FeedTechnoVision – Questions and answers

Session 2 & 3: Ernst Nef

Optimising process technology in times of grain and energy scarcity

Question	Answer
Do you think complete or significant replacement of soy protein and fishmeal with alternative protein ingredients (single cell proteins and other low viscosity proteins) will be easily adjusted without process technology development?	The adjustment depends very much on physical properties, like particle size, bulk density and moisture content of the alternative protein ingredients. However, such an adjustment should be possible without a major development in process technology.
How have you addressed the high moisture needed to extrude the fish feed with soy protein ingredients? High moisture needs to be dried in drying step utilized 60% of total heat energy.	To gelatinize starch and denaturize protein high temperatures and high moisture contents are required. Unfortunately, this results in an expensive drying process.
Globally, up to 30% of harvested raw materials are wasted due to poor storage management. How can we improve raw material storage management?	If storage is required, temperature in the silos must be controlled and especially in hot and humid regions, aeration systems must be available. Keep storage periods as short as possible.
During raw material shortage we can use low-cost raw materials by balancing nutritional contents, like sugar cane molasses. What is the difference between sugar cane molasses and beet molasses?	In general beet molasses is lower and more unform in viscosity – hence the Brix value of beet molasses is slightly lower than for sugar cane molasses.
What percentage of sugar cane molasses is recommended per ton of feed for chicken layers and dairy cattle?	Please ask a nutritionist.
Would different 'quality' of the same raw material perform differently during feed production?	Yes,

What should be the steam temperature just before injection in the conditioner?	Around 105 – 110 °C
Drying of extruded feed consumes significant amount of heat energy (60% of total). Have you thought about process optimization which allows low use of water in the extruder? Replacing water with alternative plasticizer?	Personally, I didn't think about an alternative plasticizer because extrusion is not my core business.
What is conditioning time, temperature and steam pressure?	In single conditioners, the conditioning time ranges around 10 – 15 seconds. In case of hygienizing, additional equipment like retentioners are required to reach rentention times up to 240 sec. Common secondary steam pressures are around 1.5 – 2.0 barG at a temperature of 5 – 10 °C above the saturated steam temperature.
Super-heated steam gives off heat less readily than saturated steam and takes more energy. Has research been done about this?	We are not looking for "super-super heated steam" we just want to be slightly (5-10°C) above the saturated steam temperature to ensure that there is no more water in the steam. Saturated steam shows in terms of pressure and temperature the same figures as wet steam.
What should be the actual temperature for the mixture inside the conditioner regardless of what is shown on the conditioner screen?	The final conditioning temperature is very much depending on the formulation. In general – the higher the conditioning temperature, the better the pellet quality , the lower the energy consumption. In case of a hygienizing process (poultry feed), temperatures above 80°C are recommended.

Please explain addition of roller mill: what type of roller mill do you recommend?	There are many roller mill suppliers. Common is the application of a two stage roller mill with roll diameters of 250 or 400 mm and a roll length from 1'000 to approx. 2'000 mm. Recommended is a load controlled feeder unit with an integrated magnet separator.
Is the function of the roller mill to reduce the load on the grinder? Or can you explain the advantage of introducing a roller mill?	As shown in my slide, roller mill provide you a more uniform particle size distribution, especially when it comes to layer feeds. In addition they consume up to 30 % less energy and treat the product more gently. Means less heat generation and less moisture loss.
For which type of animals would you recommend pellet feed?	Pelleted feed can be applied for almost any livestock animal. However, most of layer feeds is produced in mash form.
We have experience with adding water and surfactants, but no improvement in the final feed moisture. What could be the reason(s) for this?	I believe there is further investigation required …. How about asking the supplier of the surfactant for an explanation.
Do you have advice on monitoring enzyme activity and distribution along the feed production process?	Enzymes can be added in powder or liquid form in to the main batch mixer. In this case a high mixing accuracy and a low carry over as well as segregation degree is of great importance. To minimize the destruction of enzymes, conditioning temperatures should not exceed 85°C. Often enzymes are added in post pelleting application systems (PPA). For a high accuracy, it is recommended to control the flow rate of the dry substance (pellets) by a gravimetric feeder unit.

Which type of mixer is best: vertical or horizontal? What would be the required mixing time per ton of feed?	Basically, any renowned mixer type is able achieve a CV <5% within a certain mixing time. Most of vertical mixers ask for mixing times above 5 min, which is too long for an efficient industrial compound feed production. Therefore, horizontal mixers are commonly used. The mixing time is not defined per ton of feed, but is depending on the mixer model. The supplier of the mixer must be able to inform about the required mixing time for a specific model. State-of-the-art mixers ask for a mixing time of 1 – 2 minutes.
What do you recommend for the mixing time for a premix? After how much time would demixing occur?	The mixing time is always, whether for premixes or compound feed, related to the mixer model. Mixer suppliers must be able to inform about the required mixing time for a specific model. A de-mixing effect occurs at the moment the recommended mixing time have been exceeded. State-of-the-art mixers ask for a mixing time of 1 – 2 minutes.
What is your recommended mixing time for vitamins and minerals?	Mixing times are not related to specific additives, but to the mixer model. Mixer suppliers must be able to inform about the required mixing time for a specific model. State-of-the-art mixers ask for a mixing time of 1 – 2 minutes.
What do you recommend is the normal mixing time for premixing?	Mixing times are not related to premixes or compound feed, but to the mixer model. Mixer suppliers must be able to inform about the required mixing time for a specific model. State-of-the-art mixers ask for a mixing time of 1 – 2 minutes.

What do you mean by liquid addition in the mixer, and please can you explain the mixing cycle?	As shown on my slide, the mixing cycle is divided in three sections. Before liquid addition a dry mixing time of at least 2/3 of the total mixing time must be considered. Liquid addition supposed to be done within a min. time of 20 – 30 sec and a max. time of 50 – 60 sec. After liquid addition a wet mixing time of at least 20 sec. or 1/3 of the total mixing time is required. Dry mixing and wet mixing times, again are depending on the mixer model.
What is the strategy, and what to do, to optimize downtime of factory, especially when having to deal with different feed recipes or to accommodate urgent orders from customers?	Queuing production runs, application of process automation (e.g. use VSD on hammer mills), well maintained equipment and teach customers to place orders in time.
What would you recommend: pre- or post-grinding system?	Nowadays, new installations are in most cases designed as post grinding plant. This mainly due to lower investment cost and less space requirements.
We have a pre-grinder and suffer from its high cost. However, it is not feasible to change to a post-grinder. What can we do to optimize the operation of the pre-grinder?	The individual grinding of each single component can be in terms of energy costs a real disadvantage. Especially with difficult to grind raw materials (high fibre, fat and/or moisture contents). Well maintained grinding equipment contributes to a more efficient grinding process.
Particle size – Economical optimum: Energy efficiency or best FCR? Is d50 – 600 – 800 microns still up to date?	A d50 of 500 – 800 microns is an economical optimum for the feed production process. Means reasonable results (energy/quality) in the grinding- and pelleting section. For broiler feeds nowadays often a d50 of 1000 – 1200

	microns are requested, resulting in general in a weaker pellet quality.
Is there any possibility to directly produce crumbled feed instead of crushing pellet feed?	Since crumbles are crushed pellets, the answer is basically "no". However, there are possibilities to produce structured feeds by the use of roller mills (e.g. layer feeds). Also products from expanders or boa compactors etc. can pass the crumbler without prior pelleting.
What is the main cause of pellets to crumble after manufacturing?	Pellets (commonly 4 mm) are crumbled to adapt the particle size to requirement of the animal. The alternative would be to produce directly a smaller pellet, which will have a negative effect to pellet mill throughput and energy consumption. Hence, pelleting and subsequent crumbling is more economical.
Can the feed mill be affected by the operator? For example, can a less-experienced operator reduce production and vice versa?	Definitely – well educated production- and maintenance staff is the base for a successful production process.
Does increasing moisture of feed lead to energy savings? How?	Depends in which process section. In the grinding process a moisture content above 12 – 13 % leads to much higher energy consumption. In the pelleting process a moisture content of approx. 15 – 17 % is recommended to save energy and produce good quality pellets.
How much energy can be saved with semi full grain mixing and bagging in finished feed?	Assuming that semi full grains not supposed to be ground, the savings will be mainly in the grinding section.
In high-temperature regions how much water & oil can be added without compromising pellet quality if the mash feed moisture ranges by 10%?	In high temperature regions the moisture content in the finish product is limited to 12%. Therefore, the moisture content before pelleting is limited to approx. 15 %, achieved

	by the addition of water and super heated steam. The fat content before pelleting depends very much on the required pellet quality – in general limited by about 4% of total fat content. For higher fat inclusions post pelleting application (PPA) must be taken into consideration.
Are there innovative techniques to preserve bulk feed quality in silo storage?	Are we talking about raw material or finish products … ?? Temperature and moisture control are the most important parameters. Surfactants and /or mould inhibitors may be applied as a preservative.
Will dwell time (die length) not reduce expansion?	If I interpret your question correctly, it is a “no”.
Can you suggest tips for any feed mill operation to reduce carbon foot print to help achieve sustainability goals?	I believe many of them, especially in energy savings, have been mentioned in my presentation.