National Association of Animal Breeders

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16 COMMON QUESTIONS AND ANSWERS ON NET MERIT 2021

1. What is Net Merit ?

Net Merit or NM$ is the national US genetic selection index for dairy cattle. NM$ is an economic selection index that estimates the lifetime profitability of dairy cattle based on the combined genetic value for economically important traits. NM$ was first introduced in 1994 and has since been updated regularly to incorporate newly developed traits of economic importance.

2. Why is NM$ updated?

With cattle breeding, we consistently change our selection goals to fit the current and future dairy industry. What makes a cow profitable for a dairy producer changes over time.
NM$ should therefore be updated on a regular basis to remain current. This includes the adjustments of the economic weights in the index (which includes updated commodity and milk prices) as well as the inclusion of any new traits that affect cow profitability. Early first calving, heifer livability and RFI are new US selection traits. All three traits have a large effect on cow profitability and should therefore be incorporated in NM$.

3. What is new about NM$ 2021?

NM$ 2021 includes three updates:

1. NM$ 2021 includes three new traits: Early first calving (EFC), heifer livability (HLIV) and residual feed intake (RFI).
2. When new traits are included, genetic relationships between these and all other traits in NM$ are re-estimated to make sure that traits are not double counted.
3. All economic weights were re-evaluated and updated where needed.

4. What are the new values in NM$ 2021?

The relative values of the traits included in NM$ 2021 are shown below alongside the Relative values from NM$ 2018

Trait	Relative value % Net Merit 2018	Relative value % Net Merit 2021
Milk	-0.7	0.3
Fat	27	21.8
Protein	17.1	17.0
Daughter Pregnancy Rate	6.8	5.0
Heifer Conception Rate	1.4	0.5
Cow Conception Rate	1.7	1.2
Early First Calving	-	1.1
Calving Ability $	3.8	2.8
Productive Life	12.2	15.1
Livability	7.4	4.3
Somatic Cell Count	-4.1	-2.9
Health $	2.3	1.7
Heifer Livability	-	0.8
Udder Composite	7.5	3.1
Feet/Legs Composite	2.8	0.5
Body Weight Composite	-5.3	-9.4
Residual Feed Intake	-	-12.4

Source: AGIL, July 2021

Relative values, such as the ones given above, are the common way of listing traits in selection indices. These weightings, adding up to 100%, are based on True Transmitting Abilities (acting as if reliability is 100%) and reflect the economic importance of the traits.

However, various traits of high economic importance have low reliabilities. The new traits, early first calving, heifer livability and RFI are good examples of these. The reliability of a trait affects the contribution of that trait to the PTA for NM$. If we want to list the traits in the index according to their contribution to the PTA for NM$, we can do that by using Relative Emphasis.

The listing of the traits in NM$ based on Relative Emphasis for NM$ 2021 alongside NM$ 2018 looks like:

Trait	Relative emphasis % Net Merit 2018*	Relative emphasis % Net Merit 2021
Milk	-0.8	0.3
Fat	34.3	28.6
Protein	18.0	19.6
Daughter Pregnancy Rate	5.2	4.1
Heifer Conception Rate	1.0	0.4
Cow Conception Rate	1.2	1.0
Early First Calving	-	1.2
Calving Ability $	3.5	2.9
Productive Life	11.0	15.9
Livability	6.5	4.4
Somatic Cell Count	-3.4	-2.8
Health $	1.5	1.2
Heifer Livability	-	0.5
Udder Composite	6.9	3.4
Feet/Legs Composite	1.8	0.4
Body Weight Composite	-4.7	-9.4
Residual Feed Intake	-	-3.8

* Calculated using the standard deviations from 2021 and economic values from 2018
Source: AGIL, July 2021

5. Why do I see two sets of values and what is the difference?

Relative Emphasis is a new way of listing traits in selection indices.

Relative Emphasis takes the differences in reliability of traits into consideration and shows the trait's contribution to the PTA and ranking of the animal.

Relative value reflects the economic importance of the trait within the index and ignores reliability.

Both are different ways of describing the same index.

Now that selection indices include more traits of high economic importance but low reliability, expressing traits as Relative Emphasis can clarify the effect of the various traits on the calculated PTA.

6. Are all the CDCB Merit indices updated?

Yes, NM$ (Net Merit), CM$ (Cheese Merit), GM$ (Grazing Merit) and FM$ (Fluid Merit) are all updated to include up to date economic values, genetic relationships and the three new traits.

Relative Emphasis values for CM$, GM$ and FM$ can be found on page 2 in:
https://www.ars.usda.gov/ARSUserFiles/80420530/Publications/ARR/nmcalc-2021_ARR-NM8.pdf

7. What about breeds that do not have the new traits?

The economic weights and genetic correlations are updated for all breeds. However, because RFI is only available for Holsteins and heifer livability for Holstein and Jersey, the NM$ index looks slightly different across breeds.

Relative values for NM$ across the 6 main US dairy breeds are:

Trait	Ayrshire	Brown Swiss	Guernsey	Holstein	Jersey	Milking Shorthorn
Milk	0.3	0.3	0.3	0.3	0.3	0.3
Fat	25.2	24.0	24.1	21.8	27.0	25.2
Protein	21.5	21.5	20.8	17.0	23.1	21.5
PL	19.6	22.4	20.2	15.1	19.7	19.6
SCS	−3.9	−3.8	−3.9	−2.9	−3.1	−3.9
BWC	−11.4	−7.2	−12.5	−9.4	−5.6	−11.4
UDC	4.7	3.4	2.8	3.1	2.6	4.7
FLC	0.6	0.5	0.6	0.5	0.5	0.6
DPR	6.0	6.4	6.1	5.0	6.9	6.0
CA$	0.0	1.9	0.0	2.8	0.0	0.0
HCR	0.7	0.7	0.6	0.5	0.7	0.7
CCR	1.4	1.5	1.6	1.2	1.6	1.4
LIV	3.5	4.8	5.4	4.3	4.4	3.5
HTH$	0.0	0.0	0.0	1.7	2.1	0.0
RFI	0.0	0.0	0.0	-12.4	0.0	0.0
EFC	1.3	1.4	1.2	1.1	1.4	1.3
HLIV	0.0	0.0	0.0	0.8	1.0	0.0

Source: USDA AGIL Research Report 2021

8. What will I notice about the PTAs at the 2021 August evaluation?

The average expected PTAs for NM$ 2021 and the range of PTAs for NM$ 2021 are slightly higher compared to NM$ 2018. You will likely see an increase in the PTA for NM$ at the 2021 August Evaluations as well as some re-ranking among animals.

The increase in average PTA has to do with a wider distribution of NM$ 2021, shown in Figure 1.

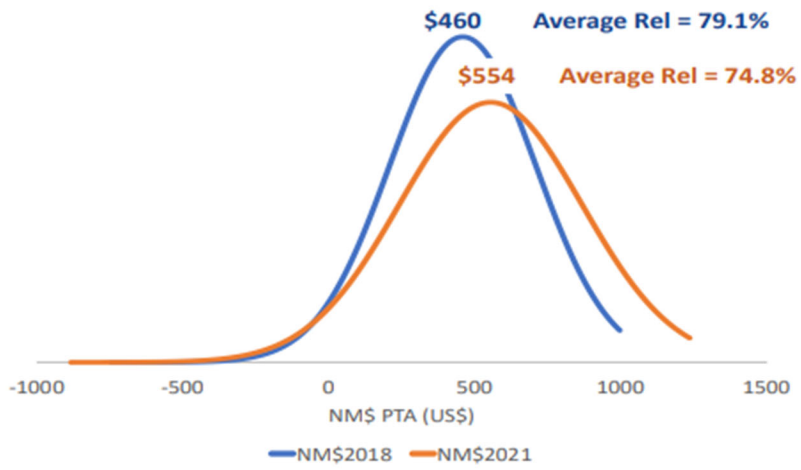

Figure 1. The distribution of NM$ 2018 vs NM$ 2021.
Source: CDCB August 2021

The inclusion of especially RFI has increased the range of NM$ because RFI is a trait with a very high economic weight and therefore a large effect on the profitability of an animal (feed is one of the largest costs of a dairy producer). However, due to the lower reliability of RFI, heifer livability and early first calving, the overall reliability of NM$ decreased a little and the standard deviation of NM$ values increased causing the wider range of NM$ values.

9. What genetic progress do I make when I select for NM$ 2021?

The CDCB has calculated the predicted yearly progress expected in 24 traits, comparing NM$ 2018 and NM$ 2021. While RFI, heifer livability and early first calving were not directly included in NM$ 2018, other correlated traits did create indirect selection for these traits. Now that the traits are in NM$ 2021, genetic progress for these traits will be faster.

	Milk (pounds)	Fat (pounds)	Protein (pounds)	Productive Life (mo.)	SCS (units)	Body Wt. Composite	Udder Composite	Feet / Leg Composite
2018 NM$	119	7.92	4.38	.48	-.02	-.05	.09	.04
2021 NM$	127	7.66	4.44	.49	-.02	-.07	.08	.03

	Daughter Pregnancy Rate (%)	Calving Ability ($)	Heifer Conc. Rate (%)	Cow Conc. Rate (%)	Cow Livability (%)	Gestation Length (days)	Health ($)	Residual Feed Intake
2018 NM$	.02	2.30	.15	.14	.23	-.12	.99	-0.81
2021 NM$	.03	2.30	.15	.15	.25	-.13	.97	-1.94

	Milk Fever (%)	Displaced Abomasum (%)	Ketosis (%)	Mastitis (%)	Metritis (%)	Retained Placenta (%)	Early 1st Calving (days)	Heifer Livability (%)
2018 NM$	.01	.06	.15	.11	.09	.00	.31	.08
2021 NM$	.01	.07	.15	.11	.09	.00	.32	.08

Source: CDCB August 2021

10. Does the higher negative weight on Body Weight Composite mean we will breed for thin and frail cows?

It is correct that NM$ 2021 shows a stronger negative weight on BWC compared to $NM 2018. This is because cows with lower body weight require less feed for maintenance. Body Weight Composite is a composite trait calculated by Holstein USA and the closest estimate available for direct body weight.

The strong weighting of BWC in NM$ may cause concerns that we will be breeding for frailer cows. This is mainly because Dairy Form (an estimate of how hard the cow is milking accounting for excess or lack of body fat) is a large component of Body Weight Composite.

However, selection for NM$ 2021 will only decrease BWC with an additional 0.02 points per year or 0.2 points per decade. On a scale from-3 to +3, this will not be noticeable. In addition, thin frail cows get penalized in their PTA for BWC because of the large negative weight on Dairy Form. And lastly, the new NM$ 2021 has increased the weighting on Productive Life which rewards animals with a genetic ability to complete a higher number of productive lactations.

Selection for NM$ 2021 is therefore not expected to lead to frailer animals with less ability to milk.

11. How are the economic weights calculated?

A lot of effort goes into the calculation of economic costs and benefits to each trait in NM$. The researchers at the USDA Animal Genomics Improvement Laboratory (AGIL) determine the values based on the best and most up to date research available. Then, suggested values are reviewed by multiple CDCB committees, academic researchers, experts in the industry and lastly by the CDCB Board of Directors. Technical details on how the economic weights were calculated and adjusted for the traits in NM$ 2021 can be found in the USDA AGIL Research Report prepared by Paul VanRaden: https://www.ars.usda.gov/ARSUserFiles/80420530/Publications/ARR/nmcalc-2021_ARR-NM8.pdf

12. Why should I select for NM$?

Genetic selection on an index of traits ensures that progress is made on multiple traits at once taking into consideration that the traits are related. While selection on separate traits means genetic progress is faster for those few traits, it is often combined with a decline in other traits that are genetically negatively correlated.

The choice of selection index is difficult since there are so many available. It remains a personal choice for each producer.

What sets NM$ apart from other indices is the extensive scientific calculation of each trait, how it is weighted and what its economic value is. NM$ is not subject to the opinion of a particular breed association or company. It is the only US index that objectively ranks each animal by their lifetime profitability for the average US dairy producer.

13. How does NM$ 2021 compare with TPI?

TPI is the proprietary selection index of Holstein USA. Just like NM$, TPI gets updated regularly. In April 2021, TPI was updated to include Feed Saved.

Below is a comparison of how the Relative Values of TPI compares to NM$ 2021 for categories of traits,

	Net Merit 2021 (%)	TPI (%)
Milk	0	0
Fat and Protein	39	38
SCS	3	4
Fertility (DPR, HCR, CCR, EFC)	8	13
Cow Health (PL, LIV, Heifer LIV, Health $)	22	10
Calving Ability (DCE, SCE, DSB, SSB)	3	2
Feed Efficiency (RFI, BWC)	22	8
Conformation (UDC, FLC, PTAT)	4	25

Common questions on Feed Efficiency

14. Why don't I see Feed Saved as a trait in NM$ 2021?

Feed Saved represents the expected pounds of feed saved per lactation based on body weight composite (BWC) and residual feed intake (RFI). BWC was already in NM$ 2018 and RFI was now added. Feed Saved is therefore represented in NM$ 2021 by RFI and BWC which is why you do not see Feed Saved listed as a separate trait.

15. What is the difference between Feed Efficiency in the US and Canada?

The United States and Canada released feed efficiency genetic evaluations in December 2020 and April 2021, respectively. In Canada, the trait was named Feed Efficiency and The United States launched Feed Saved.

While both traits are a measure of feed efficiency – or how efficiently the cow processes her feed into milk, it is important to realize that the traits are not necessarily the same. Every country that has released genetic evaluations for feed efficiency has made decisions about the data that goes into the trait, from which group of animals that data was collected, the model with which the genetic values were calculated and how those values are expressed.

The main differences between the Canadian and US traits for Feed Efficiency are:

1. Canada and The United States have shared data on feed intake. However, the datasets used to calculate the genetic evaluations are not identical.
2. The US Feed Saved is targeted to increase the amount of Feed Saved by lowering residual feed intake (RFI) as well as the maintenance requirements of animals. Feed Saved is therefore a combination of RFI and BWC. The Canadian Feed Efficiency trait is strictly RFI, a calculated measure of dry matter intake minus estimated energy used for production and maintenance. It is independent of body weight.
3. Canadian Feed Efficiency targets a particular period in lactation, after peak. Only data from mid and late lactation (60 -205 DIM) is included in the trait while the United States uses feed intake data from the entire lactation.

16. Where can I find more information about Feed Saved and RFI?

The CDCB has produced various articles on Feed Saved, which was launched in December 2020. Most information can be found here: https://www.uscdcb.com/news/

Below are a few direct links to articles and presentations on Feed Saved and RFI as part of Feed Saved.

Trait Reference Sheet on Feed Saved:

https://www.uscdcb.com/wp-content/uploads/2020/11/CDCB-Reference-Sheet-Feed-Saved-12_2020.pdf

Feed Saved Presentations by Kristen Parker Gaddis

https://www.youtube.com/watch?v=L3utJ34JSec

https://www.uscdcb.com/wp-content/uploads/2021/05/FeedSaved_InterbullPresentation_v2_NoVid-Kristen.pdf