STØTTET AF
Mælkeafgiftsfonden

# Note – Calculation of NTM weight for Saved feed, only including maintenance

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The motivation of this note is to document the calculation of the NTM weight for Maintenance efficiency and is based on the method described in the NTM report from 2018.

The TMI-model for dairy is used, and the biological assumptions for body weight can be found in table 1. By analyzing the effect of changing (reducing) mature weight of the dairy cow

3 factors have effect on the result of the TMI-model calculations

- Reduced feed for maintenance of cow
- Reduced carcass weight of slaughtered cows
- Reduced weight at first calving including heifer maintenance in the growth period

A fourth factor that might also be considered is metabolic efficiency of heifer during the rearing period, which to some extent might be genetic correlated with cow metabolic efficiency. This factor has not been taken into account in the results in table 2. Growth of bull calves is already included in current TMI – and should not be included once more.

***Table 1. Biological assumptions for body weight in the calculation of economic values for maintenance***

| Breed | **Body weight at 1st calving, kg** | **Body weight at 2nd calving, kg** | **Mature body weight, kg** |
|---|---|---|---|
| RDM | 565 | 610 | 655 |
| SRB | 565 | 610 | 655 |
| FAY | 565 | 610 | 655 |
| HOL – DNK | 590 | 635 | 680 |
| HOL – SWE | 590 | 635 | 680 |
| HOL – FIN | 590 | 635 | 680 |
| JER | 375 | 403 | 430 |

In table 2 is shown the main result of the TMI-model results. The results are negative because profit is increased with reduced body weight.

In the TMI-model the maintenance requirement of cows is based on metabolic weight (MBW = body weight$^{0.75}$). Therefor the value of changing MBW is similar for all breeds within country. The value is highest in Finland because feed prices are highest in Finland. The feed prices are nearly equal in Denmark and Sweden and therefore the value of cow maintenance is nearly the same.

If we look at the values in a TMI model where slaughter weight and heifer weight is included, the results will be additionally influenced by the difference in feed prices due the changes in heifer weight. Moreover, there are differences in beef prices for cows. They are lowest in Finland and highest in Sweden. In Finland the value become high due the higher feed prices but also because of the lower slaughter value of culled cows.

**Table 2. Economic effect of reducing cow weight. BW = Body Weight, MBW= Metabolic Body Weight.**

| Factor considered | | RDC | RDC | RDC | HOL | HOL | HOL | JER |
|---|---|---|---|---|---|---|---|---|
| | | DNK | SWE | FIN | DNK | SWE | FIN | DNK |
| Maint. cow | €/kg BW | -0.56 | -0.58 | -0.64 | -0.56 | -0.58 | -0.63 | -0.63 |
| Maint. cow | €/kg MBW | -3.73 | -3.84 | -4.22 | -3.73 | -3.84 | -4.22 | -3.73 |
| Maint. Cow, Weight of slaught. Cows, Weight at first calv. | €/kg BW | -0.64 | -0.56 | -0.82 | -0.68 | -0.60 | -0.95 | -0.86 |
| Maint. Cow, Weight of slaught. Cows, Weight at first calv. | €/kg MBW | -4.25 | -3.67 | -5.42 | -4.56 | -3.97 | -6.32 | -5.11 |

The body weights are weighted average of weight in 1st, 2nd and later lactations. The MBW is calculated for each lactation. Then a weighted average is used in the final calculation of value per kg of MBW.

The economic value of maintenance is calculated in kg body weight (BW) and MBW, but the genetic evaluation is based on MBW. It is needed to transform the standard deviation (SD) used in the evaluation from MBW to BW. Transformation of phenotypes can be done by $MBW^{(1/0.75)}$, but using this method does not work on SD. It should be possible mathematically to derive how the SD should be transformed, but the relationship can also simply be found from the relationship between the SD for MBW and the SD for BW. From table 8-9 in appendix B, it clearly appears that for RDC and HOL the relative value is at the same level and constant across countries and parities. The relative values are slightly higher for JER.

The value per index unit of maintenance can be calculated as (SD BW/10) x Economic value of 1 unit change in BW. The NTM weight for maintenance is the relative value between the calculated value of an index unit to the value of 1 Y-index unit. However, it is important to correct for the relative Y-index weight in NTM. Thereby the results show that the NTM weight factor for maintenance is 0.18 – 0.23 if only the effect of maintenance as cows is considered and is increased to 0.23 – 0.27 if considering all 3 factors. Using the economic value of 1 unit change in MBW results in the same relative NTM weights for maintenance efficiency.

***Table 3. Results for calculation of the maintenance weight in NTM - only the effect of cow maintenance is considered.***

| Breed | SD for MBW | SD for BW[1] | Economic value of 1 kg BW change[2] | Value per index unit[3] | Value of 1 Y-index unit €[4] | Relative Y-index NTM weight[5] | Relative NTM weight[6] |
|---|---|---|---|---|---|---|---|
| RDC | 5.53 | 36.3 | 0.59€ | 2.15€ | 9.38€ | 1.02 | 0.23 |
| HOL | 4.61 | 30.6 | 0.59€ | 1.81€ | 8.90€ | 0.90 | 0.18 |
| JER | 3.76 | 22.9 | 0.63€ | 1.44€ | 6.61€ | 0.83 | 0.18 |

[1] SD MBW / relative value (Table 9) – SD MBW is the SD used in the standardization of EBVs
[2]Raw averages across countries based on BW values from Table 2
[3](SD BW/10) x Economic value of 1 unit change in BW
[4]From the NTM report 2018 – page 84 section 9.1
[5]From the NTM report 2018 – page 85 table 9.3
[6]Relative NTM weight for maintenance = (Value of 1 index unit maintenance / Value of 1 Y-index unit) x Relative Y-index NTM weight

**Table 4. Results for calculation of the maintenance weight in NTM – all effects included**

| Breed | SD for MBW | SD for BW[1] | Economic value of 1 kg BW change[2] | Value per index unit[3] | Value of 1 Y-index unit €[4] | Relative Y-index NTM weight[5] | Relative NTM weight[6] |
|---|---|---|---|---|---|---|---|
| RDC | 5.53 | 36.3 | 0.67€ | 2.44€ | 9.38€ | 1.02 | 0.27 |
| HOL | 4.61 | 30.6 | 0.74€ | 2.28€ | 8.90€ | 0.90 | 0.23 |
| JER | 3.76 | 22.9 | 0.86€ | 1.97€ | 6.61€ | 0.83 | 0.25 |

[1] SD MBW / relative value (Table 9) – SD MBW is the SD used in the standardization of EBVs
[2]Raw averages across countries based on BW values from Table 2
[3](SD BW/10) x Economic value of 1 unit change in BW
[4]From the NTM report 2018 – page 84 section 9.1
[5]From the NTM report 2018 – page 85 table 9.3
[6]Relative NTM weight for maintenance = (Value of 1 index unit maintenance / Value of 1 Y-index unit) x Relative Y-index NTM weight

**NTM test runs including Saved feed**

NTM test run will be conducted using the weight factors in both table 3 and table 4. The plan is to use the weight factors in table 3 in the material send to NAV workshop participants and to inform that more factors could be considered in the future (table 4).

# Appendix A

The following tables show some examples and more details of the calculations. The are some minor differences compared to table 2, because the internal milk price is determined by the total feed costs (feed costs including maintenance costs).

**Table 5. DNK HOL example.**

| | Basic | Improved | Change | €/annual cow |
|---|---|---|---|---|
| **Cows** | | | | |
| **Body Weight (BW)** | **639.1** | **607.1** | **32.0** | |
| **Metabolic Body Weight (MBW)** | **127.1** | **122.3** | **4.8** | |
| **SFU for maintenance/year** | **2487.6** | **2393.7** | **93.9** | |
| **Feed costs,€** | **2302.13** | **2284.26** | **17.87** | **17.87** |
| **Carcass weight kg, cows** | **315.3** | **299.5** | **15.8** | |
| **27.5% cows slaughtered, 2.77€/kg** | | | | **-12.04** |
| **Heifers** | | | | |
| **Weight at 1st calving** | **590.0** | **560.5** | **29.5** | |
| **Age at 1st calving** | **775.3** | **775.3** | **0.0** | |
| **Heifer feeding, €/year** | **345.10** | **328.99** | **16.11** | **16.11** |
| | | | | |
| **Total result** | | | | **21.94** |
| | | | | |
| **Per kg change in BW – maint. only** | | | | **0.56** |
| **Per kg change in MBW – maint. only** | | | | **3.72** |
| **Per kg change in BW – 3 factor** | | | | **0.69** |
| **Per kg change in MBW – 3 factor** | | | | **4.58** |

**Table 6. DNK RDC example.**

| | Basic | Improved | Change | €/annual cow |
|---|---|---|---|---|
| **Cows** | | | | |
| **Body Weight (BW)** | **614.8** | **584.1** | **30.7** | |
| **Metabolic Body Weight (MBW)** | **123.4** | **118.8** | **4.7** | |
| **SFU for maintenance/year** | **2416.3** | **2325.1** | **91.2** | |
| **Feed costs,€** | **2099.7** | **2082.3** | **17.36** | **17.36** |
| **Carcass weight kg, cows** | **302.4** | **287.2** | **15.1** | |
| **28.4% cows slaughtered, 2.77€/kg** | | | | **-11.89** |
| **Heifers** | | | | |
| **Weight at 1st calving** | **590.0** | **560.5** | **29.5** | |
| **Age at 1st calving** | **775.3** | **775.3** | **0.0** | |
| **Heifer feeding, €/year** | **331.21** | **316.81** | **14.40** | **14.40** |
| | | | | |
| **Total result** | | | | **19.86** |
| | | | | |
| **Per kg change in BW – maint. only** | | | | **0.57** |
| **Per kg change in MBW – maint. only** | | | | **3.69** |
| **Per kg change in BW – 3 factor** | | | | **0.65** |
| **Per kg change in MBW – 3 factor** | | | | **4.26** |

**Table 7. DNK JER example.**

| | Basic | Improved | Change | €/annual cow |
|---|---|---|---|---|
| **Cows** | | | | |
| **Body Weight (BW)** | **405.7** | **385.4** | **20.3** | |
| **Metabolic Body Weight (MBW)** | **90.4** | **87.0** | **3.4** | |
| **SFU for maintenance/year** | **1769.1** | **1702.4** | **66.8** | |
| **Feed costs,€** | **1871.0** | **1858.3** | **12.71** | **12.71** |

| | | | | |
|---|---|---|---|---|
| **Carcass weight kg, cows** | **183.7** | **174.5** | **9.2** | |
| **26.3% cows slaughtered, 2.32€/kg** | | | | **-5.60** |
| **Heifers** | | | | |
| **Weight at 1st calving** | **375.0** | **356.3** | **18.8** | |
| **Age at 1st calving** | **741.9** | **741.9** | **0.0** | |
| **Heifer feeding, €/year** | **294.99** | **284.59** | **10.40** | **10.40** |
| | | | | |
| **Total result** | | | | **17.50** |
| | | | | |
| **Per kg change in BW – maint. only** | | | | **0.63** |
| **Per kg change in MBW – maint. only** | | | | **3.74** |
| **Per kg change in BW – 3 factor** | | | | **0.86** |
| **Per kg change in MBW – 3 factor** | | | | **5.13** |

## Appendix B

***Table 8. Standard deviation on raw phenotypes for cows born after 2000 in Finland and Denmark (Two different measuring methods across countries). BW phenotypes is calculated as MBW^(1/0.75). MBW = Metabolic Body Weight, BW = Body Weight.***

| RDC | MBW | | | BW | | |
|---|---|---|---|---|---|---|
| Parity | 1 | 2 | 3 | 1 | 2 | 3 |
| Finland | 10.0 | 10.3 | 10.9 | 64.8 | 67.6 | 72.6 |
| Denmark | 7.9 | 8.1 | 8.1 | 50.2 | 53.5 | 54.4 |
| HOL | | | | | | |
| Finland | 10.9 | 10.9 | 11.4 | 71.8 | 73.3 | 77.6 |
| Denmark | 7.1 | 7.5 | 8.0 | 45.8 | 49.8 | 53.5 |
| JER | | | | | | |
| Denmark | 5.5 | 5.7 | 6.2 | 32.5 | 35.1 | 38.7 |

***Table 9. Based on the results in table 8 there is calculated a relative value between the standard deviation for MBW and BW. MBW = Metabolic Body Weight, BW = Body Weight.***

| | | Relative value | | |
|---|---|---|---|---|
| | **Parity** | 1 | 2 | 3 |
| **RDC** | Finland | 0.1542 | 0.1517 | 0.1500 |
| | Denmark | 0.1565 | 0.1517 | 0.1495 |
| | **Mean** | **0.1523** | | |
| **HOL** | Finland | 0.1513 | 0.1486 | 0.1470 |
| | Denmark | 0.1559 | 0.1510 | 0.1490 |
| | **Mean** | **0.1505** | | |
| **JER** | Denmark | 0.1694 | 0.1630 | 0.1605 |
| | **Mean** | **0.1643** | | |