i'Tec_R4
June 2015

Keywords: Cooler

Survey on coolers installed in livestock feed plants in France - Use

This technical sheet completes the treatment of the survey on coolers conducted by Tecaliman in 2012. It follows **i'Tec_R2** on the technical characteristics of coolers and **i'Tec_R3** on ventilation. In this document, the conditions of use of coolers are presented, as well as the strengths and weaknesses evoked by industrial users on their process lines.

1. Types of cooled feed

1.1. Presentation of feed

Amongst the 262 responses, most correspond to equipment used for pellets. Eleven only concern a cooler operating on thermally treated meal (vertical only) and 8 on feed in either meal or pellet form (7 vertical and 1 horizontal). This corresponds to 7% of the panel (Figure 1).

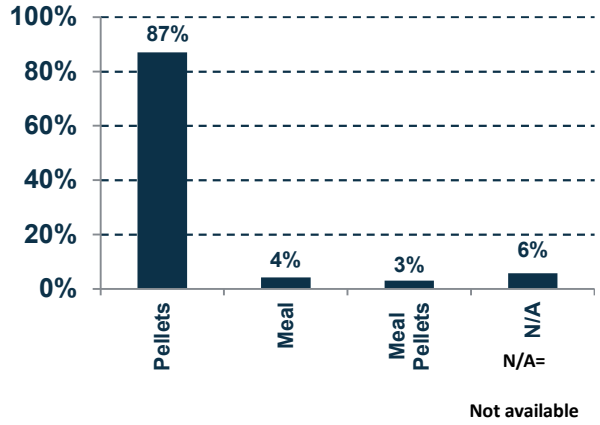


Figure 1 : Presentation of cooled fe processes

1.2. Specialisation by species

As shown in Table 1, 4/5th of processes are multi-products.

Multi-product	79 %
Specialized by species	20 %

Table 1 : Specialisation of coolers by species

The Figure 2 indicates the feed manufactured by specialist processes, on the one hand and multi-species, on the other. It can be noted, therefore, that poultry feed is manufactured for 50% on specialised process lines. Feed for ruminants/horses comes next with 27% of specialised processes.

The responses also show that:

- 10% of processes manufacturing ruminant/horse feed are specialised by species.
- 13% processes manufacturing poultry feed are specialised by species.
- This figure falls to 3% for rabbit feed and 6% for pig feed, which tends to show that this type of feed is often produced on multi-species process lines.

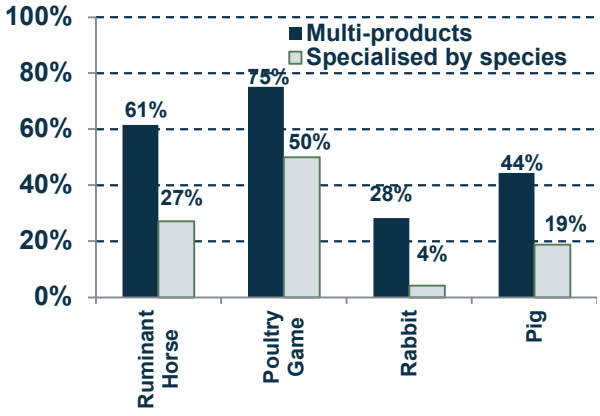


Figure 2 : Animals to which are destined feed manufactured for multi-product processes on the one hand and specialised on the other

1.3. Specialisation by diameter

Where process lines are often multi-products, in 77% of cases they are specialised by pellet diameter (Table 2).

Multi-diameters	20 %
Specialized by diameter	77 %

Table 2 : Cooler specialisation by pellet diameter:

Amongst multi-diameter process lines (52 process lines), 69% make pellets of diameter >5mm and 42% make pellets of diameter <3mm. The pellet diameters most often found on specialised process lines are those between 3 and 5mm (Figure 3). The process lines producing pellets of diameter <3mm and >5mm are only specialised in diameter

respectively in 49% and 20% of cases. The opposite phenomenon is observed for process lines producing pellets with diameters between 3 and 5 mm (77% for diameters from 3 to <4mm and 69% for diameters from 4 to 5mm).

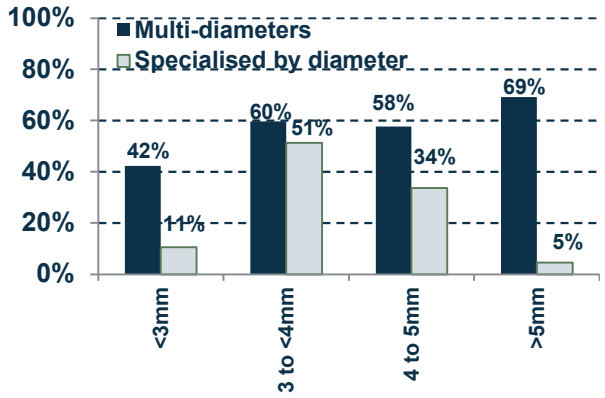


Figure 3 : Diameter of pellets produced for multi-diameter process lines on the one hand and those specialised by diameter on the other

Lastly, according to the responses, there does not appear to be a link between the process line's air flow and the pellet diameter.

2. Measurements on process lines

The temperature of the pellets is measured at the cooler outlet in 54% of cases (Figure 4). The number of positive responses collected for the measurement of feed temperature at the cooler inlet is surprising (44%). During the different visits carried out, it is relatively rare to find pellet temperature measurement systems at the extruder exit or the cooler inlet. It is possible that some industrial producers think of the temperature measurement at the conditioner as the temperature measurement at the cooler inlet.

The air temperature used for the cooler is measured in ¼ of cases and that of the discharge air in only 18% of cases.

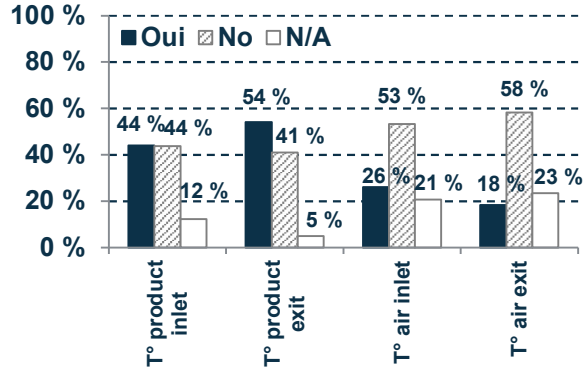


Figure 4 : Temperatures measured in the process lines

Other process measurements are evoked, such as hygrometry (9 processes on 4 sites) and the temperature in the cooler (4 processes on 3 sites).

3. Bed depth in the coolers

The Table 3 presents the median bed depths for products transmitted by the industrial producers. Two depths were requested: the minimum depth and the maximum depth. The average indicated in the table corresponds to the average of these 2 values.
The median average depth is therefore 50cm for vertical coolers and 15cm for horizontal coolers.

	Min	Average	Max
Vertical	35cm	50cm	55cm
Horizontal	10cm	15cm	17cm

Table 3 : Minimum, maximum and average pellet bed depth in coolers according to type of cooler

According to the Figure 5, 68% of vertical coolers cool bed depths of between 30cm and 60cm. It is important to note that 54% vertical models have one level and 35% 2 levels. The median of the average bed depths, in both cases however, is 50cm.
The average bed depths reported for vertical coolers seem to increase with the pelleting flow with:

- 43cm for a flow ≤5t/h
- 50cm for a flow >5 and ≤10t/h
- 51cm for a flow >10 and ≤15t/h
- 59cm for a flow >15t/h

However, this trend is not found for horizontal models.

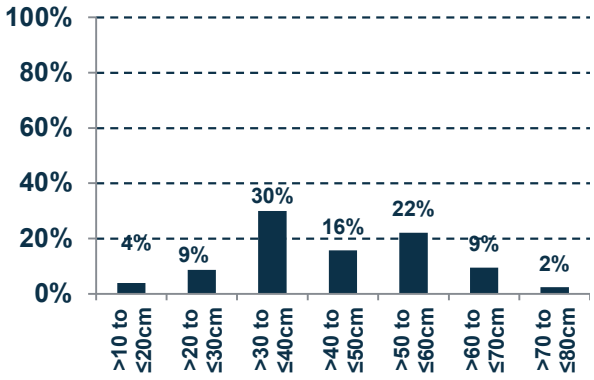


Figure 5 : Distribution of average pile depths reported for vertical coolers

On vertical process lines specialised by diameter, the median average depths are 36cm and 40cm for extreme diameters (<3mm and >5mm), i.e. a bit smaller than for the other diameters. However, only 4 coolers are concerned. The same trend is observed for horizontal coolers, but there again, the sample size is very small and does not allow conclusions to be made.

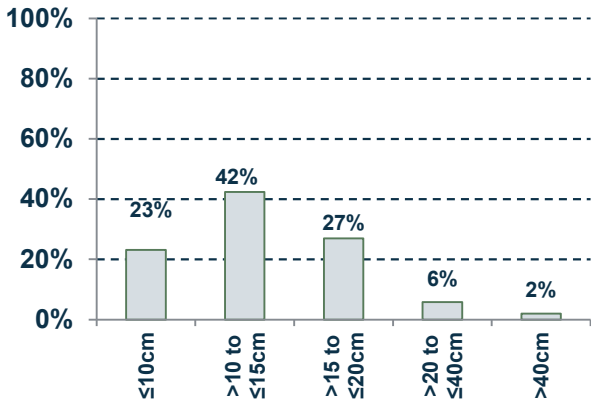


Figure 6 : Distribution of average pile depths reported for horizontal coolers

4. Strengths and weaknesses of coolers

Amongst the completed questionnaires sent back to Tecaliman, the strengths and weaknesses are rarely noted. The strengths of vertical and horizontal coolers are provided in 15% and 14% of cases. For the weaknesses, only 12% of questionnaires for vertical coolers mention them, compared to 30% for horizontal coolers. In most cases, this section of the questionnaire was not completed. This is something to be remembered before drawing definitive conclusions based on the observed responses.

For vertical coolers, **the main strengths** mentioned are efficiency and/or good dimensioning of the equipment. Rapid drainage is also appreciated on this type of equipment. On the opposite, the weaknesses stated for horizontal coolers concern drainage which is too long in 11% of cases. It would seem clearly that the strength of the first model is the weakness of the second.

Horizontal models are appreciated for their efficiency. The difference with vertical models is therefore the regularity of cooling (strength mentioned in 23% of cases), as on this type of equipment, the duration of cooling is the same over the entire feed batch.

The easy and inexpensive maintenance, the clean housing and ease of cleaning are also qualities appreciated for vertical models, as well as the model simplicity and compact dimensions.

	Vertical coolers (186)	Horizontal coolers (75)
	41 on 28 processes or 1.5 responses/process and 15% of questionnaires with responses	13 on 9 processes or 1.4 responses/process and 12% of questionnaires with responses
Efficiency/Reliability/Adapted dimensioning	22 %	69 %
Regularity of cooling		23 %
Rapid drainage	20 %	
Clean/easy cleaning	15 %	
Easy/inexpensive maintenance	10 %	
Size/design/simplicity	15 %	

Table 4 : Strengths evoked in the responses

In some cases, the dimensioning of the coolers is unsuitable. This weakness is given in 15% (vertical) and 16% (horizontal) of replies. The impact of the climate on the cooling efficiency is also a problem sometimes encountered. A producer, whose site is equipped with 5 process lines, mentioned this point at the 7 times it is evoked, which explains the considerable difference between vertical and horizontal coolers for this point.
One difficulty is more often encountered on vertical models - this is the unequal distribution of pellets in the cooler housing, despite the installation of distributors. The adjustment of the cooler when changing pellet diameters also appears to be a problem for some producers.

	Vertical coolers (186)	Horizontal coolers (75)
	39 on 27 processes or 1.4 responses/process and 14% of questionnaires with responses	44 on 23 processes or 1.9 responses/process and 30% of questionnaires with responses
Pellet distribution in the cooler	13 %	
Unsuitable dimensioning	15 %	16 %
Efficiency depending on climatic conditions	18 %	
Clogging/difficult to clean/condensation/TIL	13 %	16 %
Long drainage	3 %	11 %
Bulky		9 %
Old		11 %
Considerable/expensive maintenance		5 %
Absence speed controller/cyclone/sleeve changes	5 %	14 %
Adjustment with pellet diameter changes	15 %	

Table 5 : Weaknesses evoked in the responses

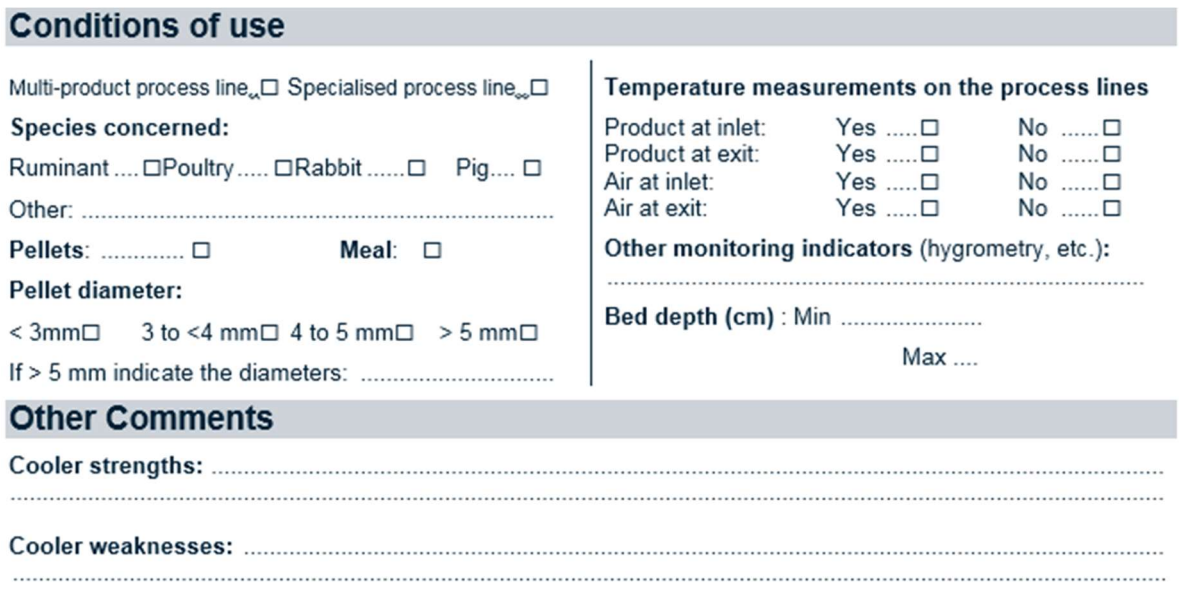
5. Conclusions

Most of the coolers are installed on multi-species process lines, specialised by pellet diameter. This is probably linked to the time required to change the extruder on the pellet press installed upstream.

With regard to process line measurements, the pellet temperature at the cooler exit is continuously measured on more than half the coolers (54%) and that of the air at the cooler inlet and exit is measured on 26% and 18% of panel process lines.

The information on pellet bed depths on the extractors or belts shows a considerable difference between vertical and horizontal models, with an average depth of 50cm for the first case and 15cm for the second. Whilst the number of levels does not seem to impact the responses for vertical models, it appears that an increase in pelleting flow is associated with higher bed depths. This observation is not, however, seen on horizontal models, which suggests a possible coincidence.

The strengths and weaknesses of the different coolers are also treated, although less than 20% of questionnaires included responses to this question. Unsurprisingly, vertical coolers are appreciated for the transitions in short batches and their easy cleaning. The regularity of cooling is highlighted for horizontal coolers.



Conditions of use

Multi-product process line ☐ Specialised process line ☐

Species concerned:

Ruminant .... ☐ Poultry ..... ☐ Rabbit ..... ☐ Pig.... ☐

Other: .....

Pellets: ..... ☐ **Meal**: ☐

Pellet diameter:

< 3mm ☐ 3 to <4 mm ☐ 4 to 5 mm ☐ > 5 mm ☐

If > 5 mm indicate the diameters: .....

Temperature measurements on the process lines

Product at inlet:	Yes .....☐	No .....☐
Product at exit:	Yes .....☐	No .....☐
Air at inlet:	Yes .....☐	No .....☐
Air at exit:	Yes .....☐	No .....☐

Other monitoring indicators (hygrometry, etc.)**:**

.....

Bed depth (cm) : Min .....

Max ....

Other Comments

Cooler strengths: .....

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Cooler weaknesses: .....

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Figure 7 : Extract from the questionnaire on which the I'Tec R1