SPESFEED NEWS

Autumn Edition May 2011

General News

As the fuel price continues to climb, the cost of most of the inputs that we use in animal agriculture will increase as well. I suspect that we will see the demand for animal products decline in communities where there is less disposable income, as people still have to use fuel to get to work – no matter what. I am afraid that things do not look exciting for pig and poultry producers in the short term.

I have included some thoughts on what not to do in hard times in this edition of the SPESFEED News, although by now it is a bit of a recurring theme.

Inside This Issue

Courses

The 2011 **Poultry Nutrition Course** will be held from the 12th to the 14th of September. In addition, we will hold a **Dairy Nutrition Course** from the 18th to the 20th of July.

Should you be interested in attending either event, please contact rick@spesfeed.co.za or blosper@afrisoft.biz.

A Laboratory System

Dave Higgs of Premier Software, who now manages the SPESFEED EXPRESS program for us, has developed a Laboratory system for the feed industry called QCLabs. The system is scalable and runs over a network, which means that anyone who is authorised to access the data may do so across a network or even the internet.

The system is simple to use, flexible and able to present results in a number of easy to use formats.

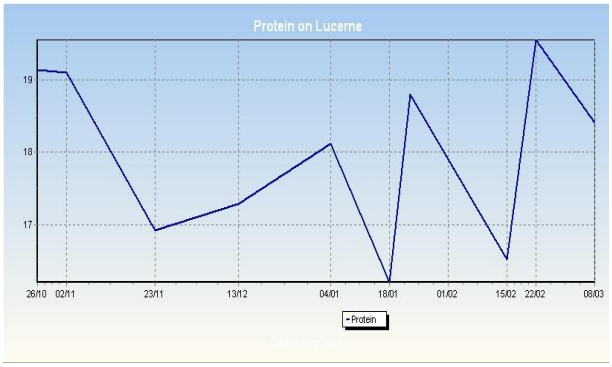
It has a main module which caters for the reports, the booking in of samples, and the maintenance of the system. A separate module, designed to be run in the lab itself, caters for the work in progress profiles and the entering of the test results. Samples can be booked in by a separate person to the results, and perhaps even in a different venue.

With each test/sample type you can specify a result range that indicates high and low values and a target value from which to calculate standard deviations. These standards may be imported into the program from the feed formulation system. The program will then automatically flag any results that deviate from the set standards.

Comprehensive reporting of system data (such as tests, ranges, suppliers, origins, work in progress, materials, products, etc) is available from the main menu. Sample based reports include:

- Single sample reports (*One report with all the requested tests*),
- Combo Reports (*where you specify the samples you want to link at print time*),
- Project reports (*where you link the samples permanently and can reprint the combination at any time*)

All reports may be graphed, with multiple ingredients, suppliers or even analytical methods included on each graph.



A data warehouse is also included as a part of the system. All data generated by the system is stored, and allows the user to "mine" it for information. You can look at your data in a number of ways; get standard deviations, averages, etc. It is also possible to specify a time period or limit your search by sample type, supplier, origin, truck/delivery note, and others. This flexibility gives you the true power of your data. The data warehouse can print or export the results of your search to a spreadsheet.

Should you be interested in the package please visit www.qclabs.co.za.

Salmonella Control in Feed Milling

I would like to draw your attention to an excellent review article by F.T. Jones which appeared in the latest edition of Journal of Applied Poultry Research (J Appl. Poult. Res. 20: 102-113). I will provide a brief précis of the article here, but would suggest that you read the original document if you are involved with *Salmonella* control in any way.

Salmonella may be found just about anywhere one may look, and that it is persistent in a wide range of materials, from fabrics to faeces. In addition, *Salmonella* has the ability to persist for long periods. This obviously compounds both the detection and control of the micro-organism in animal feed.

It has been found that sampling dust in ingredient intake bins, in air filters and in the grinding and pelleting areas of a mill, together with spilled feed and debris is a more effective method than directly sampling he feed, if one wants to check for *Salmonella* contamination. Collecting samples in an aseptic manner is important if "false positives" are to be avoided.

Because *Salmonella* are both ubiquitous and persistent, every available tool should be used in its control. Sustained effort is required if long term control is to be achieved. Control needs to involve the prevention of contamination, a reduction of opportunity for the organism to multiply and killing the pathogen itself.

Contamination can be prevented by buying "clean" ingredients where possible, controlling dust levels and preventing traffic from moving from dirty (dusty) areas of the mill to clean areas. Mostly, the feed itself and feed mills lack the moisture that the organism requires to grow. However damp patches are havens for *Salmonella* growth and millers need to prevent these. Oil and fat have been shown to protect the microorganisms from both a "harsh" environment and from any control measure we choose to apply. As a consequence of this, most *Salmonella* contamination occurs because of growth within the manufacturing system. Millers need to track down the oily, damp nooks and crannies in their mills, and eliminate them.

Salmonella can effectively be killed by heat, and it is reported that pelleting systems reduce inclusion rates of organisms from between 50 and 93%. Temperature, time at a given temperature and moisture level all play a role in both the pelleting process and the level of pathogen kill.

Chemicals used to kill *Salmonella* in feeds have primarily consisted of blends of organic acids and formaldehyde. These agents should provide protection against recontamination of the feed. However, killing *Salmonella* in feed may require inclusion rates of 1% or more, and several days may be required to destroy bacteria already existent in the feed. High levels of acidification are costly, corrosive to milling and feeding equipment, affect feed palatability, interfere with vitamin availability and endanger workers.

The use of electrolytes for poultry

At the recent Australian Poultry Science symposium, Borges and his fellow workers from Brazil presented a review article on the use of electrolytes in poultry with is well worth reading (full article is to be found at http://sydney.edu.au/vetscience/apss.

Electrolyses are monovalent ions such as sodium (Na^+), potassium (K^+) and Chlorine (Cl^-) which are derived from salts (such as NaCl) which are disassociated into their ionic components. Potassium is the major cation within the cell, whereas Na^+ and Cl^- are the major ions in the extracellular fluid (the blood and lymph). These ions play a role in maintaining the acid-base balance and are key to maintaining osmotic pressure in the body.

Heat stress causes a change in the birds acid-base balance. When birds become too hot, they increase their rate of respiration. This causes the excessive loss of carbon dioxide (CO_2) which leads to a lower CO_2 partial pressure with a consequent lowering of the blood carbonic acid (H_2CO_3) and hydrogen (H^+) concentrations. The kidneys then increase HCO_3^- and reduce H^+ excretion into the urine (uric acid) in an attempt to maintain the acid-base balance. This leads to a condition called respiratory alkalosis.

Under normal conditions water and electrolyte content are maintained within narrow limits, but when electrolytes are lost or gained and the water content does not change, an osmotic imbalance occurs. Plasma K^+ and Na^+ levels decrease as temperature increases, whereas the Cl^- level increases. The increase in Cl^- will depress H^+ excretion and decrease bicarbonate re-absorption thereby contributing to blood acidification (the opposite of alkalosis).

Nutritionists are able to add salts, primarily Potassium Chloride (KCl) and Sodium Bicarbonate ($NaHCO_3$) to the feed and/or water of heat stressed birds. Increased consumption of salts leads to an increase in water consumption which lowers body temperature and reduces heat stress. Sodium Bicarbonate led to the best results. Teeter et al., (1985) were able to demonstrate that at a 0.5% addition to the diet feed intake and weight gain improved, although not significantly. Borges contends that high levels of Cl^- in the feed decreases pH in the blood which impairs growth. This may in part explain the results seen by Teeter.

As nutritionists we are advised to maintain the optimal electrolytic balance in the diet. This can be defined as mEq (Na^++K^+-CL^-)/kg of feed. Feeds should be formulated to supply an electrolyte balance between 180 and 260 mEq/kg (decreasing as the bird ages). Borges was able to show that the best electrolyte balance in a broiler Pre-Starter diet ranged between 246 and 277 mEq/kg.

Other cations and anions also contribute to the acid-base balance but these are not normally considered due to their secondary importance
I have calculated the values derive for typical broiler diets in Southern Africa and note that mEq/kg values range from about 260 in starter diets, through to 250 in grower diets, down to 230 in finisher diets. Broiler breeder diets average around 200 mEq/kg and layer diets at 220 mEq/kg. Santos et al., (2005) were able to demonstrate that when breeder birds were offered a diet with 150 mEq/kg production was suppressed, but this was not observed at a level of 180 mEq/kg. Interestingly, adding 0.25% Sodium Bicarbonate to the diet increases these values by about 20 units.

What does this all mean in practical terms? Most typical poultry feed has a cation-anion balance within the “normal” range. In addition, this range is fairly wide, and it can only be assumed that this is because the bird has the inherent ability to maintain the correct acid-base balance. There is probably little to be gained from making expensive adjustments to the diet in order to achieve a specific dietary mEq. However, there would appear to be some justification to reduce the Cl^- level in most poultry diets, particularly under heat stress conditions. However, there is little point in using too little Sodium Bicarbonate in the feed as this is unlikely to achieve much. Rather 4 kg or more are required per ton of feed.

Rick Kleyn

Protein levels in Pullet Rearing Diets

Anderson and Jenkins of the North Carolina State University have published some interesting research where they looked at pullets (brown strains) on different feeding regimes, and the effect these had on subsequent layer performance. The complete papers can be found in the International Journal of Poultry Science volumes 9: 205-211 and 10: 169-175.

The objective of their research was to compare the reproductive performance of two different commercial brown-egg layer strains (Hy-Line Brown and H and N Brown Nick) using three different dietary regimens. The feed regimes used were a Step Down Protein (SDP) regime, and a Step Up Protein regime with a low energy starter fed for 9 weeks (SUP_9) and a Step Up Protein regime with a low energy starter fed for 12 wks (SUP_{12}). The details of these feeding regimes are shown below. In addition, the birds were housed at two laying densities and using two different feeder spaces.

Table 1: Dietary regimes used during rear.

	Starter	Grower I	Grower II
SDP			
Protein (%)	20	18	16
Feed (weeks)	0-6	7-16	17-18
ME (MJ/kg)	12.4	12.4	12.4
SUP_9			
Protein (%)	12	16	18
Feed (weeks)	0-9	10-16	17-18
ME (MJ/kg)	11.5	12.4	12.4
SUP_{12}			
Protein (%)	12	16	18
Feed (weeks)	0-12	13-16	17-18
ME (MJ/kg)	11.5	12.4	12.4

Although there were small differences between the two strains (as would be expected) these are not discussed here. A summary of the performance at the end of the rearing period (17 weeks) is contained in table 2.

Table 2: A summary of the key performance indicators of birds reared on the different feeding regimes.

Rearing Regime	Weight (kg)	Feed Cons (kg)	Energy Cons (kJ)	Ster - num (mm)	Head and Neck (%)
SDP	1.618^{a}	7.278	902.2	112^{ab}	8.2^{b}
SUP_9	1.555^{b}	7.323	901.0	113^{a}	8.1^{b}
SUP_{12}	1.510^{b}	7.160	893.5	110^{b}	8.5^{a}

As can be clearly seen the birds on the step up program were slightly lighter and consumed slightly less feed and energy (although not significantly so). It can see that there were small physical differences in the birds, with the sternum being slightly smaller and the neck and head being slightly larger (proportionally) in the birds on the SUP_{12} program.

These birds were then transferred to a layer farm where there performance was recorded. As can be seen from table 3, the rearing regimes did not impact on the subsequent productivity of the hens in any meaningful way, although mortality was lower in the case of the SUP_{12} birds. Allowing laying birds more feeder space leads to a slight increase in feed consumption. Birds housed at 482 cm^2 (4 birds per cage) had higher production parameters than those housed at 361 cm^2 (6 birds/cage). It is reported that the income from the lower stocking density was US$ 2.39 higher than the higher stocking density, but that the feed costs were US$ 0.21 higher as well. In order to calculate the true differences between the two systems, the fixed costs need to be taken into consideration as well.

Table 3: A summary of the production results of birds reared on different feeding regimes and then house in different ways.

	Prod (%)	Eggs HH	Egg Weight (g)	FCR	Mortality (%)
Rearing					
SDP	78.2	276	64.7	2.47^{a}	17.2^{b}
SUP_9	78.1	284	64.3	2.49^{a}	12.9^{ab}
SUP_{12}	77.8	286	64.4	2.55^{b}	10.7^{a}
Feeder Space					
10.2 cm	79.9	300	64.3	2.33^{p}	10.6
13.6 cm	79.0	297	64.5	2.43^{q}	11.8
Density					
361 cm^2	76.8^{x}	263^{x}	64.2	2.51	17.6^{x}
482 cm^2	79.3^{y}	300^{y}	64.5	2.50	9.5^{y}

This experiment tells us more by what it does not say than what has been shown. In essence, it is possible to really treat pullets in rear badly (using low quality diets) and they will still come into lay and perform acceptably. Tinkering with feed specs by increasing lysine by a few percentage points and reducing energy by a few calories is not going to have any real impact on outcome.

The Cost of Cutting Costs

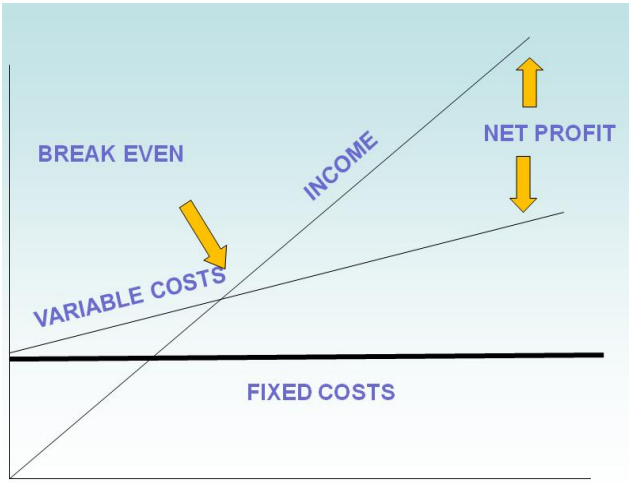
It is important to keep costs down during times of reduced profitability. It is true that our diets can become cluttered with additives and expensive "special" ingredients. Feed specifications may be over generous as well. However, even relatively small, incorrect choices regarding additives and/or feed specifications may have a dramatic impact on the bottom line of any animal production enterprise. An understanding of what constitutes profit is essential. Any changes that are considered need to be based on the bearing they will have on profit and not on the impact they will have on costs alone. Experience has taught us that those strategies that maximize profits during the good times also minimize the losses during bad times.

One of the first things any animal producer asks him/herself when product prices fall or inputs costs rise is "what can I do to reduce my costs?" In animal production, these costs are represented by the 4 F's, namely, **f**ixed costs, **f**eed, **f**ertiliser and **f**uel. Fixed costs are largely beyond the producer's control, while costs of the other three are highly volatile. There is a price threshold for most inputs, beyond which we will not go. Once this price has been exceeded, we start looking for a cheaper source of the same item, or what we *perceive* to be an identical or at least very similar item. If we fail in this, we will begin to cast around for a similar product that is affordable, or we will simply cut back on the amounts of product purchased.

How this all works is best illustrated by referring to figure one. Fixed costs remain the same regardless of the level of production. Remember that as the level of production increases so the fixed costs become proportionally smaller. In addition, it is possible to reduce fixed per animal by increasing the size of the herd or flock. Net profit is represented by the difference between the income (sale value and level of production) and the fixed and variable costs. Clearly, we can improve profits by either increasing income (difficult in hard times) or reducing costs. The danger is that should any cost saving bring about a reduction in income, the danger of falling below the breakeven point exists.

It is perhaps worth pointing out that if the fixed costs are ignored, a simple margin over variable costs is determined. It could be argued that using a margin calculation is acceptable if you were comparing results from a single production unit. In the poultry industry, where the cost of the chick and the medication program remain the same regardless of feeding program, a simple determination of the margin over feed costs (MOF) will give you a very accurate handle on what is going down on the farm.

Figure 1: A schematic representation of net profitability in animal feeding.



An aspect that we cannot ignore is the impact of time on profitability. W pay tax and interest on an annual basis, so we need to calculate profit on this basis as well. Many broiler producers now measure profitability based on the return per house per year. Dairy farmers strive to maximize the lifetime performance of their cows, which is in essence the same thing – profitability per cow per year.

Obviously as a producer, you will have a greater income if you sell more product or if the product that you do sell achieves better prices. This means that adding value, by further processing milk for example, can have a dramatic impact on overall profitability. Producers can also increase their income by ensuring that their products are market ready when prices are at their best. For example, we would all like to sell fat lambs in the few weeks leading up to Christmas, and our production systems should accommodate these market fluctuations.

While it is always important to keep input costs down, in some situations this may be detrimental. The manner in which this will occur differs from industry to industry. In the broiler industry it is difficult not to feed the birds, so saving are usually brought about by buying cheaper (lower spec) feeds. This usually leads to a reduction in growth and FCR,

and as was illustrated in the last edition of the SPESFEED News, this usually leads to a reduction in profit. When the feed specifications of layer diets are reduced, the hens simply eat more feed and intakes often increase to a point where the cost of feeding may well increase.

In the case a dairy cows, it is the lifetime productivity of the cow that has the greatest impact on overall profitability. This means we should strive to get heifers into milk as soon as we can and that each cow must produce for as many lactations as possible. Any short-term decision that affects the lifetime productivity of the cow needs to be carefully considered. Often, when feed prices increase, or the milk price drops, we are tempted to feed cows less concentrate. Unless we are able to replace the nutrients contained in the concentrate with high quality roughage, milk production will fall. High quality roughage would include ingredients such as good quality lucerne and silage that has been cut at the correct time, does not too contain too much fibrous stalk and has been properly cured. Low quality veld or eragrostis hay is simply not good enough.

In the case of extensive beef and sheep farming, producers may be tempted to cut back on lick supplements. In this instance, the reduction in essential mineral intake may cause fertility problems that will lead to a reduced calving percentage. Weaning weights will most certainly drop as well – which in turn can affect when the animals will be market ready. All of these actions may reduce profit. Thus, it is important to understand how to calculate the value of a given input and how it affects your operation.

It is true that we need to be cautious about any changes we make. However, it is still possible for a feeding program to become overrun with "special" ingredients or additives. Producers should seriously question the returns that they may or not result in. This is the stage at which that we need to get back to basics. Evaluate each component of the diet, be it an additive, ingredient and its inclusion level in the diet or the feed specification itself. Question whether a nutrient should even be considered in the formulation. The electrolyte balance discussed earlier in this newsletter is a case in point.

We often select additives that relieve the symptoms of a problem, rather than solving the root cause of that problem – and this adds to costs. A good example of this would be putting additives into broiler feeds to overcome wet litter problems, when in effect it is a house management issue.

When selecting additive, always ask yourself "Do I really need to do it this way and am I using the additive for the correct reasons?" Shift your paradigms.

"Least cost" feed formulation is often cited as the tool used by nutritionists not only to reduce feed costs, but by implication, to short change the producer. Nothing could be further from the truth. It is certainly not in the interests of any feed producer to knowingly cause farmers to lose money. A least cost diet is only as good as the nutritionist who carries out the formulation. All of the nutritionist's skill and experience is built into the matrix used, the feed specifications and inclusion level of various ingredients in the diet. In reality, least cost programs are the only tool that we have at our disposal to carry out the complex mathematics required for feed formulation, and it does not deserve the bad reputation it receives from many quarters. There are no bad feed formulation programs, only bad nutritionists.

Some measurements used in animal agriculture give no indication of profit. The widely used Performance Efficiency Factor (PEF) used in broiler production, means nothing if using it to compare two systems, but may be of some use on a single farm. Feed Efficiency (FE), which is being widely advocated as a performance indicator for dairy herds, gives no indication of profitability. It is well known that cutting back on a lick program can reduce the number of calves born.

A marginal response in the level of output can have an impact on profit. In the case of dairy cows, an increase in milk production can lead to increased profits because maintenance (nutrient requirements) and fixed costs are already covered by the previous level of production. For example, if adding one kg of concentrate (costing R 2.50) to the daily diet increases milk yield by two litres (value R 6.00) then increase in profit is R 3.50 Of course the opposite is also true, reducing concentrate allocation by 1 kg may cost you R 3.50 in profit.

The danger exists though that the extra kg of feed will not result in any additional milk output for reasons beyond our control (genotype for example). On the other hand, not meeting the cow's true genetic potential represents lost opportunity. In addition, limiting nutrient intake may lead to metabolic stresses that could lead to a reduction in fertility and longevity.

Even small changes to a feeding program can have a serious impact on profitability. You may well want to consider these points:

- Producers do not reach a level of production and profitability overnight or without considerable research and effort. In looking for ways to cut costs, plan to put in considerable research and effort to make sure changes made will affect you positively. It is much easier to lose ground than it is to gain it.
- Make changes very carefully and try to consider as many factors as possible – costs, stage of production, current and lifetime performance.
- Make changes slowly and in a stepwise manner. If you remove an additive from the diet and change a feed specification at the same time, you are unlikely to know which of the two caused a particular outcome.
- Cheaper is not always better. In many cases, it may be worse. When considering two or more products and one is considerably less expensive than the other, despite the labelling being similar, you have to ask yourself "why is this one product so much cheaper?" Is it because transport costs are lower? Is it because the seller has chosen to take a lower margin? Is it because the cheaper product is using lower quality ingredients or are non-apparent factors such as the energy level of the product different? If the answer is not forthcoming, consider looking elsewhere.
- In the same way that cheaper may not be better, throwing money at a problem does not always solve it or make the operation more profitable.
- If you make a change to a cheaper product or feeding program, you need to appreciate the compromises you have made may lead to losses in fertility, growth, feed conversion or health, or all of these at some level.
- Each production system is different and it is important that producers optimise their feeding programs to their specific operation.

Recognize and evaluate how and where all of your production costs are derived. Then ask yourself, "is there an area that I can truly afford to compromise or cut back?" In many cases the answer will be "no" and your overall profitability will be higher because you made, what initially feels like, a wrong decision.

Rick Kleyn & Colleen Engelbrecht.

DSM Poultry Tour 2011

In April, I was invited to take part in the DSM Poultry Tour of Europe. The event was held in five venues, although I did not attend them all because of a problem with my visa. My topic was how to formulate feeds using multiple enzymes combinations and I will carry some of this article in the next edition of the SPESFEED News. However, there were a number of very interesting talks that were held, some of which I may not have fully understood because of language difficulties.

At the talk in Germany Margit Back from a market data company called MEG gave some statistics about the poultry industry that were of interest.

- The world egg market has grown by some 25% in the last 10 years. While Europe has been largely static (about 5% growth), China and India have grown by 30 and 66% respectively.
- By 2012, cage layer systems will be outlawed and many smaller producers would probably produce until the end of 2011 and the stop production. Germany will no longer be self sufficient in terms of egg production.
- It was of interest that about half of all egg produced in Germany now go into the production of egg products and are not purchased by consumers.
- The Dioxin scare at the beginning of 2011 caused demand for eggs to drop by about 10%. The sales of Organic eggs increased sharply.
- Less than 20% of the eggs produced in Germany are Free Range or Organic products. Price still plays a huge role here.

Juan Carlos Abad, the Technical Director of Cobb in Spain gave a presentation on quality of day old chicks. Chick quality can principally be measured by making use of 7 day mortality.

From the table below, which was compiled by a large Spanish integrator, it is clear just how big an impact it has. Interestingly when weekly mortality is tracked, those flocks that had high 7 day mortality had another spike in mortality at 5 and 6 weeks of age.

Table: 7 day mortality versus broiler performance.

	Best 15% of Flocks	Worst 15% of Flocks
PEF	312.8	202.5
Age (days)	42.8	43
Weight (kg)	2.54	2.02
ADG (g)	59.3	47.0
Mortality (%)	2.96	11.3
7 day mortality	1.95	3.7

When one goes into detail, it becomes clear that Colibacillosis during the first week of age is the principle cause of high 7-day mortality. This is in essence the presence of *E Coli* in the yolk sac, liver and brain of the chick. The norm is in the range of 1 to 6%, but it can be as high as 70%. How then do the chicks become contaminated? Hatchery practices such as temperature management, uniformity of ventilation, the spread of hatch and length of time chicks spend in the hatcher all play a role. Surprisingly contamination from the eggshell surface played a relatively small role as a contaminant, while conditions in the hatcher were almost twice as likely to create a problem. Poor vaccination practices (injection and spray) would however appear to be the single largest contributor.

Older flocks tend to have a larger spread of hatch than young flocks and the temptation is to leave them in the hatcher longer to improve the hatch. Chicks that have been in the hatcher too long (or at too high a temperature) suffering oxidative stress and are often pale (as opposed to yellow) in colour. It was shown that by adding 5 grams of Canthaxanthin (Carophyll Red) per ton to the breeding hen's diet brought about a reduction in 7 days mortality, especially in older flocks. Canthaxanthin is a power anti- oxidant.

Carcass quality is an important issue in the European market. Catherine Hamelin, a DSM staffer, talked about how important it was to maintain the correct colour in broiler carcasses. Yellow carcass would appear to be associated with corn fed, tasty chicken. Most of the xanthophyll in a broiler chicken is carried in the sub-cutanious fat on the breast. During the summer months where feed intakes and hence fat deposition drop, it is difficult to maintain the correct carcass colour, and various combinations of red and yellow carophyll are used to do this. A further issue is that during periods of stress, the bird is able to make use of carotenoids as a precursor for Vitamin A or to use them as a source of anti-oxidants. Optimum carcass colour is attained from feeding the correct levels of carophyll for at least 3 weeks before slaughter.

Another carcass related problem is what is known as Black Bone Syndrome (BBS). This has to do with the fact that in younger broilers the bone matrix is porous, and literally bleeds during the slaughter process. When the birds are the cooked, this leaked blood cause the bone to discolour. Maria Soto and her team have done work showing that by adding Hy-D (1, 25-*dihydroxy*-vitamin D) to the diet, the number of carcasses exhibiting this syndrome can be halved.

Rick Kleyn

SPESFEED (Pty) Ltd.

Animal Nutrition Consultants

The consultants at **SPESFEED (Pty) Ltd.** publish **SPESFEED NEWS**. The purpose of the newsletter is twofold. It serves both as a source of information for those involved in animal agriculture as well as a means for us to maintain contact with our clients.

SPESFEED provides a professional technical service to the livestock and animal feed industries. Our aim is to ensure that our clients use optimal production and feeding systems in order to maximise the return on investment. The company has no affiliation to any particular product or supplier.

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