# VENTILATION IN DAIRY FARMS REALISTIC APPROACH PART 1

# OVERVIEW

1. WHO IS TOPCOOL?
2. WHO ARE WE NOT?
3. DAIRY FACTS
4. WHAT IS RECIRCULATION? WHAT IS VENTILATION?
5. WHY SHOULD WE USE ONE OR THE OTHER?
6. ….OR BOTH?
7. VENTILATION STRATEGIES

# WHO IS TOPCOOL?

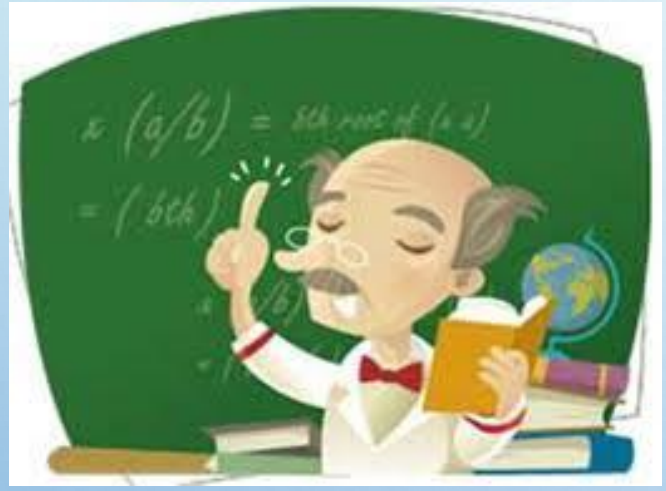
DESIGNER AND MANUFACTURER OF HIGH EFFICIENT FANS AND VENTILATION SYSTEMS, DESIGNED TO IMPROVE THE ANIMAL HEALTH AND WELFARE, BASED ON RESEARCH IN THEORY AND PRACTICE.


# STATE-OF-THE-ART PRODUCTION METHODS ENSURING RELIABLE PRODUCTS


# SERVING ALSO YOUR LIVESTOCK FARM WITH LOW MAINTANANCE AND SERVICE COSTS

# CERTIFIED MEMBER OF BOTH INTERNATIONALLY ACCEPTED LABORATORIES


# WHO ARE WE NOT?



UNIVERSITY PROFESSORS

VETERINAIRIANS

## BUT WE WORK CLOSELY WITH INDEPENDENT RESEARCH CENTERS WORLD-WIDE.

E.G.:

hogeschool hasdenbosch

Dairyland Initiative
UNIVERSITY OF WISCONSIN–MADISON

LANDESVEREINIGUNG MILCH HESSEN

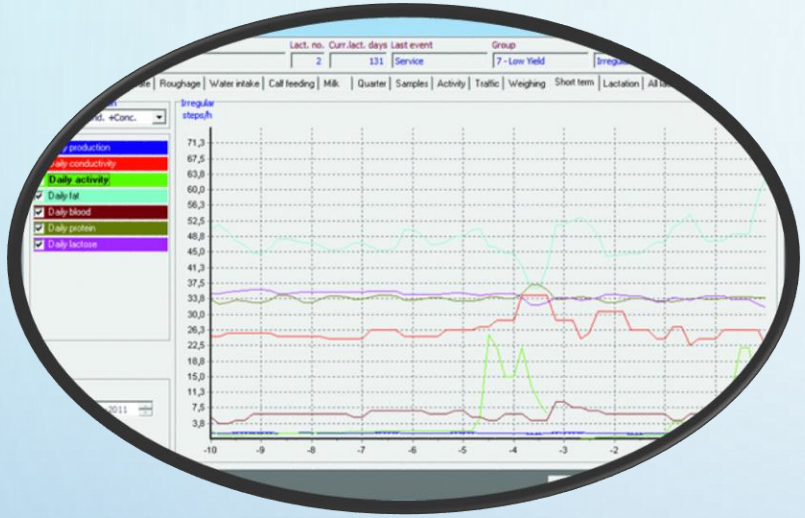
KATHOLIEKE UNIVERSITEIT LEUVEN

ALL ARE SPECIALISTS ON LIVESTOCK FARMING AND MANAGEMENT.
RECENT FOCUS ON DAIRY BEHAVIOUR AND MICRO-CLIMATE!

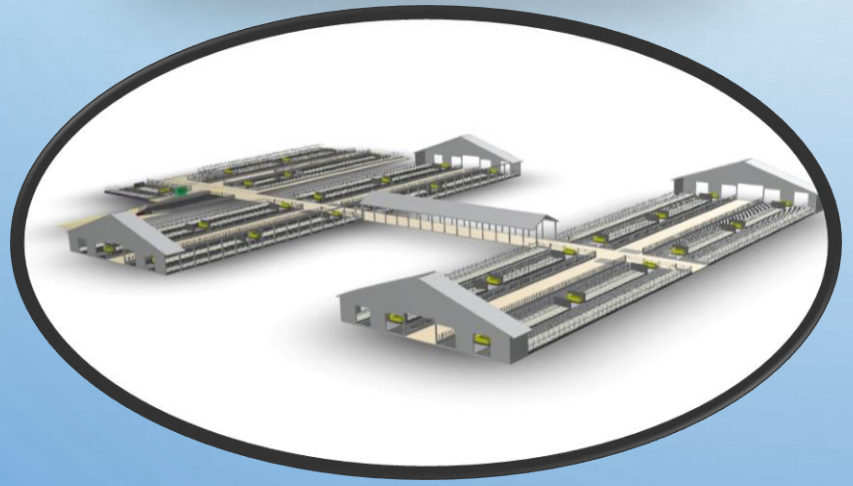
# DAIRY FACTS

## A MODERN DAIRY COW IS EQUAL TO A TOP ATHLETE

# BOTH WILL ONLY PERFORM AT THE BEST POSSIBLE RESULT IF EVERY ASPECT OF THE FARM IS PERFECT!




MANAGEMENT KNOWLEDGE AND KNOWLEDGE EXCHANGE



BUILDING DESIGN APPROPRIATE FOR CLIMATE AND HERD SIZE

BEDDING AREA INCLUDING MATERIAL PROVIDING THE BEST COMFORT, RESULTING IN IDEAL RESTING TIMES?

IS ENOUGH LIGHT AVAILABLE AT THE HOURS IT MATTERS (LLDP)?

# … AND MORE RECENTLY…

ARE WE SURE, THAT WE HAVE ENOUGH AIR AT THE CORRECT HEIGHT, AT THE PERFECT SPEED AND THAT WE REALLY PROVIDE SOMETHING TO OUR TOP-ATHLETES?

# WHAT IS HEAT STRESS FOR A DAIRY COW?

**Temperature Humidity Index (THI)**
**Relative Humidity %**

| C | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
|---|---|---|---|---|---|---|---|---|---|
| 22 | 66 | 66 | 67 | 68 | 69 | 69 | 70 | 71 | 72 |
| 24 | 68 | 69 | 70 | 70 | 71 | 72 | 73 | 74 | 75 |
| 26 | 70 | 71 | 72 | 73 | 74 | 75 | 77 | 78 | 79 |
| 28 | 72 | 73 | 74 | 76 | 77 | 78 | 80 | 81 | 82 |
| 30 | 74 | 75 | 77 | 78 | 80 | 81 | 83 | 84 | 86 |
| 32 | 76 | 77 | 79 | 81 | 83 | 84 | 86 | 88 | 90 |
| 34 | 78 | 80 | 82 | 84 | 85 | 87 | 89 | 91 | 93 |
| 36 | 80 | 82 | 84 | 86 | 88 | 90 | 93 | 95 | 97 |
| 38 | 82 | 84 | 86 | 89 | 91 | 93 | 96 | 98 | 100 |
| 40 | 84 | 86 | 89 | 91 | 94 | 96 | 99 | 101 | 104 |

No heat stress
Moderate heat stress
Severe heat stress
Dead cows

**NOAA's National Weather Service**

**Heat Index**

**Temperature (°F)**

| Relative Humidity (%) | 80 | 82 | 84 | 86 | 88 | 90 | 92 | 94 | 96 | 98 | 100 | 102 | 104 | 106 | 108 | 110 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | 80 | 81 | 83 | 85 | 88 | 91 | 94 | 97 | 101 | 105 | 109 | 114 | 119 | 124 | 130 | 136 |
| 45 | 80 | 82 | 84 | 87 | 89 | 93 | 96 | 100 | 104 | 109 | 114 | 119 | 124 | 130 | 137 | |
| 50 | 81 | 83 | 85 | 88 | 91 | 95 | 99 | 103 | 108 | 113 | 118 | 124 | 131 | 137 | | |
| 55 | 81 | 84 | 86 | 89 | 93 | 97 | 101 | 106 | 112 | 117 | 124 | 130 | 137 | | | |
| 60 | 82 | 84 | 88 | 91 | 95 | 100 | 105 | 110 | 116 | 123 | 129 | 137 | | | | |
| 65 | 82 | 85 | 89 | 93 | 98 | 103 | 108 | 114 | 121 | 126 | 130 | | | | | |
| 70 | 83 | 86 | 90 | 95 | 100 | 105 | 112 | 119 | 126 | 134 | | | | | | |
| 75 | 84 | 88 | 92 | 97 | 103 | 109 | 116 | 124 | 132 | | | | | | | |
| 80 | 84 | 89 | 94 | 100 | 106 | 113 | 121 | 129 | | | | | | | | |
| 85 | 85 | 90 | 96 | 102 | 110 | 117 | 126 | 135 | | | | | | | | |
| 90 | 86 | 91 | 98 | 105 | 113 | 122 | 131 | | | | | | | | | |
| 95 | 86 | 93 | 100 | 108 | 117 | 127 | | | | | | | | | | |
| 100 | 87 | 95 | 103 | 112 | 121 | 132 | | | | | | | | | | |

Likelihood of Heat Disorders with Prolonged Exposure or Streuous Activity

Caution  Extreme Caution  Danger  Extreme Danger

BASICALLY: IF THE COMBINATION OF TEMPERATURE AND RELATIVE HUMIDITY EXCEEDS CERTAIN LEVELS, THE COW WILL EXPERIENCE HEAT STRESS!

# EXAMPLE CALCULATIONS:

| Temp (Fahrenheit) | Relative humidity (%) |
|---|---|
| 104 | 60 |
| **THI** | |
| **93,88** | |

SCENARIO A: OUTSIDE TEMPERATURE IS 40°C (=104F) AND RELATIVE HUMIDITY IS 60%, THE THI IS 93,88

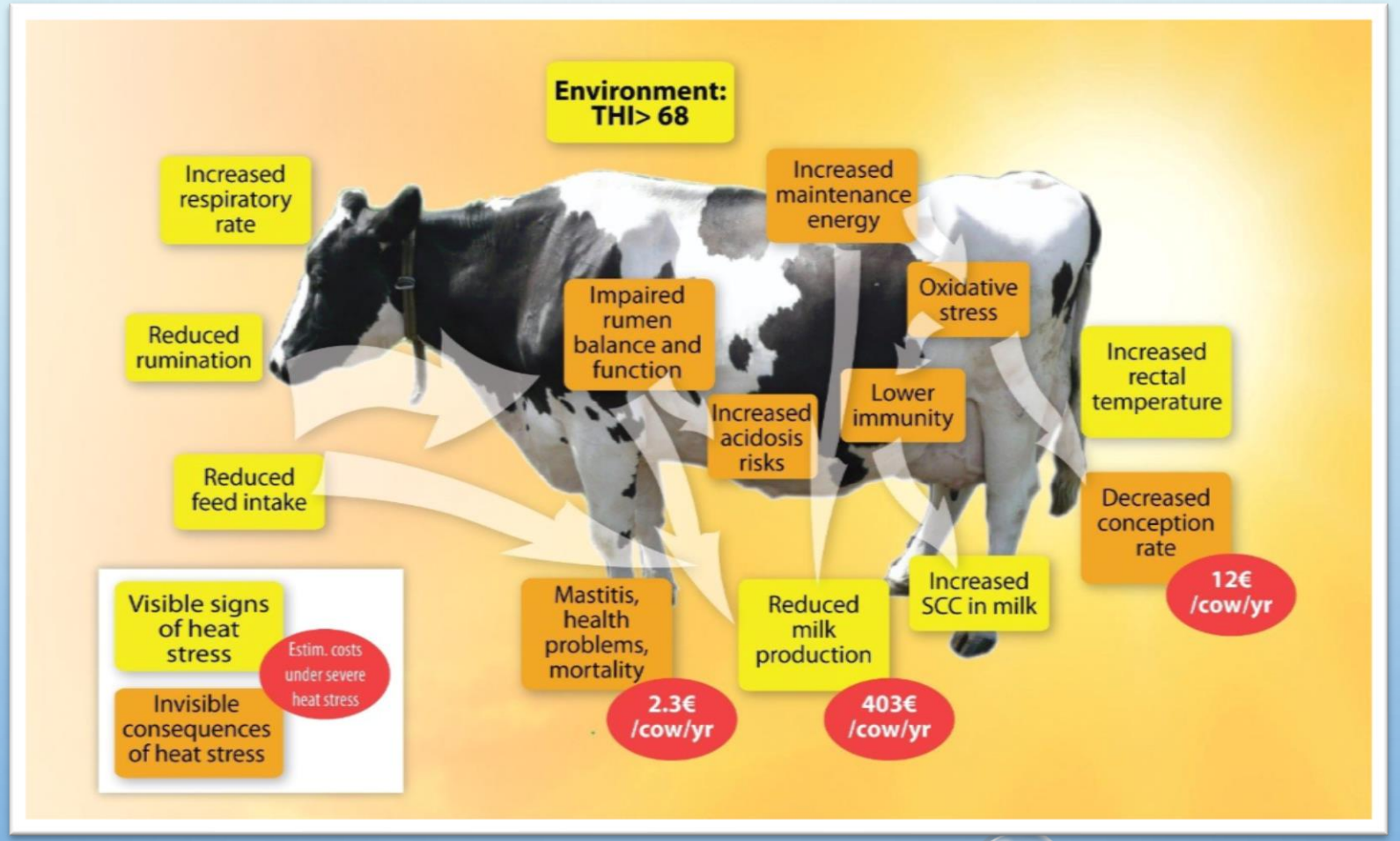
| Temp (Fahrenheit) | Relative humidity (%) |
|---|---|
| 104 | 90 |
| **THI** | |
| **101,47** | |

SCENARIO B: OUTSIDE TEMPERATURE IS 40°C (=104F) AND RELATIVE HUMIDITY IS 90%, THE THI IS 101,47

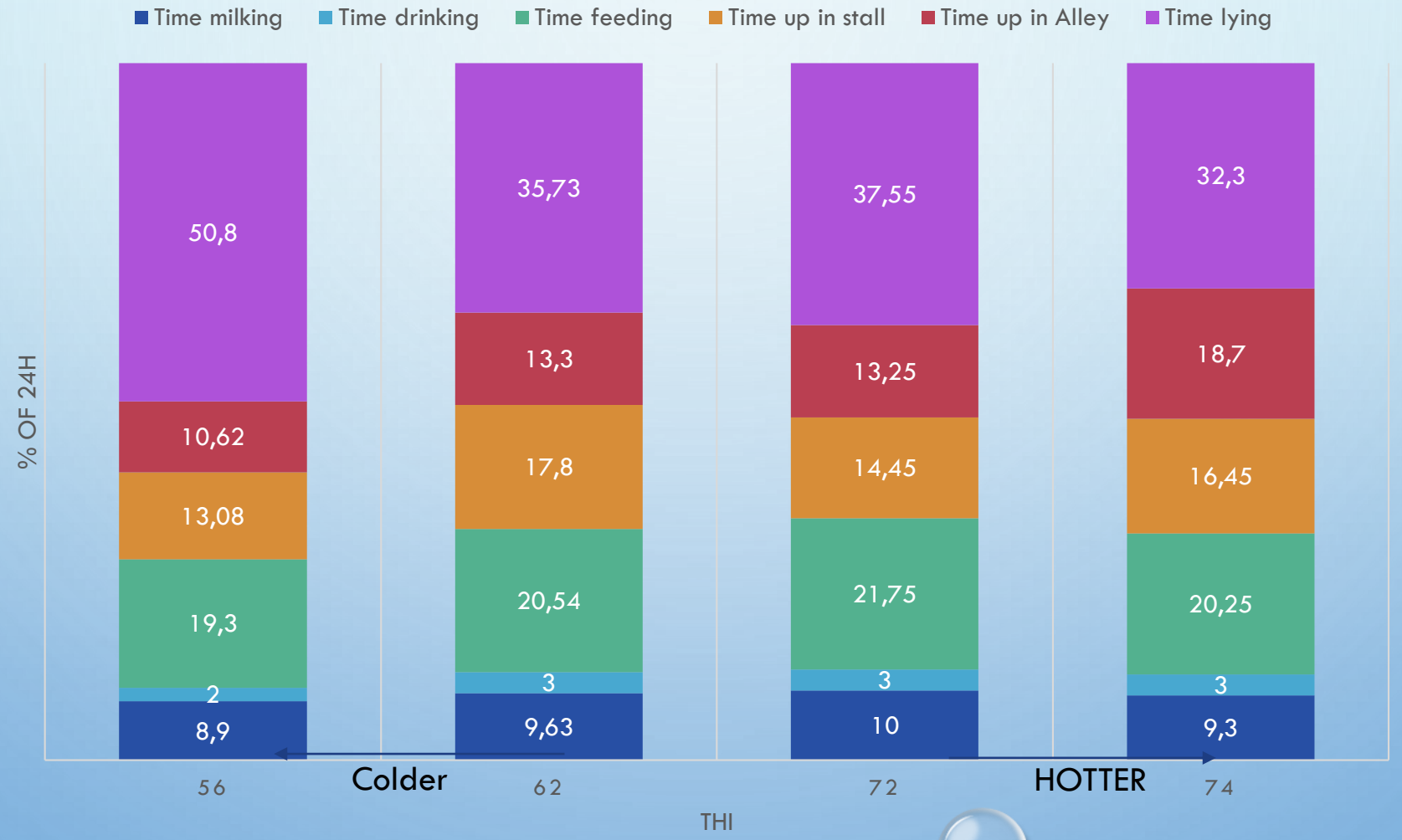
PREVIOUS CALCULATIONS SHOW, THAT THE RELATIVE HUMIDITY HAS A LOT OF IMPACT IN THE WELL-BEING OF DAIRY COWS! SO,

**NOT** ONLY TEMPERATURE!!!

# WHAT HAPPENS DURING HEAT STRESS INSIDE THE COW?



# TIME BUDGET AND HEAT STRESS PER 24H




From Cook et.al

# RESULTS IN MILK PRODUCTION

| Practical examples of heat stress | Temperatures; Humidity | Duration (hours/day | Milk loss under heat stress kg/h; kg/cow/day) |
|---|---|---|---|
| | | | |
| Stress Threshold THI [68-71] | 22°C ; 50% | 4 | {-0.283kg/h; -1.1kg/cow/day} |
| Mild-Moderate Stress THI [72-79] | 25°C ; 50% | 9 | {-0.303kg/h; -2.7kg/cow/day} |
| Moderate-Severe Stress THI [80-89] | 30°C ; 75% | 12 | {-0.322kg/h; -3.9kg/cow/day} |
| Severe Stress THI [90-99] | 34°C ; 85% | not measured | |

Source: BIVIT 3 year test worldwide


## CONCLUSION 1:

TEMPERATURE AND HUMIDITY HAVE A DIRECT EFFECT ON LYING TIMES

## CONCLUSION 2:

SHORTER LYING TIMES = LOWER MILK PRODUCTION

## CONCLUSION 3:

SMALL INCREASE OF THI RESULTS IN MILK LOSS

# SUMMARIZING!

1. THI VALUE AND CONTROL IS IMPORTANT FOR COW WELLFARE
2. TOO HIGH THI-VALUES REDUCE RESTING TIME SIGNIFICANTLY
3. TOO HIGH THI-VALUES REDUCE DMI INTAKE
4. ALL OF THE ABOVE HAVE A DIRECT EFFECT ON MILK PRODUCTION
5. REDUCED RESTING TIMES INCREASE LAMENESS
6. TOO HIGH THI VALUES REDUCE FERTILITY AND BIRTH RATES

# ANNUAL THI PERCENTAGE CHINA (3 YEAR MEASUREMENT)



**HEAT STRESS PERCENTAGE CHINA PER YEAR**

Research: Lallemand France

# WHAT IS VENTILATION?

REMOVAL OF TOXIC GASSES ($NH_3$, $CO_2$, CO, METHANE, $H_2S$) FROM A BUILDING WHILE REPLACING IT WITH FRESH AIR.

# DILLUTION IS THE SOLUTION TO POLLUTION!

# WHAT IS RECIRCULATION?

CREATING AIR MOVEMENT INSIDE ANY BUILDING BY USING UP TO A GREAT EXTEND THE AIR PRESENT INSIDE THAT BUILDING.
THIS WILL CREATE VELOCITY AS WELL AS REDUCTION OF BUILT-UP OF NH3 GASSES AND RELATIVE HUMIDITY, IF APPLIED CORRECTLY!

# VENTILATION IS NOT EQUAL TO RECIRCULATION…

VENTILATION

RECIRCULATION

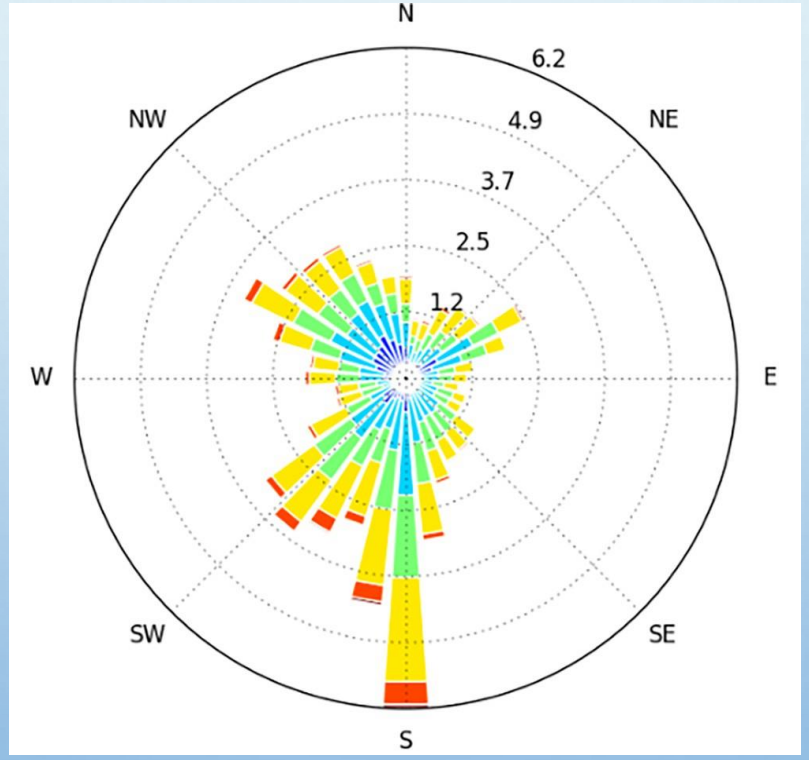
AIR VELOCITY VENTILATION

# STILL NATURAL VENTILATION IN DAIRY FARMS IS STILL VERY COMMON WORLDWIDE

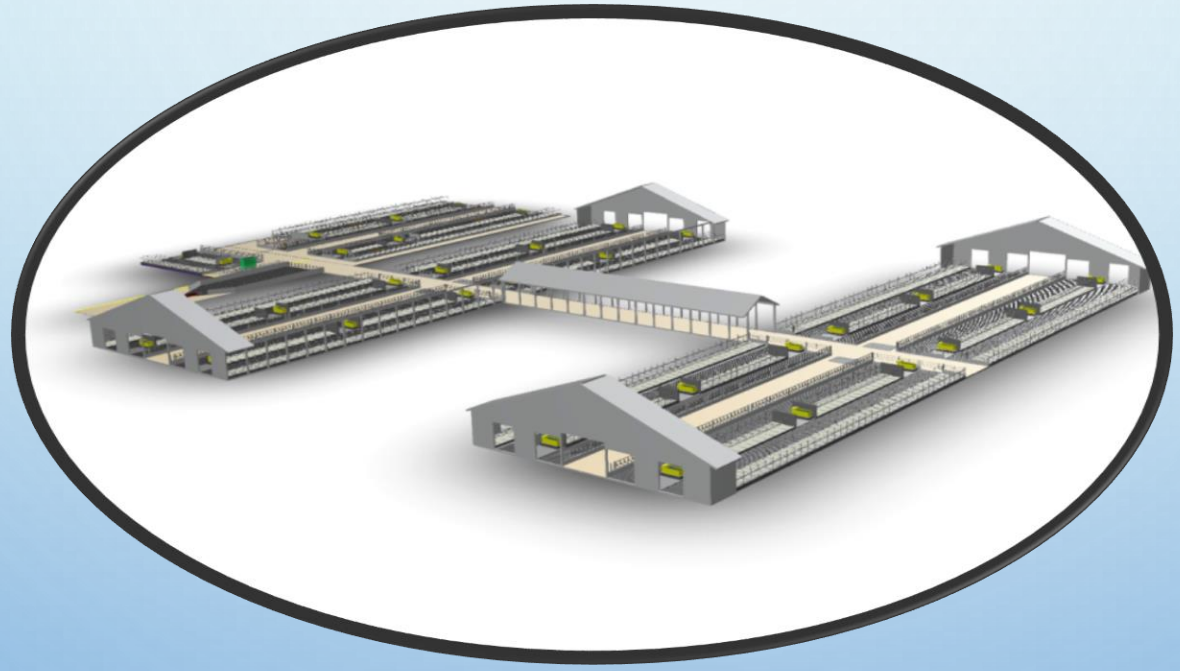
BUT DO THESE NATURAL VENTILATED BARNS CREATE ENOUGH ACH AND AIR VELOCITY TO PROVIDE AN OPTIMAL MICRO CLIMATE?

SOMETIMES, BUT NOT ALL OF THE TIMES!

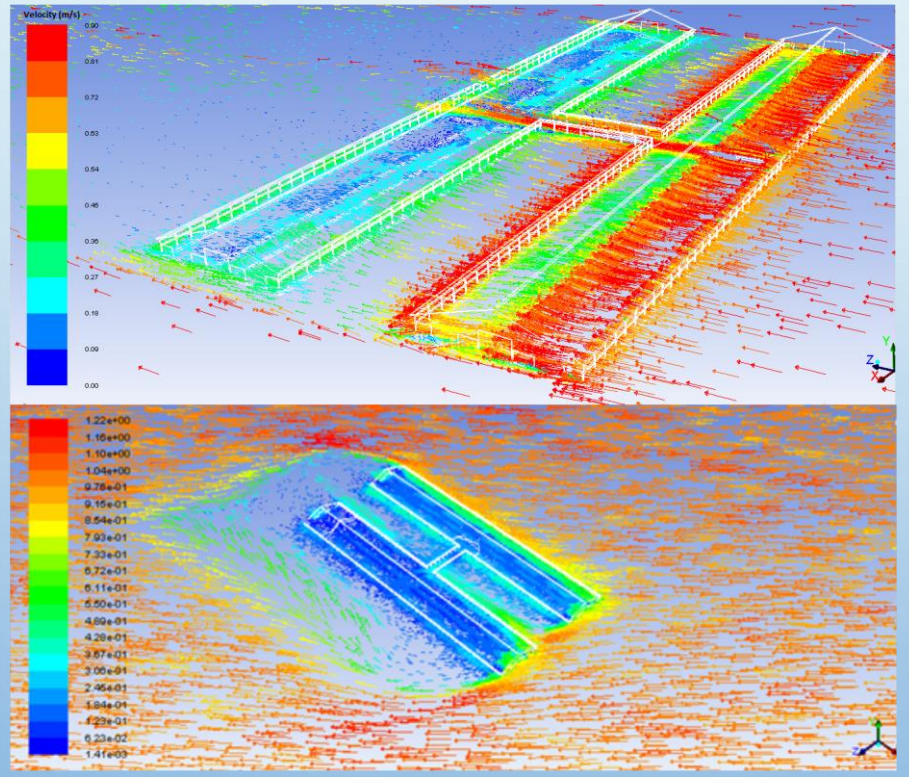
# BECAUSE THERE ARE DAYS THE WIND DOESN'T BLOW OR THE WIND SPEED IS TOO LOW!



# AND DAIRY FACILITIES BECOME BIGGER….



# AND ONE BUILDING CAN NEGATIVELY EFFECT THE NEXT ONE, ALTHOUGH POSITIONED IN THE BEST WAY...



# THEREFORE FARMERS (STILL) INVEST IN HVLS FANS!

# BUT DO THESE REALLY HELP?

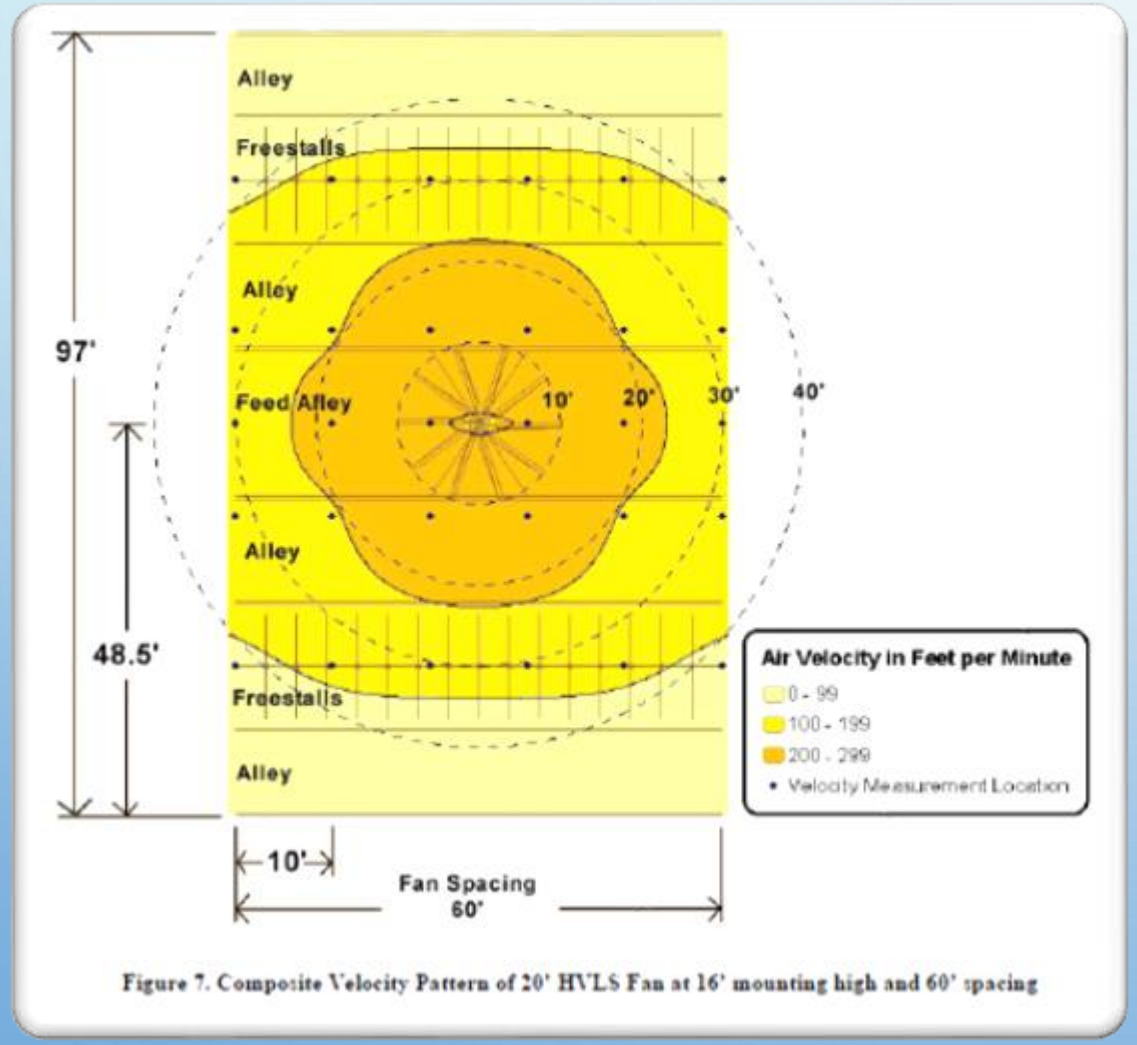



Figure 7. Composite Velocity Pattern of 20' HVLS Fan at 16' mounting high and 60' spacing

- TAKE NO PART IN VENTILATION
- ONLY DESTRATIFY AIR
- TOO LOW AIR VELOCITY TO KEEP COWS COOL

# SO? WHAT IS THE WAY FORWARD?

WE KNOW, THAT WE NEED TO REDUCE THE THI AS MUCH AS POSSIBLE!

# VARIOUS WAYS....

## PAD COOLING

### PRO'S:

- FAIRLY CHEAP
- EASY TO INSTALL
- PROVEN EFFECTIVNESS

### CON'S:

- PLUCKING UP
- INCREASE OF STATIC PRESSURE
- GROWTH OF BACTERIA/FUNGHI
- HIGH REPLACEMENT %

# VARIOUS WAYS….

## HIGH PRESSURE FOGGING:

### PRO'S:

- ULTRA-FINE MIST
- NO EFFECT ON AIR INTAKE OF THE BUILDING
- CAN BE APPLIED DIRECTLY WHERE NEEDED
- CONTROLLABLE
- COMBINES EVAPORATIVE COOLING AND WINDSPEED FOR OPTIMAL COOLING

### CON'S:

- NEEDS HIGH PRESSURE PUMP
- POSITIONING IN BARN IS IMPORTANT
- LEAKPROOF NOZZLES ARE MUST-HAVE

# VARIOUS WAYS….

## HIGH PRESSURE SOAKING:

### PRO'S:

- IN COMBINATION WITH WINDSPEED IDEAL WAY OF COOLING COWS
- NO EFFECT ON AIR INTAKE OF THE BUILDING
- CAN BE APPLIED DIRECTLY WHERE NEEDED
- CONTROLLABLE

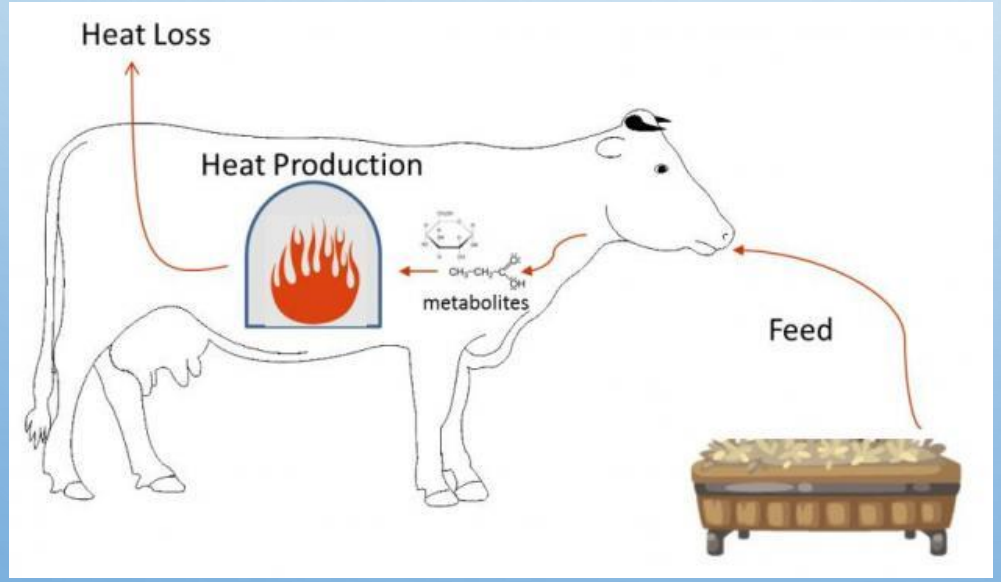
### CON'S:

- NEEDS HIGH PRESSURE PUMP
- POSITIONING IN BARN IS IMPORTANT
- DIRECTLY ABOVE HEAD LOCK ONLY POSITION TO INSTALL

# VARIOUS WAYS….

BUT MOST CAN ONLY BE APPLIED IF RELATIVE HUMIDITY IS MAX. 70%, BECAUSE:

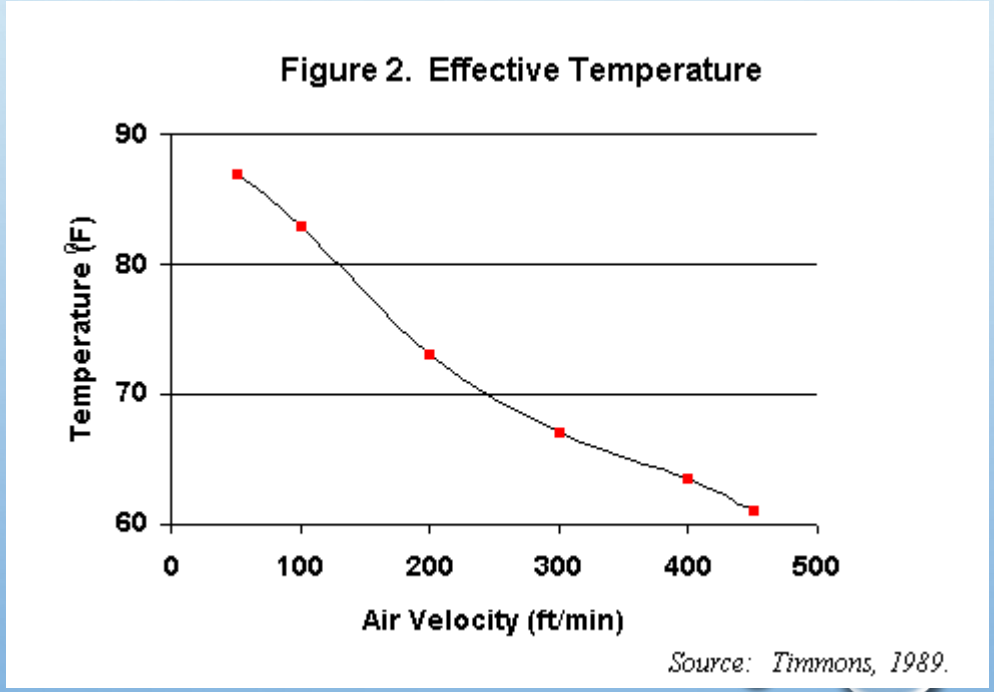
- ALL (EXCEPT SOAKING) INCREASE HUMIDITY LEVEL INSIDE THE BARN
- COWS DURING FIRST 1/3 OF LACTATION PRODUCE ADDITIONAL 8-10% HUMIDITY (2000W/PER COW)



# VARIOUS WAYS….

## AIR MOVEMENT/AIR EXCHANGE IS NECESSARY! ALWAYS!!!

THEREFORE …AS ALL PREVIOUS SYSTEMS NEED WINDSPEED OR AIR EXCHANGE (= USE OF FANS)… WE CAN LOOK AT THE COOLING POWER OR VELOCITY



# EFFECTIVE TEMPERATURES

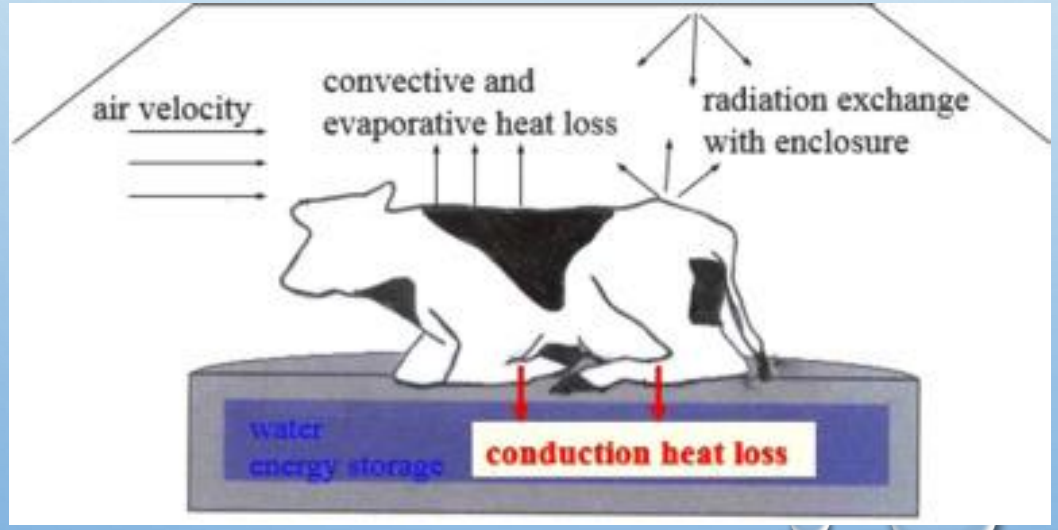
| Actual temperature | | Relative humidit | | Air Velocity | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| F | C | 50% | 70% | 0 | 100 | 200 | 300 | 400 | 500 | FPM |
| | | | | 0 | 0,5 | 1 | 1,5 | 2 | 2,5 | m/s |
| 95 | 35 | | | >95 | 90 | 80 | 76 | 74 | 72 | |
| | | | | >35 | 32,2 | 26,6 | 24,4 | 23,3 | 22,2 | |
| | | | | 101 | 96 | 87 | 84 | 79 | 76 | |
| | | | | 38,3 | 35,5 | 30,5 | 28,8 | 26,1 | 24,4 | |
| 90 | 32,2 | | | >90 | 85 | 78 | 75 | 73 | 70 | |
| | | | | >32,2 | 26,6 | 25,4 | 22,8 | 21,1 | 20 | |
| | | | | 96 | 91 | 84 | 81 | 78 | 74 | |
| | | | | 35.5 | 32,7 | 28,8 | 27,2 | 25,5 | 23,3 | |
| 85 | 29,4 | | | >85 | 80 | 76 | 73 | 70 | 68 | |
| | | | | >29,4 | 26,6 | 24,4 | 22,8 | 21,1 | 20 | |
| | | | | 89 | 86 | 81 | 78 | 76 | 74 | |
| | | | | 31,6 | 30 | 27,2 | 25,5 | 24,4 | 23,3 | |
| 80 | 26,6 | | | >80 | 76 | 72 | 70 | 66 | 65 | |
| | | | | 29,6 | 24,4 | 22,2 | 21,1 | 18,9 | 18,3 | |
| | | | | >83 | 79 | 76 | 74 | 69 | 67 | |
| | | | | 28,3 | 26,1 | 24,4 | 23,3 | 20,5 | 19,4 | |
| 75 | 23,9 | | | >75 | 73 | 70 | 68 | 64 | 62 | |
| | | | | 23,9 | 22,8 | 21,1 | 20 | 17,7 | 16,6 | |
| | | | | 78 | 76 | 74 | 72 | 68 | 66 | |
| | | | | 25,5 | 24,4 | 23,3 | 22,2 | 29 | 18,8 | |
| 70 | 21,1 | | | >70 | 66 | 65 | 64 | 62 | 61 | |
| | | | | 21,1 | 18,9 | 18,3 | 17,7 | 16,6 | 16,1 | |
| | | | | 74 | 69 | 67 | 66 | 65 | 63 | |
| | | | | 23,3 | 20,5 | 19,4 | 18,8 | 18,3 | 17,2 | |

Anytime the airspeed exceeds 500FPM(2,5m/s) the effective temperatures begin to increase again instead of decreasing because of the potential evaporation rate of moisture begins to diminish. The moisture begins to move with the airflow instead of vapourizing and allowing for evaporation from the heat source and air velocity.

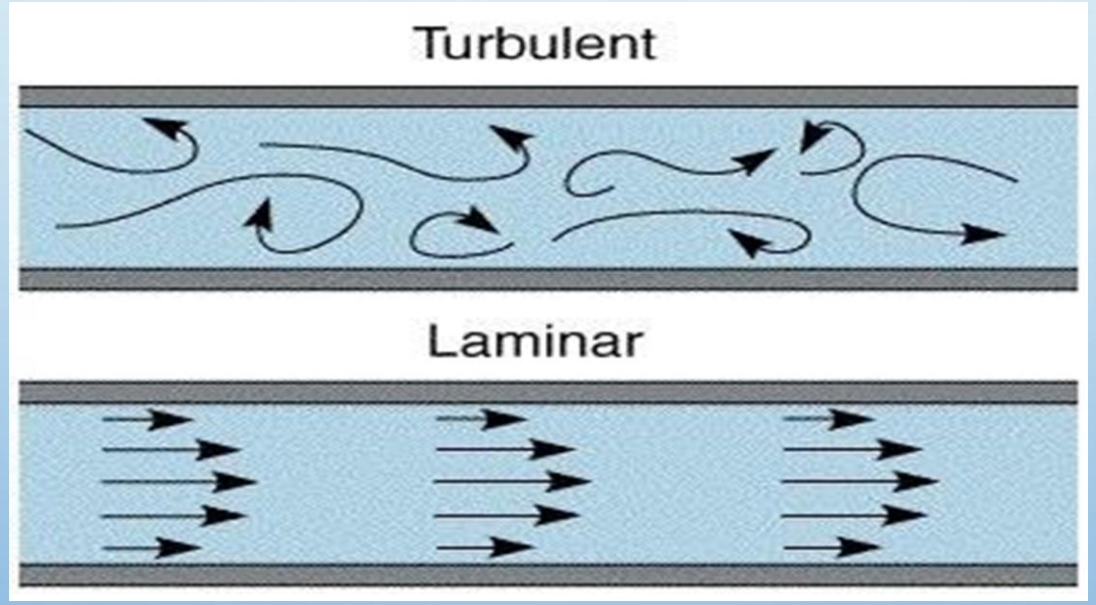
For metabolism from feed and water intake the ideal conditions are 50-60% relative humidity and 12 - 16 degrees C.

When moisture holding capacities of the air reaches dew point an increase of humidity above that will create a negative index. Therefore the effective temperature is greater than the actual temperature.

# WIND SPEED CLEARLY GENERATES ALREADY A LOT OF COOLING POWER WITHOUT INFLUENCING THE RELATIVE HUMIDITY…AS LONG AS THE MAX SPEED IS NOT GREATER THAN 500FPM OR 2,5 M/SEC



# 2 POSSIBLE WAYS THE AIR CAN BE DISCHARGED FROM A FAN

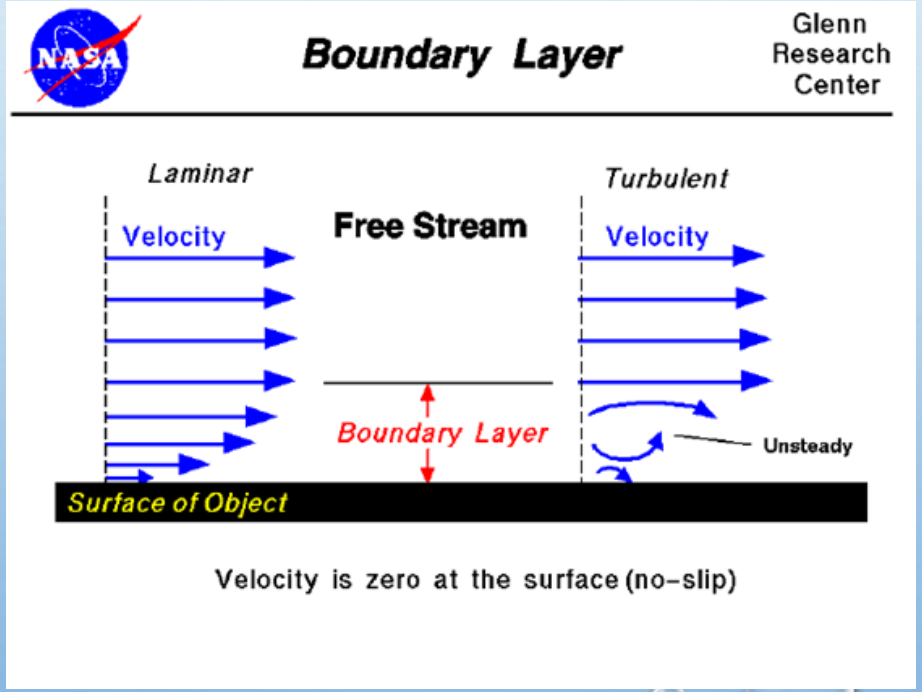


# MOST FANS ARE BASICALLY DESIGNED FOR TURBULENT AIR DISCHARGE…

# … AND SOME ARE NOT DOING THE JOB AS WELL…

# … AND SOME ARE NOT DOING THE JOB AS WELL…

# AS TURBULENT FLOWS CREATE MIXING OF LAYERS IT WILL RESULT IN MORE FRICTION. FRICTION LEADS TO REDUCTION OF SPEED WHEN MEASURED OVER THE DISTANCE BETWEEN AIR DISCHARGE AND OBJECTS.

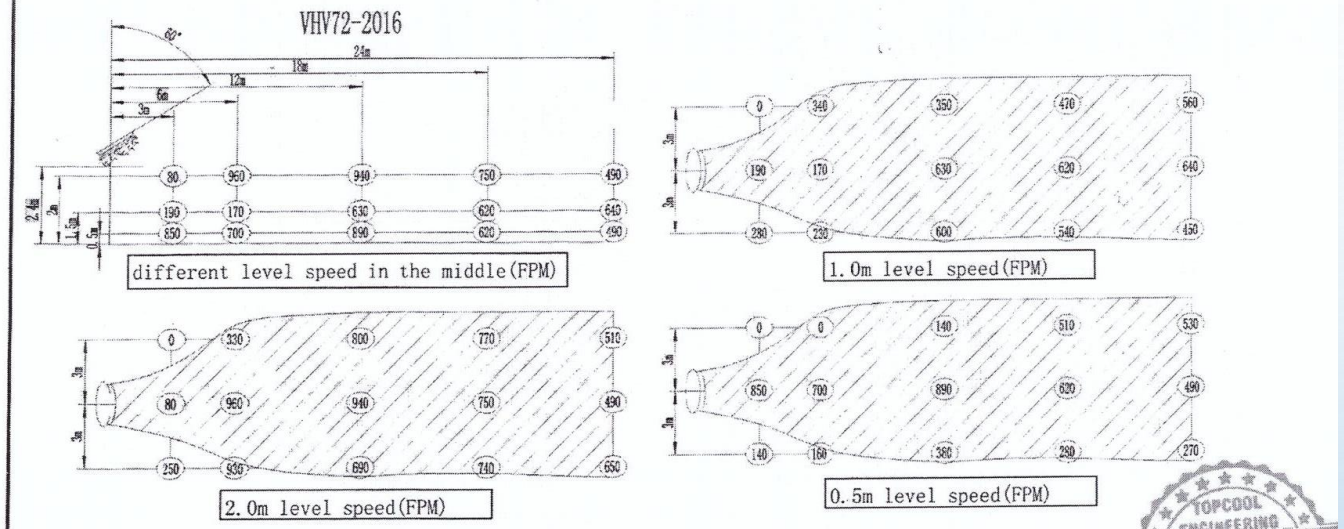


# LESS SPEED RESULTS IN LESS COOLING POWER! FANS WITH LAMINAR FLOW ARE THEREFORE BEST OPTION IN DAIRY FARMS! ESPECIALLY OVER HEAD-TO-HEADS AND WHEN SOAKING IS APPLIED!

# LESS SPEED RESULTS IN LESS COOLING POWER! FANS WITH LAMINAR FLOW ARE THEREFORE BEST OPTION IN DAIRY FARMS! ESPECIALLY OVER HEAD-TO-HEADS AND WHEN SOAKING IS APPLIED!

Test report VELOCITY MAPPING 3D (testing performed by topcool in house)

| | | | | | |
|---|---|---|---|---|---|
| Test unit: | Agricultural | Test Report: | 20151231 | Date: | 2015/12/31 |
| Manufacturer: | Topcool ventilation equipment co.ltd | | | | |
| Model: | VHV72-2016 | Description: | Recirculation VHV72 '' 2.2kw | | |
| Fan position: | | | | | |
| Distance from floor: | 2.4 meter | Guard: | No | | |
| Angle : | 60 degree | Deflector Position: | Yes | | |




different level speed in the middle(FPM)




1.0m level speed(FPM)




2.0m level speed(FPM)




0.5m level speed(FPM)

TOPCOOL ENGINEERING APPROVED SIGNED BY Levin DATE 2015-12-3

Testing performed by: Topcool engineering facility
Test Method :
a) test room 24meter wide x 60meter x 7 meter high :none obstruction
b) fan tild according of general application
c) reading are take with velocity meter 16 points model :ADM-880C

Director: GuangSheng Guan
Engeneer : Li'an Xu
Technical: Jinji Li

Topcool ventilation continues to strive for the most accurate test data available.
As additional independent accredited lab results become available we may need to revise information stated above.

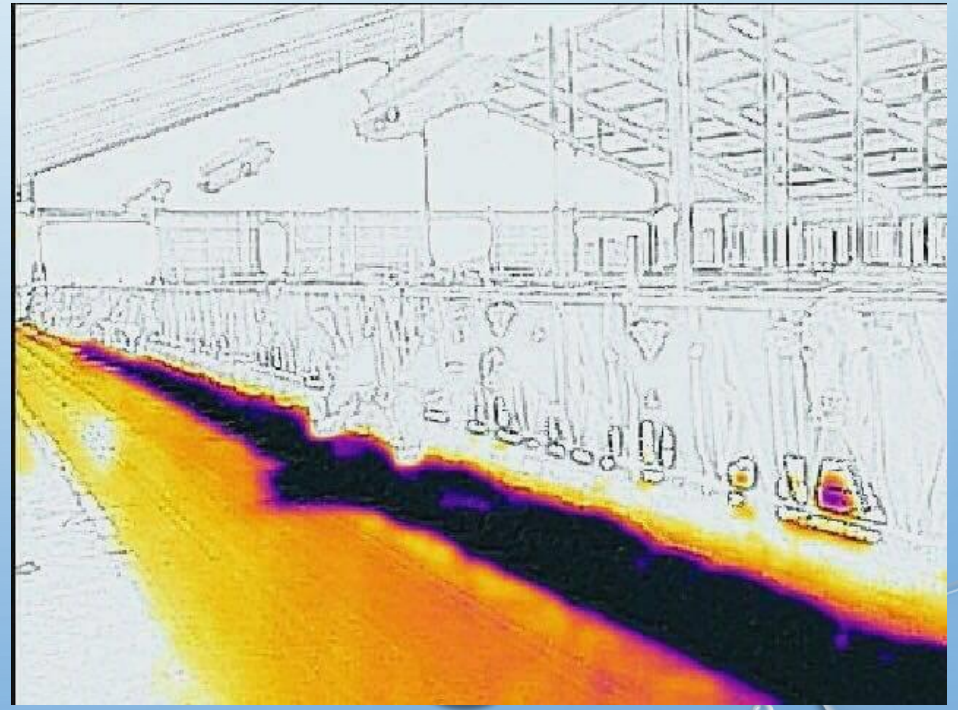
\\192.168.0.168\8-r&d\技术部 Technical Dept\风速测量(speed test)\2016-5-16\Air flow design 2016

# TOPCOOL MEASUREMENTS OF VELOCITY OF VHV FANS OVER STANDARD DISTANCES...

# COOLING BY AIR VELOCITY HAS BEEN A PROVEN WAY OF COOLING LIVESTOCK IN MOST ENVIRONMENTS AS IT DOES NOT EFFECT rH LEVELS!

BEFORE PROPER VELOCITY COOLING

AFTER PROPER VELOCITY COOLING



## SOME BASIC RULES PROVEN IN THE FIELD:

IF…

TEMPERATURE ≤ 35°C WITH rH ≤ 60%: AIR VELOCITY (WITH OPTIONAL MISTING/FOGGING)
TEMPERATURE ≤ 35°C WITH rH ≥ 70%: AIR VELOCITY (WITH OPTIONAL SOAKING OVER FEEDGATE)
TEMPERATURE ≥ 35°C WITH rH ≤ 60%: AIR VELOCITY WITH MISTING/FOGGING
TEMPERATURE ≥ 35°C WITH rH ≥ 70%: AIR VELOCITY WITH SOAKING OVER FEEDGATE

…WILL PROVIDE THE BEST COOLING RESULTS.

BUT…NO MATTER WHICH SYSTEM/COMBINATION IS MOST SUITABLE IN A CERTAIN AMBIENT/ENVIRONMENT….

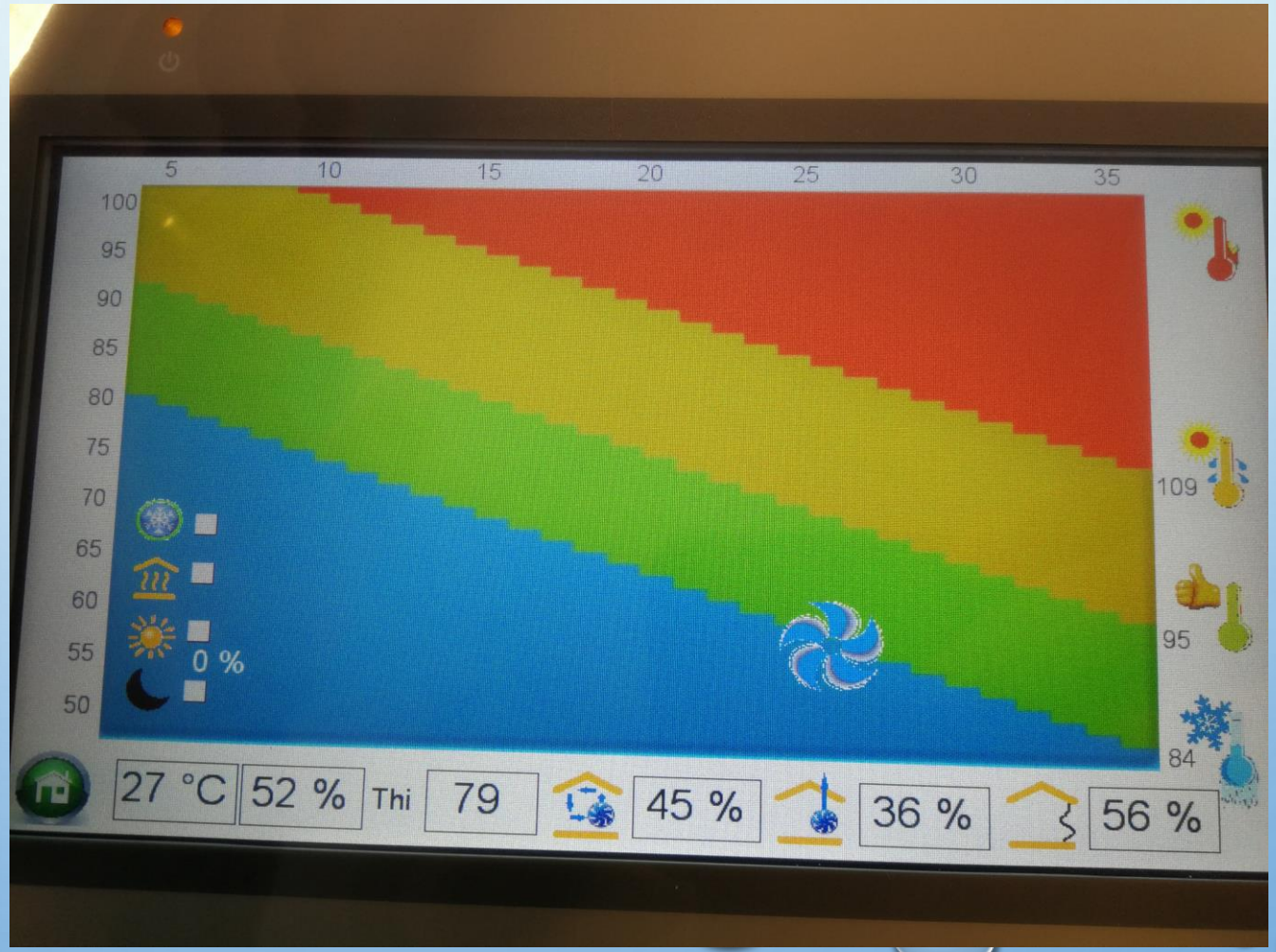
RECIRCULATION FANS (WITH OR WITHOUT SOAKING/FOGGING) NEED TO BE CONTROLLED BY FAILSAFE VFD-SYSTEMS.


## COMPARE TOPCOOL TFD WITH OTHER VFD'S.

## BENEFITS TOPCOOL TFD/TFD-BASIC:

- ALL-SINUS-FILTER ON BOARD
- ABSOLUTELY NO INTERFERENCE WITH OTHER ELECTRONIC DEVICES IN SAME BUILDING/NEIGHBOURHOOD
- SMOOTH MOTOR OPERATION – NO ADDITIONAL NOISE
- DIFFERENT TYPES RANGING FROM 2,5 – 50 AMP.
- NO SPECIAL SHIELDED CABLES NEEDED.
- NO LIMITATIONS REGARDING MAXIMUM DISTANCES BETWEEN FANS AND TFD/TFD-BASIC
- TFD OFFERS FULL TEMPERATURE CONTROL AND Rh MONITORING
- TFD-BASIC CAN BE USED AS MANUAL CONTROL OR IN COMBINATION WITH ANY CLIMATE COMPUTER
- IP 67

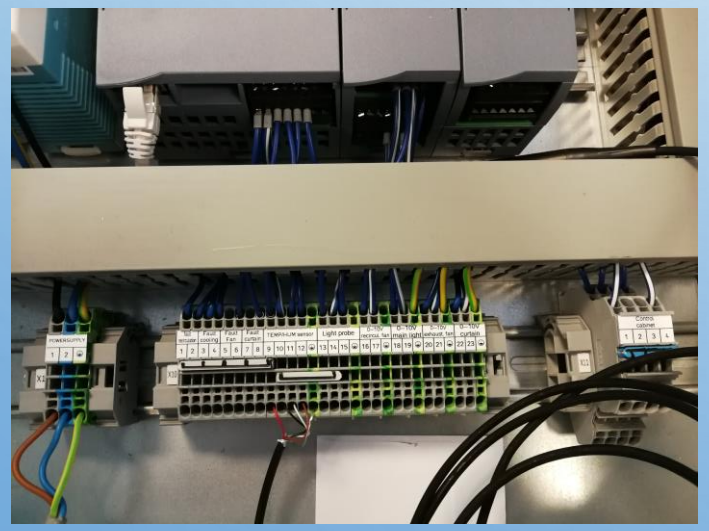
# TOPCOOL CLIMATE COMPUTER (THI-CONTROL 004)

# TOPCOOL CLIMATE COMPUTER (THI-CONTROL 004)

INPUTS:

- COMBINED TEMPERATURE AND HUMIDITY SENSOR
- LUX SENSOR (OPTIONAL IN + VERSION)
- POWER SUPPLY 230V, 50/60Hz, 1 phase
- LAN connection (Internet) phone app in preperation

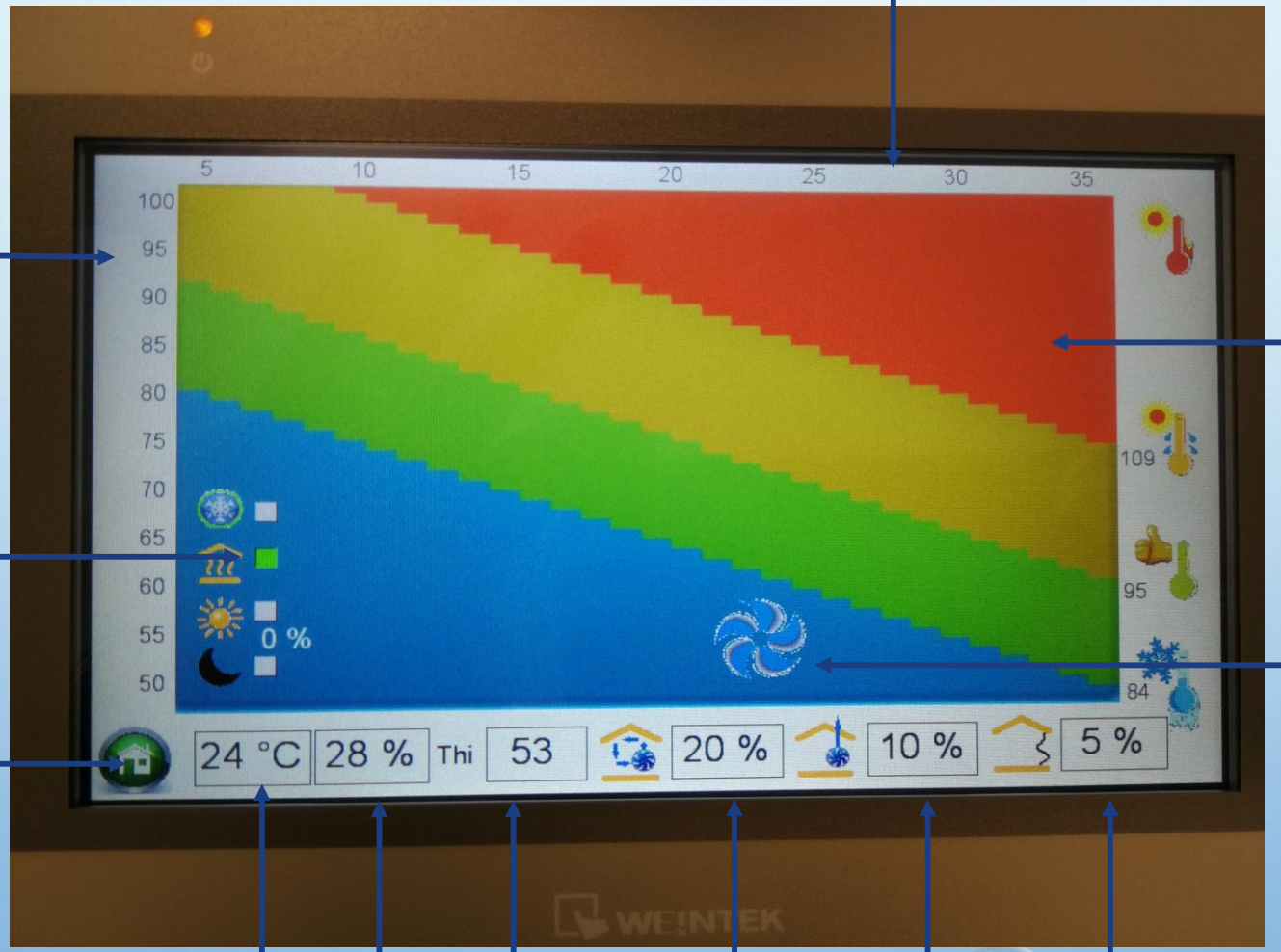


OUTPUTS:

- EXHAUST FAN STAGE (0-10v)
- RECIRCULATION FAN STAGE (0-10v)
- COOLING (NOZZLE OR SOAKING)
- CURTAINS 0-10v
- HEATING CONTACT ON/OFF
- LIGHTING SYSTEM (0-10v) AVAILABLE IN + VERSION

# TOPCOOL CLIMATE COMPUTER (THI-CONTROL 004)

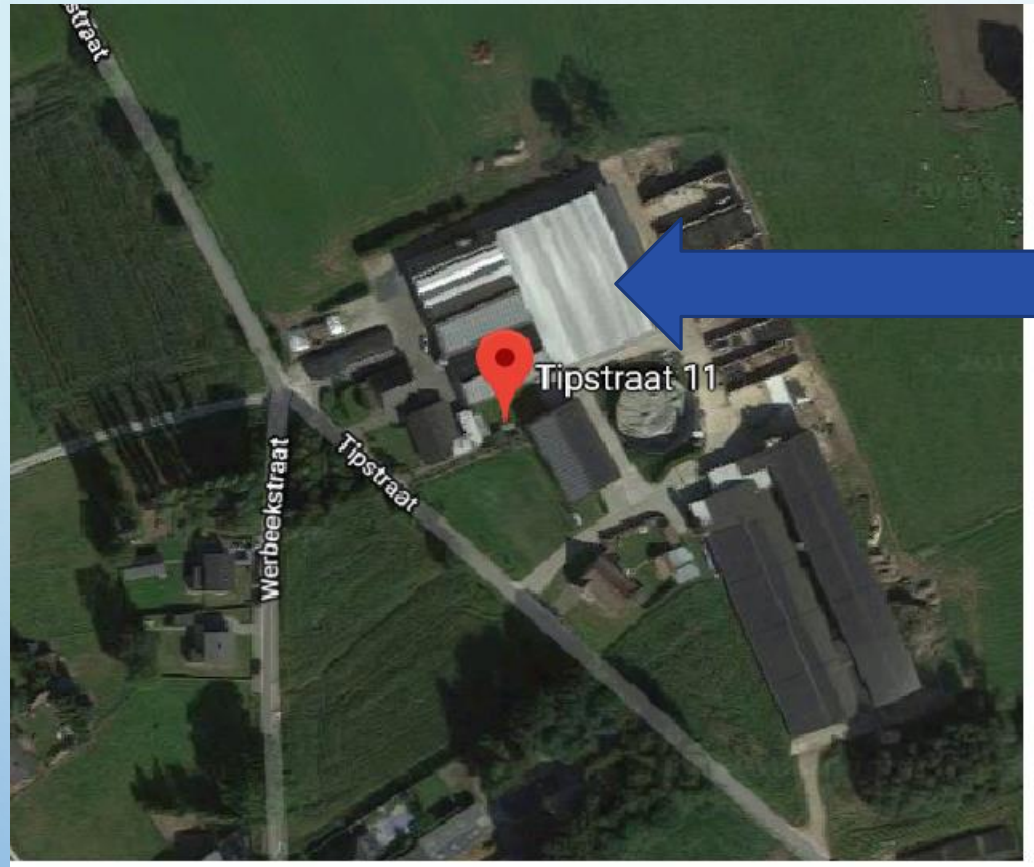
## DISPLAY



BECAUSE:

- COOLING NEEDS TO BE ADAPTED TO ACTUAL NEED OF THE ANIMAL
- MISTING/FOGGING/SOAKING SYSTEMS NEED TO BE STARTED AT A DIFFERENT PARAMETER SETTING
- WHILE SOAKING IS ACTIVE FANS CLOSE TO SOAKERS SHOULD RUN AT LOWER SPEEDS
- SAVING ENERGY (UP TO 60% PER YEAR ON RUNNING COSTS)
- REDUCTION OF rH IN WINTER/BREAK-DOWN OF NH3 MOLECULES DURING COLDER DAYS

# 2 CASE STUDIES IN EUROPE




Kris Claas Dairy, B-Dessel
160 dairy cows

TEMPERATURES IN SUMMER: AVERAGE 23°C, rH AVERAGE 68%
MAX 35°C, rH max 74%

INSTALLED ON 2017.07.09:

12 X CYCLONE FAN VHV 55” in combination with 1 x TOPCOOL TFD

FULLY AUTOMATIC VFD

INVESTMENT INCL. INSTALLATION: EUR. 27.500,00

RESULTS: - MILK REDUCTION DURING SUMMER 0%
- CALVING ON TIME (ONLY 1 COW GAVE BIRTH 4 DAYS EARLY

ROI ON JANUARY 2018: 100% PAYBACK

NASELOS DAIY NEAR LARISSA (GREECE)
> 300 DAIRY COWS.

# NASELOS DAIY NEAR LARISSA (GREECE)
# > 300 DAIRY COWS.

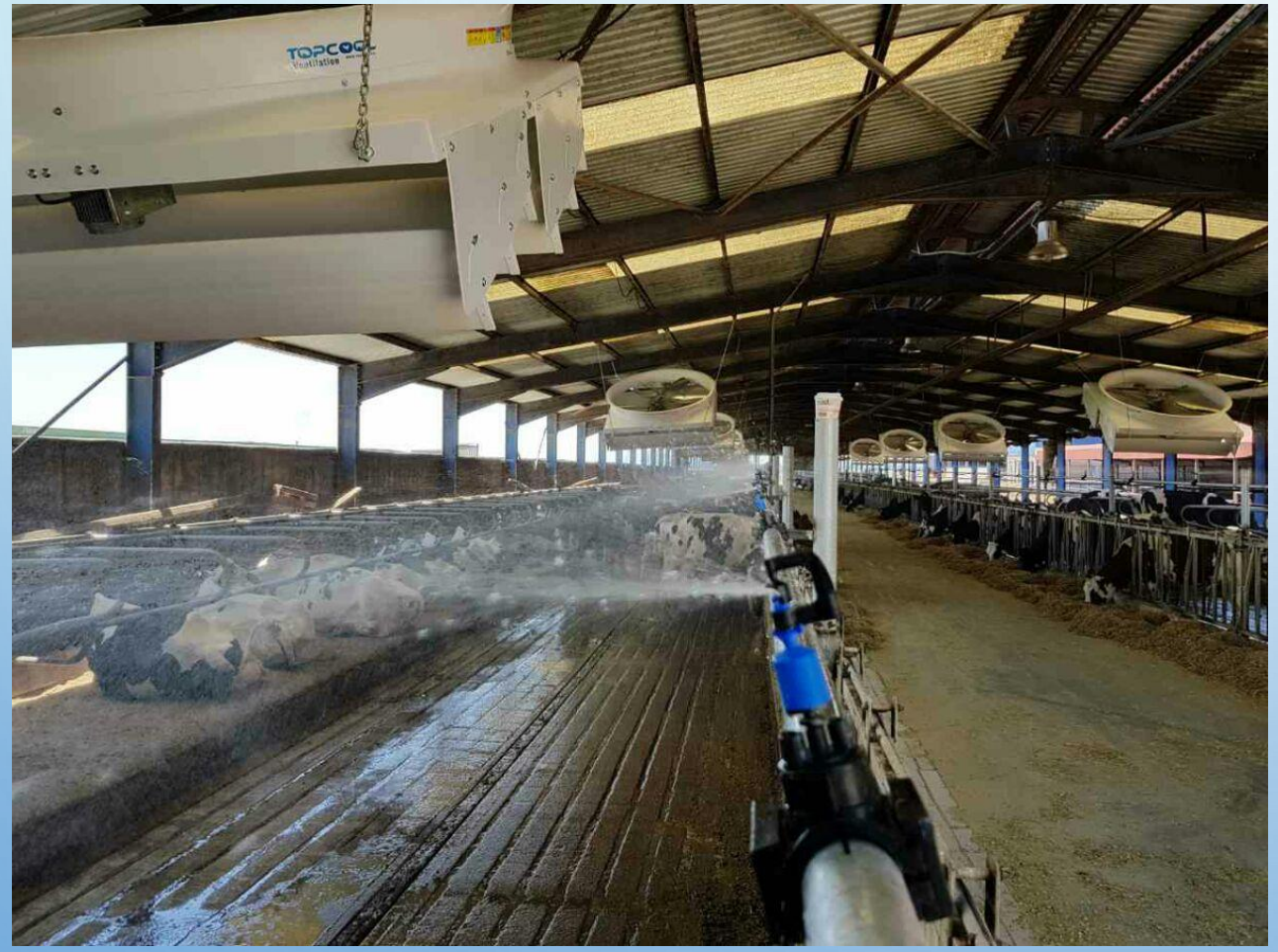
PROBLEM DURING SUMMER:

MILK DROP FROM 31,5 TO 25L/COW/DAY

INSTALLED PREVIOUSLY: DAIRY BASKET FANS 50”

LOCAL MAX TEMPERATURES: 45°C WITH rH MAX 71%

## NASELOS DAIY NEAR LARISSA (GREECE)
## > 300 DAIRY COWS.



INSTALLED JULY 2017:

8 X CYCLONE VHV72” + SOAKING SYSTEM ON TOP OF FEEDGATE
FULLY AUTOMATIC CONTROL FOR FAN SPEED AND SOAKING TIMES

REMOVED: ALL INSTALLED 50” BASKET FANS

**RESULT: AFTER 6 DAYS OPERATION MILK PRODUCTION FROM 25 TO 32,5L/COW/DAY**

IMPORTANT TO UNDERSTAND:

STILL ALL PREVIOUSLY MENTIONED SYSTEMS ARE RECIRCULATION SYSTEMS AND **NOT** VENTILATION SYSTEMS!
THIS MEANS, THAT THE INSIDE AIR IS MOVED FROM ONE PART OF THE BUILDING TO ANOTHER PART OF THE SAME BUILDING.

THERE IS **NO** DIRECT REMOVAL OF TOXIC GASSES AND PATHOGENS!

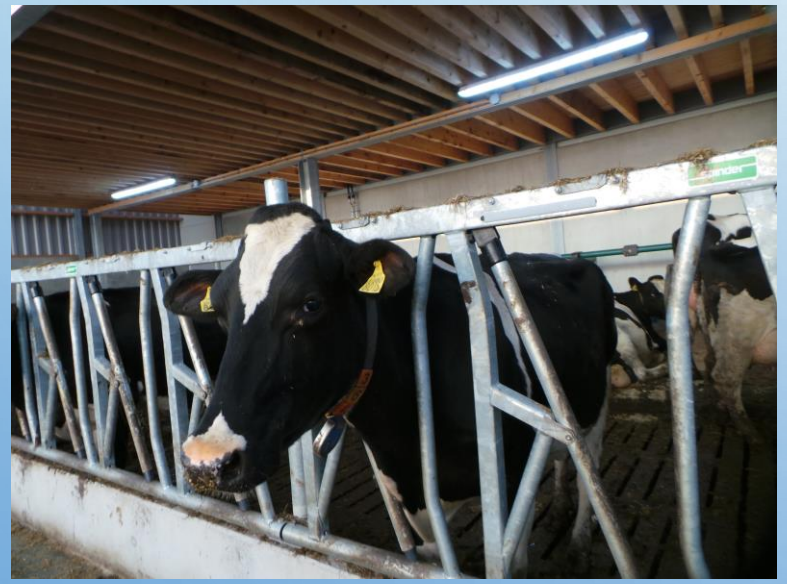
AS WE HAVE SEEN, RELATIVE HUMIDITY CAN BE A RESTRICTING FACTOR IF ADDITIONAL COOLING BY EVAPORATION IS REQUIRED.

THE USE OF IONIZATION CAN BE A PERFECT HELP IN REDUCING rH LEVELS WITH 10% (TNO (INSTITUTE FOR APPLIED SCIENCE-THE NETHERLANDS RESEARCH 2015).

REDUCTION OF rH BY 10% CREATES SOME ADDITIONAL EVAPORATIVE COOLING OPTIONS.

TOPCOOL COMBINES IONIZATION WITH FULL SPECTRUM LED LIGHTS. THIS CREATES 2 IMPORTANT BENEFITS:

- ENOUGH LUX (150-200) AT ANIMAL LEVEL FOR INCREASED MILK PRODUCTION (8-10%)
- REDUCTION OF AIRBORNE PATHOGENS (a.o. INFLUENSA) TO 0!

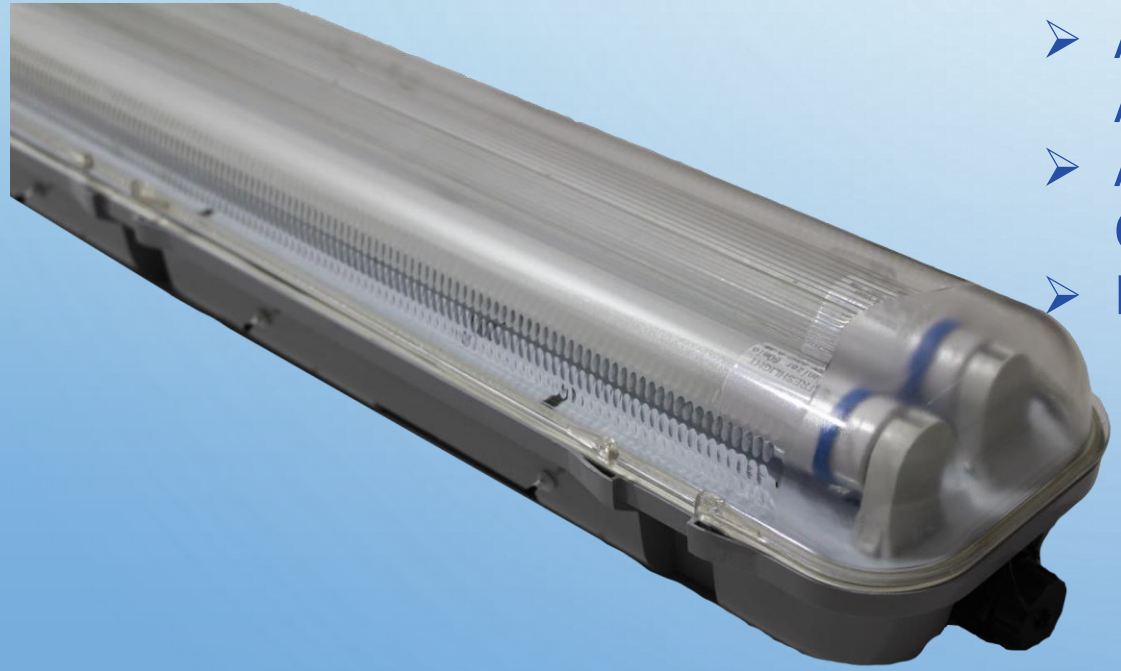


NEXT TO THESE, TOPCOOL IONIZATION SYSTEMS ARE REDUCING FINE DUST AND NH3 UP TO 50% AND REDUCE RELATIVE HUMIDITY BY 10%.

ALL OF THE ABOVE PROVIDE A HEALTHIER ENVIRONMENT AS WELL AS A HEALTHIER ANIMAL!

# TOPCOOL IONIZATION TUBES ARE:

- MADE FROM RECYCLED MATERIALS
- IP67 CERTIFIED
- EXPLOSION PROOF (ATEX 24)
- PROVIDE 160 LUMEN/WATT
- CREATING FULL SPECTRUM LIGHT
- ARE CSA, UL+, CE, DEKRA, ROHS CERTIFIED
- COME WITH 5 YEAR FULL WARRANTY
- DUTCH DESIGN
- APPROVED BY WAGENINGEN UNIVERSITY, HIGH AGRICULTURAL SCHOOL DEN BOSCH
- AVAILABLE WITHOUT LED TUBES (IONIZATION BAR ONLY)
- EXTREMELY EASY TO INSTALL (ATEX CONNECTORS)



# THANK YOU!