate that a higher incidence of heat stress over the course of the 21st century could lead to more than three times the losses currently resulting from heat stress. This could exceed over $2 billion per year for the entire U.S. dairy industry by 2100. These estimates demonstrate that heat stress has, and could continue to have, a significant financial impact on the dairy industry. In percentage terms, the impact is likely to be measurable but modest: about 6 percent for the country as a whole, with greater impacts in locations already experiencing heavier losses due to heat stress.

The economic loss estimates were determined for each county in the U.S. For more information, county-level estimates of economic losses can be found at: http://on.hoards.com/LOSS_counties.

Although our model focuses specifically on milk production losses, the impacts of rising temperatures would extend much beyond just the pounds of milk that would be lost. Models like this can begin to demonstrate some of the impacts that could result if heat abatement strategies are not used and provide indications as to areas in the U.S. where heat stress may increase and be of greater concern in the future.



Annual milk loss could average 7-plus pounds per day

PROVIDING SHADE IS IMPORTANT FOR HEIFERS, TOO

Shade structures are not only important in keeping heifers cool but can be instrumental in maintaining growth rates and reproductive performance. The Dairy Calf and Heifer Association offers the following tips for constructing shade structures during this summer season:

- **Situate structures north to south**. As the sun moves around the sky, so will the shade and the heifers will follow. This allows the area left behind to be exposed to sunlight and have the chance to dry, preventing mud holes from developing under the shade. Feedbunks usually run north to south, as well, which simplifies arranging the shade structures.
- **Less is more**. One long shade structure is better than multiple smaller ones. Heifers will tend to crowd under one shade cloth even if there is room elsewhere.

- **Do a maintenance check**. Shade clothes should be tight so there is minimal wind damage, and cloth should be replaced if it is in bad condition. The steel parts may need maintenance coatings. Portable structures should be moved occasionally to prevent blocking sunlight for vegetation.

CAN WE JUSTIFY BLANKET DRY COW THERAPY?

Most dairies incorporate the use of an intramammary antimicrobial and an internal teat sealant into their dry-off protocol. But, recent work from the University of Prince Edward Island questions the need for such a blanket procedure. The university's research, evaluating the effectiveness of using an on-farm culture system to make selective dry cow therapy decisions on low somatic cell count cows, was shared in the *Journal of Dairy Science*. Low somatic cell count was defined at less than 200,00 cells/mL.

Cows came from 16 dairies with low bulk tank somatic cell counts (less than 250,000 cells/mL). The 729 cows were randomly assigned to receive either blanket therapy or culture-based selective dry cow therapy. Cows in the blanket therapy group followed a standard protocol.

For the selective therapy group, composite milk samples were collected the day before dry-off, and cows were treated based on culture results. Culture positive cows underwent a traditional protocol, while culture negative cows received teat sealant alone.

No difference was seen between groups with regards to quarter level cure risk and new infection risk over the dry period. The risk of infection at calving and clinical mastitis in the first 120 days in milk also did not differ. Selective therapy, based on culture results, achieved the same level of success with respect to the treatment and prevention of mastitis over the dry period as blanket therapy.

BACK FAT DOESN'T TELL THE WHOLE STORY

Often, we target an average dry period body condition score (BCS) of 3.5. This benchmark is tied to the cow's use of body reserves to counteract negative energy balance, notes Heather Tucker in the April *Miner Institute Farm Report*. Research has shown that fat, though, is deposited in a hierarchy starting with internal organs and ending with deposition under the skin.

BCS is a visual assessment of fat cover, which declines as it is mobilized in early lactation. However, it tells us little about the contribution from internal fat stores. A newer method, using a transducer to scan the animal at two locations to determine total body fat stores, takes into account the contribution from both kidney and back fat.

There was a strong correlation when carcass kidney fat was compared to ultrasound measurements of kidney fat depth. This suggests that ultrasound assessment could be a reliable means to measure a crucial contributor to whole body fat stores in the future.

TILLAGE TEMPORARILY BOOSTS CONTINUOUS CORN YIELDS

"Crop rotation is the easiest yield bump you can get," notes agronomist Joe Lauer with the University of Wisconsin-Madison. Corn yields will often gain 10 to 19 percent when rotated with soybeans. This "rotation effect" is even more dramatic in stressful years.

The impact, adds Lauer, lasts, at most, two years and depends upon the length of the break between similar crops. With a break of two years or more, the yield of second-year corn is 7 to 8 percent more than continuous corn. With one break year, the yield of second-year corn matches continuous corn.

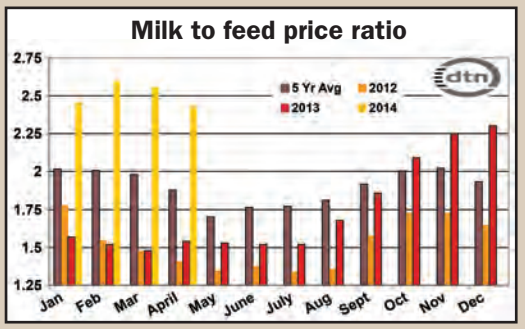
Outside of continuous corn, tillage is often not necessary in today's production systems. A corn-soybean rotation and tillage interaction study began in 1983 at Wisconsin's Arlington Research Station. The rotations include continuous corn or soybeans, alternating corn/soybeans and a five-year rotation between the two crops. Both no-till and conventional-till treatments are also applied.

Few corn yield differences are seen for rotated corn and first-year corn following five years of soybeans. During the second year, corn plots under conventional tillage had a 5 percent yield advantage over no-till plots. Yield was 10 to 11 percent greater for conventional till plots as the number of continuous corn production rose.

In a continuous system, tillage can make up for some of the rotation effect. Despite this, it does not bring yields up to rotation-based levels.

MILK-TO-FEED RATIO SOFTENS, BUT STILL HISTORICALLY STRONG

The milk-to-feed ratio slowly eroded through the spring as renewed commercial and investment buyer support stepped back into feed markets. Typically, the ratio stabilizes through the summer and increases through the end of the year. Corn prices are at levels over $5 per bushel in nearby futures. This is attributed to renewed export strength and caution surrounding planting delays. Soybean meal prices have seen similar support, increasing $40 to $50 per ton.



Milk price outlook continues to be positive, but support could be worn away by feed price gains through the summer. Weather concerns will likely be the biggest player in feed cost volatility.

—Rick Kment, DTN Dairy Analyst

VACCINE MAY NIP METRITIS IN THE BUD

Costing nearly $400 per case, metritis has a steep price tag. After testing five vaccines on a commercial New York dairy, Cornell University veterinarians may be one step closer to preventing puerperal metritis before bacteria gain a uterine foothold.

The group created five vaccines, each with a different combination of protein and/or inactivated whole cells. The vaccines, three subcutaneous and two intravaginal, were administered to late pregnant heifers at 230 and 260 days pregnant.

All of the subcutaneous vaccines were effective in reducing the puerperal metritis incidence and improved later reproduction. The Cornell lab is working to move the vaccines towards the USDA licensing process. The vaccines were not effective against endometritis.

Y CHROMOSOME LINKED TO FEMALE INFERTILITY

Some cows have male (Y) chromosome fragments in their DNA, according to a USDA study. While the reproductive study was conducted with 6,400 beef animals, it may have future implication to their dairy herd counterparts. The animals were genotyped using gene pooling, which combines DNA from multiple animals into a single pool.

The distinguishing difference between the pools was whether or not the DNA came from a pregnant or nonpregnant cow. Researchers found fragments of the Y chromosome in only the pool of DNA from nonpregnant animals. Furthermore, there was evidence that some of the Y-containing females were not freemartins; somehow they inherited Y-chromosome fragments from their sires.