MODERN TECHNOLOGY IN TABLE EGG PRODUCTION

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It is a great pleasure for me to have the honour today to address such a numerous audience about the automation of the modern poultry industry. I thank you all for being present here and I hope that one or more of the subjects will be the reason for you to have a more detailed conversation with us either later today or tomorrow. In vicw with the limited time available for my participation to this seminar, you will understand that I have to concentrate on the most important aspects answering the question : "Which requirements have to be made for modern equipment for poultry houses". It will be clear to you that it is not easy for me to answer this question in a few words. This question, I was already confronted with when I was Technical Director of an international poultry equipment supplier.

Including the time I own Farmtec, also active in the development and manufacture of poultry systems, this question has kept me busy during a few decades since the well known Flat-deck batteries were introduced. In the past, numerous manufacturers in many countries have been working more or less intensively on the development and perfecting of just as many types of laying batteries. As a result of this in various countries or regions specific types of laying batteries have been used, suitable for local temperatures, habits and financial possibilities. As a consequence of practical experience with different systems some of these have disappeared, while others were developed to meet continuously increasing requirements and the environmental problems in various highly populated countries. Now in 1991 we all agree that large-scale production of table eggs not only depends on the laying battery, but also depends on many other aspects, such as :

A. Prevailing temperature in relation with :
   - constuction of poultry houses
   - insulation of poultry houses
   - ventilation / cooling of poultry houses
   - ventilation of batteries

B. Available labour and motivation in view with the grade of automation for feeding, egg collection and manure removal.

C. Financial means related to the establishment of a project, its size and future possibilities for expansion with in the project budget.

D. Quality and cost of feed in relation with the condition of egg producing birds or the need for feedrationing.

E. Welfare and environment aspects in some countries related to animal-friendly farming and nuisance to the surroundings in view with subjects as manure-and ventilation.

Before entering into specific details of requirements for poultry systems and automation there of, I consider it usefull to emphasize on the general though also important points concerning poultry house design.

Layerhouse

Already in an early stage of project planning considerations have to be made about the position of the house in relation with the position of the sun and/or prevailing wind directions in view with temperatures and effects of wind. These aspects will influence the recommendations to be made for insulation of the these poultry house and the type of ventilation and/or cooling system. Alth ough the building materials and habits can vary from one country to another, it is recommendable to involve the supplier of poultry equipment in the house design. In general such companies have a wide experience in this field. Usually the floor of the poultry house contributes to the building costs to a large extend and it has to be made in accordance with the type of battery to be installed. It therefore has to be designed in close cooperation with the supplier of the batteries, also considering the type of manure removal system to

be installed.

Ventilation of a layerhouse

No doubt it will be known to you that optimum production not only depends on the brand or type of battery. There should always be continuous efforts to obtain the most favourable living conditions for the layers since in the end these have to produce the eggs. Particularly in hot climate areas the ventilation system has to be selected critically.

(fig . 1) Especially in countries like korea and Japan we have applied floor-ventilation successfully in many poultry houses. The fresh air is blown in by fans via openings in the floor from underneath and the hot air is taken out from the ridge. This proces of up-going hot air is in accordance with nature and consequently such a system can be considered as energy - saving. Air-inlet curtains or baffles are not required for this system.
Consequently the house can be darkened and a light programm can be made, which has positive effects on feedconsumption, cannibalism and pecking at eggs by the birds. This system can be seen as a combination of natural ventilation as often applied in Holland and mechanical ventilation. My colleague Mr. Cremers of Fancom will go into more details about possibilities of automatic ventilation of poultry houses.

The laying battery

In view with time available, I will concentrate on manure belt batteries, being popular in Europe and in Asian countries as well. The reasons of this popularity are :

(fig. 2) A. Narrow battery design, flat floor of poultry house, low concentration of ammonia and less nuisance by flies because weckly manure removal.

B. Possibility for manure drying on the battery untill approx. 45-50% dry matter.

Although manure belt batteries require a higher investment compared with California - or stairstep batteries, the floor of the poultry house does not require manure pits, which results in lower investment in civil works.

Next I consider it usefull to mention some important details that are the basis for high quality :

1. All metal battery components have to be properly galvanized against corrosion with a zine layer of minimum 20 micron. Cage bottoms have to be galvanized smoothly and after welding.

(fig. 3)

2. Supporting battery parts like stands or cross bars should not be in touch with manure, to avoid corrosion shortening the life span of the battery.

All cage parts for which contact with manure cannot be avoided should be within reach of the birds' toes (nails) sothat these are continuously cleaning the parts concerned.

(fig. 4) Particularly for the cage bottoms this accessability is important for the life span. Under the bottoms there should not be any supports on which manure can build up. The same goes for suspension brackets or clips.

3.

(fig. 5) The battery structure should be of sufficient strength to carry a person inspecting the cages on the upper tiers.

4.

(fig. 6) Cage doors need to be opened over the entire cage width and beight, preferably by one hand. This will result in faster housing and removing of layers, minimizing damaging of the birds.

5.

(fig. 7) The cage partitions should preferably be solid and smooth. Solid partitions contribute to quietness and privacy of the

birds while also the birds' feathers are better protected of the feathers that protects the bird against heat or cold, which is very important for production results and energy needs. Often poultry farmers and battery manufacturers make objections against solid partitions, saying that these are badly effecting ventilation in comparison with wire partitions. These objections are understandable though fully incorrect, since it never appeared in practice. Ventilation of cages is only in cross direction and never from cages to cage. The heat produced by the birds is going up and never through adjacent cages.

6.

(fig. 8) The feedtroughs need to have properly designed anti waste rims on both sides to avoid spillage of feed.

7.

(fig. 9) When chainfeeding is applied, the feedtroughs need to be protected where these are connected to each other. Special wearlates for this purpose can double the life span of the feed troughs.

8.

(fig. 10) To protect the eggs in the egg channel, the cage must include a well positioned egg guard.

The egg guard has 2 funcions :

a. To avoid egg pecking by the birds provided the distance to the egg channel measures 14 cm. or more and an opening for the eggs to roll down of 55 cm. maximum.

(fig. 11) b. To avoid dead birds from sliding into the egg channel, which could cause eggs to pile up or fall down during automatic egg collection.

9.

(fig. 12) An essential part of the laying battery is the cage botiom, which is the first part of the battery being in contact with the eggs. As well the gentle receipt of the freshly laid egg as the gentle - and earliest roll down to the egg channel have positive effects on the egg scale quality, before the eggs are conveyed from the battrey to the central egg collecting area.

In view with the aspects I mentioned, following points need full attention when judging a laying battery :

a. The flexibility of the cage bottom

As often 20% of the layers lay their eggs in a standing position a flexible receipt of the egg by the cage bottom is absolutely necessary. This flexibility of the bottom is determined by the wire-thickness, the number of wires in the cage bottom and the connection of the bottom to the surrounding cage partitions. Preference must be given to cage bottoms made from thin wire of hard quality. Practice has shown that a wire diameter of 2,05 mm results in the lowest percentage of cracked eggs. It hardly needs saying that high-quality cage bottoms need to be hot-dipped galvanized after welding. The zinc layer should not contain any sharp points or zinc drops that could cause damage to bird's legs or eggs. Also the moveability (vibration) of a flexible cage bottom is important for immediate rolling down of the eggs.

(fig. 13) To obtain moveability of the cage bottom it should preferably not be fully fixed to the cagepartitions by hooks, clamps or clips. Freely supported cage bottoms, for example on a supporting wire, contribute to moveability.

(fig. 14) *b. The slope of cage bottom*

For an immediate rolling down of the egg out of reach by the birds, the correct slope of cage bottom is desired. Of course this slope should not be too steep. If so the speed of rolling down would be too high by which eggs can get cracked in the egg channel.
In Europe a lot of research has been done on the effects and consequences of various bottom slopes.
The conclusion was reached that a slope of 7,5 degrees can be considered as giving the best results.

(fig. 15) Depending on the hardness of cage bottom wires and their suspension, bottoms are allowed to bend to a certain extend. When a cage too long, causing an

increased percentage of cracks.

c. No cross wires under the feedtrough

Another point of importance for a properly rolling down of the eggs to the egg channel is to have no cross wires in the cage bottom where it is covered by the feedtrough. This place does not allow the birds to touch the eggs, which in fact means that eggs can remain there if croes wires are included.

By the points just mentioned I think that the most important cage details related to egg handling have been emphasized. Also about various egg collection systems many details can be said. Unfortunately time is a limiting factor. Mr. Jansen of Moba will speak about egg grading and packing later.

(fig. 16) *d. The wiremesh dimensions of the cage bottom.*

I also would like to mention the influence that the cage bottom has on the welfare of the birds. Apart from wire diameter and hardness also the number of cross wires is of importance to the flexibility of the bottom. There should be sufficient cross wires. A wiremesh of 1 x 1,5 inch is preferred. Very often other sizes are made, such as 1 x 2 inch and even 1 x 2,5 inch. The danger of such large sizes is that the birds' feet can easily get stuck in the cage bottom. Of course this should be avoided.

The manure belts

For manure belt batteries good, reliable and automatically operated manure removal systems are necessary. Since the manure can only be removed on via manure belts, breakdowns can cause considerable problems. Normally wet manure is removed twice a week and dry manure once a week. In view with this I consider it recommendable to convince you that a manure belt system can be operated automatically, without continuously checking and adjusting of the manure belts.

Complaints often heard about manure belt batteries are :

- poor tracking of manure belts, that deform at the drive roller if not adjusted frequently
- slipping drive rollers caused by poor contact with the belts
- damaged manure belts due to sharp parts in the battery
- poorly performing belt scraping blades that do not clean the manure belts sufficiently, thus causing remaining manure to enter various cages, increasing the risk of coccidioses

Although in the past most batteries were equiped with trevira manure belts, presently most belts are made of pp (polypropylene). PP belts are as well better as cheaper. As a result of a higher stiffness of PP, the belts can be better quided in the battery, preventing derailments.

(fig. 17)

PP belts cannot be installed under high tension because this material is less elastic. In view with this, extra pressure rollers in combination with the drive roller are necessary to avoid slip.

- 3 wide pressure rollers are preferred rather than 2 narrow ones
- the pressure rollers must be individually pivoted for proper tracking of the manure belts on the drive rollers
- the pressure rollers must be spring-loaded to allow for irragularities on the manure belts
- (fig. 17A)
  When the rollers are not spring loaded and without bearings, the belt will not be self-correcting which is shown in this picture.

(fig. 18) The non elasticity of PP belts and the expansion capabilities of PP, resulting from temperature differences, make it necessary to continuously check and adjust the belt tension. This is to avoid that the belt will become too slack and touch the floor or cages below, while tension can become too high during low temperature, causing deformation of the belts.

12. For manure drying warming up of the necessary outside air is desired, during most seasons. By heating the relative humidity of the air is decreasing which will result in a more effective drying of the manure. To warm up the air, 3 methods are known :

a. heating by so called heat-exhangers
b. heating by adding extra heat
c. heating via polyethylene-tubes, suspended near the hot ceiling of the poultry house
d. making use of air inside the poultry house (without heating)

a. Warming up by heat-exhangers

Many years of experience with heat-exchangers, cquiped with plastic-or glass tubes through which the hot inside air is blown, cannot be considered as positively. Some arguments are :

- heat-exchangers are very expensive
- heat-exchangers require much energy (electricity cost)
- heat-exchangers are used in types of poultry houses without sufficient space for other systems

b. Warming up by adding extra heat

Extra heat can be added to all systems (except d.) Additional heating can be required if :

- the capacity (efficiency) of the system used is too low
- the average relative humidity of the outside air is too high
- extremoly high requirements are made for manure drying (dry matter content of 50% or more)

Direct heating by open tire in air channels is not recommendable because of inerased risk of fire.

(fig. 23)

c. Warming up of air via polyethylene tubes, suspended near the house ceiling, whereby fresh outside air is blown trough these tubes over the entire house length, to the front of the house, is widely applied, because:

- the investment is reasonably low in comparison with other systems
- the efficiency is higher compared with other systems
- it hardly requires maintenance
- its energy requirements are low, provided the system is well designed and calculated.

d. If available inside air is used for manure drying, by fan blades located in the cages, the effect can be disappointing in houses where inside humidity is too high. This system does not allow for extra heat to be added to increase the drying effect. Moreover this type of system is relatively expensive which is caused by a large number of moving fan blades in the cages, that are not within easy reach and not quietly operating.

(fig. 23)

13. This drawing shows the principle of a well-functioning manure drying-and storage system, as successfully installed in many poultry farms. The fresh outside air is filtered to remove dust and flies, after which it is blown into polyethylene air tubes by centrifugal fans. Through these tubes, that are surrounded by warm air under the house ceiling, the fresh air is guided to the other end of the house. While moving in that direction exchange of heat is taking place with the result that the fresh air is warmed up by approx. 10 degr. C. Next the air is blown equally over the manure, via PVC airducts installed on both sides of the manure belts over the entire battery length. This results in a continuous manure drying proces. The fans can be controlled in 5 steps to adapt the air volume in accordance with the seasons.

For those countries where extremely high summer temperatures prevail, the heat exchange system can be by-passed sothat the fresh outside air is quided directly over the manure without warming up. Weekly the manure is removed from the battery and loaded into a container via cross-and elevating belts, for transportation elsewhere. Since the manure pre-dried on the battery can reach dry matter contents + 45-50%, it can easily be piled up and further processed.

(fig. 24)

It is also possible to convey the manure to a manure store weekly. By fermentation temperature of the manure will reach values of 70 - 80 degr. C. The moisture still present will evaporate sothat after 4-5 weeks the manure can become very dry with dry matter contents of 70 - 80%. This is a natural process whereby no extra energy is consumed.

For equal distribution in the manure store a so called centrifugal manure sprealer/disc can be installed. By means of this disc, which is speed controlled, the manure can be equally distributed over the entire surface of the manure store. This guarantees an optimum manure drying effect. Also nuisance by flies is minimized because the continuously developing flies are weekly covered by a layer of fresh manure. As the manure spreading disc is located near the ridge of the manure store, this store can be filled economically.

(fig. 25)

It is also possible to plan a manure store between 2 poultry houses. This requires a well adapted ventilation system. In this case the manure spreader is installed in such a way that it is moveable, for equal distribution of manure over the entire length of the store. At present 3 double poultry houses of this type are erected in korea.

(fig. 26)

Finally I would like to bring under your attention a completely new feeding system for birds kept on batteries, namely the " WIRCOM" computer controlled feedrationing system for individual feeding per cage. This WIRCOM-system has been developed by FARMTEC and is now operating in practice in many layer houses, with tremendous success. The conventionally available feeding systems, such as chainfeeding, feedcarts or augerfeeding all operating on the basis of volume without taking into account the actual number of birds present in the cages. The WIRCOM system is feeding on the basis of weight and can distribute most accurately the

correct amount of feed, based on the actual number of birds present in the individual cages.

The system is also automatically correcting the necessary feed amount of per individual cage in accordance with the prevailing temperature per cage. This temperature can vary from one cage to another, depending on the tier height and/or the location of the poultry house. WIRCOM is automatically recording dead birds removed from the cages, measured cage temperatures and the feed given per cage in grams with an accuracy of 0,1 gram. Also remaining feed in the feedtrough is detected and recorded per cage.

WIRCOM ensures accurate and reliable feedrationing per individual cage. This results in substantial feed savings. Another aspect of WIRCOM is that it ensures a iniform flock of birds, preventing overweight of the birds. Consequently mortality will be less and production will increase.

(fig. 27)

The WIRCOM system can be fully programmed and it operates fully automatically. Furthermore all key records per cage, tier and battery are shown and registered via a monitor or printer. It can also be connected to a poultry management computer system. This unique and sensational system was especially developed to achieve; savings in feedcosts, flock-uniformity, increased egg production and less mortality, all related to a perfect and optimum farm administration.

Having reached the end of my address, I realise that in your opinion some subjects may not have been explained sufficiently, while other points may have included too many details. Most of these subjects are important enough to have separate attention. I would therefore appreciate it very much to further discuss with you any questions or suggestions that you may have concerning these subjects, or other points related to these, within the time available for this purpose.

I sincerely hope that my contribution to this seminar has been of interest to you and I like to thank you again for your presence and your attention.