University of California
Agriculture and Natural Resources
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# Golden State Dairy Newsletter: *Special Drought Edition- July 2021*

## ABOUT THIS ISSUE

It's no secret that we're in the midst of one of the most challenging droughts that our state has ever experienced. The goal of this special edition newsletter is to provide information you can use now to mitigate a plethora of challenges that dairy producers face related to reduced water availability. On the pages that follow, you will find research-based information from UC academics to inform management practices and decisions.

More information is available on numerous websites and in additional resources cited throughout. UC scientists have compiled drought resources that are available at http://ciwr.ucanr.edu/California_Drought_Expertise/. Additional resources for managing drought for dairies can be found on the new CA Dairy Quality Assurance website: https://cdqap.org/ruminations/dairies-and-drought/.

## EVERY DROP COUNTS DURING DROUGHT

*Dr. Deanne Meyer - UC Davis & UC ANR*

Water. Cows drink it. Bulk tanks, milking equipment and parlors are cleaned with it. Cows are cooled by water. Although much progress was made to reduce water use on dairies in recent years, everyday management makes a difference.

Every drop of water counts. Let's review where water can escape our management on farms. Attention to water use areas where no activity occurs will maximize water use efficiency in the production area. *(Continued on page 2)*

## ***Also In this Issue…***



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A quick look at water use areas, daily, serves to save water.

- Check and replace leaky drop hose sprayers in the parlor.
- Turn off floor hoses when not in use (they can put out over 10 gallons a minute)
- Shut-off running faucets in the milk room if not being used.
- Turn off water sources in calf bottle cleaning area when not in use.
- Evaluate soaker and sprinkler nozzles daily. A broken nozzle emits far more water than a functional one. During hot days, at 4 minute "off" increments and 1 minute "on", there are 288 "on" cycles, and potentially hundreds of nozzles. Fixing a nozzle conserves much water each day.
- Check water trough floats to be sure they function properly and are set to prevent overflow. Overflowing troughs can send gallons of water an hour into the waste stream.
- When water troughs are drained, be sure their plugs are securely reinserted.
- Carefully evaluate animal use of misters after dark to determine if you're getting your value from water. (Are there any cows standing at the mister line at midnight?)

As the water table continues to drop, it's imperative to stay vigilant on water management. Every pair of eyes can help improve water use at the dairy.

*Overflowing troughs waste water that could be utilized elsewhere.*

## SORGHUM PRODUCTION UNDER DEFICIT IRRIGATION

*Dr. Bob Hutmacher– UC West Side REC and UC Davis*

It is widely generalized that most sorghums have better tolerance of extremes of drought and high temperatures than commercial corn cultivars, and for the most part this is a reasonable generalization. Sorghum productivity in tons of total biomass per unit of applied irrigation water has been shown to be significantly higher than corn in multiple experiments done under rainfed conditions where irrigations are a supplement to rainfall. The biomass yields of many forage sorghums, even those producing some grain, also are more resilient than corn when exposed to water or high temperature stresses at any specific growth stage, such as during flowering and pollination stages. Sorghum germplasm has origins in regions exposed to both drought and intense high temperature periods (including Africa), and plant mechanisms for improved tolerance to drought and high temperatures have evolved or been selected for in response to these challenges. *(Continued on page 3)*

Management Under Drought – In assessing likely sorghum responses to reduced water applications, consider the diversity across sorghum types in characteristics such as rooting density/depth, days to harvest, and growth habit (varying maturities, forages ranging from multi-cut sudangrass to one-cut tall photoperiod responsive types, multi-purpose types with significant grain heads, brachytic types, etc.). Particularly in forage types, these characteristics can impact duration of leaf development, water stress responses and total water use. Remember that if significant periods of plant water stress are imposed with deficit irrigations, yields/biomass production will be reduced, you are just trying to minimize negative impacts of stress through better timing of stress periods. Generalizations regarding when to focus irrigations if you plan to deficit irrigate (not meet full plant water needs) can be broadly summarized as: **Grain sorghum**: (a) achieve good stand establishment and early root /shoot growth by avoiding moderate to severe stress during first 30-35 days after emergence during panicle differentiation; (b) If water is available, irrigate again prior to boot growth stage; (c) avoid severe stress during grain fill period if possible. **Forage sorghum:** (a) similar to grain sorghum, but can get away with delaying 1st or 2nd irrigations, particularly if planting longer-season photoperiod sensitive types – stress should not be so severe as to affect seedling survival and root establishment; (b) avoid severe stress during late panicle differentiation through flowering if growing a multi-purpose type forage where grain yields are an important part of yield/quality. Even if a deficit irrigation plan is a necessity during the growing season, a good pre-irrigation to provide stored soil water in upper 2-3 feet is almost always the best plan (if possible). When not possible, under very dry conditions after planting, you may need a 2 to 4 inch irrigation soon after planting to encourage emergence and early root development. Remember that what you can "get away with" in terms of growing season deficit irrigations is strongly influenced by depth of stored soil water and how that impacts the root system development and access to stored soil water.

Other Considerations – High Temperature Sensitivity Under Drought Conditions –**High Temperatures:** In sorghums producing grain, some exposure to high daily maximum temperatures can cause direct impacts on flowering and pollen viability, which can then impact both yields and forage quality. Despite this sensitivity, high temperature damage to grain production is generally less in sorghum than in many other grains due in part to: (a) perfect flowers in sorghum (male/female flower parts together; b) early AM timing of pollen "release"; and c) relative abundance of pollen. When high temperatures extend for many days, plant responses are not only due to exposure to peak/maximum daily temperatures, but also multiple indirect impacts, including high night-time temperatures and elevated respiration, combination stresses (such as water stress plus high temperatures, or high temperatures plus anoxia if you are irrigating in heavy soils). Since all these combination stresses can impact assimilation and growth, they can significantly affect yields of both forage and grain-producing types of sorghum. Achieving the best possible crop responses under any combination of these conditions (drought, high temperatures, salinity) depends on good timing in use of available resources, and a measure of good fortune in hoping that they don't all occur at the same time.

## IRRIGATION STRATEGIES FOR CORN DURING DROUGHT YEARS

*Konrad Mathesius- UCCE Yolo, Sacramento, Solano Counties*

Unlike some other crops, corn is not drought tolerant; any reduction in irrigation will reduce yields. However, the impact of drought stress differs depending on when it occurs in the crop's growth cycle. Additionally, growers can adopt several strategies that maximize crop per drop.

### Control weeds early

A weedy seedbed can quickly use up water in the soil profile that would otherwise be available for seedlings. Early stages of development are critical in allowing plants to invest energy in establishing their root zone. A larger root zone will help plants better cope with stress throughout the rest of the season.

### Irrigate to optimize plant development (Figure 1)

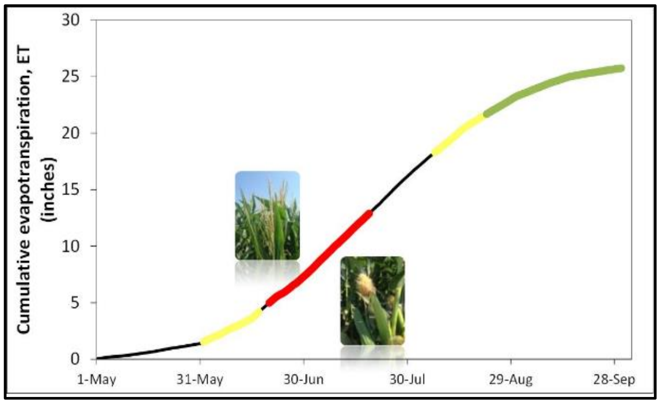



***Fig. 1:** Impact of drought stress on yield at different crop growth stages. High impact (red), moderate impact (yellow), minimal impact (green).*

Stand establishment: Don't skimp on water early in the seedling stage. This will allow crops to establish a strong root zone and will not require much total water because crop water demand is low. *Note: Use your best quality water in the early growth stages as corn can be sensitive to salts that are often associated with well water*.

Rapid Growth: Scaling back irrigation during the rapid growth phase by 5% to 10% will reduce yields, but not as much as it might in other growth phases.

Reproductive Phase: The two weeks leading up to and after tassel and silking is the most critical stage for crop growth. Yields can be disproportionately reduced if plants are stressed at this time.

Approaching Maturity: Irrigation can be scaled back somewhat during this period (5-10% deficits), but soils need to have sufficient available water to carry the crop to maturity.

After Maturity: irrigating after the crop is mature is most likely wasted water. In silage corn the plant is considered mature at 50% milk line. In grain corn, maturity is indicated by a black abscission layer.

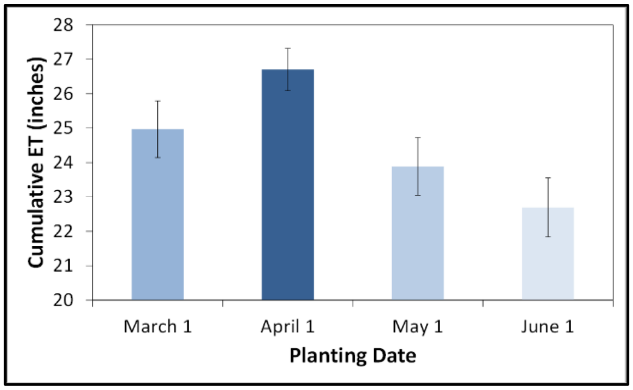



***Fig. 2**: Planting dates affect seasonal ET*

### *Planning for the future*

**Plant short-season varieties later in the year.**

While no longer an option this year, planting later in the year (mid-May/ June) shortens the growing season, which reduces the overall water requirement of the crop (Figure 2). For several physiological reasons, short-season corn planted relatively late in the season requires less total water than long-season corn and reduces the time a crop spends in growth phases where stress can disproportionately affect yield.

### Leverage conservation methods by using no-till and residue retention

No-till and residue retention can save growers ½ - 1" and 2 - 4" of water, respectively. Consider how conservation practices may benefit future water limited crops.

*This article is adapted from a more in-depth piece written by Mark Lundy, Ph.D.- Managing Irrigated Corn During Drought. See https://anrcatalog.ucanr.edu/pdf/8551.pdf for additional information.*

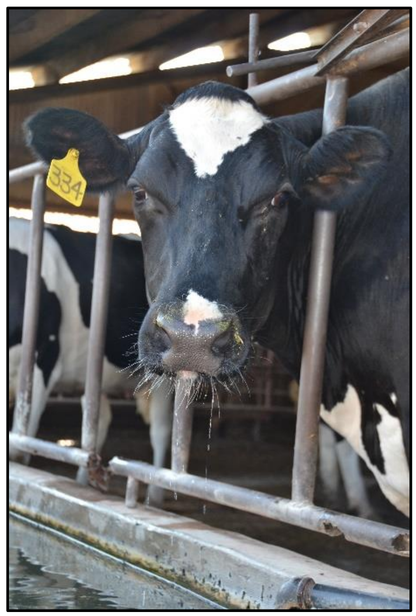
**CULLING DECISIONS DURING DROUGHT**

*Dr. Randi Black.- UCCE Sonoma, Marin, and Mendocino Counties*

Drought conditions create a situation of reduced water availability and increased feed costs. This requires dairy producers to use water and feed more efficiently and make difficult culling decisions. Culling decisions should maximize the profitability for the herd and eliminate animals that utilize resources inefficiently. So, how should one go about making these decisions?

First, it's important to determine how many animals you will be able to support during the drought. Inventory feed and/or pasture quantity and quality and determine if additional feed can or should be purchased. Also, evaluate water needed for cow drinking, feed, and parlor use and whether water storage and allotments can meet the demand. Understanding the cost and supply of feed and water resources projected, over the next 6-months to a year, will create a starting point of how many animals your resources may support. Compare that value with your current animal inventory. The difference is potentially the starting point for herd reduction.

Next, consider culling underperforming cows. Open cows may not pay for their cost of production when limited resources are available. Low production, high somatic cell count, poor udder conformation, poor feet and leg health, previous mastitis incidence, and poor temperament cows should also be considered for culling. Older cows that may need more feed to maintain body condition and may not breed back as easily should also be considered. Developing a ranking of cows on these culling criteria can assist in beginning culling decisions, with the ability to move down the list as resources dictate.



Maintaining heifers can be costly, but these animals contribute to the genetic progress of the herd. Focus heifer culling on animals from cows performing in the lower portion of the herd or open heifers at breeding age and size. Reducing the heifer herd too much can result in a lack of replacement heifers, which can be costly in the future and negatively impact genetic progress.

Higher culling rates impact the dairy long term. Determining the best animals to keep in the herd will ensure that you maintain efficiency and profitability during the drought, but are able to bounce back when the drought subsides. Consult your nutritionist, farm advisors, and financial advisors to assist in making these difficult decisions and help keep your dairy sustainable.

**Take Home Messages**

- Determine herd reduction need through projected feed and water availability.
- Rank cows for poor reproductive performance, low production, high cell count, age, or health concerns and cull animals down the list as resources dictate.
- Maintain herd genetic progress by culling open heifers and heifers from underperforming cows and keeping high genetic heifers.
- Consult your nutritionist, farm advisors, and financial advisors to assist in making long-term decisions.

**DROUGHT MAY INCREASE THE CHANCES FOR RISKY LEVELS OF NITRATE IN FORAGES**

*Konrad Mathesius - UCCE Yolo, Sacramento, Solano Counties*
*Dr. Gabriele Maier - UC Davis School of Veterinary Medicine & UC ANR*
*Josh Davy- UCCE Tehama, Glenn & Colusa Counties*
*Dr. Mark Lundy - UC Davis & UC ANR*

**Why is nitrate toxicity more of a concern during dry years?** Drought conditions in California this year are the worst they've been in decades. Drought stress can lead to excessive nitrate levels in forage, particularly if moderately high rates of nitrogen fertilizer were applied either pre-plant or in-season. This year, many growers ended up cutting their winter crops early for hay instead of grain, meaning that there is a higher chance that hay on the market was over-fertilized. Buyers should consider testing hay in advance of feeding to mitigate feed concentrations accordingly if higher than normal nitrate levels exist.

Nitrate accumulation is more of an issue in some hays than others. Sorghum species (such as Sudan grass) are particularly prone to high nitrate accumulation. Even crops such as oats, barley, and wheat can have excessively high nitrate concentrations in normal years, let alone drought years such as this. Weedy fields also tend to have much higher levels of nitrate.

**When in doubt, test for nitrates.** Testing hay and forage for nitrates is the only way to ascertain if a problem really exists. Keep in mind that forage concentrations are variable, so proper sampling is important. Speak to your lab about proper sample preparation and shipping.

*Nitrate Test Thresholds in Different Reporting Units, Dry Basis*

| ***NO3 (dry matter)*** | ***NO3-N (dry matter)*** | ***KNO3 (dry matter)*** | ***Feeding Recommendations*** |
|---|---|---|---|
| < 5,000 ppm (0.5%) | < 1,200 ppm (0.12%) | < 8,100 ppm (0.81%) | Generally Considered Safe for Livestock |
| > 5,000 ppm (0.5%) but < 10,000 ppm (1%) ppm | > 1,200 ppm (0.12 %) but < 2,300 ppm (0.23%) | > 8,100 ppm (0.81%) but < 16,000 ppm (1.62%) | Caution: Problems can occur at this level (particularly in pregnant animals) |
| >10,000ppm (1%) | > 2,300 ppm | >16,200ppm (1.62%) | Do not feed |

**Table 1:** Interpreting nitrate (differing reporting units) forage tests. Wet basis results are rare and have different thresholds from dry basis results; pay close attention to the details of your report.

**What else can growers and livestock managers do?** At this point in the year, most hay has been harvested, but for advice on what growers can do in drought conditions to reduce nitrate in feed visit: https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=46409 .

For more about nitrate toxicosis, see UC ANR's Livestock Poisoning Plants of California https://anrcatalog.ucanr.edu/pdf/8398.pdf and CAHFS Connections, July 2021 https://cahfs.vetmed.ucdavis.edu/cahfs-connection/cahfs-connection-newsletter-july-2021

## A FEW TIPS TO COOL CATTLE, KEEPING WATER USE IN MIND

*Dr. Grazyne Tresoldi - CSU Chico*
*Dr. Cassandra Tucker - UC Davis*

Heat stress is a reality and must be managed on CA dairies. During summer, milk production and fertility drop and modifications are needed to keep cows cool. Feedline soakers are common to maintain animal comfort. The water sprayed at the feedline bunk is more valuable than ever, especially during drought conditions. For more than a decade, our research team has been looking into solutions that keep CA cows cool using minimal water and energy. Here are some practical ideas that will help you achieve high cow production and comfort while efficiently using water.


***Fig. 1:*** *Soaking an empty, unshaded bunk. More cows would benefit from this water if the bunk was shaded.*

**Shade over the feedbunk.** First things first. Cows enjoy shade and avoid sunny areas during peak heat – even if the soakers are running there (Fig. 1). In drylots, we have found that cows reduce feedbunk visits by half if unshaded. If you manage a dairy with uncovered feedbunks, adding shade over this area will mean more cows will spend time in this area and the water sprayed there will cool more cows.

**Turn on soakers early & use automated controllers**. Turning on soakers earlier helps cows keep cool from the start and is more efficient than trying to cool them down once body temperature has already risen. Cows start feeling hot sooner than we do, usually when the air temperature is about 72°F. To ensure water is turned on and off only when needed by the cows, automated controllers help keep things consistent. The location of the controllers is also essential to provide cooling and save water. It works best if they are placed in the barn to capture the weather that the cows experience.


***Fig. 2:*** *Fans placed so that they cool cows at the bunk; moving air over wet animals removes more heat than when they are dry and means we need less soaking overall.*

**Move the fans to over the feedbunk**. Moving the fans from over the lying area to the feedline, where the soakers are, can maintain cow cooling while reducing water use by half (Fig. 2). This is because the air moved by the fans removes more heat from wet cattle than dry ones. We modified the spray cycle from 1.5 min on/6 min off to 0.5 min on/4.5 min off by making this change in one of our studies. Cow cooling was achieved using 2.4 gal/cow/hour – 65% less water than some dairies in CA.

**Mind the flow rate used**. The higher the flow rate, the larger the droplets, and more water sprayed per unit of time. Although relatively lower flow rate soakers (e.g., 0.4 gal/min) can reduce heat stress, the fine droplets can drift to the bunk and affect feed quality. Using soakers that deliver larger droplets is preferred. We have found that both 0.9 and 1.3 gal/min nozzles effectively cool cows, but using 1.3 gal/min resulted in extra 3 lbs. of milk/cow/day.

**Keep an eye on new technology**. A promising tool to cut water use while maintaining cow comfort would be to only spray where cows are actually present. We have a prototype for this and hope to do more with it soon. Other less water-intensive approaches like chilled lying mats and cooled air have been tested too, but neither of these was as effective and efficient at cooling cows as soakers and fans.

**Look Inside:**

# Golden State Dairy Newsletter:

## ***Special Drought Edition***

## July 2021

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