

A practical definition & tool for resilience for dairy cows

Problem

Resilience is a cow's capacity to respond to perturbations, and thus, safeguard future ability to contribute genes to the next generation. However, a practical definition is lacking, hampering large-scale phenotyping of resilience in commercial populations.

Solution

A practical definition of resilience, reflecting a cow's ability to re-calve.

Outcome

A tool to compute a cow's lifetime resilience score, based on data that is readily available on farm. This tool will facilitate phenotyping of resilience on a large scale, and in commercial populations.

Practical recommendations

A farmer wants a cow that is easy to take care of. In other words, a cow that is not strongly affected by very hot or cold days, by pathogens that are circulating in the barn, or by quality of feed, etc. These are the cows that never (or rarely) get sick and that get back in calf easily. With this in mind, the practical resilience definition is leaning heavily on the ability of cows to re-calve. This has the advantage that the practical definition explicitly looks at future reproductive performance. Moreover, information of this ability to re-calve is available for every new parity, making it a practical resilience trait that is easier to select for in breeding programs. The underlying assumption is that poorer resilience will negatively impact reproduction performance.



Figure 1 Computing a cow's lifetime resilience score based on data readily available on farm

Taking the aforementioned into consideration, a practical definition for resilience depends on several traits, with some strongly related to the ability of a cow to re-calve, and others more strongly with health and production. For dairy cattle, the practical resilience definition is based on a scoring system consisting of five categories, each with their own weighting (see Figure 1).

In general terms, a cow receives plus points for each calving, for a shorter calving interval, fewer inseminations, and a higher milk production compared to her herd peers. On the other hand, she will receive minus points when the number of inseminations increases, for each curative treatment day, and if her milk production is lower compared to her herd peers.

By using readily available data, we were able to assess a practical lifetime resilience score. For the cow data at hand, the lifetime resilience score ranged between 31 and 6031 points. Moreover, cows that reached the next parity have a higher score than cows that are culled before the next parity (Table 1).

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Further reading

[Productive lifespan and resilience rank can be predicted from on-farm first parity sensor time series but not using a common equation across farm](#)

Resources

[Dairy Cows for Data - Optimizing Resilience & Efficiency](#)

Computing lifetime resilience score

Input data:

- # of calvings of each cow
- Age at first calving of each cow
- Age at first calving herd average
- Calving interval of each cow
- Calving interval herd average
- # of inseminations per lactation
- # of curative treatment days
- 305-days milk yield of each cow
- 305-days milk yield parity-peers

Also, when only looking at data from the first lactation, using the practical lifetime resilience score shows that cows that do stay on farm for multiple lactations already have a higher score in the first lactation than cows that are culled during their first parity.

Table 1 Total lifetime resilience score, and resilience score per parity

#lactations	#cows	Average	Average score per lactation											
		Total score	1	2	3	4	5	6	7	8	9	10	11	
1	315	410	410											
2	387	907	497	410										
3	385	1401	497	495	409									
4	313	1908	497	505	485	421								
5	227	2428	498	510	492	496	432							
6	108	2963	500	520	506	506	497	434						
7	43	3501	514	536	509	510	494	511	427					
8	13	3815	484	496	505	486	470	500	498	376				
9	6	4609	498	512	525	506	505	535	518	499	511			
10	0													
11	3	5752	493	571	542	544	542	542	533	522	517	461	485	

On-farm application

System approach

The practical resilience definition is linked with the ability of a cow to re-calve, and with her health and milk production performance. It can be calculated using readily available farm data, making it a definition that can be used on a large scale and in commercial populations. This tool enables farmers to rank their cows, and to use the information in their daily management.

“GENomic management Tools to Optimize Resilience and Efficiency - GenTORE” is an H2020 project which aims to develop innovative genome-enabled selection and management tools to empower farmers to optimize cattle resilience and efficiency in different and changing environments.
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