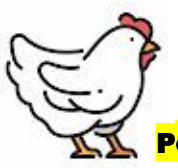
राष्ट्रीय कृषि विस्तार प्रबंध संस्थान (मैनेज)
(कृषि एवं किसान कल्याण मंत्रालय, भारत सरकार का एक स्वायत्त संगठन)
NATIONAL INSTITUTE OF
AGRICULTURAL EXTENSION MANAGEMENT
(An Autonomous Organization of Ministry of Agriculture & Farmers Welfare, Government of India)

Welcome to Webinar

Climate Change Induced Heat Stress Effect in Poultry



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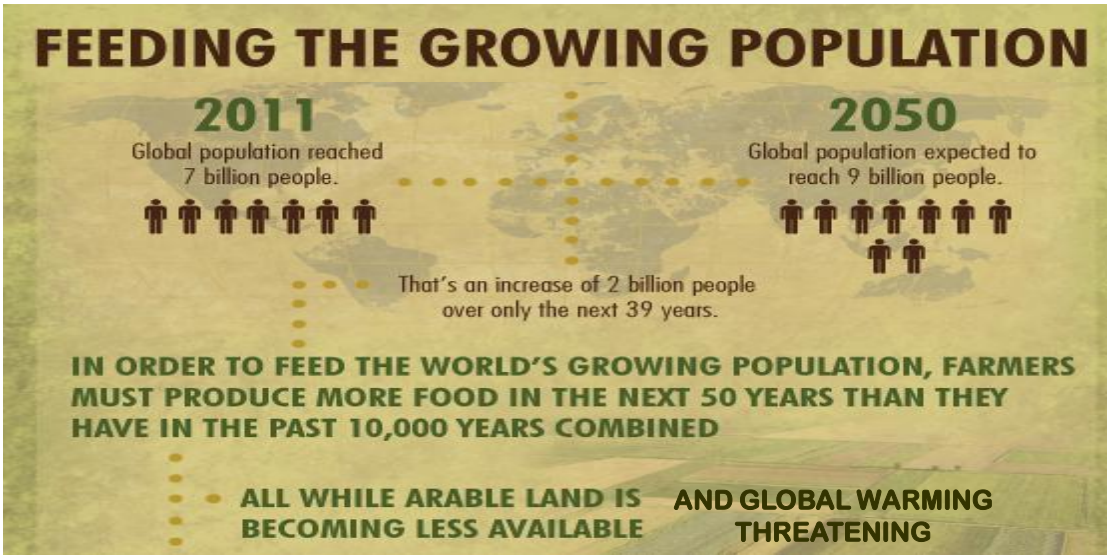
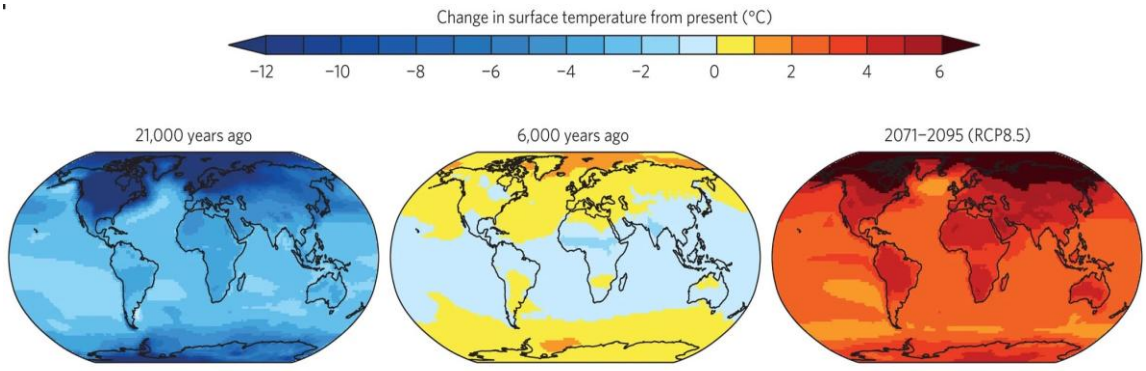
Climate Change Challenge & Protein Food Production



Climate Change



Curtsey: World bank Portal

Climate change describes Global Warming; the ongoing increase in Global Average Temperature and its effects on Earth's Climate & all life living on it

Climate Change – as we see

- **Change in Environmental Temperature; world become hotter year after year**
- **Extended Summer with higher Temperature every year**
- **Shortened Monsoon with Less Rain resulting Ground water Quantity & Quality issue for all**
- **Erratic Winter with fluctuating Temperature; hotter in some area & extreme cold with snow in other**
- **Un-seasonal Rain, Glacier burst flood in Hills**

Climate Change – as we see

➢ Drinking Water Quantity & Quality Crisis throughout the world

➢ Quantitative & Qualitative Adverse effect on Agriculture because most Agri Crops are season dependent; Food become Costlier everyday

➢ Change in Biodiversity
- Extinction of some species
- Emergence of new species
- Change in Genetic Character of Existing Species

➢ Change in Adaptive Capacity of Existing Species due to change in Temperature & Drinking Water issues

Climate Change - as our Chicks see

Chicks are not a material but a living substance; Sufferer of Global Warming

- Elevation of Environmental Temperature beyond their comfort zone which they need for Health & efficient Productivity

- Deterioration of drinking water quality

- Reduce Crop yield due to Draught/Flood results Increase Cost of Feed Raw Material leading to Compromised quality in Feed

- Fungal growth in Maize & other Crops, facilitating production of Mycotoxins

- Emergence of New Diseases from new/mutated microorganisms affecting Health & Productivity

Climate Change - as our Chicks see

Emergence of New Disease from New/ Mutated Microorganisms

Less/ Erratic Rainfall - Deterioration of drinking Water Quality

Rise in Climate Temperature – Effect on Health & Productivity

Reduce Crop Yield, Increase Cost of RM – Compromised Feed Quality

Fungus growth in Feed Crop – Mycotoxins Problem in RM

Climate Change Induced Heat Stress Effect in Poultry

- Chickens are homeotherms & regulate their body Temperature across a wide range of external Temperature.
- But continuous high climate Temp overwhelm the thermoregulatory mechanisms, resulting imbalance between the amount of metabolic heat produced & their capacity to dissipate body heat in the environment

- Chickens lack sweat glands, which would facilitate latent heat loss by evaporation (perspiration), and have limited un-feathered body surface areas for effective loss of sensible heat through conduction, radiation, & convection

Comfort Zone Temperature & RH for Chicken

TEMPERATURE AND HUMIDITY STRESS INDEX FOR COMMERCIAL LAYING HENS
(HEAT STRESS INDEX = 0.6 X DRY BULB TEMPERATURE + 0.4 X WET BULB TEMPERATURE)

Relative Humidity (%)

°F	°C	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
68	20	63	63	63	64	64	64	64	65	65	65	66	66	66	66	67	67	67	67	68	68
72	22	64	65	65	66	66	66	67	67	67	68	68	69	69	69	70	70	70	71	71	72
75	24	66	67	67	68	68	69	69	70	70	70	71	71	72	72	73	73	74	74	75	75
79	26	68	69	69	70	70	71	71	72	73	73	74	74	75	75	76	77	77	78	78	79
82	28	70	70	71	72	72	73	74	74	75	76	76	77	78	78	79	80	80	81	82	82
86	30	71	72	73	74	74	75	76	77	78	78	79	80	81	81	82	83	84	84	85	86
90	32	73	74	75	76	77	77	78	79	80	81	82	83	84	84	85	86	87	88	89	90
93	34	75	76	77	78	79	80	81	82	83	84	84	85	86	87	88	89	90	91	92	93
97	36	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	93	94	95	96	97
100	38	78	79	81	82	83	84	85	86	88	89	90	91	92	93	95	96	97	98	99	100

Temperature

Bird Comfort Zone (heat index < 70): No action needed; a good time to prepare for future hot weather.

Alert (heat index 70–75): Begin taking heat stress reduction measures in the flock; increase ventilation rate; increase fan speed and use foggers (run foggers based on relative humidity). Monitor bird behavior for signs of heat stress; ensure drinker and ventilation systems are functioning properly.

Danger (heat index 76–81): Heat stress conditions exist; take immediate measures to reduce heat stress in the flock. Increase ventilation rate in closed houses and use evaporative cooling based on relative humidity; in open houses run stir fans and misters. Adjust nutrient density of bird's diet to match any reduction in feed consumption. Move air over the birds at a minimum velocity of 1.8–2.0 meters/second. Periodically flush water lines with cooler water. Closely monitor flock behavior. Maximize nighttime cooling.

Emergency (heat index > 81): Extreme heat stress conditions exist; avoid handling birds for transfer or vaccination. Do not feed during the hottest part of the day. Decrease light intensity to reduce bird activity and body heat production.

Climate Change Induced Heat Stress Effect in Poultry

What is Heat Stress?

- **A situation when chicken faces difficulty in achieving balance between body heat production & body heat loss**
- **It may occur at any age and with all kinds of poultry; Broiler, Egg Laying Pullet and Breeder**
- **Heat Stress (HS) is not only uncomfortable for a chicken, it also damages organs, cause egg deformation, Reduce Fertility, decrease hatchability and even death**

Climate Change Induced Heat Stress Effect in Poultry

- With Increase in Climate Temperature, the Thermal gradient between the Body surface and the surrounding environment lessens with Dissipation of Sensible Heat decreasing, resulting Chicken suffering from environment-induced Hyperthermia.
- This increase Respiratory rate (Thermal Polypnea or Panting) to maximize Loss of Latent Heat via Evaporation of water from the Respiratory tract.

Panting_24 Parg_2017.mp4

- Relative Humidity (RH) imposes a Ceiling on water evaporation resulting Latent Heat Dissipation.
- Thus, elevated Ambient Temperature associated with high RH limits Heat Removal from the body and intensify the harmful effects of Heat Stress in Poultry

Climate Change Induced Heat Stress Effect in Poultry

Rise in Climate Temperature disturbs normal Physiological Functions in Chicken Body and induces Cell Injury

Heat Stress causes several Physiological changes like Oxidative Stress, Acid base Imbalance, Immuno-suppression resulting Increased Mortality and reduced Feed Intake leading to Poor Body weight & Lowered Egg production

Dehydration is the most harmful panting related issue, causing Immuno-suppression & Increased Water Intake

Heat Stress impact the Expression of Gene related to Growth, Production Performance & Resistance to disease

Increased Water Intake results Gut Health Problem by diluting Nutrients in the intestinal lumen and Poor Litter with Ammonia Problem through watery droppings

Climate Change Induced Heat Stress Effect in Broiler

Increased atmospheric Temperature Induced Heat Stress causes

- Restlessness & Panting, unnecessary loss of energy
- Oxidative Stress causes Gut Health Problem > 1. Less Digestion with Reduced Productivity, 2. Less Immunity with more Infections & 3. Less Boarder Protection more & more infections
- Reduced Feed Intake on account of Heat related discomfort
- Reduced Weight gain on account of Low Feed Intake & Loss of Energy while Panting
- Heat Stress has Permanent damaging effect; damages the muscles affecting Meat Quality and Lowering Breast Muscle Yield

Climate Change Induced Heat Stress Effect in Poultry

- Disturbs Lipid metabolism by affecting enzyme function in lipid breakdown causing Excess Fat deposition instead of converting to meat
- Reduces Protein content of the muscles, reduction of muscle pH & Water Holding Capacity and ultimately affecting Juiciness of Chicken Meat
- Cause Immuno-suppression and facilitates entry of all sorts of Microorganisms already exit in poultry environment
- Cause Respiratory Distress and facilitates occurrence of respiratory infections like E coli, CRD, IB, ND (RD), Avian Influenza, etc.

Heat Stress Effect on Physiology of Layer Chicken

• Panting causes Respiratory Alkalosis, acid base imbalance leading to permanent physiological damages.

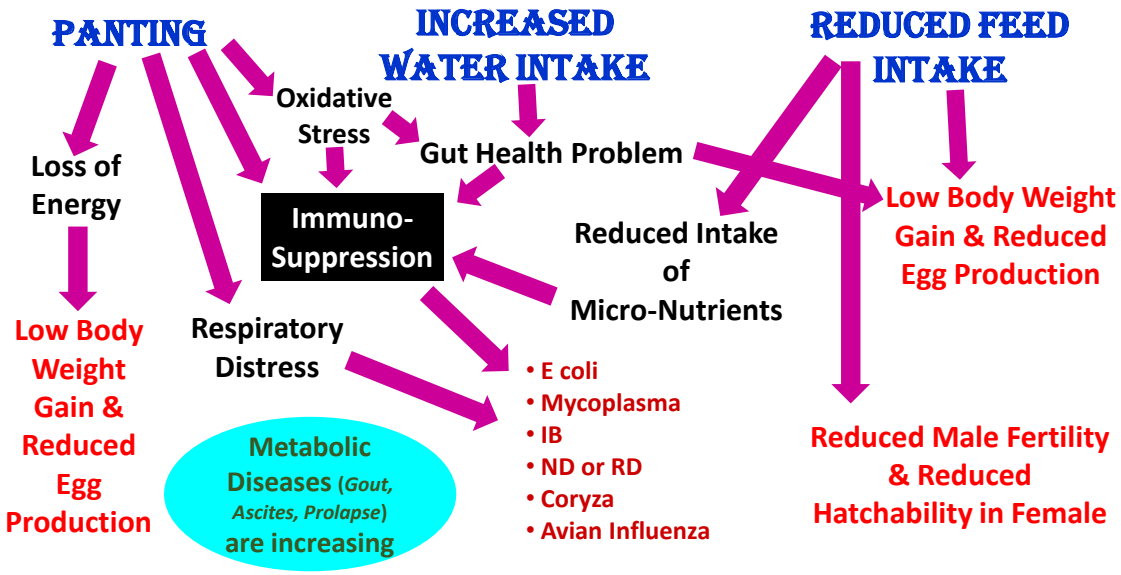
- Alkalosis reduces blood ionized Calcium and ultimately Eggshell mineralization resulting Reduced Egg production accompanying Pale Egg, Soft Shell Eggs, Thin Shell Egg with increased Breakage % in Layer & Breeder
- Heat Stress affect affects Male Fertility and Hatchability in Breeder Hen

Heat Stress Effect on Physiology of Layer Chicken

- Reduced Feed Intake
- Reduced Egg Production
- Reduced Egg Weight
- Poor Shell Quality
- Reduced Albumin Height in Egg
- Reduced Male Fertility
- Reduced Hatchability

- Poor Growth
- Cannibalism
- Respiratory Distress leading to Respiratory Infections like E coli, CRD, Coryza, ND, IB, AI
- Immuno-Suppression

Climate Change Induced Heat Stress Effect in Poultry



Heat Stress Effect on Chicken – Vicious Cycle

- After 70 years of genetic research, the modern fast-growing, highly efficient Broilers and almost daily Egg producing Layers with high metabolic rate needs highly dense nutrients in feed
- To exploit the genetic potential & to sustain the metabolic activity today's chicken need comfortable climate all through their life
- They are less thermotolerant & more susceptible to Heat Stress due to extremely high metabolic rates and poorly developed cardiovascular & respiratory systems
- Under open house farming system, Chickens from most poultry producing areas of this subcontinent are under Heat Stress for around 9 months in a year resulting Poor Health, especially the respiratory system & Poor Productivity in both Broiler & Layer.
- Poultry Farmers are far below to reaching the genetic potential productivity in terms of Meat & Egg.

Heat Stress Effect on Chicken – Vicious Cycle

- Under Heat Stress, water intake increases leading to dilution of Nutrients inside intestinal lumen resulting mal-absorption and passage of nutrients into the hind gut
- This favours growth of undesirable microorganism, loss of microbial equilibrium in the gut, Dysbacteriosis, Enteritis, Watery dropping, Wet Litter condition resulting further increase in Humidity at the bird's level leading to increase discomfort level & dehydration. The chicken will consume more water and the condition aggravates in a cyclic manner
- Globally Respiratory diseases are on rise in Broiler, Layer & Breeders leading to Mortality and Cost of Medication & Manpower
- Gut Health is the major issue in today's poultry, which is directly related to Climate Change induced Increase Environment Temperature
- Poultry Productivity in terms of Meat & Egg are far below to genetic potential due to climate change related Heat Stress.

Heat Stress Effect on Chicken – Vicious Cycle

- Closed EC house invented to offer much needed comfort to Chicken to obtain the genetic potential production

- With Increase in climate Temperature & un-seasonal Rain, Climate control closed house system are literally failing, especially with high RH outside or min compromise in construction. Evaporative Cooling & Tunnel Ventilation failed to maintain Comfort environment inside with rising Climate Temperature outside creating many Blank spot in the middle of EC house causing Breathing problem leading to Panting
- Panting cause increase water intake resulting Dilution of Nutrients in the intestine, passage of nutrients in the hind gut, growth of undesirable microorganism, loss of microbiota equilibrium, Dysbacteriosis, Enteritis, Watery dropping, Poor litter condition, Ammonia Build-up and further deterioration of the Ventilation of the house.

Heat Stress Effect on Chicken – Vicious Cycle

- This results Poor Feed Intake with Poor Body Weight Gain & Egg Production in one hand and Respiratory Distress leading to occurrence of Respiratory Diseases like E coli, CRD, IB, ND, Coryza & Avian Influenza etc on the other.
- This condition are increasingly very common in Environmental Control poultry house globally because of Climate Change related Rise in ambient Temperature.
- Respiratory disease are on rise in Broiler, Layer & Breeders in closed EC house leading to Mortality and Cost of Medication & Manpower
- Productivity in terms of Meat & Egg are below to genetic potential even in EC Poultry House

Mitigation Strategy of Climate Change Induced Heat Stress

Efficient Poultry production

• Awareness of genetic Potential & Need of the Chicken to reach there

• Planning & Implementation to extract 100% potential in farming business providing the need on time

• Use of Technologies, specially Poultry Civil & Electrical Engineering and Artificial Intelligence

• Alternative Feed Raw material source which are less vulnerable to climate changes

Biosecurity to Minimize Loss

• Poultry Loosing aprox 20% Productivity due to Disease globally

• Controlling Disease through Scientific Biosecurity measure will minimize Loss, which in turn reduce energy consumption by Poultry Industry, helping the planet to become little less hotter

Mitigation Strategy of Climate Change Induced Heat Stress

By Using Natural Resources

- Compulsory use of Solar Power in poultry production
- Production of Bio Gas/Electricity from Poultry Manure

• Reduced Requirement of Electricity leading to Reduced Coal Burning in Thermal Power plant resulting Reduced Heat generation, helping Climate to become less hotter
• Reduced Production of Poultry Waste generated Heat, reduced Heating of Environment
• Reduced Production of Carbon particulate Pollutant from Thermal power unit helping Human and Poultry fraternity to breath freely and reducing Respiratory diseases
• Direct Financial Benefits from Selling/Using Dried Manure

- Rain Water Harvesting

• To reduce Ground water use in Poultry to save the same for human society
• To reduce Electricity consumption to lift water from underground, indirectly saving Heat generation for Climate Change

Climate Change Induced Heat Stress Effect in Poultry

Climate Change Induced Heat Stress cause Discomfort environment to Chicken

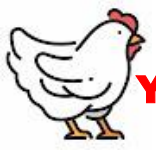
Poultry Productivity is lower under climate change Scenario, Production Cost Increasing

Take Home Message

Heat Stress cause Immuno-Suppression and Chickens become increasingly Vulnerable to Disease

Efficient Poultry Production, Use of Natural Resources & Biosecurity can Mitigate

Thank You



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