Feed efficiency is also roughage utilisation

Cows with high feed efficiency have a lower feed intake but achieve the same production. Does this imply that breeding should focus on cows that need a relatively high concentrate ration? Research contradicts this. Farmers who breed for feed efficiency also breed for roughage utilisation.

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The introduction of breeding values for feed efficiency has enabled targeted breeding of cows that convert feed into milk more efficiently. 'Good feed efficiency is important for economic milk production that has a lower environmental impact. I think we can all agree on that', says Roel Veerkamp, professor and researcher at the Animal Breeding and Genomics group at Wageningen Livestock Research. 'But breeding for feed efficiency is also a contentious subject', he remarks. 'By breeding for feed efficiency are we in fact selecting cows that need a higher concentrate ration to achieve high milk production? Don't we really need cows with the capacity to intake a lot of roughage?', is how Veerkamp sums up two frequently asked questions.

Differences in feed uptake

To answer these questions, researchers at Wageningen Livestock Research analysed data on the feed intake, body weight and milk production of 3164 cows collected on farms of Wageningen UR.

They calculated and defined different traits for the animals. For all cows, they defined the so-called extra feed intake capacity (FIC). This is defined as the difference between the measured feed intake and the expected feed intake of a cow based on the diet satiety value and status of the cow (age and lactation stage). 'Cows with a high score for this trait have a higher feed intake than average', is how Veerkamp explains the practical significance of this score.

The researchers also defined a trait for feed saved (FS) for all the cows. That is, the difference between the predicted feed intake (total dry matter intake (DMI)); based on the milk production and the measured feed intake. 'Cows with a positive result after this calculation need less feed than average for the same milk production. So, they convert their feed intake relatively efficiently into milk production' explains the professor.

Extra feed does not always equal extra milk

A higher additional feed intake capacity correlates on average with a lower score for the feed saved trait. 'Cows that eat more give more milk on average', confirms Veerkamp. 'But this extra milk production does not compensate for the extra feed they need. In other words, cows with a high feed intake are actually less efficient producers on average. So the extra ration they consume is partly diverted to functions other than milk production', says the professor to clarify the findings. A (partial) explanation for this conclusion is that cows with a high feed intake have a heavier body weight and therefore need more feed for maintenance, according to the data set.

But there also appears to be a clearly adverse genetic correlation between the extra feed intake capacity and feed saved traits. 'Breeding for feed intake capacity reduces the feed efficiency, however the reverse is also true: breeding for feed efficiency reduces feed intake capacity', explains Veerkamp. This might seem to be unfavourable, but it is not according to him. 'Cows with a reduced feed intake capacity are not a disadvantage as long as the feed they do eat is efficiently converted into milk production', he states.

Are efficient cows concentrate cows?

The initial results of this study resulted in an important question that needed further investigation. Does breeding with a focus on higher feed efficiency mean breeding cows that – because they have a lower feed intake capacity – need a relatively high concentrate ration to achieve the same milk production? To answer this question, the researchers defined two additional traits. For all cows, they defined the residual roughage intake (RRI). That is, the difference between the measured and the predicted roughage intake, based on the milk production and the measured concentrate intake.

'Cows that score lower for this trait need on average less roughage for the same milk production than cows that score higher for this trait. So cows with a lower residual roughage intake convert roughage more efficiently into milk than cows with a higher residual roughage intake', explains Veerkamp. And finally, a residual concentrate intake (RCI), was defined. That is, the difference between the measured and the predicted concentrate intake, based on the milk production and the measured roughage intake. Cows with a lower residual concentrate intake need less concentrate to achieve the same milk production.

For practical purposes in the Netherlands and Flanders there seems to be little advantage in distinguishing between roughage and concentrate intake efficiency

Concentrate feed intake efficiency not hereditary

The researchers concluded that there is a close link - including genetically - between the traits for residual roughage intake and feed saved. 'This means that cows with a high total feed efficiency also efficiently convert the roughage component of the ration into milk', explains Veerkamp. The researchers found hardly any genetic differences between cows regarding the residual concentrate intake trait. There was also little correlation between this trait and the feed saved trait. 'In other words, breeding for feed efficiency does not affect the concentrate utilisation efficiency of cows. To put it another way, breeding for feed efficiency does not mean breeding "concentrate cows"', according to the professor.

In Veerkamp's view, this conclusion aligns well with practical experiences. 'In the experiments with feed, a significant percentage of the concentrate was mixed with the basic ration, as is common practice on most dairy farms. This means that cows largely intake roughage and concentrate in a fixed ratio.' He explains that the concentrate fed to cows individually in a cow feeding station, in the parlour or at the milking robot only represents a relatively small proportion of the total ration. Moreover, the additional concentrate ration for all cows is limited and based on the same curve based on production or the stage of lactation. Any individual differences in the concentrate utilisation are not (yet) factored in. 'For practical purposes in the Netherlands and Flanders, for the time being there seems to be little advantage in distinguishing between total feed efficiency, roughage and concentrate intake efficiency traits when defining breeding goals.' concludes Veerkamp. 'If you target feed efficiency in your breeding goals, you are breeding for roughage utilisation efficiency anyway.'

This study was - as yet- unable to answer one important question from dairy farmers about breeding for feed efficiency: are cows that produce most efficiently on a ration provided in the barn also cows that produce most efficiently on a ration with lots of meadow access? 'We currently do not have enough data on cows with a feed intake measured in the actual meadow. And there seems to be nothing that suggests a difference in the efficiency of cows fed a ration in the barn and those allowed to graze outdoors', Veerkamp indicates. 'But this is certainly an aspect we would like to include in our research in future.'

Conclusions

- Breeding for feed intake capacity reduces the feed efficiency. And, conversely, breeding for feed efficiency reduces the feed intake capacity.
- A high total feed efficiency is directly linked to better roughage utilisation. For practical purposes in the Netherlands and Flanders there seems to be little advantage in distinguishing between roughage and concentrate intake efficiency.
- This study does not answer the question of whether there is a difference in the efficiency of cows fed a ration in the barn and those allowed to graze outdoors.