

## MANAGING CARBON DIOXIDE

Chick Master people are certainly not experts in the world of avian biology. Sure we have some folks with degrees in that kind of thing and we invest in the research by the well-respected universities, but we won't pretend that we know everything there is to know about the interaction of a fertile egg and the setters and hatchers that we sell.

However, we do have some thoughts and we have spent some time evaluating how our thoughts translate into results in the real world. The purpose of this document is not to bore you with scientific theory that few of us understand; it's to share with you what we think, why we think it, and what information we have to believe that our thoughts are correct.

Experiments in CO<sub>2</sub> levels began many years ago when our Buckeye group started recommending single stage setting and the use of fully closed dampers. No one really understood why, but the hatch results seemed better. Closed dampers meant higher humidity levels, more stable temperatures and more demand on cooling capacity. Everyone understood that but no one understood how they impacted upon one another.

About six years ago we began researching the effect of carbon dioxide as a variable element by keeping temperature and humidity levels constant while injecting carbon dioxide into the setter chamber. In most cases we found significant benefits in the formation of the embryo. But, since nothing is that simple, we also found cases where the impact was negative. We tried changing temperatures, humidity levels, carbon dioxide profiles and adjusted the air flow characteristics. Gradually a picture came into focus. We thought we knew what worked best, but we had no idea if there was any scientific support for what we believed.



We researched the publications available in our industry. In almost all cases the research didn't deal directly with the hatchery process or the methodology of the research was flawed. We had reached several conclusions that we were looking to refute or confirm. Among them:

- We found that eggs from old flocks and eggs that were old (7 days plus) seemed to perform far better when the CO<sub>2</sub> levels were elevated in the early part of the set;
- We found that eggs from young flocks and fresh eggs reacted negatively to elevated CO<sub>2</sub> early in the set;
- We found that when the two positives were combined (old flock, old eggs) the effect of the CO<sub>2</sub> was amazing, frequently improving the hatch by as much as 5%. Conversely, when the two negatives were combined we had a very poor hatch often reduced by 2% or more against a control group;
- We found that embryo growth in the early days of a high CO<sub>2</sub> set was measurably better for a while. But, sometime around the end of the 6th day the growth curve seemed to invert and the low CO<sub>2</sub> embryos closed the weight gap;
- We found that embryos that started in fairly high levels of CO<sub>2</sub> (up to 1.2%) seemed to be able to handle high CO<sub>2</sub> late in the process (days 17 and later) without damage, but embryos introduced to high CO<sub>2</sub> for the first time late in the cycle suffered severe late death, hatcher death and early farm mortality;

About that same time we began to apply the principles we believed in to the multistage process. We created the HOOCHO bird (COO and HHO anagram) to tell the world that managing carbon dioxide and humidity were the keys to quantity and quality of hatch. We showed that increasing the carbon dioxide level in the setter (to about 4,000 parts per million) resulted in a better hatch percentage and heavier, healthier birds. The carbon

## Announcing our 2007 Open House

October 17-18 - Medina Ohio



**Chick Master is pleased to invite you to attend our annual Open House in Medina, Ohio. We have organized a power-packed two day program of presentations on the process of incubation, the importance of good ventilation, and the latest technology in energy management. Single stage incubation tips, energy saving upgrades now available, the latest equipment innovations - all on display and open for discussion.**

For more details and a registration form please visit [chickmaster.com](http://chickmaster.com) or contact Patricia Montane by telephone on +1 (201) 871 8810 ext 106.

dioxide helped, but the reduced air flow also stabilized the temperatures and reduced/eliminated the use of humidity sprays and the horrific impact those sprays have on fertile eggs.

The results of our research with the truly intelligent folks are telling us that what we saw intuitively is borne out physiologically. The higher CO<sub>2</sub> levels in the first six days coincides with the period where the embryo is developing its major organs and vascular systems. Both of these developments are improved by the presence of carbon dioxide. After the sixth day, the continued development of the embryo requires oxygen. Since carbon dioxide and oxygen compete with each other, the presence of one roughly translates into the absence of the other. Therefore, the decision to open dampers on or about the sixth day has proven to be the correct recommendation.

The increased carbon dioxide level also slows the deterioration (thinning) of the albumen. Since the older eggs/older flocks already have thinned albumen, this impact is critical to the increased hatch we saw. The other

See us at:

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11 to 14 September  
Rennes, France

## Another day at the Ventilation Psychiatrist's office

By Ty Phoon and introducing his new associate Cy Clone

**H**ello again. Ty Phoon here, You can call me Doc Phoon. I'm sure you remember that I'm a psychiatrist dealing with hatchery related depression and other emotional disorders stemming from misuse and misinformation. Ha! No shortage of potential clients in this profession!!! In fact, I've already had to add a colleague in North America (talk about a place loaded with opportunity!). My new associate, Cy Clone, has only just joined the practice and already he's "booked solid". Get the joke? See, our practice is based on erroneous use of moisture, air and other gases---no "solids". So it's really funny to talk about being "booked solid". Well, OK so it loses some of the humor when you have to explain it.

Let me tell you about my most interesting case since we were last together. About two weeks ago into my office rolls a spray nozzle. One of the most severe cases of depression I've ever seen. Seems this patient and his entire family have lost their jobs. Clearly he had been crying a lot since every few seconds large droplets would go flying all over my egg tray décor. At first I thought his problem was compounded by an allergic reaction (he was sooo stuffed up he could hardly spit!), but then I realized that he was simply clogged up from working with the typical hatchery supply water.

I asked him to lay in the vinegar bath so he could clear his head a bit (a little trick I learned from a former patient who ran a hatchery that didn't have water chillers--just a few days before he suffocated himself by standing in a 500 CFM air flow). I told him that spitting all over my egg trays was going to cost me a bunch of money and he didn't have insurance to pay for that. He did as I asked, but I have to admit it didn't help for long. A short time later he was right

back to spluttering and splashing all over my valuable stuff. I understood why everyone else wanted him out just like I did.

"Why has this happened to us?" he asked as he blubbered and splashed.

"We have done this job for years. Setters, hatchers we didn't care. We went right into the heat and "whooshed" away. Gallon after gallon, we did what they wanted.

Air came and air went, but we stood like sentinels, guarding against dryness. Minerals clogged us up, we endured the indignity of the vinegar baths; some of us were destroyed irreparably after only weeks but we did as they asked. Now along comes this HOOCHO bird and we are thrown away like yesterdays eggshells. Why, oh why??"

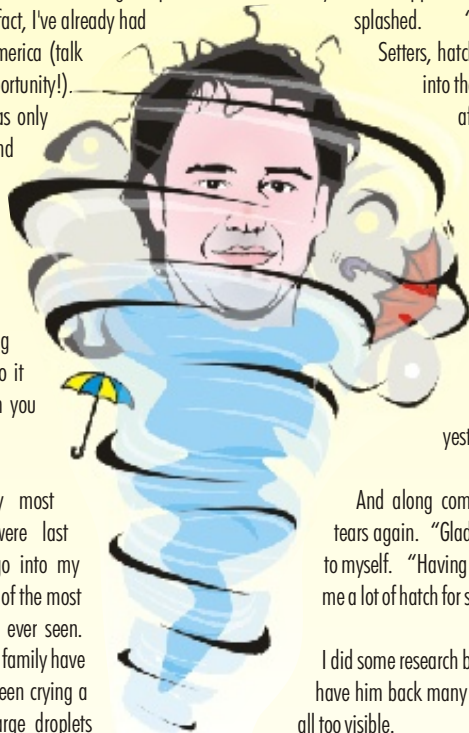
And along come the splashes of mineral enriched tears again. "Glad my furniture isn't an egg" I thought to myself. "Having stuff like him around eggs would cost me a lot of hatch for sure."

I did some research before his next visit. Couldn't afford to have him back many more times. The water stains were all too visible.

When he returned, I gave him the bad news. It seems that this HOOCHO concept was gaining total acceptance and had permanently changed the world he used to know. I found that it had completely changed the way people approach incubation. Seems they now realized--in increasing numbers---that humidity sprays like him were extremely damaging to the setter and hatcher environment. Reduced hatch numbers, wider hatch windows and dehydrated chicks all traced to him.

"Your time is past my friend" I told him as gently as I could. People have learned to run setters using humidity control. Since they have reduced the amount of moisture they remove from their setters by cooling with water inside pipes, they don't need to spray

*Continued on page 3 column 1*



Meet my new associate Cy Clone.

If Spare Parts are a puzzle to you...



visit our on-line shop at  
**www.chickmaster.com**  
*and start earning points today*



To Our Hatchery Friends:



## The worlds premier Single Stage system

Chick Master Avida systems are the result of many years of development that was begun by Chick Master France in the 1980's. The design of the setter has not radically changed over the years but a great deal of fine tuning has resulted in a machine that has become recognized as the ultimate for performance, simplicity of operation and bio-security. It has now been sold in every continent of the world and over 60 countries. Avida systems have consistently performed superbly in trials resulting in Chick Master recently winning highly prestigious projects in Germany, France and Mexico to name but a few. Notably the PHW Group Rechterfeld project in Germany was won against very stiff competition and, when finally completed, will be the largest and most modern hatchery in the world, setting an incredible 3.5 million eggs per week. Chick Master has also supplied its ground breaking Heat Recovery and Energy Management Systems for this project. Indeed, energy conservation is rapidly becoming a major factor in the decision making process for new hatchery projects and Chick Master is well positioned to provide the complete package that today's leading companies are looking for.



Loading an Avida single-stage setter. Avidas have just one trolley positioned each side of the central paddle fans to ensure that the optimum heating, cooling and ventilation are provided at all times directly and without obstruction.

Over the coming months you will see many articles highlighting some of the hatchery projects, big and small, that Chick Master has supplied around the world for broiler, layer and breeder operations.

Watch this space! 

Another day at the Ventilation Psychiatrist's office - continued from page 2

water into the setter. The temperature stays more consistent and they have eliminated the water splash on their valuable fertile eggs. Maintenance costs have dropped. They are not coming back to you." He cried, again getting blotches of water on my floor and my couch. "What about hatchers!" he practically screamed, grabbing onto this last bastion of hope. "Surely they will never take me out of the hatchers!!" It pained me to have to tell him the truth but he had to face reality.

"They don't want you in the hatchers either." I tried to soften the devastation as my words hit him like an exploder going off in a telephone booth. "Well, maybe some of the high altitude hatcheries or a few of the layer hatcheries might still offer some hope. But the rest are also realizing that you don't belong." I told him the whole truth despite his blubbling and spitting. "It seems that you only make chicks more uncomfortable in hatchers. It looked like you were helping, but they have realized that all you do is make the air heavier and more difficult to breathe. You cause the chicks to pant, further dehydrating them. They want you out."

"Unbelievable!!" Faced with his total elimination from the world he had presided over for decades, the desperation of his position hit him fully in the spray hole. "But I have friends out there!! I have hatchery managers who still believe in me--I even have consultants who have not lost faith in me. I can come back!!"

"I am Ty Phoon" I reminded him. "I spend all of my working hours helping the gods of the past accept that times change even in hatcheries. You must accept this. The HOOCHO bird has won. You have some time yet! Use it wisely while some out there refuse to hear the word of the new order. Use it while there is still equipment out there that simply can't work without you. But realize that even the friends who made equipment that required you have now abandoned you. Even the high priests of air cooling have converted. They have repented their old misguided ways."

The humidity level in my office was unbearable. The tears flowed unceasingly. Large chunks of calcium clattered to the floor. "This session is almost over. In the time that's left, consider your future. Save yourself. Retrain. Perhaps a job in the greenhouse department?" He brightened up. "Yes, of course" he said. "The plants aren't smart enough to get upset when we clog up and leave blotches all over them! Heck, some of those places get a premium by selling the worst ones as "variegated leaf" specialties!! I'm on my way to the hot house!"

Another success story for Cy Clone.

By the way, Ty and I are starting an outplacement service for old spray nozzles. We have already signed a partnership agreement with the Chick Master team to get them to spread the word to the still unenlightened. We're working on the other setters and hatcher teams out there, but for some reason they don't completely understand this brave new world. Beware the technical or sales consultant wearing a raincoat.

The "Ty and Cy" road show is appearing daily in hatcheries all around the world. Look for them in your neighborhood soon! 🐔

## The Art of

# STAGE PROGRAMMING

## Part Six: Auto Damper Low Humidity

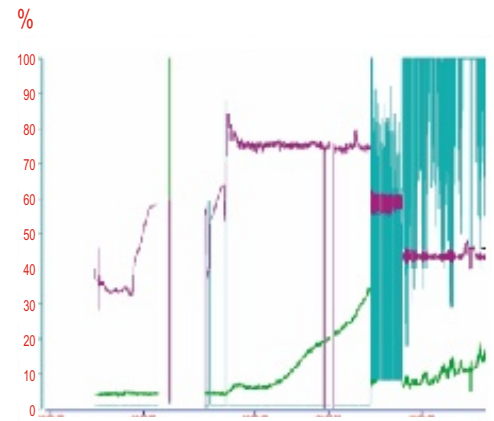
In continuation of the Articles which were contained in our previous Chick Master E-news Bulletins, we are now in a position to look at the next stage of the "Step" program, again examining in detail what is happening, how it is happening and why it is happening.

This stage is shown below and is from a recommended stage program used in many Chick Master Avida hatcheries throughout the world.

### STAGE 6: AUTO DAMPER LOW HUMIDITY

In e-News #8 we covered Stage 5, the Auto Damper High Humidity phase, where we made subtle changes to the incubation conditions to meet the developing embryo's changing needs. We are now at day 10 of the incubation cycle where there continues to be a substantial increase in embryo heat output. To cope with this, the temperature set point is lowered, but at the same time ensuring optimum embryo development is taking place.

The control of the damper remains in Automatic Humidity Control (AHC), but with the need to ensure egg weight loss is taking place at the correct level the humidity set point is lowered from 45% to 40% RH. Additionally, the minimum damper set point is increased so that the damper remains open at all times in order to achieve the correct weight loss.



Composite Graph showing RH% (purple), damper position (blue) and CO<sub>2</sub> values (green) from a typical Chick Master Galaxy System plot. (Please note that the CO<sub>2</sub> scale is not shown)

This can be seen from the graph, illustrated above, showing the RH% decreasing from the closed-up stages of the step program through to the Auto Damper (High Humidity) and Auto Damper (Low Humidity) phases. This is a reaction to the embryos increasing oxygen consumption and the subsequent increase in CO<sub>2</sub> and heat output.

Having reacted to the embryos ever-changing needs by adjusting the machines conditions through the step program we are now ready to advance to Stage 7 and temperature reduction.

In subsequent E-News Bulletins, we will discuss further the ever changing needs of these embryos as we move towards the temperature reduction phase 🐔

Stage Number	6
Temp Set Point	99.3
Temp High Alarm	100.2
Temp Low Alarm	98.8
Humid Set Point	40.0
Humid High Alarm	65.0
Humid Low Alarm	20.0
Man. Damper Set Point	20.0
Min. Damper Set Point	20.0
Damper Mode	AHC
Cooling Mode	Wat
Aux Fan On At Damper	40.0
Aux Fan Auto/Man/Off	off
CO <sub>2</sub> Set Point	0.0
CO <sub>2</sub> High Alarm	2.0
CO <sub>2</sub> Low Alarm	0.0
Turning Tilt Time	55.0
Level Time (mins)	5.0
Time In Hours	120.0
	Auto Damper
	Low Humidity

Chick Master stage program showing Stage Six the Auto damper Low Humidity phase



David Marsh

## Ask the Eggsperts



Angel Salazar

Your chance to ask our hatchery and embryology experts the questions.

**Q** What is chick yield and how is it best to be measured?

*Mr J.T. - Norway*

**A** The chick yield figure is best to be based on accurate figures of average egg weight from a sample of eggs and an average chick weight from these eggs. If three setter trays of eggs are weighed per flock, minus the weight of the setter trays, then this is usually enough. The chicks from these three trays can then be weighed in order to calculate their average weight and what percentage they are of the starting average egg weight. Generally a figure of 67-68% is the best range to have for day old chicks. If actual starting egg weight figures are not available then a sample of eggs can be weighed on hatch day. The calculation of chick yield can then be done based on standard egg weights but then adjusted to the Parent Stock (PS) age at the time the set took place (i.e. 3 week prior). The percentage over or under that the chick yield is, (based on standard egg weight), can be used to adjust the actual chick yield figured on hatch day.

**Q** Why is my chick yield figure so high and what is the effect of this?

*Mr J.T. - Norway*

**A** Providing the approach is as detailed above then it is possible to monitor chick yield accurately and link it to farm performance on a regular basis. It can be used as a basis to fine tune the incubation process. In some instances, if average egg weight figures are not available and based on standards from a PS guide, this can give chick yield figures that are too high. In many cases actual average egg weight is often above the PS guide standards, which of course will give higher average chick weights. On the one hand if chick yield is above target, say 70%+ it will lead to heavy sluggish chicks which will not start well. On the other hand if chick yield is too low, say 65% or less, then it can often indicate dehydrated chicks, which again are not a good thing.

*Managing CO<sub>2</sub> in the Hatching Process - continued from page 1*

side of that coin is that the young flocks/fresh eggs need the lower CO<sub>2</sub> levels to allow the thinner albumen necessary to permit the embryo to locate itself correctly in relation to the yolk sac. We knew it worked, now we know why.

We also realized that the eggs themselves produce very little CO<sub>2</sub> in the first few days. Those first few days are very critical to the old flock/old egg sets. For that reason, we offered CO<sub>2</sub> injection systems. Young flocks and/or fresh eggs don't need CO<sub>2</sub> injection. Where is the exact line of "need/don't need"? We don't know that yet. It's still a research in progress. To find that key, we need more information on the definition of albumen quality and we are working on getting that.

These realizations assured us that opening the dampers at or about the sixth day also eliminated any concerns we had about egg dry-down. The old theory of targeting weight loss at 15% of the initial egg weight proved to be grossly incorrect. Instead, we found that 9% to 11% at transfer (18 day/19 day) is the correct target. The difference is simple to explain -the CO<sub>2</sub> enhanced embryo is heavier. More calcium has transferred from the shell to the skeleton and the yolk lipids have been more efficiently converted to muscle, therefore the weight is inside the chick! In all but the most extreme conditions, opening the damper at 6 days gives us more than enough time to properly dry the egg. In cases of inadequate ventilation systems, some adjustments are needed. However, dehumidification has not been required anywhere with the system we employ.

In summary our system has been developed by careful evaluation of real world results for many years then confirmed by research. We believe in both worlds, we simply believe that the real world has more value than the theoretical one. There may and most certainly are improvements that remain to be discovered. For now, we are comfortable that the system of CO<sub>2</sub> management and humidity management that we propose (the HOOCHO concept) will bring you results that you will be proud of. They will also make you profitable! ☺

## FUN TIME

Why did the chicken cross the road ?  
To get to the other side

Why did the rooster cross the road ?  
To cockadoodle dooo something

Why did the rubber chicken cross the road ?  
Because she wanted to stretch a leg

Why did the turkey cross the road ?  
To prove he wasn't chicken

Why did the chicken cross the road, roll in the mud and cross the road again ?  
Because he was a dirty double-crosser

Why didn't the chicken skeleton cross the road ?  
Because he didn't have enough guts

Why did the chicken cross the playground ?  
To get to the other slide

Why did the turtle cross the road ?  
To get to the shell station

Why did the horse cross the road ?  
Because the chicken needed a day off

## DID YOU KNOW?

The longest recorded flight of a chicken is 13 seconds.

Chickens cannot see the color blue - Owls are the only birds that can.