MAY 2022

Shawano County Ag Newsletter

University of Madison Division of Extension

Extension
UNIVERSITY OF WISCONSIN-MADISON
SHAWANO COUNTY

Shawano County Extension
311 North Main Street
Shawano, WI 54166
(715) 526-6136

Hours:
Monday- Friday
8:00 AM - 4:30 PM

Facebook and Twitter:
@AgShawano

Website:
shawano.extension. wisc.edu

In This Issue

Hello All!

Wow! What a spring! We started it out with a chilly spring but what a tropical heat wave we had in the beginning of May this year. In this newsletter I have included information on corn germination, value of alfalfa, quality monitoring, and heat stress in cattle.

Also in this newsletter is an announcement of the implementation of Extension's regional staffing model. I have transitioned from the Shawano County Crops and Soils Educator into a Regional Dairy Educator for Shawano, Oconto, and Marinette Counties. Scott Reuss the former Oconto and Marinette Counties Crops and Soils Educator will now be covering Shawano County in addition to Oconto, Marinette, Lincoln and Langlade Counties. There will be some updates coming to our webpages and newsletters so be on the lookout for those.

Finally, I want to mention that results from a research project that was sponsored by the Midwest Forage Association and the Shawano County Forage council is included in this newsletter. Scott Reuss and I completed this study over the 2020 and 2021 growing seasons. It looked at the effect of differing levels of potassium, sulfur, and boron fertilizer on established alfalfa. We are excited to share these results with you.

Wishing you a safe and productive spring!

Kimberly Schmidt
Agriculture Educator
608-265-1144
email: kimberly.schmidt@wisc.edu

Extension Regional Staffing Model

The University of Wisconsin-Division of Extension Agriculture Institute is moving to a structure of having regional educators across the state. Shawano, Oconto, Marinette, Lincoln, and Langlade counties will be transitioning to this structure on April 15th. Regional educators will provide research-based education to dairy and crop producers by assessing the needs of farmers across their region and designing and delivering educational programming and services to meet these needs.

Dairy and crop production are the largest agricultural industries in the state and Regional Educators will offer specific expertise that can serve those industries across several counties. Regional Educators will:

- Design and deliver educational meetings and field days in the counties they represent
- Provide consultation on production challenges to farmers and agricultural consultants
- Contribute to digital outreach opportunities on agricultural topics through email, websites, and social media
- Collaborate with other educators and specialists across the state
- Engage with Extension Committees on progress and planning

Shawano, Oconto, Marinette, Lincoln, and Langlade counties will be served by a Regional Crops Educator, Scott Reuss. Scott has been serving in Extension since 1997 in Marinette County. His current focus in programing is in nutrient management with additional programing in farm management and pest management. Contact information for Scott is scott.reuss@wisc.edu or 715-701-0966.

Shawano, Oconto, and Marinette counties will be served by a Regional Dairy Educator. The Regional Dairy, Kimberly Schmidt. Kimberly joined Extension in 2018. She earned a Bachelor's Degree from UW-Madison with a major in Animal Science and a Master's Degree in Animal Science from University of Tennessee-Knoxville where her research focused on the heat stress and protein metabolism in lactating cattle. Before joining Extension, Kimberly was dairy nutritionist. In her current role, she develops agriculture programming focusing on alternative and traditional forage management. Contact information for Kimberly is kimberly.schmidt@wisc.edu or 715-526-6136.

Kimberly Schmidt
Regional Dairy Educator

Scott Reuss
Regional Crops and Soils Educator

Upcoming Events

N12098 County Rd D, Clintonville, WI 54929

8:30 am - 12:30 pm

7:00 am Dairy Dash

Adults: $8.00 Kids(4-11): $5.00 Kids under 3: Free

Summer Badger Crop Connect Sessions Coming Soon!

2nd and 4th Wednesdays starting June 8th
Topics included: pest and disease management, cover crops, corn silage, and many others

More information here:
https://cropsandsoils.extension.wisc.edu/programs/badger-crop-connect/

Dairy Situation and Outlook, May 18, 2022

Written by:

Bob Cropp, Professor Emeritus University of Wisconsin Cooperative Extension University of Wisconsin-Madison

Milk prices continue well above year ago levels. The April Class III price was $24.42, and May will be near $25.00. The April Class IV price was $25.31 but May will be lower near $24.5. While volatile dairy product prices have held at levels to maintain Class III and Class IV prices near these levels. During the month or May cheddar barrel cheese started the month at $2.34 per pound, got as low as $2.30, but has strengthened since then and is now $2.45. Forty-pound cheddar blocks started the month at $2.38 per pound, got as low as $2.2625, but has also strengthened since then and is now $2,3750. Dry whey prices continues to weaken. Dry whey started the month at $0.5750 per pound and is now $0.5025. Dry whey was as high as $0.86 per pound back in February. This drop in the value of dry whey has taken about $2 off the Class III price.

Prices of butter and nonfat dry milk have held at levels to maintain a strong Class IV price. During the month of May butter was as high as $2.8025 per pound and as low as $2.61 and is now $2.7925. Nonfat dry milk was as high as $1.88 per pound and as low as $1.7075 and is now $1.7450.

But milk prices for the reminder of the year are uncertain. Prices should stay well above year above levels but how much higher is uncertain. There is uncertainty as to the level of milk production, domestic sales, and dairy exports all of which will determine the level of milk prices. With much higher feed prices and the price of all other inputs milk production is not likely to show much of any increase this year. Dairy replacement numbers are also lower, and some dairy cooperatives have in place base type plans that limited their members increasing milk production. USDA is forecasting just a 0.2% increase in this year's milk production over last year. Milk production at this level will support higher milk prices. If milk production would increase at higher levels by the last half of the year, milk prices could weaken some.

USDA's estimated April milk production was 1.0% below a year ago, the sixth consecutive month milk production was below a year ago. Milk cow numbers were 98,000 head below a year ago, a 1.0% decrease with no increase in milk per cow. April milk production was below a year ago in three of the five leading states. Milk production was below a year ago by 0.6% in California, 0.1% in Wisconsin, 0.8% in New York with no change in Idaho and a 4.7% increase in Texas. Milk cow numbers were lower than a year go by 2,000 in California, 1,000 in Wisconsin, 6,000 in New York with no change in Idaho and 13,000 more in Texas. South Dakota led all states with April milk production up 16.7% from a year ago with 25,000 more cows followed by Georgia with milk production up 12.1% with 9,000 more cows. April milk production was below a year ago by 12.1% in Florida with 12,000 fewer cows and 12.9% in New Mexico with 41,000 fewer cows.

How milk and dairy product sales hold up for the remaining of the year is uncertain. Inflation is cutting into consumer spending power. This may cause consumers to cut back on going to restaurants which would dampen butter and cheese sales. Higher retail prices may also reduce consumer purchases of dairy products in the grocery store. While fluid (beverage) milk sales are expected to decline butter and cheese sales are still expected to show some increase in sales.

Dairy exports continue to do well but may not match the record exports of last year. The volume of March exports were just one percent lower than a year ago. This was the fourth consecutive month the volume of exports was below a year ago. The exports of nonfat dry milk/skim milk powder and dry whey resulted in the lower total volume. Compared to a year ago March exports of nonfat dry milk/skim milk powder were down 7% and dry whey 11%. Cheese exports continue to do well being 13% higher than a year ago and butterfat was 59% higher. Milk production in Oceania and Western Europe, two leading dairy exporters continues to run below a year ago levels which leaves open opportunities for U.S. exports. World dairy products prices have been declining but as U.S. prices are still competitive on the world market.

In summary, milk prices will stay well above year ago levels. But it is uncertain as to how much higher. If milk production does not increase above year ago levels the Class III price could strengthen by summer and fall as milk production is seasonally lower in the summer while butter and cheese inventories start to build for the seasonally high sales for thanksgiving and the holidays. But, if milk production does strengthen some last half of the year this could dampen Class III and Class IV price increases. Nevertheless, 2022 should end the year with prices averaging well above a year ago. USDA is forecasting the Class III price to average $20.50 compared to $17.08 last year and the Class IV price to average $21.40 compared to $16.09 last year. Prices could very well average higher. Current dairy futures are more optimistic with Class III $24 until August then $23 and ending at $22 in December. Class IV futures are $24 until October then $23 and ending at $22 in December. We need to keep in mind that milk prices can change quickly with small changes in milk production, milk and dairy product sales and dairy exports.

Alfalfa Quality Monitoring

Be on the look out for PEAQ stick readings this May!

Weekly regional PEAQ stick readings can be found on:
Shawano County Extension Facebook Page
Shawano, Marinette, and Oconto Counties Extension Websites or call 715-732-7510 for a recorded message

State wide data can be found on:
https://fyi.extension.wisc.edu/scissorsclip/

You can also take your own readings using the chart on the left.

Height of Tallest Stem (from soil surface to stem tip)	Stage of Most Mature Stem		
	LATE VEGETATIVE Vegetative (>12") No buds visible	BUD STAGE 1 or more nodes with visible buds. No flowers visible	FLOWER STAGE 1 or more nodes with open flower(s)
-inches-	----------Relative Feed Value----------		
16	237	225	210
17	230	218	204
18	224	212	198
19	217	207	193
20	211	201	188
21	205	196	183
22	200	190	178
23	195	185	174
24	190	181	170
25	185	176	166
26	180	172	162
27	175	168	158
28	171	164	154
29	167	160	151
30	163	156	147
31	159	152	144
32	155	149	140
33	152	145	137
34	148	142	134
35	145	139	131
36	142	136	128
37	138	133	126
38	135	130	123
39	132	127	121
40	129	124	118
41	127	122	115
42	124	119	113

Hay Market Report May 9, 2022

Data Compiled by: Richard Halopka, Clark County Extension Crops & Soils Agent
Published on: https://cropsandsoils.extension.wisc.edu/hay-market-report/

Hay Grade	Bale Type	Price ($/ton)		
		Average	Minimum	Maximum
Prime (>151 RFV/RFQ)	Small Square	$284.00	$240.00	$300.00
	Large Square	$224.00	$160.00	$275.00
	Large Round	$223.00	$185.00	$300.00
Grade 1 (125 to 150 RFV/RFQ)	Small Square	$192.00	$160.00	$224.00
	Large Square	$185.00	$140.00	$250.00
	Large Round	$173.00	$120.00	$235.00
Grade 2 (103 to 124 RFV/RFQ)	Small Square	No Reported Sales		
	Large Square	$146.00	$100.00	$220.00
	Large Round	$152.00	$95.00	$210.00
Grade 3 (87 to 102 RFV/RFQ)	Small Square	No Reported Sales		
	Large Square	$129.00	$55.00	$200.00
	Large Round	$118.00	$40.00	$195.00

Demand and Sales Comments

Prices were steady in the market this week with some markets reducing auctions to once a week or bi-weekly. Low quality hay was sharply discounted. If you have questions on this report contact richard.halopka@wisc.edu. If you need forage or have forage to sell or straw, connect to the Farmer-to-Farmer webpage at http://farmertofarmer.uwex.edu/. You may contact your local county agriculture educator if you need help placing an ad. There is no charge for the service.

Value of Standing Alfalfa

Adapted from : Determining the Value of Standing Alfalfa in 2022 by Kevin Jarek, Extension Outagamie Crops and Soils Agent
Published: https://outagamie.extension.wisc.edu/determining-the-value-of-standing-alfalfa-in-2022/

Three factors to consider when determining the potential value of an alfalfa stand:

Expected Dry Matter (DM) Yield in Tons per Acre

The best way to determine yield is by weighing the forage at harvest, however, that is not always possible if there is no scale available. When weighing is not an option expected Dry Matter (DM) yield can be estimated by measuring alfalfa stand density as illustrated in Extension Bulletin A3320 Alfalfa Stand Assessment: Is This Stand Good Enough to Keep? (https://fyi.extension.wisc.edu/forage/alfalfa-yield-and-stand/) or by utilizing multi-year data from the Wisconsin Alfalfa Yield and Persistence (WAYP) program managed by the University of Wisconsin-Madison and Division of Extension. The 2020 WAYP project summary can be downloaded for review at: https://arlington.ars.wisc.edu/wp-content/uploads/sites/115/2022/04/2021-WAYP-Summary.pdf

Estimated Value of a Ton of DM

The most current Hay Market Report is in this issue. The value of a ton of DM is determined via the following calculations:

Price for a Ton of DM

As baled hay, assume moisture of 15% which means it is 85% dry matter or 0.85 DM

$$\frac{\$224}{\text{as fed ton}} \times \frac{\text{as fed ton}}{0.85 \text{ ton DM}} = \frac{\$263.53}{\text{ton DM}}$$

Standing alfalfa must be adjusted for both field losses and potential weather risk, both of which can significantly impact the quality of the harvested forage. The buyer and seller can decide if they wish to use a factor other than 25%. If we use $263.53 per ton DM and apply a 25% risk adjustment, we end up with a risk adjusted value for a ton of DM standing alfalfa as follows: ($263.53 X 0.25 = $65.91), $263.53 - $65.91 = $197.62 per ton of DM.

Harvesting Costs

Expenses are based on the costs reported in the Wisconsin Custom Rate Guide 2020 at https://fyi.extension.wisc.edu/news/2021/05/12/2020-custom-rate-guide/ or the 2022 Iowa Farm Custom Rate Survey at https://www.extension.iastate.edu/agdm/crops/pdf/a3-10.pdf. Estimated rates for individual field operations are identified below:

Mowing and Conditioning per acre:	***Windrow Merging per acre:***	***Chopping, Hauling, and Filling per acre:***
$16.61 per acre, statewide average (WI - 2020)	$14.00 per acre, statewide average (WI - 2020)	$45.00 -$65.00 per acre, $55.00 average *
$12-$25 per acre, $16.20 statewide average (IA - 2022)	$10-$15.25 per acre, $14.30 statewide average (IA - 2022)	Visit the WI Custom Rate Guide for charges expressed in *dollars/hour* or *dollars/ton* to calculate costs using those posted values.

*Estimated range based on farm data, 2020 WI Custom Rate Guide does not provide per acre cost.

This is a short summary of a longer article written by Kevin Jarek, Extension Outagamie County Crops and Soils Agent. For a more in-depth explanation of alfalfa value: Determining the Value of Standing Alfalfa in 2022 (https://outagamie.extension.wisc.edu/determining-the-value-of-standing-alfalfa-in-2022/)

Effects of potassium, sulfur, and boron fertilization rates on alfalfa production in Northeastern Wisconsin

- A study funded by the Midwest Forage Association through the Midwest Forage Research Program; Rock River Laboratory; and the Shawano County Forage Council.

- Investigators: Scott Reuss & Kimberly Schmidt. Marinette/Oconto and Shawano Counties Agriculture Agent/Educator with UW-Madison, Division of Extension.

- Special thanks to Mike Guseck, Porterfield, WI; and Townline Acres (Doug, Dillon, and Derek Breyer), Birnamwood, WI for hosting the research on their farms.

This two-site study was conducted to assess how potassium, sulfur, and boron fertilization affects alfalfa yield and forage quality. Specifically, we utilized methods in an attempt to get information to help assess:

+ How long these nutrients may impact alfalfa after an application?

+ Are there measurable, consistent interactions between these nutrients' applications? If so, should these interactions impact application decision-making?

+ Are the fine sandy loam soils of NE WI managed properly by applying the state-wide potassium and sulfur application recommendations for alfalfa?

+ What sulfur rate is best for NE WI alfalfa fields, as Midwestern recommendations vary significantly?

What we did:

- Compared interactions of four potassium rates (0, 50%, 100%, and 150% of soil test-based recommendation); four sulfur rates (0, 15, 30, and 45 lbs/acre); and 0 or 2 lbs boron/acre. I.e. 32 randomized treatments in 20' x 20' plots, with four full repetitions at each site. A couple details to go with the application methods are that the 100% and 150% Potassium recommendations were heavier than the maximum recommended single time application rate, so these were split in half and applied equally after first and second crops in 2020. Sulfur was applied via elemental sulfur, applied in one application after first crop, as was the boron fertilizer product.
- Measured yield for three cuts at Birnamwood (2020 2nd, 3rd, 4th) and four cuts at Porterfield (2020 2nd and 3rd, 2021 1st and 2nd).
- Counted stems in late summer 2020 and prior to 1st crop 2021.
- Collected quality samples from the Porterfield site's 2020 3rd crop and 2021 1st crop. Funding only allowed for 1 repetition (32 total samples) to be sampled each time.

What we found:

- Addition of potassium and sulfur increased yield, but only sulfur created positive economic return.
- Addition of potassium decreased forage quality.
- Addition of sulfur had slight positive impacts on forage quality.
- Addition of boron resulted in no measurable effects.
- Stem count increased over winter at both sites – in all treatments.
- Interactions between the nutrients were not consistent between the two sites.

Effects of Potassium or Sulfur Addition on DM Alfalfa Yield (DM Tons/Ac)

	Birnamwood	Birnamwood	Porterfield	Porterfield
Harvest date	Potassium effect	Sulfur effect	Potassium effect	Sulfur effect
2nd crop, 2020	.02	.02	.05	.03
3rd crop, 2020	.03	.04	.03	.07
4th crop, 2020	.05	.06	NA	NA
1st crop, 2021	NA	NA	.07	.08
2nd crop, 2021	NA	NA	.05	.08

The effect of adding any potassium or sulfur are summarized here, averaged over the three application rates and the repetitions. Number reported is increased tons DM/acre in comparison to the zero application rate plots for the nutrients. You can see that the effects lasted throughout the length of the study from one application.

Interactions between the three nutrients. In this study, we were not able to measure consistent interaction effects between potassium, sulfur, and boron. There were some interactions noted, but they were not consistent across sites, across harvest dates, nor across application rates.

Effects of Potassium or Sulfur Addition on measured alfalfa forage quality

The tables here report the results of the forage quality analysis conducted for third crop, 2020, and first crop, 2021 samples collected from one full repetition at the Porterfield site. Funding only allowed us to analyze quality parameters (done via wet chemistry methodology to ensure mineral accuracy) for these amounts, but the data strongly indicates that there are negative consequences of potassium addition. It also showed slight positive effects of adding sulfur. The milk/acre numbers at the end of each table are calculated using the actual forage quality results and actual forage yields for the associated treatment groupings. Milk/acre gives a one number way to measure the collective impact of forage yield and quality.

Sulfur appl. rate	CP%	Mg%	Ca%	RFQ	Milk /ton	aNDF %	$tNDFD_{30}$ %	$uNDF_{240}$ %	Calculated milk/ acre
0	19.7	0.22	1.00	166	2880	38.2	45.7	15.7	3053
15 lbs/acre	20.0	0.22	0.96	166	2887	38.3	46.0	15.5	3357
30 lbs/acre	20.2	0.20	0.96	162	2847	38.7	45.8	15.8	3564
45 lbs/acre	20.1	0.21	0.97	167	2861	38.0	45.8	15.4	3303

Potassium appl. rate	CP%	K%	Ca%	RFQ	Milk /ton	aNDF %	$tNDFD_{30}$ %	$uNDF_{240}$ %	Calculated milk/ acre
0	20.4	2.4	1.01	173	2959	37.9	48.0	14.7	3509
50% Rec.	20.2	2.7	0.99	167	2881	38.2	46.0	15.5	3318
100% Rec.	20.0	2.8	0.95	162	2823	38.4	45.0	16.0	3147
150% Rec.	19.5	2.9	0.92	159	2811	38.7	44.3	16.2	3303

Notes for Potassium results: Mg% decreased in concert with Ca%. All NDFD parameters tested decreased in a similar pattern to tNDFD30%.

Economic Return – the Key result! Extra forage yield and/or better forage quality are both good things, but do applications of these nutrients pay for themselves? Certainly, for boron, the answer was easy- NO! Even though the cost of adding two lbs. of boron is very low, it led to zero measurable effects. For sulfur additions, the answer was also easy – YES! Each rate of added sulfur and both sites led to measurable positive economic return. This positive return ranged from $4.50 to $43 across rates and sites, but was greatest at both sites at the 30 lbs. S/Ac. application rate. At $0.50/lb. S, application costs were calculated to be $7.50. $15, and $22.50 for the three Sulfur application rates.

Potassium cost of application was much higher than the other nutrients. At the time of the study, potassium cost $0.30/lb. K, thus application costs for this study ranged from $45 to $153/acre across rates and sites. The relatively low forage yield increases and definite forage quality decreases combined in such a way that potassium application resulted in a negative return on investment in all situations except the 50% of recommendation rate at Porterfield. The impact was only a positive $5/acre. The other two rates at Porterfield both resulted in approximately a negative $100/acre return, and the rates of return to potassium application at Birnamwood worsened as rates increased. At the 50% application rate, return was -$21/acre; -$59/acre at the 100% rate; and -$111/acre at the 150% rate.

What does it all mean? This is only one study, but our results clearly show that sulfur additions are warranted to alfalfa fields in NE WI, and indications are strong that 30 lbs./acre leads to optimum returns. Our results also strongly indicate that boron additions to alfalfa are not warranted, even though cost of application is low. Lastly, these results should give all of us pause when adding potash to alfalfa fields. We need it to get maximum yield, but overapplication is certainly negatively impacting our checkbook and our alfalfa quality. In a year such as 2022 when potash prices are extremely high, cutting application rates to half of recommendations appears to be warranted.

Corn Agronomy: The Magic of Corn Seed Germination and Emergence

Joe Lauer, UW Madison Extension Corn Agronomist
hhttp://wisccorn.blogspot.com/2022/05/B124.html
May 13, 2022

I think nearly every corn planter in Wisconsin was planting this past week. There are some wet areas in northeastern Wisconsin that have prevented planting, but a significant jump in planted acreage should be measured by USDA-NASS in next Monday's progress report.

Now the magic begins when dry seed imbibes water and bare or brown fields turn greener every day across the landscape. The germination process and the success of the seed in emerging and establishing is key and the first yield component determined for the growing season.

Protected within the seed coat is an embryonic plant that remains dormant until germination is initiated by the physical process of imbibing water. The white starchy endosperm is the main energy source until the young seedling is established. After planting, water and oxygen are imbibed into the seed for 24-48 hours activating growth hormones and enzymes. Starch is broken down supplying the embryo with energy for metabolism and cell division.

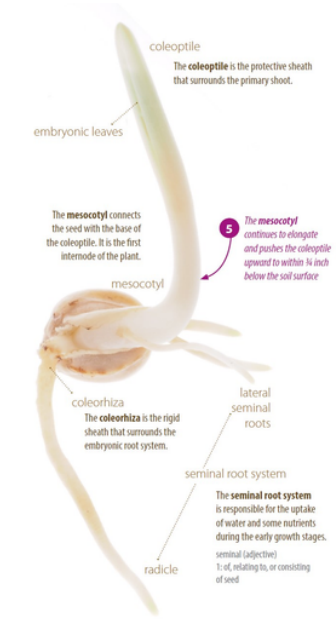

Figure 1. Diagram of germinating corn. Credit: Mimi Broeske.

Within the embryo is a miniature corn plant that already has a primary shoot, leaves and root system protected by rigid sheaths called the coleoptile (above-ground) and coleorhiza (below-ground). The first structure to emerge from the seed is the radicle root, followed by the coleoptile and seminal roots.

The coleoptile is pushed to the soil surface by the mesocotyl. When sunlight falls on the coleoptile tip, enzymes are activated that soften the tip allowing the first true leaf of the plant to break through. The growing point of corn is 3/4 of an inch below the soil surface and will remain below-ground until the plant has 5 to 6 leaves.

The germination process from dry seed to seedling emergence requires about 125 Growing Degree Units (GDUs). Normally in the beginning of May, we accumulate about 10 GDUs per day, so emergence takes about 12 to 13 days. The 2022 growing season is starting out fast with record high temperatures, and I have seen some recently planted fields already emerged. Emergence GDUs may need to be adjusted:

1. If conservation tillage is implemented, add 30-60 GDUs.
2. If planting date is before April 25, add 10-25 GDUs.
3. If planting date is after May 15, subtract 50-70 GDUs
4. If seeding depth is below 2 inches, add 15 GDUs for each inch below.
5. If seed-bed condition has soil crusting or massive clods, add 30 GDUs.
6. If seed-zone soil moisture is below optimum, add 30 GDUs.

There might be many reasons why a seedling does not emerge in a stand of corn. The germination process is really a race between pest pressure (diseases and insects) and the ability of the seedling to outgrow the pest. Seed treatments protect the seedling from disease and insects for the first 30 to 45 days of the growing season. Planting into cloddy/crusted or cold soils can result in seedling leaves unfurling below-ground, reducing plant stand and yield potential. Imbibitional chilling can result in plant death.

This is one of my favorite times of the year in Wisconsin. I wonder what the growing season has in store for these developing plants. As you drive around the state, enjoy the landscape and all the different greens that develop over the month of May.

Further Reading:

Broeske, M. and J. Lauer. 2020. Visual Guide to Corn Development. University of Wisconsin Nutrient and Pest Management Program. https://ipcm.wisc.edu/download/pubsGuides/UW_CornDevGuide.pdf

Extension
UNIVERSITY OF WISCONSIN–MADISON

Animal Handling During Heat Stress

As summer temperatures rise, dairy cows are at greater risk for heat stress. Heat stressed dairy cows suffer from reduced dry matter intake, leading to reduced milk production. Farmers may also see reduced fertility or loss of a pregnancy and increased metabolic and lameness issues. Combating heat stress in the herd requires an action plan to prevent heat stress and address heat stress-related issues.

Temperature Humidity Index

Cattle aim to maintain their internal core body temperature within a narrow range. To regulate body temperature, they exchange heat with their environments, both gaining and losing heat. The air temperature and relative humidity surrounding the animals are important factors affecting cows' ability to lose heat. A commonly used term within the dairy industry, Temperature Humidity Index (**THI, below**), combines both air temperature and relative humidity to approximate the level of heat stress cattle experience. The chart is color-coded according to categories of heat stress ranging from mild (*lightly shaded*) to severe (*darkly shaded*) for lactating dairy cows.

Important caveats to keep in mind about THI:

1. If cattle are housed with direct sun exposure, for example on pasture or in open lots, THI does not account for the effects of solar radiation, which contributes further to heat stress. The same goes for calves in outdoor hutches.
2. THI must be estimated using the microclimate surrounding the animals, for example in their home pen or in the parlor, not the outside weather conditions.
3. The THI cutoff of 72, and more recently 68, was based on when studies have found lactating dairy cows to show reductions in milk production. Keep in mind cattle of all ages can experience negative effects on animal welfare, even at lower THI values.
4. Lastly, individual animals can respond differently, within the same environments. This is why it is important to look for animal-based signs of heat stress and not rely solely on THI.

Despite these limitations, the THI chart can be a useful tool to help plan activities around times when you anticipate cattle to experience heat stress.

Cows' Signs of Heat Stress

Even when planning ahead, sometimes when cattle are handled, the level of heat stress they experience can worsen. This is because greater activity levels increase the production of body heat.

Air Temperature (°F)	Relative Humidity (%)																				
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
65	61	61	62	62	62	62	62	62	63	63	63	63	63	64	64	64	64	64	65	65	65
70	63	64	64	64	65	65	65	66	66	66	67	67	67	68	68	68	69	69	69	70	70
75	66	66	67	67	68	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75
80	68	69	69	70	70	71	72	72	73	73	74	74	75	76	76	77	78	78	79	79	80
85	70	71	72	72	73	74	75	75	76	77	78	78	79	80	81	81	82	83	84	84	85
90	72	73	74	75	76	77	78	79	79	80	81	82	83	84	85	86	86	87	88	89	90
95	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
100	77	78	79	80	82	83	84	85	86	87	88	90	91	92	93	94	95	97	98	99	100
105	79	80	82	83	84	86	87	88	89	91	92	93	95	96	97	99	100	101	102	104	105
110	81	83	84	86	87	89	90	91	93	94	96	97	99	100	101	103	104	106	107	109	110

Written by Aerica Bjurstrom, Sarah Grotjan, Jennifer Van Os, & Amanda Young. Reviewed by Tina Kohlman and Sandra Stuttgen. July, 2020.

When working animals, look for signs of heat stress they may exhibit. A clear indicator of severe heat stress is panting. Look for animals breathing with their mouths wide open, tongues out, drooling, or a combination of these signs.

Before severe panting begins, cattle will show elevated respiration (breathing) rates. The respiratory rate for adult cattle at rest ranges from 25 to 50 breaths per minute. As the breathing rate increases the cattle will begin to demonstrate an effort to breathe as they use their respiration to cool themselves. This effort may be seen as their rib cage rises and falls while they are standing and their body begins to rock. A rule of thumb to identify heat stress in lactating cows is 60 breaths per minute or 1 breath per second. When you notice cows breathing that quickly or even faster, this is an indication they are struggling to cope adequately with the heat, and additional cooling would be beneficial. By the time panting occurs, cows breathe at an average of 100 breaths per minute.

For more information on how to recognize signs of heat stress, see the fact sheet Heat Stress Abatement in Dairy Facilities.

Cooling Techniques

When cattle breathe faster, pant, and sweat, they lose moisture. This needs to be replenished by increasing water intake. Therefore, it is critical the animals have access to a plentiful supply of clean drinking water.

If cattle show signs of heat stress while being handled you can provide emergency relief using a combination of methods.

Provide the following strategies when cattle begin to show signs of heat stress:

1. Ensure the animals have access to shade if they are located in direct sunlight. Otherwise, they will continue to gain heat from solar radiation, exacerbating heat stress.
2. Soak them directly with water, for example, using a hose. Apply approximately a gallon of water to thoroughly soak the animal to the skin, starting along their shoulders and backs, allowing some water to drip down their sides. This cools cows through a combination of evaporation and fluid convection (dripping water). You should observe a rapid reduction in respiration rate within minutes of applying the water. Likewise, a rectal thermometer should show a reduction in body temperature after 15 minutes. If needed, repeat the soaking within 15 minutes or less after the initial soaking until the signs of heat stress are reduced.
3. Lastly, combine the soaking with high-speed air, either by taking advantage of natural air movement from wind or by positioning the animal under a fan or in a shaded breeze. This enhances the cooling effect from soaking by assisting with evaporation. If combining soaking with high-speed air, re-wet the animals sooner, since they will dry faster.

For more information on everyday strategies for keeping cows cool in your facilities, see the fact sheet Heat Stress Abatement in Dairy Facilities.

Tasks Requiring Animal Movement

The THI chart is an important consideration when moving cattle. To prevent cattle losses during handling, refer to the THI chart to determine the likelihood of heat stress during high temperature and humidity conditions.

Remember, however, dairy animals can experience discomfort and poor welfare associated with heat stress in milder weather, before production losses set in.

To prevent added heat stress, handle animals during the early morning hours before the temperature rises into the risky THI level. Limit the length of time animals spend in headlocks or other handling equipment where their stress from confinement may exaggerate the heat stress conditions. When THI is 72 or higher, consider postponing animal handling related tasks which can be performed during cooler weather. An animal's internal temperature peaks approximately two hours after the environmental temperature peaks and it takes the animal four to six hours to lower their temperature back to normal. If possible, the evening hours should be left for the animals to cool down and not used for handling unless it is necessary.

Cattle will eat more and show reproductive activity during the cooler evenings. If possible, do not interfere with their comfort during this time.

Use caution while vaccinating cattle during high THI levels. A normal reaction to a vaccine is a mild fever (increase in core body temperature by one or two degrees). Vaccine induced heat stroke may occur when this elevated core body

temperature coincides with high THI levels. To prevent the possibility of induced heat stroke, vaccinate extremely early in the morning. This practice enables the cattle to have their immune response to the vaccine under control before the ambient temperature starts to rise. Another option is to vaccinate cattle in the evening, six hours after the peak daytime temperature. Using this option, the normal vaccine reaction (increase of one or two degrees of the cattle's internal temperature) will occur during the cooler evening hours.

Extra care should be taken if the evening temperatures do not drop below 70°F as the cattle have no chance to recover before another day of heat and humidity. The longer the heat stretch lasts, the more stressful it is on the cattle.

When animals become nervous and stressed, their core body temperature naturally rises. At all times, remember to use low-stress handling techniques to keep their core body temperature down. Move cattle slowly, calmly, and short distances, if possible. Plan ahead and avoid any unnecessary movements or stressful handling.

Make note of any compromised cattle. Cattle which are sick, lame, heavy, weak, recently calved, or newly purchased are all at high risk for heat stress. Watch these cattle closely for signs of heat stress and take extra precautions to cool them down if needed.

Check and clean waterers to ensure cattle have adequate clean water. Check hoses, pumps, floats, and all parts of the water supply system to make sure water is available at all times. In the summer heat, cattle water intake increases, and many cattle may drink at the same time. Check to make sure the refill rate is adequate, enabling all cattle to drink. To ensure adequate access to water, consider adding additional, temporary tanks, if needed.

Cattle will congregate around the waterer to capture evaporative cooling coming off the water. This leads to manure build up and flies around the waterers. Remove manure build up around water tanks and locate the tanks in a high, dry area. If puddling occurs at the base of the water tank, move the water tank to higher ground.

Transporting Animals

During hot and humid weather, the temperature inside the trailer is much higher than the outside temperature. Avoid transporting cattle in moderate to severe THI conditions. Monitor the weather forecast and plan accordingly. If possible, postpone transport until cooler and less humid weather arrives.

Additionally, the high temperatures and humidity of summer can result in severe stress. Remember to check the weather before loading cattle and along the way. This will help ensure a safe and uneventful trip.

Checklist Hot Weather Factors *(Source: Beef Quality Assurance)*

1. Extreme heat conditions exist when temperature and humidity are at levels in which they create a heat index greater than or equal to 100ºF. Heat index levels 100ºF or greater pose a significant health risk to stressed cattle. Avoid transporting cattle in extreme heat conditions.
2. Avoid hauling and handling cattle between 11:00 am and 4:00 pm, which is most often the hottest time of the day. If cattle must be hauled at times of high temperature and humidity, **avoid stopping**. If stopping along the way is absolutely necessary. Make stop durations as short as possible.
    a. Stop during cooler parts of the day, if at all possible.
    b. Pick shaded areas to park if you have to stop.
3. Consider placing fewer cattle on the trailer during hot weather.
4. Handle cattle gently and patiently during extreme heat conditions. When cattle are stressed in extreme heat conditions, they are more likely to become non-ambulatory, sick, and possibly die.
5. Haul animals fit to transport. Fitness for transport is determined by multiple considerations including the health, mobility, and body condition score (BCS) of the animal. Do not transfer cattle with BCS score less than 2 non-ambulatory animals or those with severe mobility issues and animals appearing exhausted, dehydrated, or otherwise health impaired.

Special Needs of Non-Ambulatory Cows

Increased temperatures cause a chain reaction of events, compromising a dairy cow's ability to tolerate heat stress. One of the first changes we may see is less time resting.

When a cow lies down, its internal temperature increases. Cows tend to stand to regulate their internal temperature. Increasing standing time puts additional stress on their feet, which in turn leads to an increased possibility of lameness. Compared to healthy counterparts, lame cows have increased susceptibility of falling and injuring themselves.

Assessment of a Down Cow

If a cow is down, it is important to assess the situation to determine the best outcome for the animal before addressing it. What caused the cow to fall? If the cow fell due to an environmental issue such as slippery floors or a tripping hazard, rectify that situation so other cows and people can pass through the area safely.

If the cow fell due to an existing injury, assess its injury and any new injuries that may have occurred as a result of the fall. If the cow appears to be capable of standing, encourage her to do so on her own. Providing aid such as sand or straw bedding can provide better footing for standing. If the cow needs assistance such as hobbles, lifting apparatus, or float tank, carefully following the equipment's use guidelines and referring to the farm's animal handling protocols before moving or assisting the animal. Hitting, tail twisting, or inappropriate/incorrect use of equipment is considered abuse and is unacceptable.

If a cow is down on concrete, she must be moved within six hours to prevent pressure damage in the legs. A disabled animal should be moved to a stable surface such as a dirt/sand pack, pasture, or straw bedded pack. If a cow is moved to a location outside for recovery, always provide shade, food, and water.

Moving a Down Cow

If a cow is unable to stand and needs to be moved by equipment, it should be a coordinated effort between the equipment operator and the person or people working with the cow. The farm's animal handling protocols should be followed carefully to ensure the safety of the animal and the people working with it. A tractor bucket deep enough to hold the entire body of the cow or a sled wide enough to hold the cow without her body hanging off the surface are appropriate tools for moving a non-ambulatory animal. In both cases, a sled or bucket should be at least six to eight feet long to accommodate the length of the cow. A cow should never be dragged on any surface. Move the cow by rolling it on to the sled or bucket, never attempt to scoop the cow up with a bucket.

A cow should never be pulled or moved by her legs or head. Before rolling a cow onto the sled or bucket, her head should be secured with a halter tied to a rear leg. Once the cow is relocated to a location with good footing, allow the cow to stand with her own power. Down cows should be provided deep dry bedding and freshwater. If a cow is moved to a location outside for recovery, shade and protection from the elements should be provided.

Down Cow Care

If a cow is down for more than 12 hours, a veterinarian hould be consulted on further treatment or euthanasia. Down cows should have dry deep bedding to aid in standing. Encouraging a cow to stand should be done in short bursts and should not cause or prolong pain to the animal. Thoroughly evaluate the cow for proper diagnosis. Common reasons cows to be down are metabolic (milk fever), musculoskeletal (nerve damage, injury, hip injury, muscle/tissue damage from being down), toxic mastitis (especially common is due to heat stress), and toxic metritis.

Diagnosis and subsequent care are critical to a cow's recovery. Work with the farm's veterinarian on a treatment plan. Frequently re-evaluate the cow's progress and adjust treatment accordingly. Be sure to keep accurate records of treatment and outcome. A standard operating procedure template and guideline form can be found on nationaldairyfarm.com.

References

- Bohmanova, J., I. Misztal, and J. B. Cole. 2007. Temperature-humidity indices as indicators of milk production losses due to heat stress. J. Dairy Sci. 90:1947-1956.
- Bianca, W. 1968. Thermoregulation. In: Adaptation of domestic animals, ed. E. S. E. Hafez. Lea & Febiger, Philadelphia, PA.
- Chen, J. M., K. E. Schütz, and C. B. Tucker. 2015. Cooling cows efficiently with sprinklers: Physiological responses to water spray. J. Dairy Sci. 98:6925-6938.
- The Dairyland Initiative. 2020. https://thedairylandinitiative.vetmed.wisc.edu/home/housing-module/adult-cow-housing/ventilation-and-heat-abatement/
- Kelly, C.F. and T. E. Bond. 1971. Bioclimatic factors and their measurement. In: A guide to environmental research on animals, National Research Council. National Academies Press, Washington, DC.
- Polsky, L. and M. A. G. von Keyserlingk. 2017. Invited review: Effects of heat stress on dairy cattle welfare. J. Dairy Sci. 100:8645-8657.
- Schütz, K. E., A. R. Rogers, Y. A. Poulouin, N. R. Cox, and C. B. Tucker. 2010. The amount of shade influences the behavior and physiology of dairy cattle. J. Dairy Sci. 93:125–133.
- Silanikove, N. 2000. Effects of heat stress on the welfare of extensively managed domestic ruminants. Livest. Prod. Sci. 67:1–18.
- Tresoldi, G., K. E. Schütz, and C. B. Tucker. 2016. Assessing heat load in drylot dairy cattle: Refining on-farm sampling methodology. J. Dairy Sci. 99:8970-8980.
- Van Os, J. M. C. 2019. Considerations for cooling dairy cows with water. Vet. Clin. N. Am. 35:157-173.
- Vitali, A., M. Segnalini, L. Bertocchi, U. Bernabucci, A. Nardone, and N. Lacetera. 2009. Seasonal pattern of mortality and relationships between mortality and temperature-humidity index in dairy cows. J. Dairy Sci. 92:3781-3790.
- Webster, J. 1993. Environmental physiology and behaviour. In: Understanding the dairy cow, ed. J. Webster. Blackwell Scientific Publications, Boston, MA.
- FARM Farmers Assuring Responsible Management https://nationaldairyfarm.com/dairy-care365/
- Beef Quality Assurance (BQA) www.bqa.org