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VOLUME - 20

ISSUE - 7

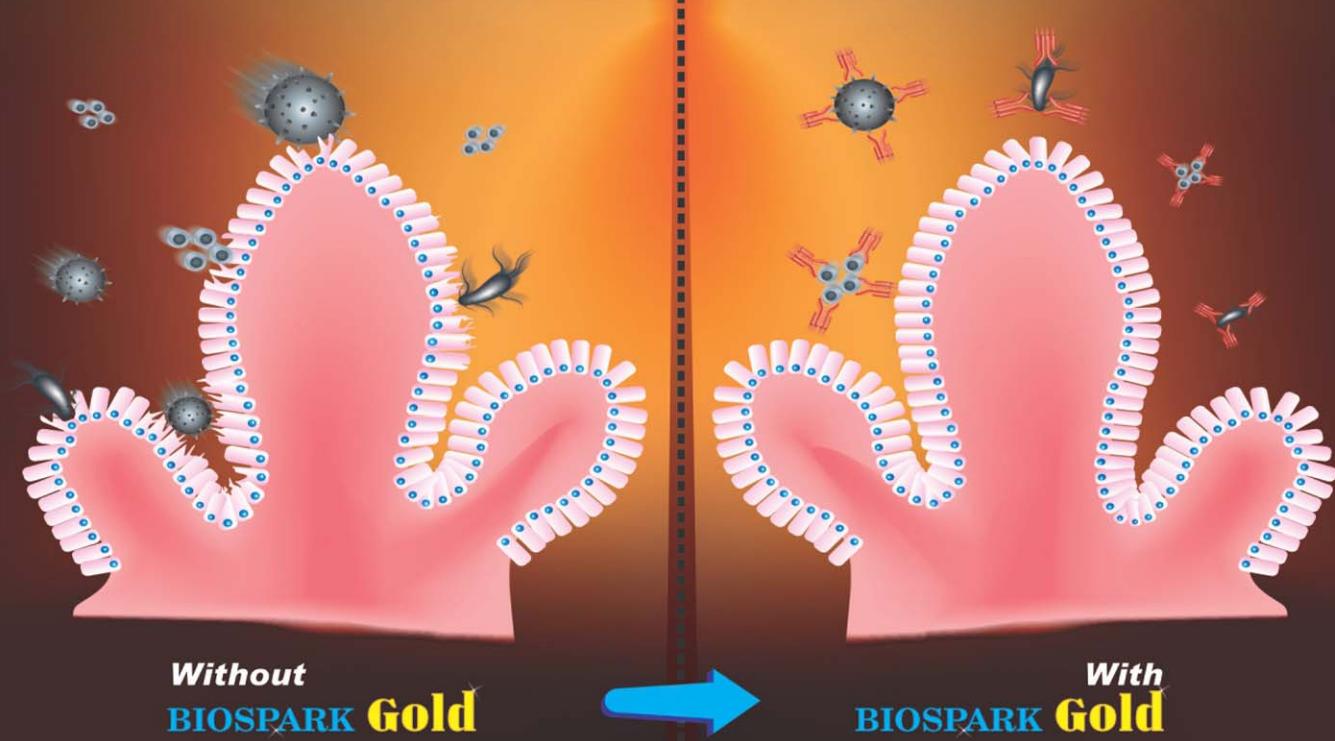
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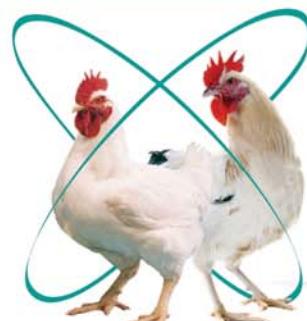
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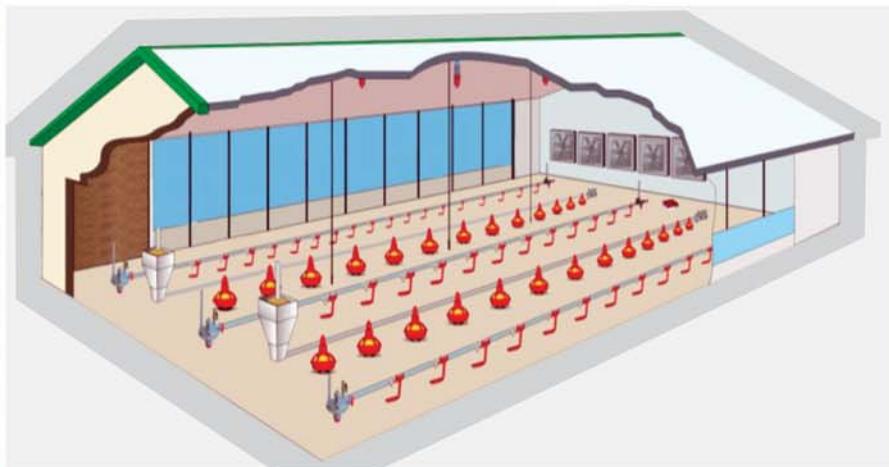
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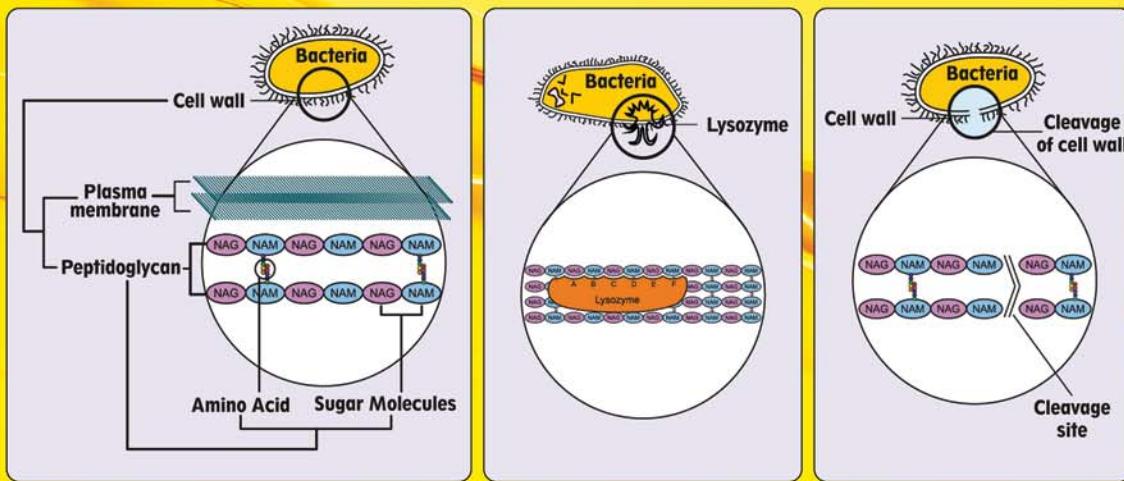
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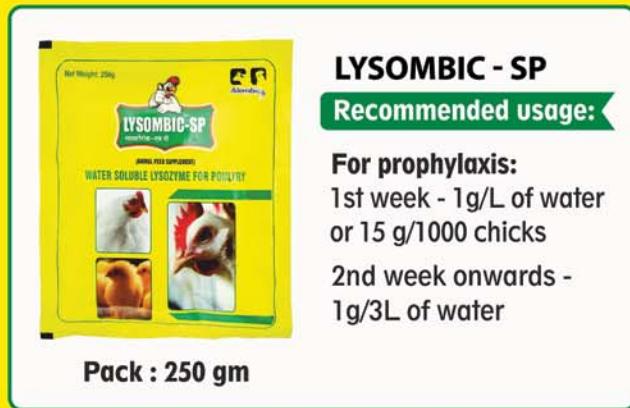
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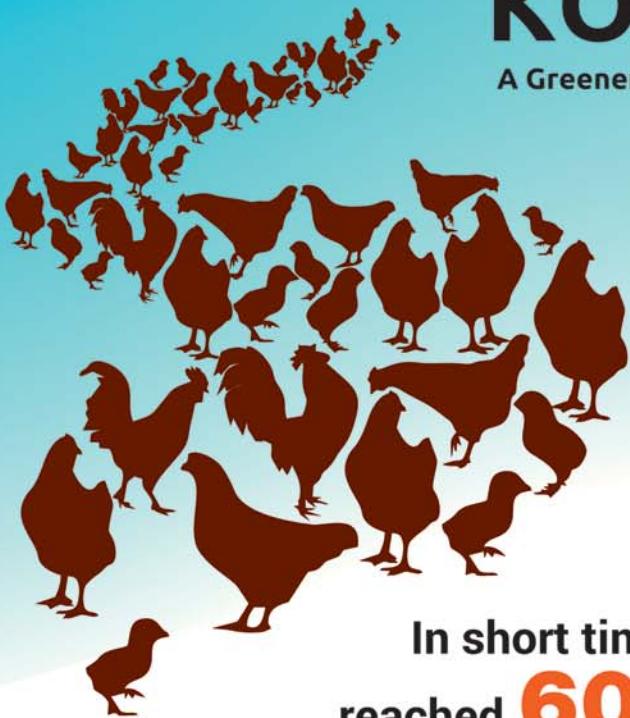


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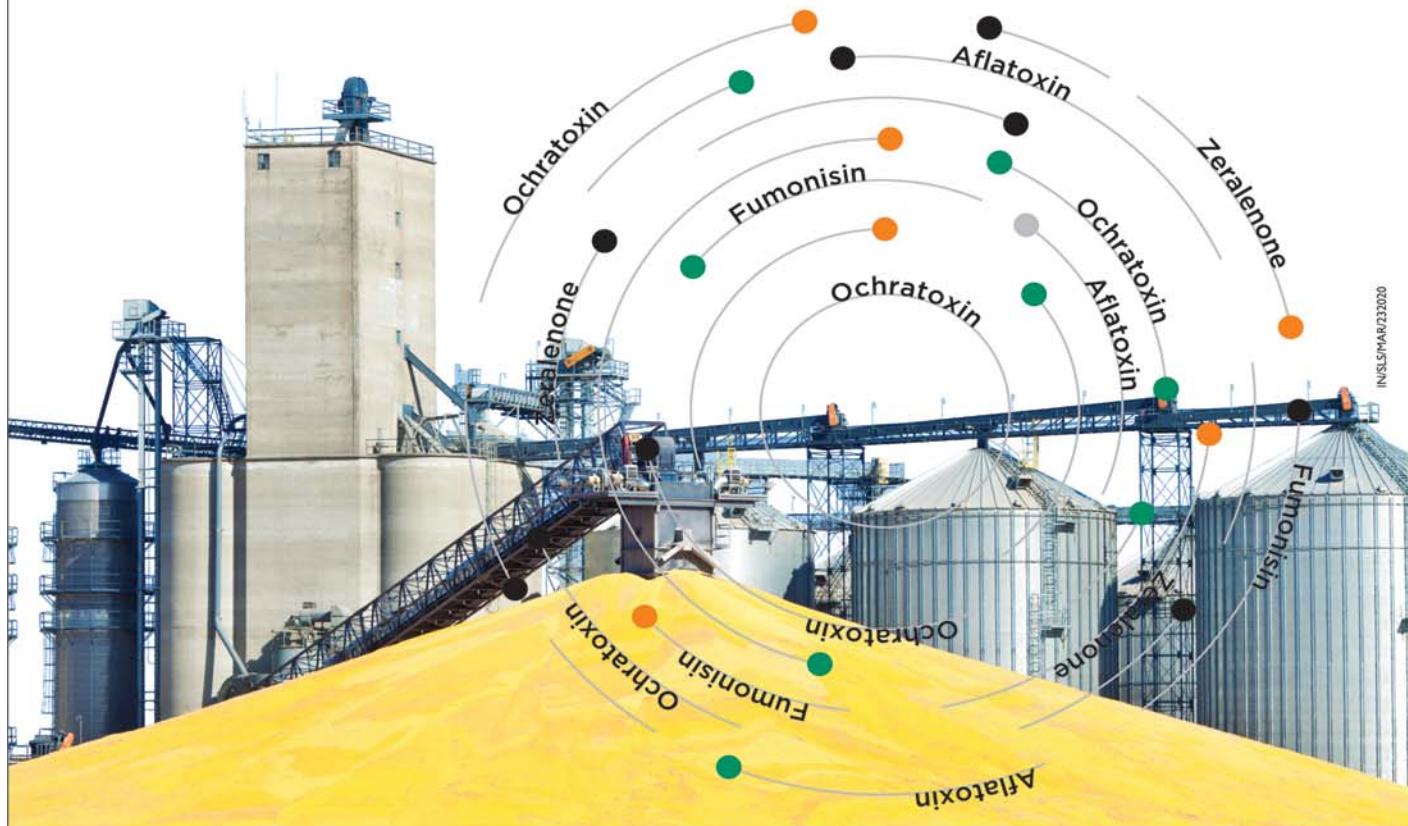
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Printed, Published and Owned by B. Kalyan Kumar, Printed at Karshak Art Printers, 40, A.P.H.B. Blocks, Vidyanagar, Hyderabad - 500 044. India
Published at 2-1-444/16, 1st Floor, O.U.Road, Nallakunta, Hyd-44. Editor: B. Shiv Shankar.

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Heat stress amelioration in Poultry

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India is a tropical country and the temperature here usually surges 40°C-45°C in the summer season. The birds at very high temperature suffer the most. Therefore their management in summer is of vital importance as the acute heat stress reduce the overall performance and productivity of the flock in terms of egg and meat production.

Every living being has an optimal range of temperature which is known as "thermo-neutral zone" or the "zone of comfort". For poultry thermo-neutral zone is the range of environmental temperature i.e. 18-23°C. in which the birds do not change their behaviour, show no sign of discomfort and use minimum amount of metabolic energy to maintain the body temperature as at this temperature heat produced is equal to heat loss. The different methods of heat loss from the body of birds are radiation, conduction, convection and evaporation. Out of these radiation, conduction and convection come under the "sensible" heat loss and the evaporation is taken as "insensible" heat loss. Usually the birds loose heat from the wattles, shank and the other un-feathered areas of the body. The sensible heat loss occurs when the environmental temperature is about 13-24°C and the insensible when temperature reaches about 27-30 °C. Except the evaporation, the heat loss depends upon the temperature difference between bird and environment. Evaporation mainly occurs through the loss of water vapour from the respiratory tract linings, panting or hyperventilation needs energy of birds to remove excess of the heat through the moist lining of the respiratory passage mainly.

In the hot summer months the method of evaporative heat loss becomes the most significant method of heat loss from the birds.

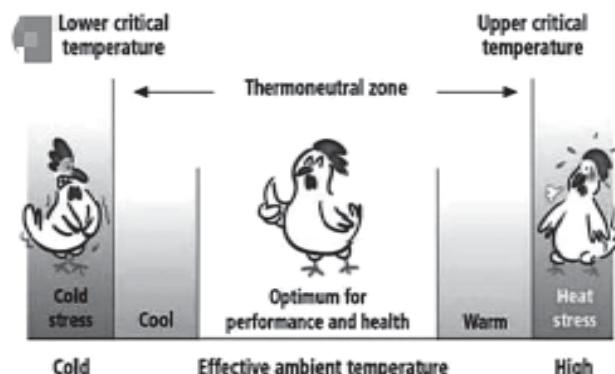
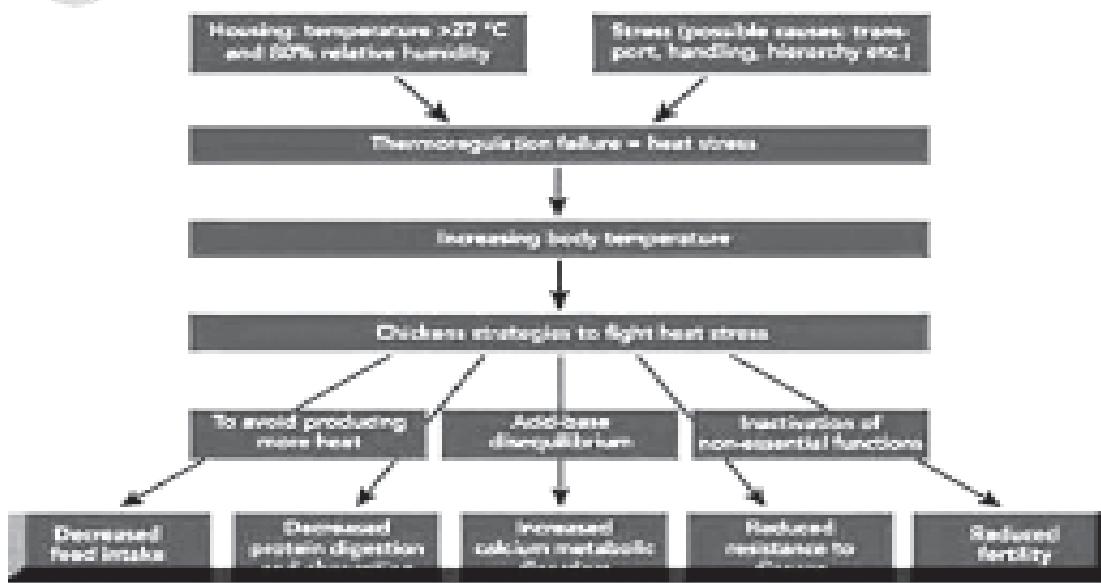


Figure 1. Environmental temperature and thermal zone

Adverse effects of high environmental temperature on birds

- At high environment temperature birds need less energy to maintain their body temperature results in decreased feed consumption and nutrients intake, so the growth and production decrease.
- Some physiological factors as oxygen consumption, pulse rate, blood pressure, thyroid size and activity, blood calcium level and body weight reduce drastically.
- The ecto-parasites increase in the summer and following monsoon, high environmental temperature with high relative humidity leads to coccidiosis which is an economically important protozoal disease.
- Since the poultry have no sweat glands so they start panting vigorously results in the respiratory alkalosis. About 1% increase in the temperature leads to 1% decrease in the heat production of the body.
- Increase in the water consumption occurs in summer which indirectly leads to more water in the droppings and more wet litter problems.

Effect of Heat Stress on Poultry



- Metabolic diseases such as fatty liver haemorrhagic syndrome, heat stroke, liver rupture also increase, specially heavy birds and the broilers are most prone to these conditions.
- The egg shell quality decreases to a greater extent because of the respiratory alkalosis which leads to reduction in the partial pressure of carbon dioxide in the lungs and thus increase alkalinity.
- Due to decreased egg shell quality and egg size the value and price of egg is reduced in the market.
- Low mating behaviour and mating frequency is the most commonly reported problem in the breeder birds during summer which leads to a significant decrease in the hatchability and fertility.
- Birds start shedding more feathers to loose excessive heat produced, also gasping and panting is visible. Excessive panting leads to generation of more body heat and throwing out of more and more carbon dioxide, to balance it kidney excrete greater amount of electrolyte and salts, causing their deficiency also.
- There is decrease in the egg size due to reduction in the Very Low Density Lipoproteins (VLDP), vitellogenins and other necessary proteins, if the temperature is very high.
- Birds on the slatted floor and caged floors suffer most while deep litter birds have the advantage of cooling themselves to some extent by dust bathing and relatively more available space.

- Immunity of the birds get decreased because heat stress leads to the formation of free radicals which cause disruption of the cell membranes and also alter the function of DNA, produce the mutations and cause the change in the cytotoxic and enzyme activity.
- Evaporative heat loss only occurs if the inspired air has low moisture levels, if both the relative humidity and the environmental temperature are high, bird will not be able to lose that excessive heat and finally die of the prostration. The fatty and heavy birds are first affected as their air sacs get constricted and are not able to remove the excess body heat so efficiently.

Alleviating measures to reduce summer stress in birds

The adverse effects of the high temperature can be managed up-to a great extent by the proper housing, water, feed and other management in the summer season. To combat the heat stress in poultry, the managemental and other practices to be followed are as under:

Housing Management:

- India being a tropical country, the direction or orientation (of long axis) of the poultry house should be from East to West with a slight tilt towards the Southern side in the East and towards North in the West. This will prevent the direct sunlight on the poultry house and also severe drafts and rain water splashing into the poultry house in monsoon.
- The width or breadth of poultry house should be maximum 9 metre if only natural cross ventilation is present based on the temperature, humidity, wind velocity, type of the house and nature of the bird. In case the width exceeds 10 metre, for the proper air flow in the poultry house “ridge ventilation” or ‘mechanical ventilation” should be provided.
- The eaves of the house must project at-least 1 metre on all the sides as this(overhang) will

prevent the direct splashing of the rain water into the house as well as check the direct falling of sunlight in the house. .

- Overcrowding or the paucity of standing space in the poultry house is the another cause of heat stress and mortality in the summer months so proper care should be taken to provide adequate space and reduce the stocking density in the poultry farm. Reduce the strength of birds by 10 percent in house, which can reduce temperature due to decreased body heat production.
- In case of mechanical ventilation, rate of airflow and air exchange rate should be increased by 20-25% in the farm.
- The poultry houses in the tropics are open curtained with height of side wall of 20 cm and all the side up-to roof is open, and given with the wire mesh of 12mm size and 18 gauge thickness or 25 mm size chain link mesh.
- Wind chill effect can be produce to cool the birds even without much drop in temperature of the house by increasing the air movement directly over the bird by the cooler or exhaust fan.
- A proper and appropriate roofing material can lower temperature by 5-10°C than the outside temperature. In the advanced and commercial poultry farms painting the upper surface of the roof with white paints should be done to reflect the sunrays back and simultaneously the inner surface of roof(ceiling) should be painted with the darker hue to absorb more heat from the bird's level, but the coal tar must not be painted on the ceiling because it will melt and fall on the birds and cause severe injury. Put thatch over the roof or run sprinklers on roof between 11 am to 6 pm to reduce temperature in shed. This can bring down temperature by about 5°C. For small scale poultry production thatched roof is preferable.



- The roof must be raised to a height of 4 metre at the ridge (centre) and 3-3.5 metre at eaves(side wall) of the poultry house. Higher the roof from the bird level, lower the temperature of the poultry house. For the birds reared in the cages the minimum height at the centre of the house should be 14 feet.
- During the day time the mechanical ventilation with the evaporative coolers should be done. Evaporative cooling is produced by pad coolers or foggers, but these should be used in the places where the relative humidity in the vicinity environment is not high. In extreme conditions, birds may dip in the cool water for 2-3 min. with head above water level and then put in the open space.
- Sprinklers must be arranged on the top of the roof to cool the roof and foggers must be arranged inside the poultry house to function in the hot and dry time to produce the evaporative cooling in the house.
- Provide 3 exhaust fans on one side and 1 pad cooler on other side (in dry heat areas) and completely seal the shed , it brings the temperature down.
- Row of the trees which are shady and fast growing should be planted near the poultry house to reduce the summer drafts, but excessive trees near poultry farm attract the wild birds also which might spread infection in the poultry house.

- Thickness of the litter material should be reduced to 2-3 inches because thick litter produce more heat. Caked and wet litter should be removed as soon as possible to prevent the spread of the coccidiosis. Racking of litter should be done frequently.

Water Management:

- The amount of clean, cool, fresh drinking water must be increased than normal, specially in the hotter part of the day, usually in the typical summer season, water to feed ratio reaches 4:1
- Watering space per bird must also be increased. The water pipes must not be exposed to direct sunlight in nipple system. Change the water at-least twice a day or more with cool and fresh water. Increase in the number of waterers by 25%. Cover the water tanks by wet gunny bags.
- Addition of 0.25% salt in the water increase the water consumption thereby reduces chance of dehydration. Increase the frequency of watering to the birds and during medication and vaccination do not withhold the water.

Feeding Management:

In summer, feed should be made denser with nutrients like vitamins and minerals to compensate for reduced intake. Thus as the hot season progresses it may be necessary to fine tune feed formula again in mid-summer. In addition following measures, which have bearing on heat stress control, should be adapted in summer feed formula:

- a) **Crude Protein:** Crude Protein level in feed should not be increased and protein from only vegetable source should be used. Proteins in general and those from animal sources in particular have higher heat increment values

i.e. produce more internal heat in the body. While keeping protein levels same, crucial amino acids may be increased to compensate for reduced feed intake.

b) Fats: Fat should be increased by 2 to 3% at the cost of carbohydrates without changing ME. Fats are good in summer because their heat increment value is lowest give better cooling effect in body because of higher water content and fat stimulates feed consumption.

c) Vitamin C: Because of the release of corticosteroids in heat stress, there is increased demand for vitamin C by adrenal glands for controlled production of hormones needed for gluconeogenesis. In heat stress there is also reduced synthesis and partial depletion of vitamin C. Inclusion of vitamin C at 200-400 g/ton of feed is recommended in summer months. If included in feed, there is no need to give it in water again.

d) Sodium bicarbonate: It has positive effect of increasing water intake, and also reducing systemic acidosis. It can also be given through feed instead of drinking water. In vegetable protein based feed, inclusion of soda bicarb at 0.4% (4 kg/ton) + sodium chloride 0.25% (2.5kg/ton) would properly balance sodium and chloride levels in feed.

e) Betain (osmolyte): Betain (0.5 to 1 g/ton) helps in maintaining water balance in the body cells against extra cellular osmotic gradient. Electrolytes also have similar action and are better given through water.

f) Anti oxidants: In heat stress there is excessive oxidative metabolism and release of free radicals in the body. Free radicals damage all types of biological molecules and cells of vital organs more so of immune system. Vitamin E captures and neutralizes free radicals and its inclusion at 50 to

100 ppm in feed is advisable. Vitamin C also has antioxidant property. Similarly antioxidants namely butylated hydroxy toluene, butylated hydroxy anelene and ethoxyquin will protect fats and oils in feed from oxidative rancidity.

Other recommendations:

- a) Virginiamycin 15 to 20 ppm in feed apart from being growth promoter, reduces metabolic heat production, alleviates heat stress and stimulates immune responses.
- b) Anticoccidials: Nicarbazine and Monensin are contraindicated in summer. Former decreases tolerance to heat and later depresses water intake.
- c) Biotin supplementation at 150 micrograms /kg feed is recommended.
- d) Vitamin K supplementation is recommended particularly at the time of debeaking or if there is threat of coccidiosis because in heat stress blood clotting time is prolonged.
- e) Toxin binders: In wet summer, there is rapid growth and toxin formation in feed. Good quality toxin binders at higher dose should be used in feed.

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Mahaboobnagar	87	90	95	99	103	106				111	113	115	120	130	140	145	150	140	130	125	127	127	129	134	135					
Nizamabad	87	90	95	99	103	106				111	113	115	120	130	140	145	150	140	130	125	127	127	129	134	135					
Kurnool	87	90	95	99	103	106				111	113	115	120	130	140	145	150	140	130	125	127	117	129	134	135					
Vizag	87	90	95	99	103	106				111	111	113	120	130	140	145	150	140	130	125	127	117	120	125	130					
Khammam	87	90	95	99	103	106				111	111	113	120	130	140	145	150	140	130	125	127	117	120	125	122					
Godavari	87	90	95	99	103	106				111	111	113	120	130	140	140	150	140	130	125	127	107	120	125	124					
Vijayawada	80	85	95	92	100	103				100	105	105	107	115	125	135	135	135	132	122	115	117	108	112	117	125				
Guntur	80	85	95	92	100	103				101	106	106	108	115	125	135	135	134	123	116	118	109	114	119	143					
Ongole	80	85	95	92	100	103				102	107	107	109	115	125	135	135	135	124	117	119	143	115	120	143					
Chittoor	95	98	103	96	115	120				120	120	120	123	128	138	143	143	143	143	143	143	143	143	143	143					
Nellore	95	98	103	96	115	120				120	120	120	123	128	138	143	143	143	143	143	143	136	143	143	144					
Ananthapur	91	94	99	104	110	117	122			122	122	122	124	129	132	134	139	142	142	142	142	136	136	140	144	144				
Kadapa	95	98	103	96	115	120				120	120	120	123	128	138	143	143	143	143	143	143	143	143	143	143					



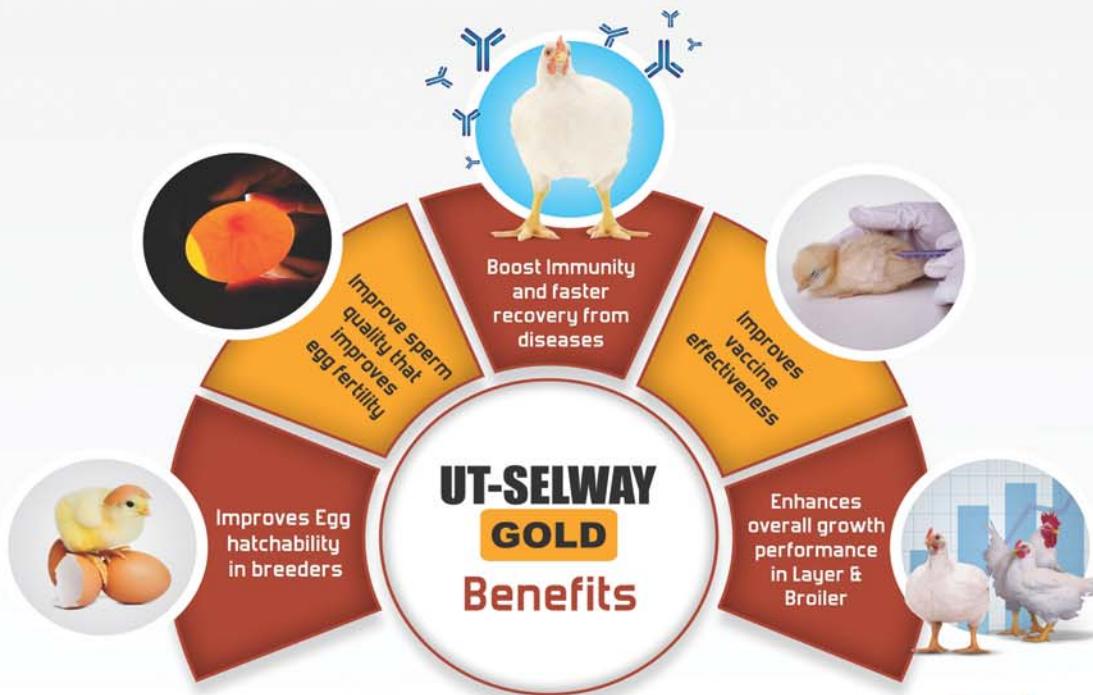
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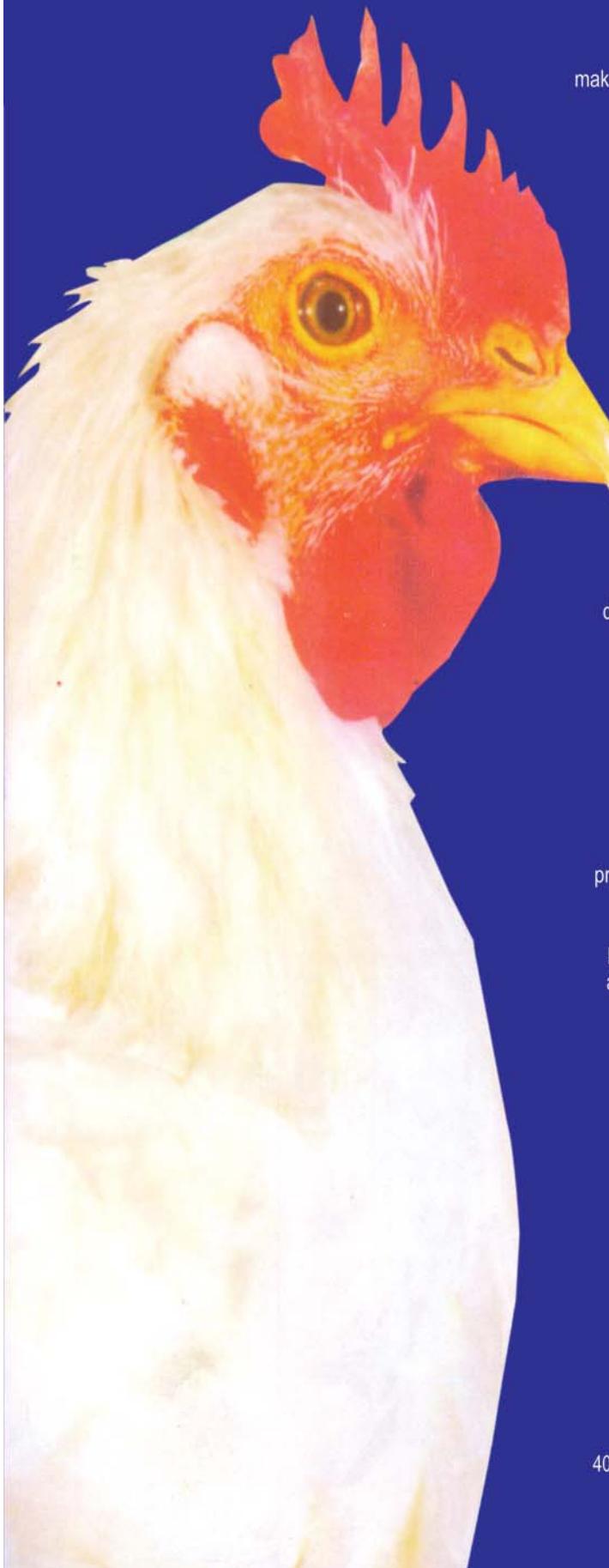
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* D. Michael Fry - Department of Avian Sciences, University of California, Davis, California - Environ Health Perspect 103(Suppl 7):165-171 (1995)

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Cryptosporidiosis in birds

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Introduction

Cryptosporidium, an Apicomplexan parasite is the etiological agent for the diseases condition called as cryptosporidiosis. Cryptosporidiosis is considered to be an important disease of humans, animals and birds. *Cryptosporidium* species have been reported from wide variety of birds including chicken, black throated finch, jungle fowl, domestic pigeon, domestic goose, pheasants, parakeet, quails, turkey etc. from Asia, Europe, Australia and North America. Hence, along with coccidiosis, cryptosporidiosis can be considered as one of the most important protozoan disease of birds. The disease results in respiratory and digestive problems in the birds. *Cryptosporidium* species was first reported by Tyzzer in 1929 in gallinaceous birds. However, he did not name the parasite. Slavin in 1955 reported a structurally similar parasite in turkeys and named them *C. meleagridis*. *C. baileyi* was another species reported from birds by Upton and Haynes. *Cryptosporidium* species have been reported from more than 30 bird species belonging to the orders Cathartiformes, Galliformes, Columbiformes, Anseriformes, Charadriiformes, Passeriformes, Psittaciformes, Falconiformes, Gruiformes, Strigiformes and Struthiniformes.

Parasite species infecting the birds

A number of species have been incriminated to cause cryptosporidiosis in birds. At present around 38 species are considered valid in fish, amphibians, birds, reptiles and mammals. Amongst these species, only three species i.e. *C. meleagridis*, *C. baileyi* and *C. galli* exhibit specificity to birds. Along with these species certain other genotypes including avian genotype I-V, goose genotype I-V, Black duck genotype, Eurasian woodcock genotype had also been recorded in birds. *C. meleagridis* also possesses zoonotic potential and hence infects humans. There are a few parasitic species which are rarely reported in birds: *C. parvum*, *C. hominis*, *C. andersoni* and *C. muris*. Varying degrees of

enteritis is elicited by the protozoan species recorded in the gastrointestinal tract i.e. *C. meleagridis* and *C. galli*.

Clinical aftermaths

The most common observations due to cryptosporidiosis in birds are: Gastro-intestinal, respiratory and renal disease conditions. In case of gastro-intestinal involvement, the parasites (*C. meleagridis* and *C. galli*) invade salivary and oesophageal glands, proventriculus, small and large intestines, cloaca and bursa of Fabricius. The clinical symptoms most commonly observed involve diarrhoea, decreased body weight, dehydration and lethargy etc. Distension of small intestine due to gas and mucoid intestinal contents is also visible grossly. The disease can be more markedly observed in concomitant infections with other parasitic diseases or viruses. The respiratory disease entity is due to *C. baileyi* infection and the disease condition has been reported in chicken, quails, pheasants, duck, turkey, gulls and other pet bird species. The disease condition involves the infection of nasopharynx, sinuses, nasal turbinates, trachea, lungs, air sacs and conjunctiva. Along with coccidiosis, respiratory cryptosporidiosis can be considered as one of the major hindrances in poultry industry as it leads to economic losses due to morbidity and mortality of birds. The disease entity under respiratory form can further be categorized based upon upper respiratory tract involvement including sinusitis or swollen head and lower respiratory tract involvement including infection of trachea, bronchi and air sacs. The most common clinical signs are observed in lower respiratory tract and consist of sneezing, coughing, gurgling, dyspnoea, depression, lethargy, anorexia, unthriftiness and hence increased mortality. The gross lesions in deceased bird represent accumulation of mucoid exudates in the sinuses, trachea, nasal passage or conjunctival sac, along with congested/hypemic sinuses, cloudy air sacs, mottled grey-red lungs, mottled liver, bursal atrophy,

swollen spleen and emaciated carcass. Along with the involvement of respiratory and gastro-intestinal tract, cases of the involvement of kidneys have also been reported in jungle fowl, chicken and finches. *C. baileyi* is the species associated with the renal manifestation and even involve urinary tract. In the cases where kidneys were involved, overt signs were not evident before death. Also, report of a very heavy infection of cloaca and bursal tissues with *Cryptosporidium* species resulting in prolapse of cloaca and phallus in ostriches has also been documented.

Diagnosis

a) Detection of oocysts

The staining of the suspected faecal samples with various methods helps in the detection of the oocysts of *Cryptosporidium* in the faeces. Due to the low sensitivity of the staining techniques, false negative results are also common in samples with low oocyst shedding. The different staining methods which can help in detection involve modified acid fast or Kinyoun staining, Safranin-methylene blue staining method, negative staining methods, dimethyl sulfoxide modified acid fast staining, fluorescent stain, immunofluorescence stain, haematoxylin and eosin staining. Iodine saline wet mount method can also be used for the observation of highly refractile, round and double walled oocysts ranging from the size of 4-6 μm .

b) Molecular approach

Various molecular techniques have been employed for the detection of cryptosporidiosis and these mainly include PCR, Nested PCR, Real time PCR, Restriction Fragment Length Polymorphism, Multiplex Real time PCR, Microsatellite analysis, Fluorescent *in situ* hybridization and Loop mediated isothermal amplification etc.

c) Serological tests

Various serological techniques involving antibody and antigen detection have also been developed. Specific anti-*Cryptosporidium* IgG or IgM or both can be detected by using Enzyme

Linked Immunosorbent assay (ELISA). Antigen detection is most commonly performed by the application of immunochromatographic methods. The commercial test kits are available with the name Xpect *Cryptosporidium* test, ImmunoCard STAT, RIDAQuick, Crypto-Strip etc.

Treatment

Many drugs (various anticoccidial drugs) have been tried for the treatment of cryptosporidiosis in the past, but any effective drug for the prophylaxis and treatment of bird cryptosporidiosis is still lacking. The treatment should be targeted against the concurrent infections which cause immune suppression in birds, making them more susceptible for cryptosporidiosis. Supportive therapy always helps in reducing the fatality/mortality.

Prevention and control

- a) As the disease condition is most commonly associated with the management, so regular cleaning and disinfection of the poultry farms and premises help in destroying the infective stages.
- b) The infection is most commonly transmitted through contaminated feed and water, so avoid contamination of feeding material and water with poultry/bird's droppings.
- c) The infected birds excrete a heavy load of highly resistant oocysts, which are further transmitted to susceptible birds, so clean the cages, feeding cups and water troughs regularly.
- d) Always wash the hands with disinfectant liquids or soaps after handling or playing with the birds.
- e) The dry conditions help in restricting the infection, so always try to keep the premises dry.
- f) The disease condition is associated with the immunity of the host and hence, every single measure should be taken to maintain the immune status of the birds.
- g) Infected birds should be isolated from the rest of the flock and should be provided with supportive therapy.
- h) Steam cleaning is effective in reducing infection as oocysts are inactivated above about 65°C.

MONSOON MANAGEMENT

TECHNOVIEW

WATER THE FORGOTTEN NUTRIENT

Water

Water is one of the most essential nutrient which is involved in all the physiological functions of the body. Water also softens food and carries it through the body, aids in digestion and absorption, and cools the body as it evaporates through the bird's lungs and air sacs. 70% of total body weight is comprised of water. Even after supplying water consciously, it is taken completely for granted and often receives attention when there is some problem. Water is also consumed in large quantities compared to other nutrients. Hence, its quality and availability plays a major role in the birds health and productivity.

Significance of Water quality in Poultry

Water quality in poultry plays a significant role. Drinking water used in poultry production may contain considerable amount of contaminants like metals, sulphates, nitrates. Such contaminants

usually gets absorbed from Gastro intestinal tract. They may not posses severe threat to poultry health but may impact the production. Physical, chemical and biological parameters plays a significant role in providing safe, potable and wholesome water for maximum production.

Quality Parameters:

a. Color: Color of water is primarily a concern of water quality due to aesthetic reasons. Colored water gives a appearance of being unfit for poultry use. Normally, drinking water should be clear and colourless. As a general observation, reddish brown color may indicate the presence of iron while blue color indicates copper. Change in color can also be due to presence of other algae or humic compounds.

b. Turbidity: Turbidity is the light transmitting properties of water and is comprised of suspended and colloidal material. Increase in turbidity indicates impure water. Impurity like suspension of materials such as silt, clay,

algae or organic materials in water can lead to sedimentation of mud and organic matter in the tank which can ultimately lead to formation of bio-film. Turbidity above 5 ppm result in unpalatable water and indicate surface contamination. Turbid water can be filtered to remove particular contaminants and prevent clogged water lines.

c. Taste and odour: It is true that birds have less taste buds on their tongue as compared to humans but it does not mean that they cannot identify the difference in taste. Taste can be affected by the presence of salts, and a bitter taste is usually associated with the presence of ferrous and manganese sulfates. Hydrogen sulfide is indicated by a rotten egg odour. Hydrogen sulfide may also combine with iron to form black water (iron sulfide) that may also implicate the presence of sulfate-reducing bacteria.

d. Temperature: Temperature of the environment plays a major role in the drinking water consumption pattern of the birds. Since, birds don't have sweat glands to cool down body temperature, panting and drinking water are two important tools for birds to cool down their body. Optimum drinking water temperature is considered between 17° C to 24° C. It is always a challenge for farmers in temperate region like ours to provide sufficient quantity of water while maintaining the temperature. Since, thermoregulation is one of the important function of water in birds body, the temperature of the water should not exceed temperature of the body. Every possible measure should be taken to ensure the water is cool.

e. pH: pH is the measurement of acidity and alkalinity of water. In the pH scale pH 7 is considered as neutral, pH less than 7 indicates acidity while pH greater than 7 indicates alkalinity. For use in poultry, acidic pH is considered to be ideal. Levels below 6.3 may degrade performance but pH 5-6 is recommended for desired pathogen control.

f. Hardness: Hardness of water is the amount of dissolved calcium and magnesium in it. It is expressed as an equivalent of calcium carbonate. It measures the tendency of water to precipitate soap and form scale. Hard water leads to deposition of calcium carbonate in watering system. This can also lead to obstruction to normal flow and clogging of nipples. Even though hard water is not commonly harmful to poultry but it can lead to reduced effectiveness of water administered medications, disinfectants and cleaning agents. It reduces the consumption of water in birds which can lead to improper digestion indirectly affecting the performance.

g. Bacterial Count: Ideally there should not be any bacteria present in the water. Presence of micro-organisms is typically due to surface contamination by organic minerals. This can lead to poor performance and economical losses. Water troughs may also get contaminated due to litter. Faeces secretions of the birds also plays a major role in such cases. If the birds are diseased then it takes no time for disease to spread in the entire flock. Diseases like Ranikhet, Fowl Cholera, IBD, IB, Salmonellosis, Colibacillosis, Coccidiosis and Ascariasis spread readily through contaminated water.

Drinking Water Quality guidelines for Poultry

Contaminants/ Characteristic	Level considered average	Maximum acceptable level	Remarks
Bacteria			
Total Bacteria	0/ml	100/ml	0/ml is desirable
Coliform bacteria	0/ml	50/ml	0/ml is desirable
Nitrogen compounds			
Nitrate	10 mg/l	25 to 45 mg/l	Levels from 3 to 20 mg/l affect performance
Nitrite	0.4 mg/l	4 mg/l	
pH	6.8 to 7.5	—	pH 5-6 is recommended for desired pathogen control.
Total hardness	60 to 180	—	Hardness levels < 60 are unusually soft; those > 180 are very hard.
Naturally occurring chemicals			
Calcium	60 mg/l	—	Levels as low as 14 mg/l may be detrimental if the sodium level is higher than 50 mg/l.
Chloride	14 mg/l	250 mg/l	
Copper	0.002 mg/l	0.6 mg/l	Higher levels produce a bad odor and taste
Iron	0.2 mg/l	0.3 mg/l	
Lead	—	0.2 mg/l	Higher levels are toxic
Magnesium	14 mg/l	125 mg/l	Higher levels have a laxative effect. Levels > 50 mg/ml may affect performance if magnesium & chloride levels are high.
Sodium	32 mg/l	—	Levels above 50 mg/l may affect performance if the sulfate or chloride level is high.
Sulfate	125 mg/l	250 mg/l	Higher levels have a laxative effect. Levels >50 mg/l may affect performance if magnesium and chloride levels are high
Zinc	—	1.50 mg/l	Higher levels are toxic

Source: Adapted from T.A. Carter and R.E. Sneed, Drinking water guidelines for poultry. Poultry Science and Technology Guide No. 42, North Carolina State University

The contamination of water meant for poultry due to surface water may increase many folds in monsoon season. During monsoon season, many of the natural reservoirs are filled with rain water and sometimes overflow due to excess rain. This water may also be runoff of various fertilizers and pesticides used in agriculture.

Aftermath of Cyclonic conditions like that of recent Amphan super cyclone can put major challenges in front of farmers where they may have birds with them but lack the infrastructure to ensure proper feeding and watering to the birds. In such situation every step taken should ensure the safeguard of the only asset remaining with poultry farmer that is bird.

Among the cleaners, sanitizers and disinfectants, QAC's has many advantages, for example, low human toxicity, skin and material tolerability, no odour. Combined with other disinfecting agents, QAC's have synergistic effects including broad spectrum of activity etc. Hence it is important to select the sanitizers/disinfectants/cleaners which are unique and cost effective solutions

Management practices during Monsoon season and Optima's solutions:

1. Before the arrival of the monsoon season, proper check of the drainage and water pipeline.
2. To remove biofilm and pipeline cleaning in absence of birds with **Clean & Clear Aqua** @ 50 ml / lit of water for 6-8 hrs and in presence of birds @ 25ml/lit water to be used.
3. Water and rodent proofing of the shed.
4. Waterers, feeders and cool pads can be cleaned with **Clean & Clear Aqua** @ 10 ml / lit of water.

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5. Feeders should be kept away from the reach of rain water.
6. In case of outbreak, spraying **True-Value** @ 4ml/lit of water can be effective to stop spread of infection.
7. While its raining, it should be ensured that rain water is not entering the shed though curtains.
8. Proper ventilation to avoid suffocation and increase in ammonia when raining.
9. Continues water sanitization with **Newgen** _{Aqua} @ 1- 2ml/ 10 lit of water.
10. Lid of the water tank should be tightly closed so that rain water does not get mixed.
11. To attain desired acid pH, **RECTIFIER** @ 1ml/10 lit of drinking water is very effective.
12. PH of the water at the last nipple of the water line should be checked to ensure that availability of acidified water to the birds.
13. Some of the Optima's services for Water quality are:

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COVID-19 on Indian Poultry Industry – A Worst Hit?



Rumors & conjecture on India's social media associated with novel Corona virus hit consumption of poultry meat & eggs, resulting in a price crash. This false rumor has slashed Indian Poultry industry sales by almost 50% and the losses were pegged at INR 22,000 - 25,000 Crore. AIPBA has urged Central Government to seek support to prevent upheaval.

The novel Corona virus has had a prodigious bump on all walks of life to businesses. As the COVID-19 pandemic continues to spread its wrath globally, with no signs yet of slowing down, the poultry sector in India is one amongst the many being severely hit.

Rumors and fake news associated with novel Corona virus hit consumption of poultry meat and eggs, resulting in a price crash. A lot of misleading posts on social media from mid-January have created a false impression that human can contract Corona virus by consuming chicken. This false rumor has slashed Indian poultry sales by almost 50%. Indian Poultry industry suffered heavily as a consequence of false rumors and subsequently due to problems in supply chain during the period of lockdown. Total loss to the Indian Poultry industry was pegged at INR 22,000-25,000 crore.

Poultry sector in India contributes INR 1.3 Lakh crore to the country's GDP and considered as most organized sector among all livestock and agriculture sectors in India. Before COVID-19, Indian poultry industry was doing well and producing about 1.25 Lakh Crore value of products per year with a production of about 27-28 crores eggs a day and 40 crore broiler chicks per month.



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Owing to rumors & lockdown, farm-gate prices were ruling at ₹ 15-35 per kg of live bird in various regions against the production cost of ₹ 80-85 per kg and the price of egg dropped from INR 4 to INR 1.5-2 per egg. A knock-on fall in prices has hurt poultry farmers and as a result, they had to start cutting down on the production to trim losses. With such a present scenario, there could be around 20-25% reduction in total placement or availability of the birds or eggs for the entire year. The overall impact on the poultry sector had spillover effects on allied sectors such as feed manufacturers, medicines and vaccine manufacturers, equipment providers, agricultural crops, logistics & exports, which show widespread economic implications of this crisis.

In view to curb crisis in the Poultry sector, vigorous campaigns were started to stop misleading information, creating consumer awareness, improving chicken meat consumption to restore gaining the consumer confidence. Also, the All India Poultry Breeders Association (AIPBA) has submitted a memorandum to Central Government, on March 30, seeking "urgent financial assistance and rescue package" for the industry. The association has requested a restructuring of loans, allowing conversion of existing working capital loans cash credit (CC) limits to term loans with two years moratorium. The association has also mentioned that all small poultry farmers with less than 20,000 capacity farms should be provided with a compensation of INR 100 per bird based on their chicks' purchase bill paid through banking transactions. It further sought exemption of GST on soya seed and soya meal, which has added to the input cost on poultry feed to the farmers. Looking at today's circumstances, now the consumer fear on linking chicken with corona is on much lower side. Poultry players are still waiting for the response from government.

The situation of poultry sector is now getting normal, the rates are better, demand is coming and in all probability the recovery is going to be on the positive side.

Covid-19 has caused disruption in market in terms of supply, demand, production or logistics; however, the biggest disruption is on consumer behavior. The ongoing lockdown to combat COVID-19 has altered consumers' purchase decisions — higher spends on health and hygiene products, adapting to limited product availability, and preferring home deliveries over store visits. In terms of industry dynamics, the Indian poultry market is predominantly of fresh meat and processed meat accounts for just 5 to 10 percent depending on the geography. With social distancing becoming a norm, the need for hygienically packed meat untouched by hand will increase. Thus, the COVID-19 outbreak could trigger the growth of the processed meat segment both from the demand and supply per se. Going forward, industry's transition to a chilled or frozen market would be crucial for increasing value addition as well as international trade.

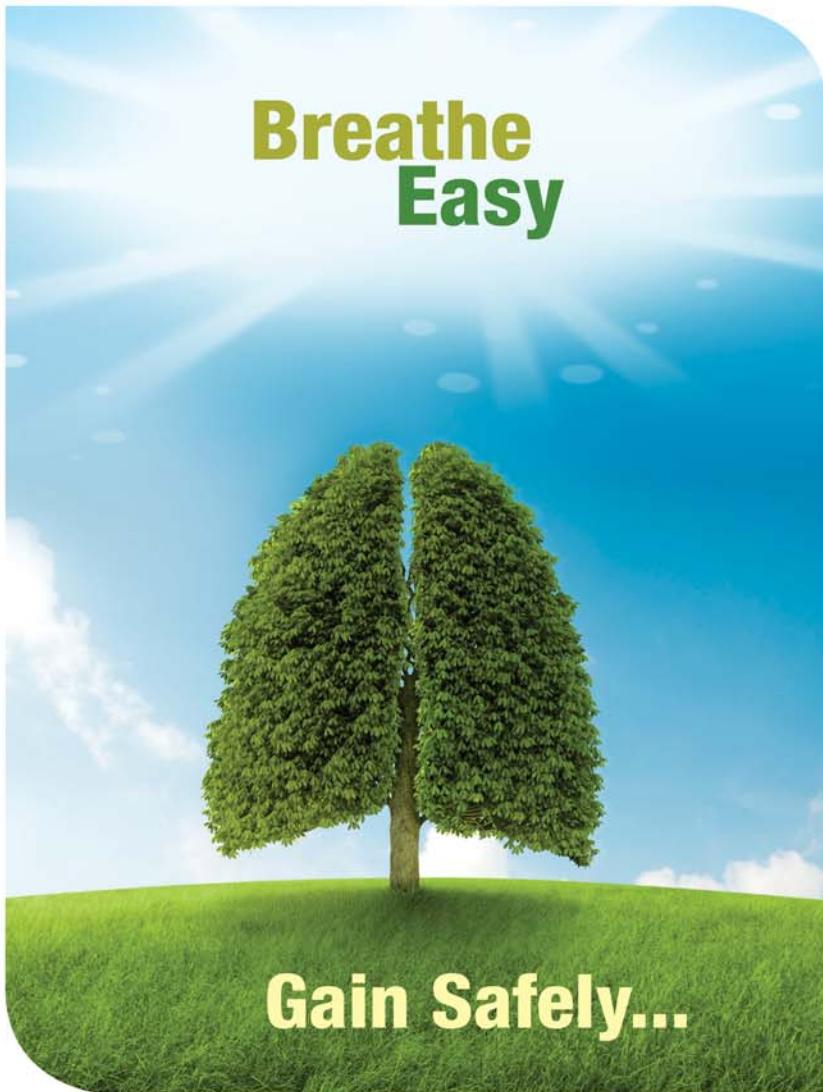
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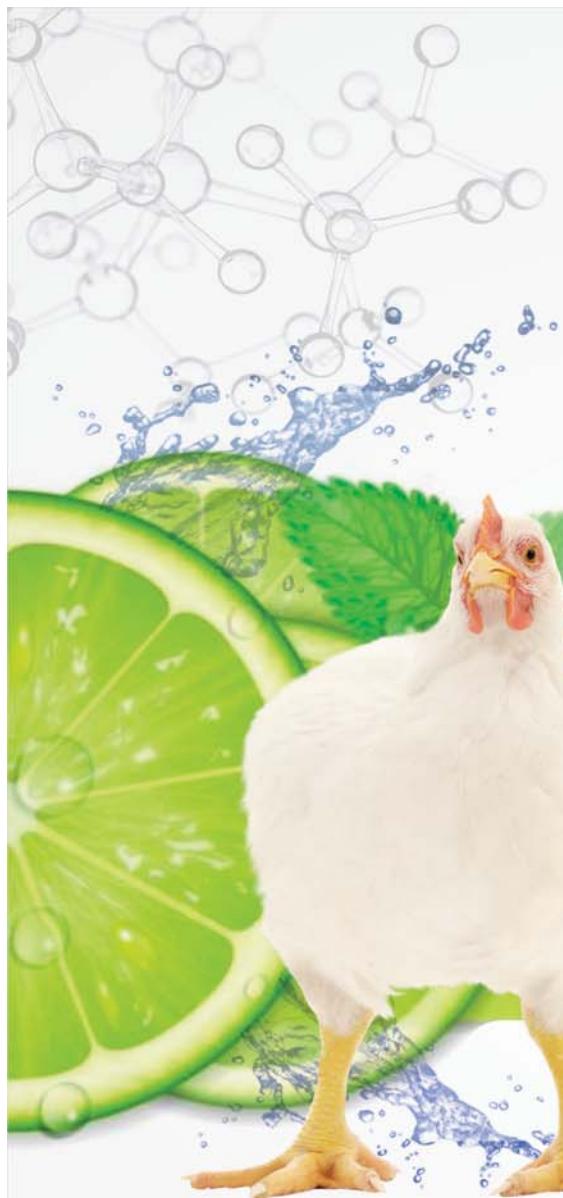
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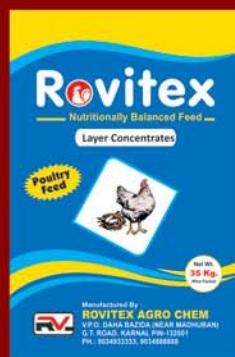
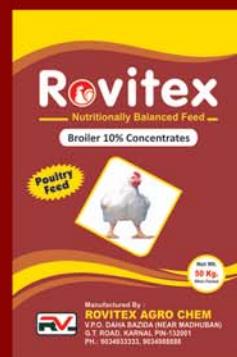
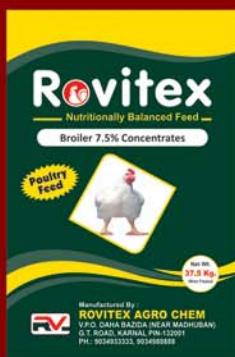
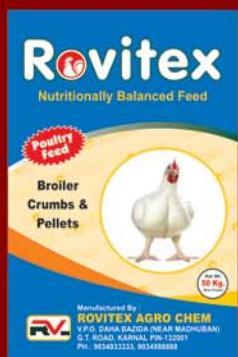
- ❖ Broiler 10% Concentrates
- ❖ Broiler 7.5% Concentrates
- ❖ Broiler 5.5% Concentrates
- ❖ Broiler 3.5% Concentrates
- ❖ Broiler 2.5% Concentrates
- ❖ Broiler 1.5% Concentrates

Layer Concentrates:

- ❖ Layer 5% Concentrates
- ❖ Layer 10% Concentrates
- ❖ Layer 25% Concentrates
- ❖ Layer 35% Concentrates

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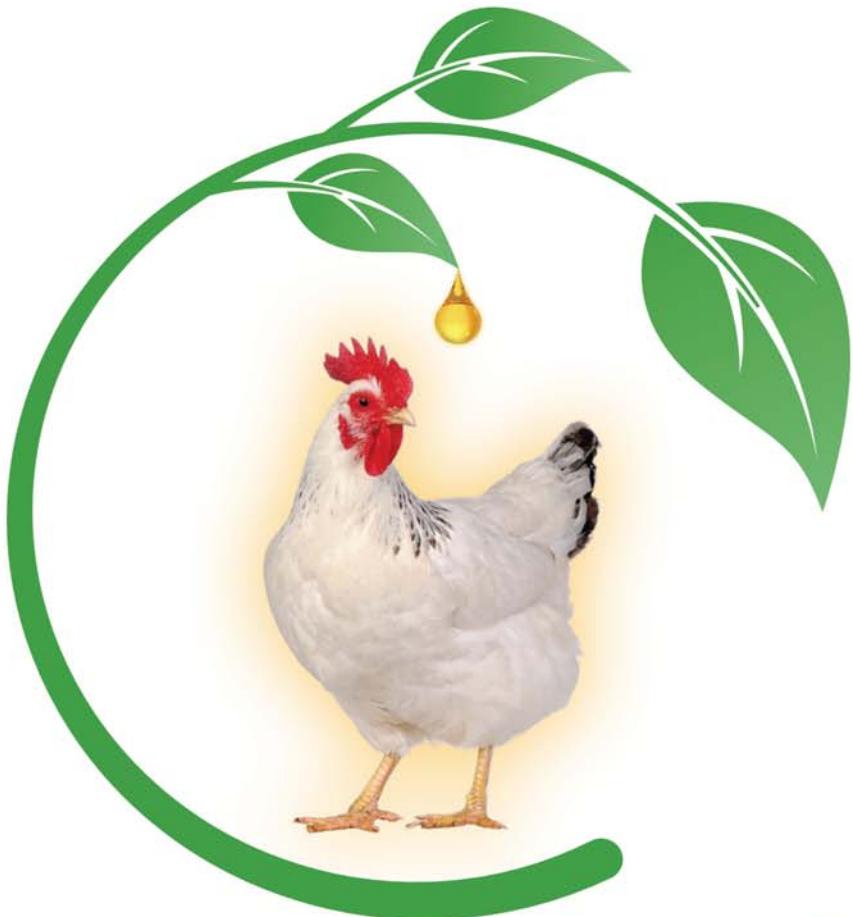
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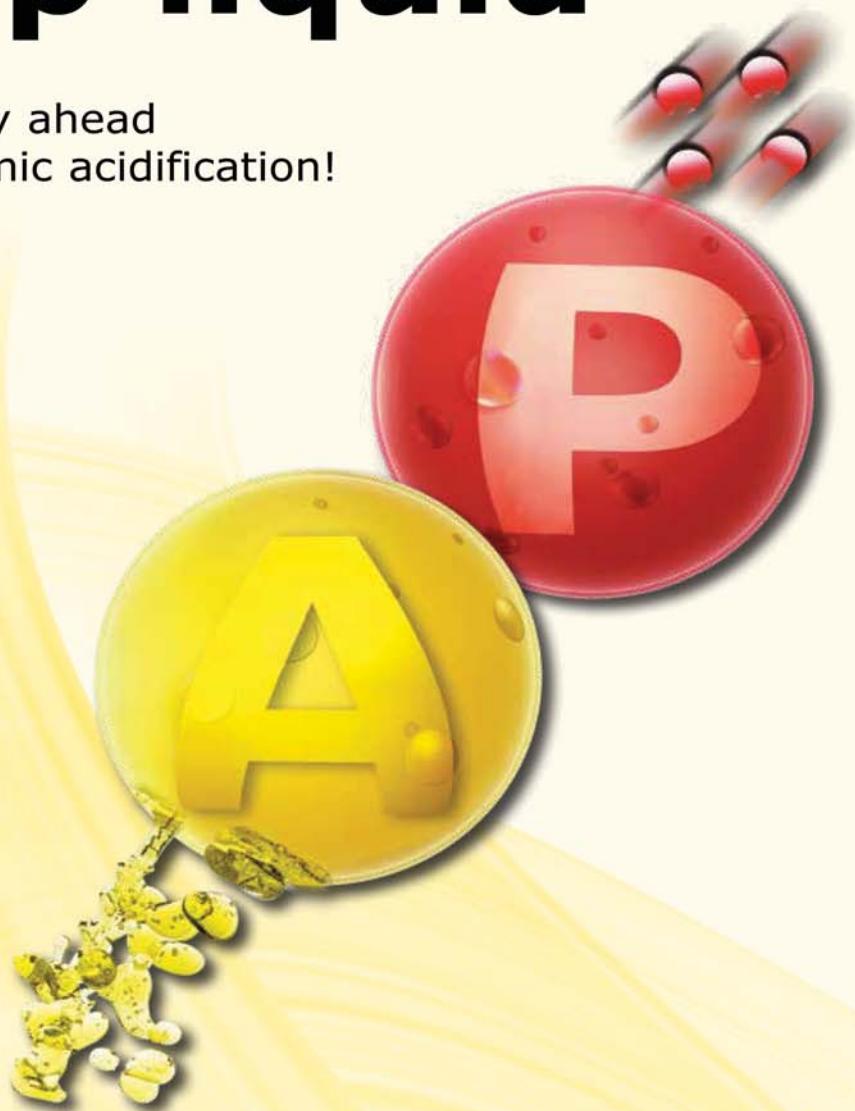
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PRESS RELEASE

Strategies to reduce *Campylobacter* in poultry flocks

Campylobacter is a Gram-negative bacterium that is present in the gastrointestinal tract of birds and it is known to affect humans

The importance of *Campylobacter* in the poultry industry is largely related to human campylobacteriosis and the role of poultry as a vector and reservoir for this zoonosis.

The annual cost of campylobacteriosis to public health systems, including the loss of individual health and productivity is estimated at:

- over 2.4 billion in the EU
- US\$1.2 to \$4 billion in the United States

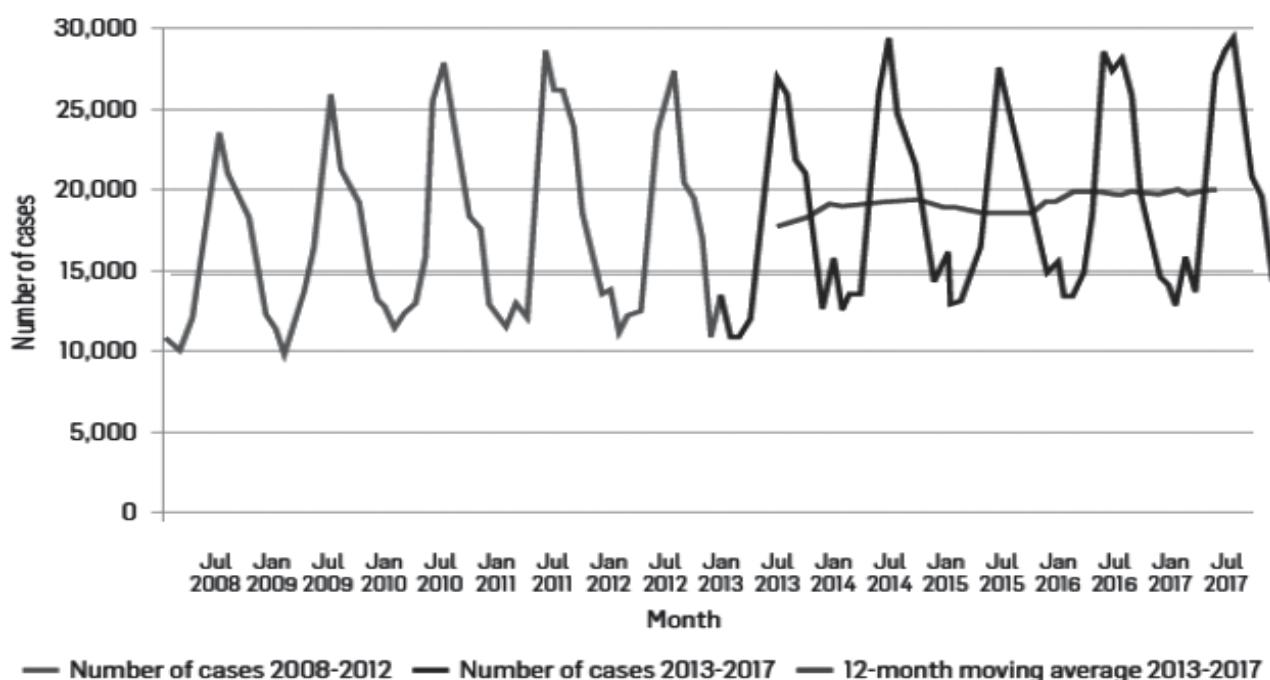
The impact of campylobacteriosis in humans is well known. It usually results in severe abdominal pains and diarrhea, which can lead to hospitalization. But

it is worth remembering that it can lead to death and, in some cases, lead to serious complications, such as Guillain-Barre syndrome, reactive arthritis, bacteremia, inflammatory bowel disease and irritable bowel syndrome. There are an estimated 9 million cases of campylobacteriosis in the EU alone each year

Campylobacter jejuni is often considered as one of the most important causes of human food borne disease in developed countries with an estimate of 2.5 million cases of human campylobacteriosis in the USA per year (1020 cases/100000 people/year).

Consequently, it is important to control this pathogen in poultry production.

Figure 1.
Trend in reported confirmed human cases of campylobacteriosis in the EU/EEA, 2017



Source: FFSA, 2016

Occurrence

Campylobacterspp. are part of the microflora present in the digestive tracts of many wild and domestic animals including pigs, cattle and poultry, without inducing clinical signs. However, scientists around the world widely agree that poultry products, including meat, are the primary source of campylobacteriosis in humans

Poultry species are considered to be an important vector for human campylobacteriosis. For example, 83 % of broiler chickens sampled in a live poultry market in New York City carried *Campylobacter jejuni* in their intestines (Grant et al., 1980). Using retrospective epidemiological studies, chicken meat manipulation and chicken meat consumption (especially raw or undercooked) were strongly related with increased risk of developing Campylobacter-associated diarrhea in humans (Harris et al., 1986).

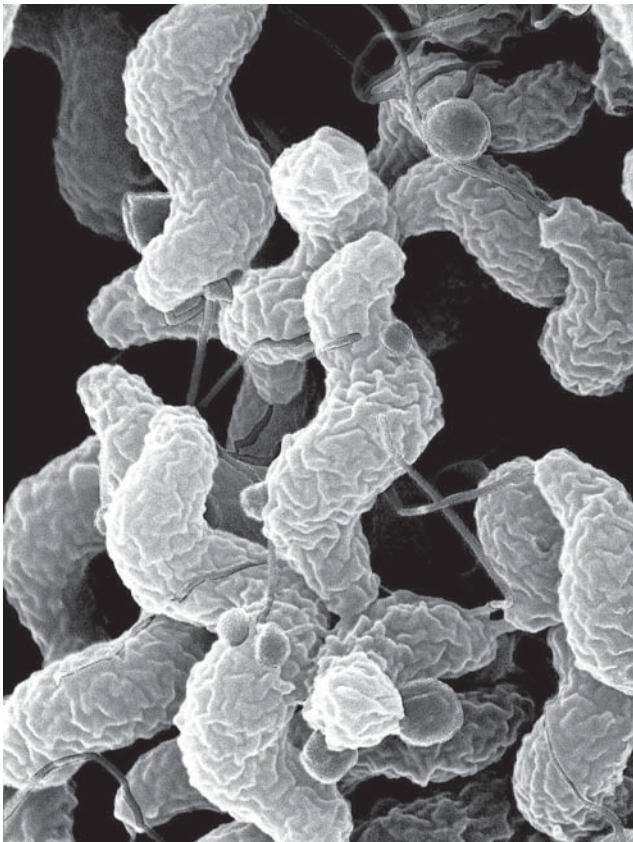


Figure 2. *Campylobacter (jejuni)* in poultry is a food safety concern. Source: Agricultural Research Service (ARS) USDA

According to the European Food Safety Authority (EFSA), in 2017, 37.4% of 13445 sampling units (single and batch samples) of fresh broiler meat were found to be positive for *Campylobacter spp.*. This number for turkey birds were 31.5% (in 1028 sampling units tested for campylobacter). The proportion of positive units in poultry birds, other than broilers and turkeys were 27.7% (in 1425 sample units).

It is important to remember that *Campylobacter spp.* are not necessarily commensal bacteria but have been shown to have the potential to cause disease in poultry: diarrhea and reductions in feed efficiency. In the UK, for example, estimates suggest that the costs to the industry are up to US\$29.16 per thousand broilers. Controlling the situation on farm is of benefit to poultry producers, and not just meeting contamination levels for poultry leaving the processing plant.

Why *Campylobacter spp.* is hard to control

Campylobacter bacteria do not proliferate outside the alimentary tract of warm-blooded animals. They can survive up to several weeks in food products, particularly those stored at low temperatures. *Campylobacter spp.* colonize the mucosa of the cecum and cloaca crypts of infected chickens. They may also infect the spleen and liver, and circulate in the blood.

A single gram of infected chicken feces can contain up to one hundred billion *Campylobacter*. Even this level of infection may not cause changes in cecal mucosa. In commercial production, birds carry high levels of *Campylobacterspp.* in the intestine as part of their normal microflora without showing any signs of clinical disease. In addition, there is no change in mortality or feed conversion rates in infected flocks.

When and how *Campylobacter* infect poultry

The prevalence of *Campylobacter*-positive poultry flocks is generally high, though this varies by region, season and production type (intensive, free range, organic, etc.). In some cases, the contamination is as little as 2% of the flock, and in other cases, contamination can reach 100%.

It is rare to find *Campylobacter* in birds younger than three weeks old. Scientists believe that this may relate to the presence of maternal antibodies and the rapid development of a chick's gastro intestinal tract and microbiota. However, after three weeks, even if one bird in the flock becomes infected, the whole flock can be infected in less than four days

Vectors of *Campylobacter* transmission include:

- Feces
- Insects
- Water
- Rodents
- People
- Vehicles
- Equipment

Measure	Success and implementation status
Vaccine	Does not exist
Extreme temperature intervention	Claims to reduces rate of carcass contamination by up to 90%. Does not eliminate risk to humans.
Chlorine wash	Not permitted in the EU due to concerns over carcinogenic residues
Stringent biosecurity	May reduce rate of carcass contamination by 50% to 70%, though difficult to attain under commercial conditions.
Stop thinning	Single out-loading of flocks can reduce contamination by 80%. Puts pressure on production and introduces short-term challenges.
Slaughter at 28 days	Dramatic reduction in contamination levels. Impractical due to market requirements.

Table 1. Management strategies to counteract *Campylobacter* contamination in broilers.

Source: BIOMIN

Effective vaccine lacking

Work to develop vaccines against campylobacteriosis both in animal and human health sectors is already well established. Within the human sector, no vaccine to prevent *Campylobacter*-associated illness has been approved by a regulatory authority anywhere in the world. The main problem likely stems from an incomplete understanding of *Campylobacter jejuni* pathogenesis and antigenic diversity, as well as its association with some post-infectious syndromes.

Within the poultry industry, numerous strategies have been developed and experimentally checked in attempts to create an effective vaccine. However, no efficient vaccine against *Campylobacter* is currently available

Measure	Success and implementation status
Bacteriocins	Some effect in scientific trials showing reductions of contamination in the caeca. More investigative work required.
Bacteriophages	In vivo use tends to be therapeutic. Considered for in slaughterhouse treatment of carcasses but problems may occur in registration.
Organic acids	Mixture of acids needed. The pH of drinking water has to be lowered to between 4.0 and 4.5 for optimum results. Varied results obtained.
Phytogenic feed additives	In vitro trials not replicated in vivo to date. More work required.
Probiotics	Several trials show significant reduction of <i>Campylobacter</i> colonization. Perhaps the most promising for commercial purposes.

Table 2. Nutritional strategies to counteract *Campylobacter* contamination in broilers.

Source: BIOMIN

Why antibiotics are not effective against campylobacter infection in poultry

Campylobacter spp. is not recognized as a specific pathogen under commercial conditions. Therefore, treatment of the flock is not a consideration. One must be cautious of the zoonotic risk associated with *C. jejuni* and its ability to rapidly develop antibiotic resistance. In reality, an antibiotic control strategy would not be a practical choice for management of *Campylobacter* on commercial poultry farms

Solutions

There is still no definitive solution to control *Campylobacter* in poultry flocks. Yet, there are several strategies that can reduce its incidence, so improving food safety and enhancing farm profits.

Broiler producers need to apply a series of measures to reduce *Campylobacter* contamination levels. A mixed approach starts with improved biosecurity, changes to management practices, proven feed or water intervention with additives and, finally, intervention measures during slaughter.

Table 1 provides an overview of management strategies to counter *Campylobacter*. These management methods, however, are not all applicable universally, for example within the EU there are restrictions due either to availability legislation or consumer demand for carcass size. In addition to management strategies, there is also

the option to use feed additives or water treatments, which can further reduce the level of *Campylobacter* contamination, as shown in *Table 2*. Of these, probiotics may be the most promising approach for controlling *Campylobacter* through nutritional interventions.

10 tips for maintaining high levels of biosecurity and keeping *Campylobacter* at bay

It is important to highlight prevention and good gut performance management to control *Campylobacter*. These 10 tips are meant to help you maintain high levels of biosecurity in your poultry houses in order to ensure food safety and profitability.

1. Segregate the clean and dirty areas of the poultry house entrance with a physical barrier
2. Keep equipment in the poultry house for the whole cycle
3. Practice regular hand hygiene
4. Wear disposable overalls
5. Apply rodent control
6. Ensure good water quality
7. Withdraw feed between 8 and 12 hours prior to slaughter
8. Educate catching and transport teams
9. Discuss lairage(ie. The factory yard) and slaughterhouse practices
10. Control contamination within the birds' gut

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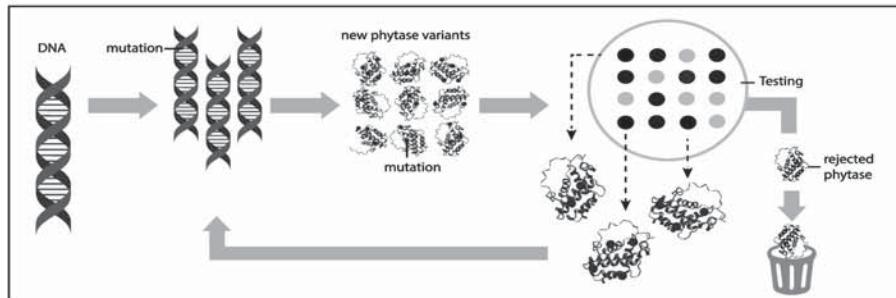
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Are all phytase products the same?

Dr. Sachin Patil, AGM-Key clients-Huvepharma SEA (Pune) Pvt. Ltd.

No. Each commercial phytase molecule is different. Even products derived from the same bacteria (such as *E.coli*) ultimately differ based on their amino acid sequences. These sequences, similar to DNA, mark important differences. For example, a chicken and a turkey share most of the same DNA—but their DNA sequence makes them different animals. OptiPhos® Plus was developed by Cornell University (USA), it is derived from a specific *E.coli* micro-organism isolated from the intestine of a normal pig then it's fermented in *Pichia pastoris* and produced under precise specifications producing a very potent 6-phytase. This process gives OptiPhos® Plus its potency, as well as peak activity at pH levels found naturally in the upper digestive tract of the chicken. Other phytase manufacturers can make claims about similarity. However, at the molecular level each product is different, and that difference makes OptiPhos® Plus the most potent molecule.

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Criteria for selecting a fast phytase- PPS

What are the criteria to select a good phytase? Why select the fastest phytase? The importance of **pH profile**, **pepsin resistance** and **speed (PPS)** has shown to be critical to yield a fast phytase with reliable matrix values and super dosing properties.

The main reason for using an exogenous added phytase in feed is to liberate phosphorous (P), bounded as phytate, in raw materials. This does not only lead to a lower feed cost by reducing the amount of added inorganic P, but also exerts a positive effect on performance by degradation of phytic acid, which is a known anti-nutritional factor in feed. In practical animal nutrition, a fast acting phytase has two major benefits. First of all, the higher the speed, the higher the P release from the phytate will be, and the less extra inorganic P needs to be added to the feed. Secondly, as phytate also exerts anti-nutritional properties linked to the binding of minerals, protein and even fatty acids, its faster destruction will thereby improve the digestibility of these nutrients and increase animal performance.

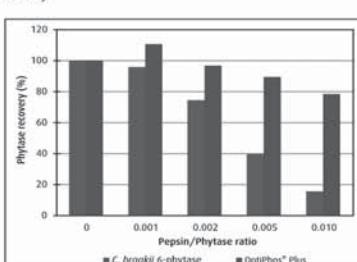
pH profile

It is well-known that phytic acid must be in solution for the exogenous phytase to be able to hydrolyse the phosphate groups. Phytic acid is largely soluble at pH levels below 4.0 (gizzard/stomach). However, at higher pH levels (as in the small intestine), it forms complexes with positively charged ions, like calcium. A good phytase therefore needs to be active in vivo in the upper digestive tract, throughout the complete acid pH range from pH 2 to 4.

(Fig-1 Relative phytase activity at different pH levels)

Pepsin degradation

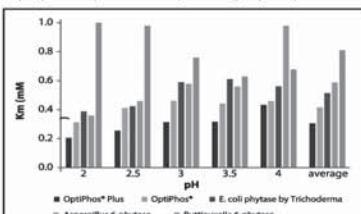
Pepsin is a protease present in the stomach/gizzard, responsible for the degradation of proteins. As phytases, like any other enzymes, are proteins, they can be broken down by pepsin which obviously leads to the loss of their efficacy. OptiPhos® Plus is resistant to this degradation by pepsin, so no losses of efficacy due to the pepsin breakdown of OptiPhos® Plus will happen and the full quantity of OptiPhos® Plus dosed into the feed is effective!



(Fig-2 Phytase recovery after prolonged exposure of different phytases at different low pepsin levels during 2 h)

High affinity and speed

The speed of hydrolysis of phytate by a phytase (the Vmax) is largely dependent on its pH profile and pepsin resistance and can be determined during in vitro enzymatic studies (the so called Michaelis-Menten kinetic studies). In view of the short duration of feeding in the gastric region where the phytic acid is soluble and degradable, it is obvious that the Vmax of a phytase needs to be as high as possible and will influence the greater efficiency of phytase (Figure 3).



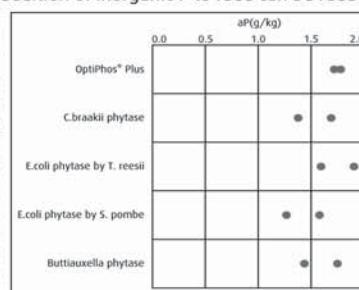
(Fig-3 OptiPhos® Plus has a higher affinity (lower Km) than other phytases at different pH values)

In practice, the **Vmax/Km**, or the **Kcat/Km** ratio, is used as criteria to compare phytases: the higher the value (a high Vmax (Kcat) and a low Km), the more phytate will be broken down, and the higher the P matrix value of the phytase will be.

The speed of phytate degradation by OptiPhos® Plus is maintained even when phytate concentration in the gizzard/stomach drop to very low levels. This is called the affinity, and is determined by the Km value, which is the concentration of phytate at which the phytase still works at 50% of its maximum speed. OptiPhos® Plus has shown to have a low Km value, indicating it can keep its high speed up long even when phytate concentrations drop to a low level. This is also why OptiPhos® Plus has high P matrix values and is especially well suited for superdosing applications.

Scientifically proven P matrix values

In order to calculate how much the addition of inorganic P to feed can be reduced by a phytase, each phytase supplier provides their specific P matrix values. The higher these matrix-values are, the more interesting the phytase becomes for a nutritionist when calculating with best cost formulation. It is however of the utmost importance for the nutritionist to be able to 100% rely on the correctness of these supplier's matrix values. Trials done by independent research institutes, which are published in scientific peer reviewed journals, form an adequate and solid base for determining (and comparing) matrix values. These matrix values might be referred to as the 'scientific matrix values' and may be differentiated from the matrix values provided by the manufacturer, which we might call the 'supplier matrix value'. Such research in this scientific literature over the period 2002-2017 for poultry, for instance, have revealed that most phytase suppliers, except OptiPhos® Plus, overestimated the matrix value by up to 25%, and might thereby lead to under performance of the animals (Figure 4).



(Fig-4 Scientific matrix values (orange dots) versus supplier matrix values (green dots) of different commercially available phytase at double dose in broilers.

Superdosing effects at double dose

Phytate is known to exert anti-nutritional aspects by binding minerals, proteins and even fatty acids, hindering their digestion and absorption by the animal. A fast working phytase like OptiPhos® Plus thereby will yield faster positive effects on improvement of performance, and will yield super dosing effects at double dose. Other phytases will need three to four times the normal dose to yield this effect.

Conclusions

It can be concluded that the intrinsic characteristics of a phytase source is determined for a large part by its in vivo activity and its speed of action. The choice of a phytase, active at all relevant pH ranges, resistant to pepsin and showing a high speed of phytic acid degradation is therefore of the utmost importance to secure adequate and reliable P release from phytate. The better the phytase scores at these three points, the better and more reliable its P matrix values will be and the stronger the chicken performance will be enhanced through super dosing.

- OptiPhos® Plus achieves its greater aP release at a lower level than other Phytase products
- Highest savings of inorganic phosphate (MCP and DCP) sources, so Reducing feed cost
- A faster elimination of the anti-nutritional factor phytate, so demonstrating superdosing effects already at double dose

Ionophores - Past, Present and Future

Coccidiosis, caused by protozoan parasites of the genus *Eimeria*, is still one of the most widespread and difficult to manage poultry diseases, causing considerable economic losses especially in the broiler industry.

Intensification of commercial poultry production has relied on effective prophylactic control of coccidiosis. The sequential introduction of sulfadrugs, synthetic anticoccidials and then ionophores changed this, facilitating rapid increases in the scale and intensity of poultry production. Current levels of poultry production would not be sustainable in the absence of effective anticoccidial control.

Synthetic compounds

Synthetic compounds were the first actives to be discovered that controlled coccidiosis. Different synthetic products have different working mechanisms, although their exact mode of action is not always clear. In general, these products enter

the intestinal cells and interact with the parasite, even when in an intracellular phase (for example in the schizont phase). Synthetic products are very strong anti-coccidial products which result in a significant reduction of the coccidiosis infection pressure.

Ionophoreanticoccidials

The introduction of ionophoreanticoccidials in the 1970s proved to be critical for the development of modern poultry production. Ionophores interact with ion transportation within the parasite, hence their name which is derived from the Greek 'ion phorus', meaning 'ion carrier'. Ionophores transport ions (e.g. sodium (Na⁺), potassium (K⁺), hydrogen (H⁺) etc.) across hydrophobic membranes, in this case, the parasite wall (Figure 1). This increases the concentration of these ions inside the parasite, eventually resulting in the uptake of water through osmosis causing the parasite to swell and burst.

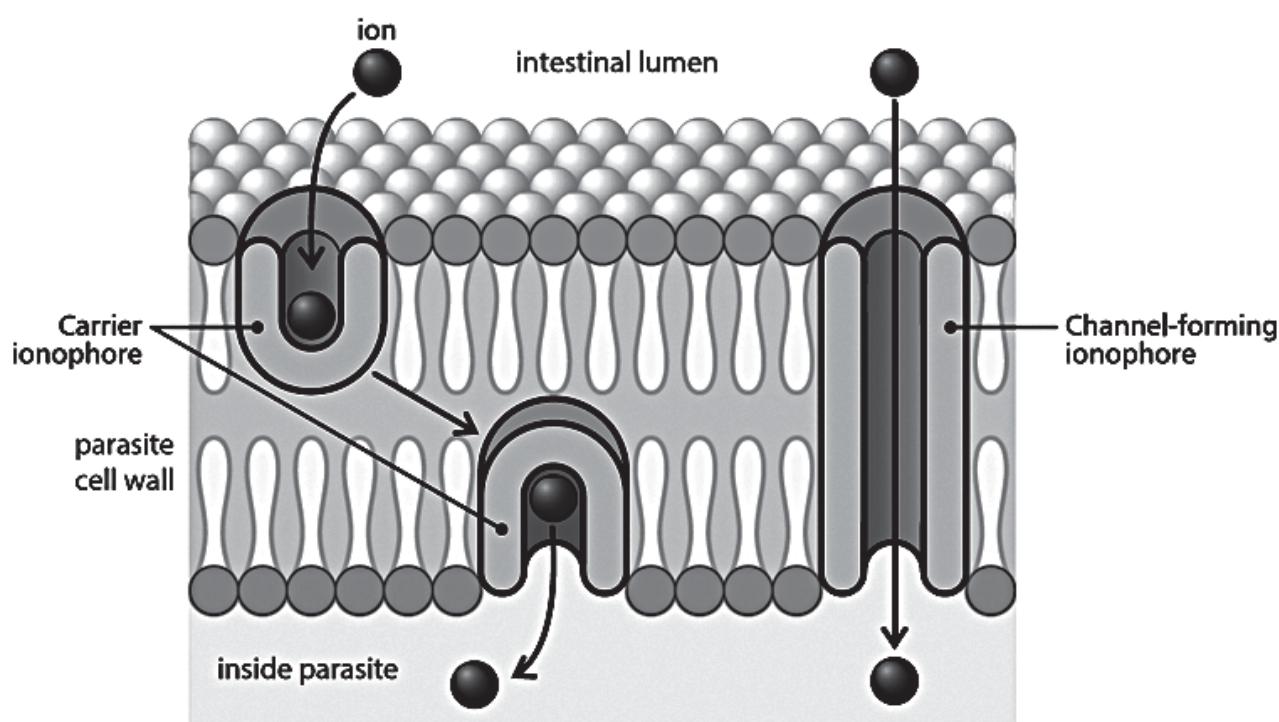


Figure 1. Illustration of ion transport by ionophores. Ionophores have two ways in which they transport ions into the parasite: by forming a channel or by acting as a carrier to pass the cell membranes. The carrier pathway (left) is used by ionophores applied in poultry

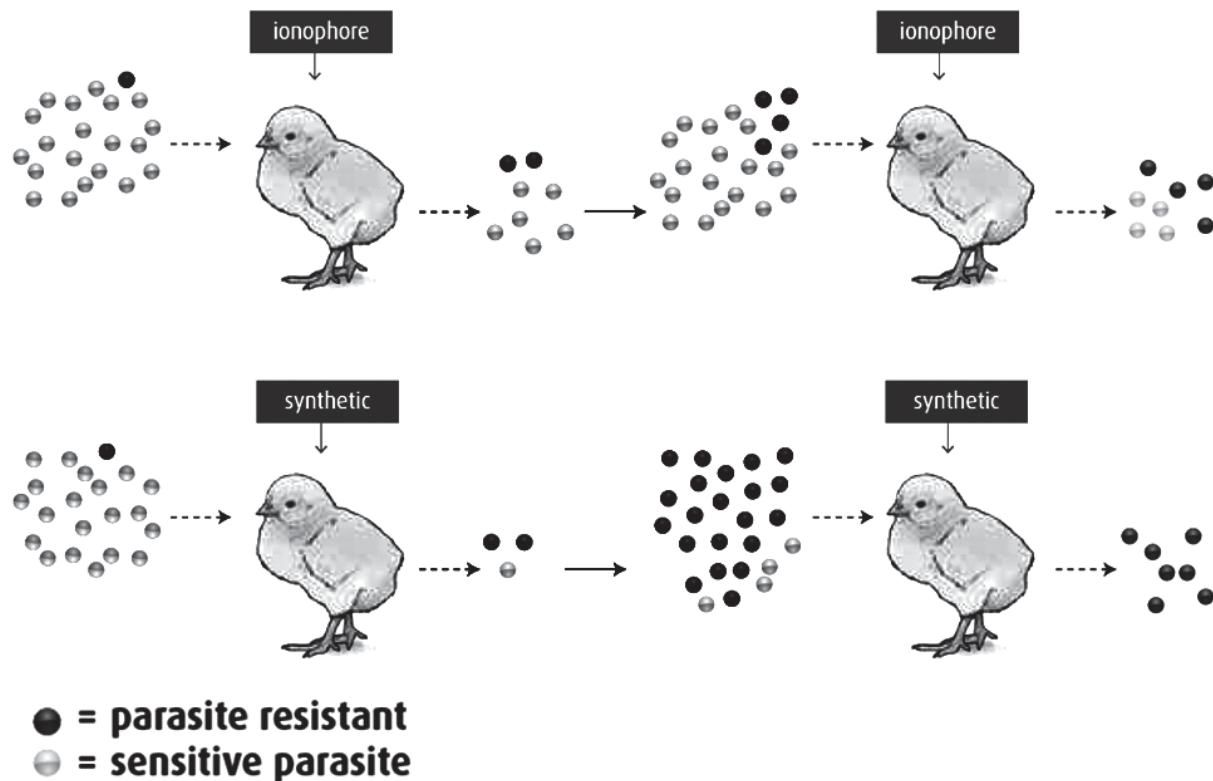


Figure 2. Resistant and sensitive parasite strain population following treatment with ionophore and synthetic coccidiosis control products. In contrast to synthetic products, ionophores will allow some parasite multiplication. This will result in higher shedding of sensitive parasites which will compete with the resistant parasites. As a result, the house will not be flooded by resistant strains.

Slow resistance

One of the main characteristics of an ionophore product is the slow selection for resistance. Some parasites will always escape the effect of the product, known as 'ionophore leakage'. This is an inherent property of all ionophores, linked to their mode of action. The consequence is that, besides the parasites with reduced sensitivity, some completely sensitive parasites will survive the effect of the ionophore. The competitive advantage for the resistant parasites is less pronounced and the shift to an increasingly resistant parasite population is a much slower process in comparison to synthetic compounds (Figure 2).

Categorizing ionophores

The mode of action of ionophores makes them unsuitable for use as curative products. Ionophores will not enter the intestinal cells and are only able

to destroy the parasite during the motile stages of the life cycle (sporozoites and merozoites). This means that, to be effective, the ionophore must be present in the intestinal lumen at the time of the motile stages. It is therefore important to avoid interrupted medication since birds kept on litter ingest oocysts continuously.

It is very important to state that ionophores are antiparasitic products which also exert an antimicrobial activity. In parallel with their mode of action against *Eimeria* as described above, the lipophilic ionophore attaches to the lipid-rich cell membranes of Gram-positive bacteria. Ionophores bind Na^+ , K^+ and H^+ and facilitate their transfer across the bacterial cell membrane, resulting in an increase in H^+ concentration inside the Gram-positive cell which eventually leads to the death of the bacteria. Different studies have demonstrated that the different ionophores all possess

antibacterial properties which inhibit the growth of poultry *Clostridium perfringens* strains *in vitro* and reduce lesions in a necrotic enteritis model *in vivo*. The parasitic and antimicrobial modes of action however, are not related to any drug used for human medicine.

Ionophores and resistance

Till today, there is no proven evidence that the use of ionophores and cross-resistance or co-selection of resistance to antimicrobials critical in human medicine has been demonstrated. Since their discovery almost 50 years ago, ionophores have been the most popular products for coccidiosis control worldwide.

A coccidiosis toolbox without ionophores

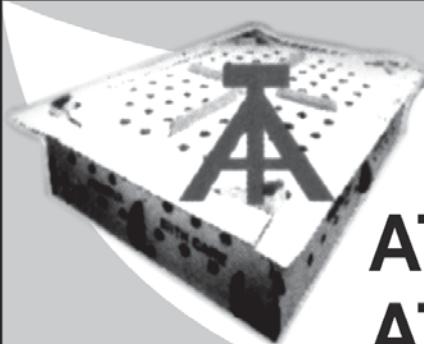
When removing ionophores from the coccidiosis toolbox, awareness of the potential threats must be heightened. Coccidiosis is ubiquitous and it is generally accepted that, under current production systems, coccidiosis control remains necessary. When ionophores are withdrawn, there is an increased risk of sub-clinical and clinical coccidiosis because resistance issues caused by synthetic anticoccidial products will be more prevalent. The more products that are available for poultry producers means that an optimised rotation can be applied in a correct and responsible way.

Coccidiosis vaccination might also prove beneficial here to manage resistance development.

Coccidiosis is one of the main triggers for other gastrointestinal disorders like necrotic enteritis and dysbacteriosis. Therefore, an increase in sub-clinical and clinical coccidiosis might also result in increased occurrence of these intestinal disorders which, in turn, might increase the use of therapeutic antimicrobials via the drinking water. Animal welfare and sustainable poultry production will be compromised.

Conclusion

In summary, poultry production would not have evolved into the highly efficient meat production industry it is without the help of ionophores for the prevention of coccidiosis. Removing this crucial element of the coccidiosis control toolbox will unavoidably mean a reduction in poultry production performance, giving lower outputs and jeopardizing animal health and welfare. Due to the nature of poultry production and the features of coccidiosis, prevention of coccidiosis is crucial in order to remain competitive and ensure animal welfare and health. Prevention can only be achieved using all the available tools which includes chemical products, vaccines and ionophores in rotation programs. Using these tools at different time points will bring the most efficient and long-term viable strategy.



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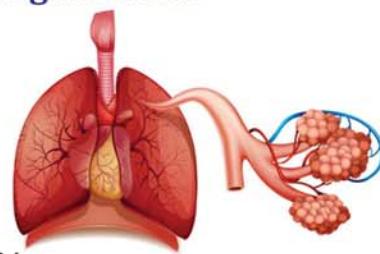
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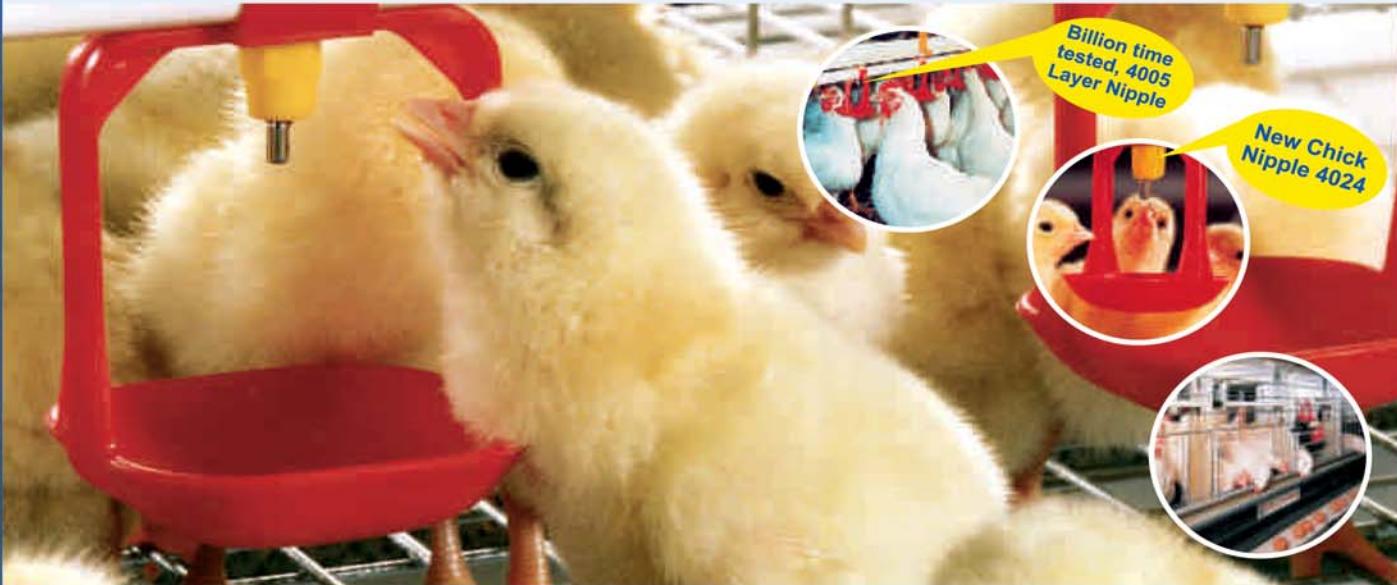
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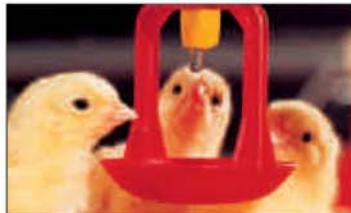


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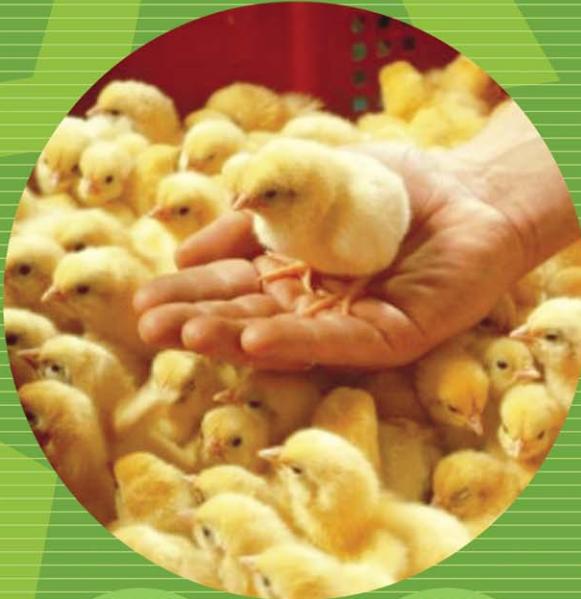


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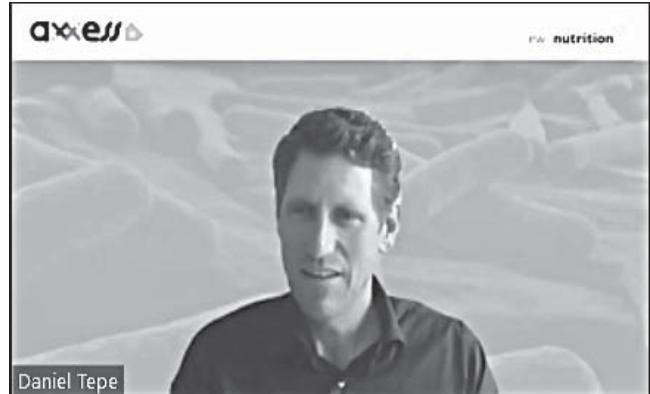
Test With Confidence™

EW Nutrition Launches revolutionary Axxess XY through digital platform

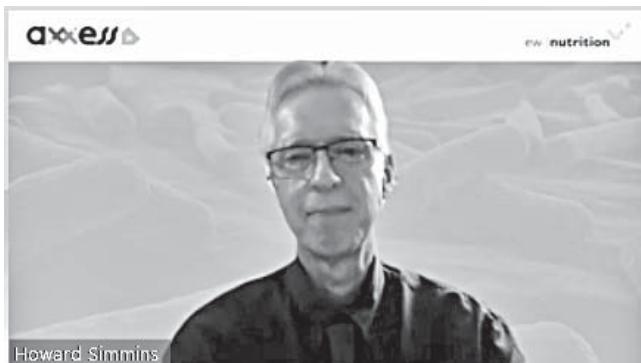
On 7th July 2020, EW Nutrition officially launched Axxess XY, a novel, intrinsically thermostable enzyme that delivers top performance to feed producers and the livestock industry. The revolutionary product was launched at an online customer-centric event organized for South Asian Region.

In its effort to improve animal gut health, control toxin risk, and reduce antibiotic use, EW Nutrition has long supported the South Asian livestock industry with its holistic, science-backed solutions. The company has now introduced a revolutionary solution to improve feed cost savings to the customers. This enzyme comes with the highest level of intrinsic thermostability and is active against both soluble and insoluble arabinoxylans. The top benefit of Axxess XY is an unparalleled flexibility in feed formulation, resulting in significant feed cost savings.

previous generation carbohydrase enzymes and also guided audience on how to optimize use of xylanases to get maximum benefits.



Daniel Tepe, Managing Director, EW Nutrition shared the vision and mission of organization and reinforced the modus operandi of EWN operation as Partner in Progress with the customers.



The mechanisms and derived profits of the new product were discussed during the e-launch of Axxess XY. The key speaker was **Dr. Howard Simmins, Independent KOL, InSci Associates Ltd**, a leading world-renowned authority on enzymes. Dr. Simmins is an accomplished global communicator and his expertise is focused on feed additives development for animal nutrition and health. Dr. Simmins highlighted the limitations of



Dr. Andreus Michels, Head of Biotechnology, EW Nutrition highlighted the strength of its research and development facilities in various global research centers. EWN invests the highest percentage of its revenue on innovation in the feed industry. He highlighted the fact that EWN enzyme development laboratory is the only fully equipped laboratory dedicated exclusively to animal health industry.



Dr. Ajay Awati, Global Category Manager, Enzymes, highlighted the need for such a revolutionary solution in serving animal feed industry. He further described Axxess XY's unique value proposition along with the origin of molecule, structure of novel molecule and functionality that sets it apart from currently available xylanases in the market.



Dr. S. Mahendran, Regional Technical Manager, South Asia threw light on feed formulation optimization and explained how the addition of Axxess XY can help release additional energy from feed, which results in optimum performance and production.

The unparalleled thermostability of Axxess XY became a talking point among the audience and various integrators showed their interest in using the new enzyme in their formulations. Also, EW Nutrition's efforts to bring everyone together on a knowledge-sharing platform was highly applauded by the attendees. Industry partners also iterated the need for more detailed sessions in future.

The e-launch program was a great opportunity to reach to a wider array of breeders, broiler integrators and consultants across South Asia. Major key stakeholders – technical consultants, university professors, farm managers, integrators etc. – attended the e-launch and benefitted from the information provided during the event.

"We are pleased to bring our revolutionary enzyme solution to our South Asian partners, thus enriching our portfolio of products and services to the benefit of the local livestock industry," says Michael Gerrits, Managing Director, EW Nutrition. "We are confident that Axxess XY will be a breakthrough for our customers, and we look forward to providing and servicing our comprehensive animal nutrition solutions in South Asia, a most valuable and respected market."

About EW Nutrition

EW Nutrition is an international animal nutrition company that offers integrators, feed producers, and self-mixing farmers comprehensive animal nutrition solutions for gut health, antibiotic reduction, young animal nutrition, toxin risk management and more.

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Rise in demand for processed Meat due to Pandemic?

Dr Krishna Chandra Sahoo, Global Product Manager, Vethphage Pharmaceutical

The coronavirus pandemic and the ensuing safety scare could end up triggering the demand and supply of processed meats, with the right nudge from the government and active participation from private players. India has over 10 lakh poultry farmers who breed close to 800 million birds annually. The sector contributes 4.5 percent to the national GDP. The market is predominantly driven by the production and sale of fresh meat, and processed meat accounts for slightly over 5 percent. If you look at countries like France and Russia, processed meats take up over 30 percent of the market share. There is clearly a lot of scope to double the current market share of processed meats.

A live market puts a lot of pressure on producers as the meat process are affected by the economics of supply and demand as well as unpredictable market shocks. The rearing process and the gestation period make it difficult for farmers to vary the supply with the demand. This is compounded by the fact that the cycle of meat consumption is not constant in India. Producers end bearing reduced margins and even sustain losses to keep up the farming volumes. To give a fair idea, the loss suffered by the industry due to the current crisis is upwards of INR 20,000 crores.

The benefits of processed meat

A mature processed meat market will be beneficial to producers and customers alike. Processing technology will increase the shelf life of all meat products, which will make it easier for farmers to absorb any shocks due to the improved control over the inventory. Also, the fact that the product can be stored will shield them from unexpected crashes in prices.

Social distancing is going to be the norm for the foreseeable future, and the need for hygienically stored meat which is not touched by hand is going to go up. Customers are going to educate themselves and start looking for traceability, and fresh and hygienic meat. Processed meat is the logical answer to all the above demands, and it will allow producers to adhere to the strict quality requirements. Players who can integrate themselves into a brand-driven processed meat market could gain a lot from this trend.

What are the challenges?

The main challenge in hastening this transition is Indians' preference to buying fresh food. We are used to buying



Dr Krishna
Chandra Sahoo

fresh vegetables, fruits, and poultry. To bring about a large-scale behavioral change, we need to seriously invest in customer education. It will be quite challenging to convince them that the taste of the meat and the nutrient value will remain undisturbed due to the processing.

The second biggest challenge is the fears of unemployment among wholesale meat traders and butchers, who will become redundant with the growth of the processed meat market. However, as processed meat gains a greater market share, such

intermediaries in the supply chain can adjust to different roles in the new network. For instance, there will be plenty of new employment opportunities in processing plants.

The final challenge lies in upgrading the infrastructure of processing plants and the supply chain. At present, the capacity utilization in our processing plants is slightly over 50 percent, and is therefore not a pressing problem. On the other hand, we need heavy investment to improve the infrastructure of the supply chain. We need an efficient cold chain from processing plants to storage units extending all the way to retail refrigeration. We need favorable policies from the government if we want to attract lucrative foreign investments.

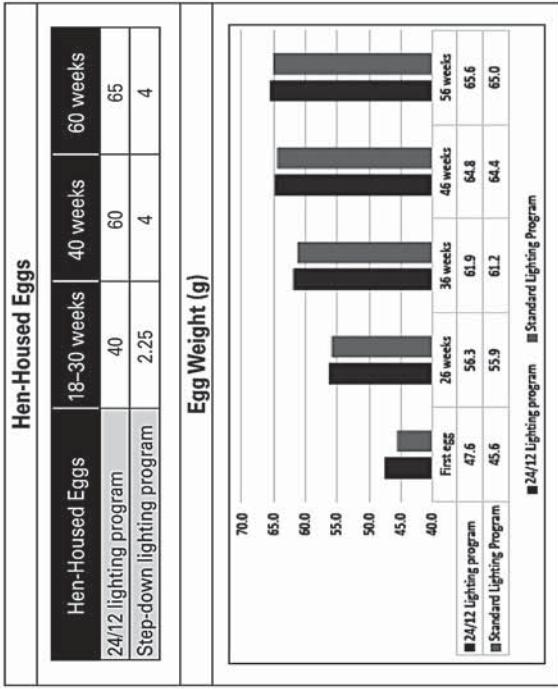
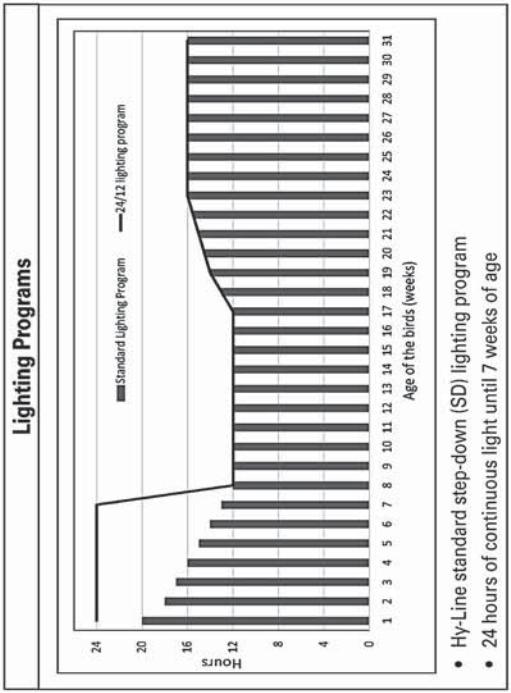
The road ahead

In the long run, both producers and customers will benefit from the move to processed meats. Wet market will continue to operate alongside. To ignite a behavioral change, we need to create more awareness and change the public's perception towards processed meats. There are plenty of factors that will accelerate a change in consumption patterns – changing demographic profiles and lifestyles, exposure to a wider variety of cuisines, and growth of modern restaurants and retail chains.

Once we start to see an increase in customer acceptance, we will be able to come up with strategies to create and use more capacities. Players in the market can seize the opportunity to strike international ties, and boost our exports. Central regulations will play a key role in attracting investor interest and promoting the consumption of processed meat. While the transition is not going to happen overnight, we can expect to see a mature processed meat market in five years.

EFFECTS OF GROWING PERIOD LIGHTING PROGRAMS ON LAYING PERFORMANCE

Purpose: Study the growth and lay performance of W-80 commercial under 2 different lighting programs



Laying Period Results:

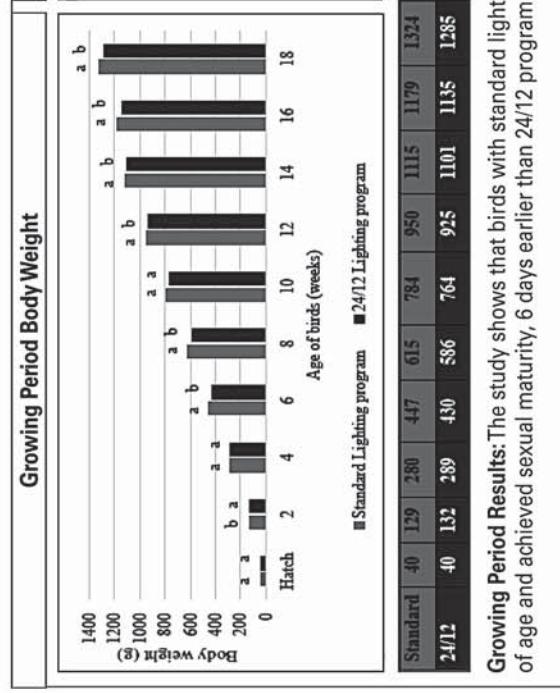
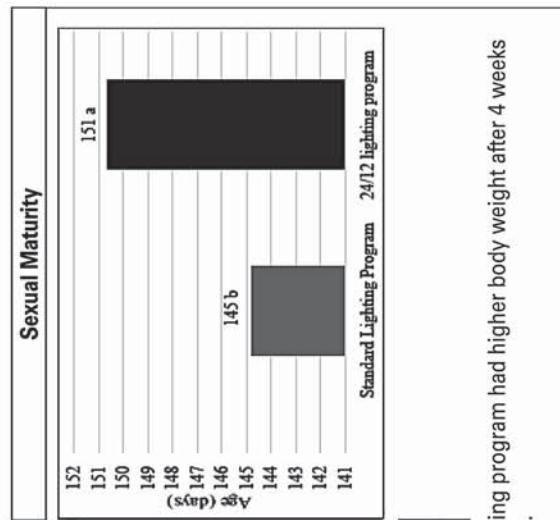
- Sexual Maturity: Attained maturity 6 days earlier
- Hen-Housed Eggs: 12 eggs more at 60 weeks of age
- Egg Weight: Lighter egg weight profile at later age.

Conclusion:

- Study shows that step-down lighting program (Hy-Line recommended program for W-80 flocks in India) has significant impact on growing period body weight, sexual maturity, hen-housed eggs and egg weight, compared to 24/12 lighting program.

Hy-Line Standard Step-Down Lighting Program

Age in Weeks	Light Hours	Growing Period		Stimulation and Laying Period
		Age in Weeks	Light Hours	
1	20	1	17	BW=100 g with 85% Uniformity
2	19	2	18	+1 hour
3	17	3	19	+1 hour
4	16	4	20	+1/2 hour
		5	21	+1/2 hour



Growing Period Results: The study shows that birds with standard lighting program had higher body weight after 4 weeks of age and achieved sexual maturity, 6 days earlier than 24/12 program.

I P Marketing Services ban China products

By Dr Onkar Pawaskar and Dr Mangesh Sagar

I P Marketing Services, a partnership firm and production hand of Volschendorf has always been a trusted name for its customers in Indian poultry industry.

With the current ongoing crisis with the China, we at I P Marketing Services has decided to stand strong with our country and try to do the best at our level as Indian citizens.

In a move towards the anti China products we assure all our associate customers and industry mates that we have BANNED CHINA RAW MATERIALS and stopped using them in our finished goods and strict measures have been taken to follow it. The purchase and production department has also been informed to check the manufacturing country before buying any raw material.

We now proudly announce that we are with our Indian government in its mission "MAKE IN INDIA" and also extend our gratitude toward our country by further extending the mission "PURELY MADE IN INDIA".

I P Marketing Services is engaged into the business of manufacture and marketing of poultry feed additives and supplements for Indian poultry industry and also for supply to certain Asian and European countries.

I P Marketing Services has involved in identifying quality conscious, genuine and reliable raw material suppliers. Initially started with only one product, the company has now more than 30 products in its portfolio. The company is now a proud manufacturer of many poultry feed additives and supplements like cocktail enzymes, toxin binders, pellet binders emulsifiers etc.

I P Marketing Services has also received ISO 22000:2005, ISO 9001:2015 and FAMIqs certifications. FAMIqs has made IPMS a more reliable and quality partner for many industry mates and also to many others who wants to get associated nationally. I P marketing Services is now one of the most trustworthy suppliers of poultry feed additives and supplements nationally and globally.

For any queries please contact

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Vetphage Extends a Helping Hand to Support Poultry Farmers During Lockdown

Vetphage offered bacteriophages feed additives – BAFASAL+G to farmers free of cost

300 liters of the product worth 27 lakh rupees were distributed

June 2020: To help poultry farmers tide over the market crunch caused due to the COVID 19 pandemic, Vetphage Pharmaceuticals, in collaboration with its parent company Proteon Pharmaceuticals, distributed their top of the line poultry feed additive BAFASAL+G free of charge to farmers.

Poultry farms in India were already facing pressure on their profit margins due to the steady increase in feed prices. The government's decision last year to increase the minimum support prices for soybean and maize, two of the products most commonly used as poultry feed, led to an increase in the cost of production of a poultry. At a time when they were struggling to pass this on to the consumers despite a demand, the coronavirus pandemic turned everything helter-skelter. When the news of the pandemic started spreading, misinformation spread along with it, and a lot of people were inundated with erroneous forwards that claimed that the virus can be transmitted through the consumption of poultry meat. This caused the demand for poultry meat to



Dr. Ramdas Kambale

drop, and the prices dropped along with it, from over 75 rupees per kg to 5 rupees per kg, in just over a month

Despite efforts by the Ministry of Animal Husbandry, Department of Health and Family Welfare, Poultry Federations of India and Breeders Associations across the country to quell the rumours, the panic had settled in and the public started

avoiding meat & egg consumption, which led to a sharp fall in demand, and a huge setback for farmers who depended on farming poultry for their livelihood. "Since poultry is a low margin commodity, it takes over 10 production cycles to recover the losses, which are currently upwards of Rs. 20000 crores. This does not bode well for the economy either as the industry contributes 6-7 percent to our national GDP. Considering the dire situation, Vetphage Pharmaceuticals decided to give the industry a push by supplying high quality poultry feed additive (BAFASAL+G) to the farmers free of cost." Said Dr. Ramdas Kamble, Senior Vice President, Vetphage pharmaceuticals.,

BAFASAL+G is an innovative feed additive consisting of a cocktail of 6 lytic bacteriophages, with 2 phages targeting *S. Gallinarum* specifically, without any negative impact on the gut microbiome of chicken. By directly impacting *Salmonella* bacteria, BAFASAL+G helps create space for good bacteria to proliferate, thereby improving gut health, bird performance and preventing high mortality in broiler, layer & breeder flocks. BAFASAL+G also helps to reduce the usage of antibiotics and improves profitability.

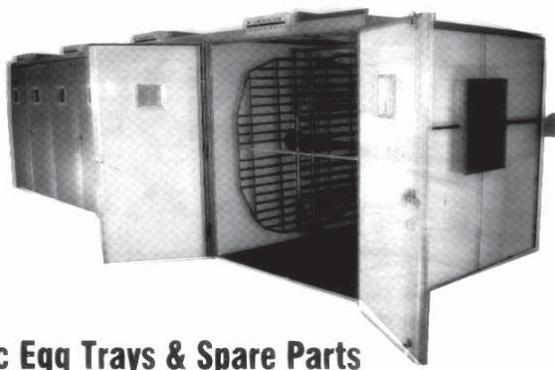
Vetphage has successfully distributed over 300 liters of the product, valued at over 27 lakh rupees, to 57 poultry farmers across the country. The product has shown proven results when it comes to improving the efficacy of flocks, increasing the body weight of broilers, and increasing production performance during the moulting and post moulting phase in layers.

A lot of farmers have already shut farms due to the current crisis and the viability issues. If the current trend continues, poultry farmers will end up facing more losses. Not only will it disrupt their livelihood, it will also affect livestock production, and have an adverse impact on the market, which will in turn affect more farmers and stakeholders. Meanwhile, the institutes that finance players in the industry are looking forward to more concrete policy support and guidelines from the central government so that they can issue fresh working capital to businesses who are looking to revive the slump in their production. With their initiative, Vetphage Pharmaceuticals joins the government and other industry players in their efforts to boost production and sales volume of struggling poultry farmers, and they intend to continue supporting them in the future.



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PRESS RELEASE

DSM to add world-leading animal nutrition and health specialty businesses with acquisition of Erber Group

Heerlen, NL, 12 Jun 2020 08:00 CEST

Royal DSM, a global science-based company in Nutrition, Health and Sustainable Living, announces that it has reached agreement to acquire Erber Group for an enterprise value of •980m. The value of the transaction represents an EV/EBITDA multiple of about 14x the 2020 EBITDA (fiscal year ending September 2020). The transaction – which excludes two smaller units in the Erber Group – is expected to be earnings enhancing in the first year upon completion.

Erber Group's specialty animal nutrition and health businesses, Biomin and Romer Labs, specialize primarily in mycotoxin risk management, gut health performance management, and food and feed safety diagnostic solutions, expanding DSM's range of higher value-add specialty solutions. Romer Labs also complements DSM's human nutrition and health offering to food industry customers. Sanphar and EFB, representing 7% of Erber Group's total sales, are not included in this transaction.

The acquired businesses have combined sales of •330m and an Adjusted EBITDA margin above 20% for the twelve months to the end of March 2020, with a high single-digit organic sales growth rate over the past 5 years. The acquisition will be debt financed, with committed bridge financing in place. DSM continues to benefit from a strong balance sheet and remains committed to maintaining a strong investment grade credit profile.

With state-of-the-art research and manufacturing facilities and approximately 1,200 employees around the world, the acquisition of Erber Group is a unique strategic opportunity that provides revenue-enhancing synergies from the combined offering, global customer base, and complementary geographic strengths. Austrian-based Erber Group offers DSM the opportunity to enter the mycotoxin

risk management market as the world leader and extends the company's position as one of the top suppliers in the rapidly growing animal gut performance management market.

Mycotoxins occur as a result of natural fungus contaminants in animal feed and threaten the health of both animals and humans. In addition to increasing the risk of illness, mycotoxins also reduce the nutritional value of feed. Biomin's patented and proprietary technology provides the most scientifically advanced mycotoxin protection available. Biomin is also a major producer of phytogenic and probiotic feed alternatives to antibiotics, which complements and strengthens DSM's position in the rapidly growing global eubiotics market for improving animal gut health.

Romer Labs is at the forefront of diagnostic technology with innovative testing solutions for the analysis of mycotoxins in feed and food, food allergens and pathogens as well as veterinary drug residues, with accredited full-service labs in Austria, UK, USA and Singapore. DSM's extensive global network of food and beverage customers as well as feed customers stand to benefit from Romer Labs' expertise and the combined group's data-based quality assurance offering.

The acquisition of Erber Group further strengthens DSM's expertise and reputation as a leading provider of animal health and nutrition solutions for farm productivity and sustainability, with an emphasis on emissions reduction, feed consumption efficiency, and better use of water and land.

Geraldine Matchett and Dimitri de Vreeze, Co-CEOs of DSM, said: "*These are great businesses with strong and sustained track records of profitable growth and attractive margins. Biomin and Romer Labs will help strengthen and accelerate the growth*

of our specialty animal nutrition and health offering, including our big data and diagnostic capabilities, and it is exciting to be entrusted to take these family-founded businesses forward. It was immediately clear to us that the people at Erber Group share our purpose-led mission and will make a wonderful addition to DSM".

Dr. Erich Erber, Founder and President of Erber Group, commented: "In DSM, I recognize the mutual values of sustainable stewardship that are so important to us. The world must reduce farming's environmental impact at the same time as increasing protein production to feed 10 billion people by 2050. To do that, we have to make sure protein is produced sustainably, using renewable ingredients as much as possible, while protecting the well-being of animals. DSM is the perfect home for our businesses, as Biomin and Romer Labs will be able to use their new scale to intensify our

joint contribution to a more sustainable world's food supply".

The transaction, which remains subject to customary conditions, is expected to close in Q4 2020.

More details can be found in the below Presentation to Investors.

Related links

- [Presentation to Investors: Acquisition of the Erber Group](#)

For more information

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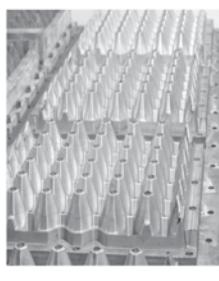
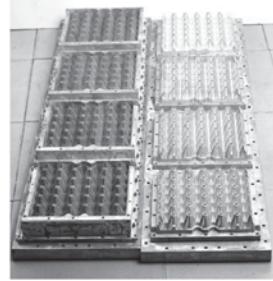
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WELTEC BIOPOWER Builds Biogas Plant for Greek Abattoir

Efficient Bioenergy Generation from Animal Waste

In the summer of 2020, the German plant manufacturer WELTEC BIOPOWER will start building a biogas plant in Veria, northern Greece. The main investor and operator of the project is one of the largest abattoirs for cattle and pigs in Greece. The 500-kW plant – which WELTEC has planned in collaboration with its Greek partner Tetoros Machinery in Megara – is set to go live as early as mid-November 2020.

For many years, a lot of animal waste has accumulated in the north of Greece. According to the Greek research institute CRES, the waste from animal husbandry and slaughtering throughout Greece amounts to 17.5 million t/year. This corresponds to a potential biogas capacity of approximately 370 MW. The capacity currently installed in Greece is only about 83 MW.



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The anaerobic digestion process will mainly use cattle manure and meat processing leftovers. Apart from these substrates, the 4,903-m³ stainless-steel digester will also be fed with production wastewater and fats.

The new WELTEC plant in Veria will make use part of these resources for the generation of energy. The anaerobic digestion process will mainly use cattle manure and meat processing leftovers. Apart from these substrates, the 4,903-m³ stainless-steel digester will also be fed with production wastewater and fats. The input substances will come from the operator's own abattoir and farms as well as from farmers in the vicinity.

The highly efficient digestion will start with a customised input process. For this purpose, the substrates will first be loaded into a 60-m³ moving floor feeder. The feeder will transport solid substrates, such as orange peels, to the **MULTIMix** unit, where they will be shredded and then pumped to

the digester. Liquid substrates will be pumped directly into the digester from two storage units. „Following the digestion process, the entire digestate will be treated in a downstream hygienisation unit”, explains Alain Priser, International Sales Manager at WELTEC BIOPOWER.

Meanwhile, Greek investors are looking for such custom-tailored plants in order to make profitable and climate-neutral use of the wide variety of raw materials. This is the only way how the share of renewable energies in the power generation can be doubled from the current level of 30 percent to 60 percent in 2030. This target was defined in National Energy and Climate Plan 2021 to 2030 (NECP) adopted by Greece. An intermediate step will be to shut down 14 coal-fired power plants in the next five years. Besides natural gas, renewable energies are to play a key role in closing the resulting power supply gap.

In the coming decade, Greece will invest some •9 billion in such plants. During this period, the installed biogas and biomass utilisation capacity is expected to triple. In this process, new laws are to provide investment security. „The Greek power grid operators will be required to preferentially connect these plants to the grid, purchase their electricity and pay defined minimum prices”, explains WELTEC's Greek partner John Tetoros. Tetoros Machinery and WELTEC BIOPOWER have collaborated in the Greek energy reform since 2007. With a portfolio of 18 plants and extensions that they have set up, they are the market leader for biogas plants in Greece. Based on the concept of the latest plant in Veria, more plants are likely to be added to the portfolio.

Company Portrait

WELTEC BIOPOWER GmbH is one of the world's leading enterprises in the field of stainless-steel biogas plant construction. The company has planned, developed and built anaerobic digestion plants since 2001. Today, the medium-sized company has about 80 employees at the headquarters in Vechta, Germany, and has established more than 300 energy plants in 25 countries worldwide. The global distribution and service network spans six continents. The range of customers includes businesses from the agriculture, food, waste and wastewater industries.

The strength of WELTEC BIOPOWER lies in custom-tailored design and technically mature solutions for projects up to 10 megawatt capacity. In this context, the high proportion of internally developed components is a key success factor. The company also owes its leading edge to the use of stainless steel. This enables the input of a diverse range of feedstocks, a fast and economic assembly and a consistently high quality standard ? regardless of the location.

After a biogas plant goes live, WELTEC BIOPOWER offers additional support through its experienced mechanical and biological service team. 24/7 availability contribute significantly to the efficiency of the plant.

Nordmethan, a subsidiary company of WELTEC BIOPOWER, addresses another business area: The operation of biomethane plants and the provision of heat through energy contracting. In this way, the WELTEC Group covers the entire value chain of energy generation with biogas and biomethane – from the plant construction to the plant operation.

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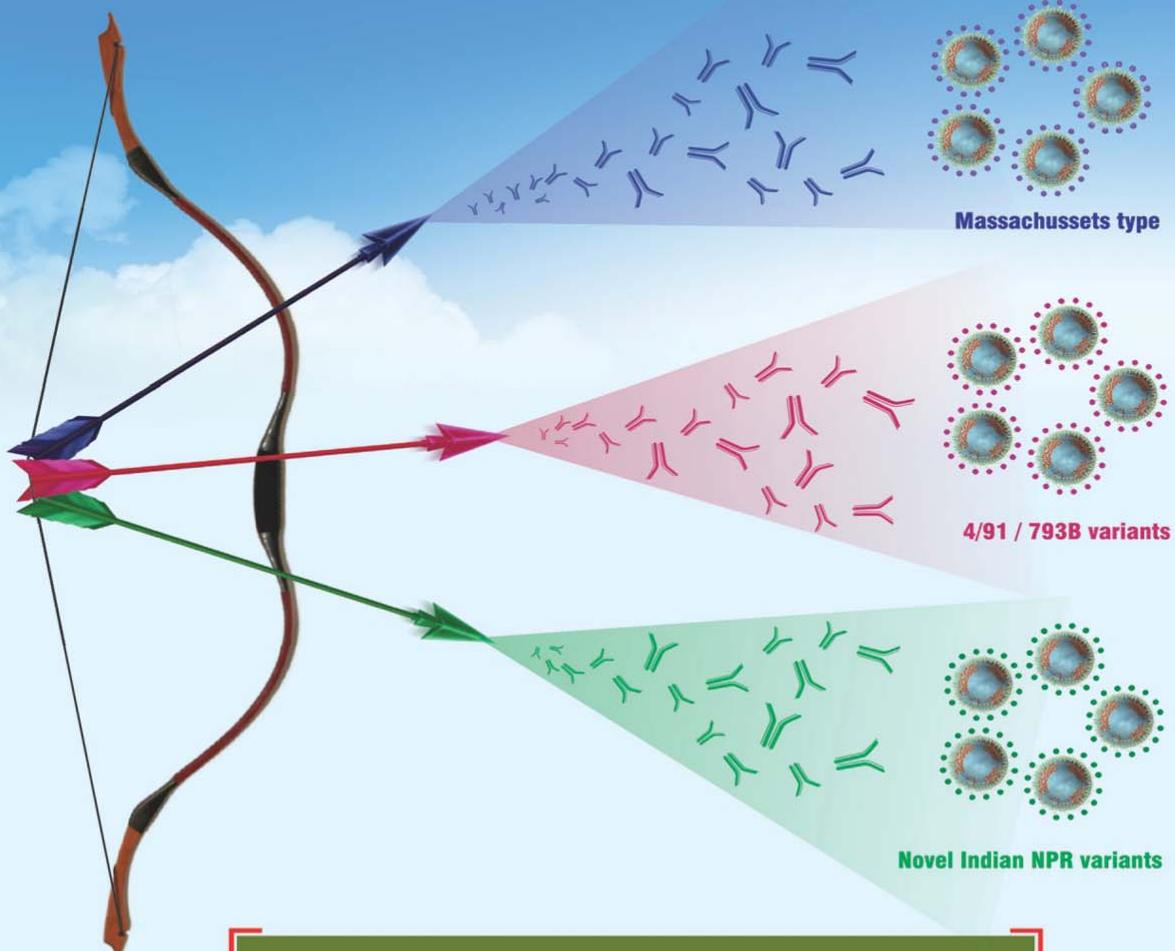
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