

Overview of disease effects in SimHerd

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Tabel 1: Overview of disease effects on cow-level ¹ in SimHerd

	Milk fever	Dystocia	Retained Placenta	Metritis	Displaced Abom.	Ketosis	Mastitis	Digital Derm.	Foul in the foot	Claw and leg probl.
Yield loss ²	1.0%	0%	0.9%	2.0%	4.0%	2.2%	7.7%	1.7%	9.6%	4.0%
Reduced ³ conception rate	1	1	0.75	0.74	1	0.28	1	0.64	0.05	0.43
Duration of reduced conception	0	0	119	119	0	63	0	49	21	140
Withdrawal of milk, days	0	7	3	6	6	7	7	0	7	0
Mortality risk ⁴	0.13	0.04	0	0	0.07	0	0.02	0.01	0.015	0.042
Risk for involuntary culling ⁴	0	0	0	0	0.13	0	0.06	0.009	0.013	0.036

¹The effect on the cow's cell count, feed intake, weight and insemination period are also included in the model, though not presented in this table.

²Yield loss (as a % of lactation yield) depends on the time where the disease occurs in the lactation. A profile for milk loss is represented in the model for each disease (see page 3). In the figure 1 to 10 it is shown how diseases affects milk yield during lactation in case the disease occurs at the, according to the previously mentioned risk profile, most likely time during lactation. The cow's feed intake is reduced proportionally to the drop in milk yield.

³Conception rate (CR) for healthy cows (50% for example) is reduced by this factor. An illustration: 0,75 means that a cow with Retained Placenta has a CR of $50\% * 0,75 = 37,5\%$. The duration of this reduced CR is 119 days, where after the cow is healthy again and has a CR of 50% (see also page 2).

⁴Risk of dying or getting culled involuntarily in the week of disease occurrence (see also page 2).

Literature references: the articles below are documentation articles of the SimHerd model. These articles contain all the literature references behind the single assumptions as presented in table 1.

- The incorporation of **milk fever, dystocia, retained placenta, metritis, displaced abomasum and ketosis** in the SimHerd model is documented in Østergaard et al. 2003 (Preventive Veterinary Medicine, vol. 58, page 125-143).
- The incorporation of **mastitis** in the SimHerd model is documented in Østergaard et al. 2005 (Journal of Dairy Science, vol. 88, page 4243-57).
- The incorporation of **digital dermatitis and claw and leg problems** is documented in Ettema et al. 2010 (Preventive Veterinary Medicine, vol. 95, page 64-73).
- The assumed effect of **foul-in-the foot (interdigital phlegmon)** on milk production is based on Hernandez et al. 2002 (Journal American Vet. Med. Association, vol. 220, page 640-644).

How to adjust the assumed effects of disease on production

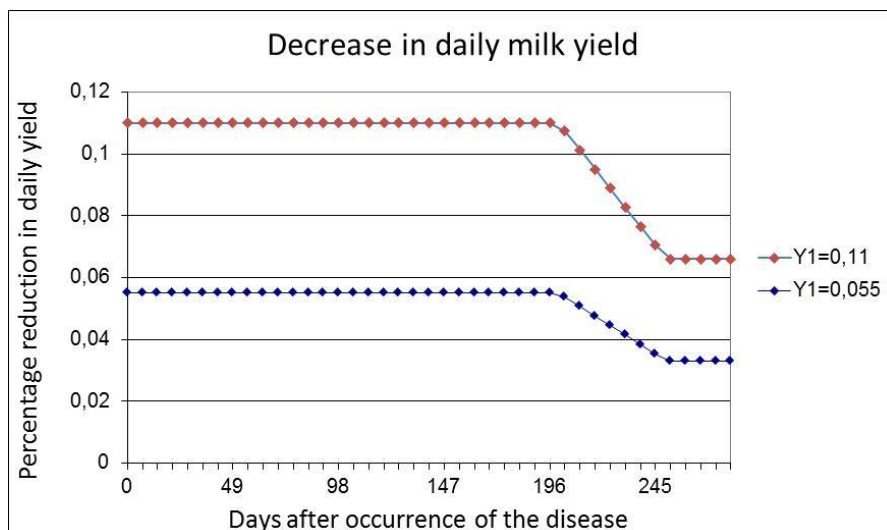
In case you wish to adjust the assumed effects in SimHerd, this can be done fairly straightforward for the effects on conception, involuntary culling and death (see below, in the subcategory “-claw and leg problems”). Each disease has a subcategory in which these parameters can be adjusted. The value for 0,43 can for example be reduced to 0,20, whereby the model assumes that the conception risk for a lame cow is 80% lower compared to a healthy cow (the conception risk of a healthy cow is multiplied by 0,20).

-Milk fever	1025	Odds Ratio of conception	?	0.4	<input type="text" value="0.43"/>	odds ratio
-Dystocia	1026	Duration of reduced odds of conception	?	140	<input type="text" value="140"/>	days
-Retained placenta	1027	Effect on insemination period	?	0	<input type="text" value="0"/>	days
-Metritis	1028	Risk of death in week of onset	?	0.0	<input type="text" value="0.042"/>	probability
-Displaced abomasum	1029	Risk of involuntary slaughtering in week of onset	?	0.0	<input type="text" value="0.036"/>	probability
-Ketosis	1030	Effect on milk withdrawal days	?	0	<input type="text" value="0"/>	days
-Mastitis	1031	Odds Ration of estrus obersevation	?	1	<input type="text" value="1"/>	odds ratio
-Digital dermatitis	1032	Duration effect on estrus obersevation	?	0	<input type="text" value="0"/>	days
-Foul in the foot						
-Claw and leg problems						
Somatic cell count						

To adjust the effects of the diseases on milk yield is not very straightforward. The effect on milk yield is specified with a “three-line-spline” function that has 7 parameters for primi- and multiparous cows (see the screendump below).

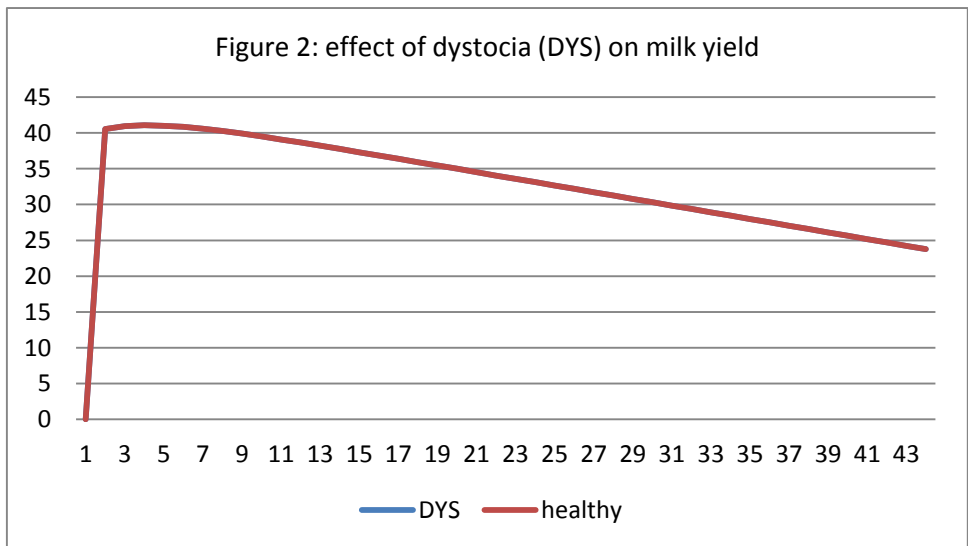
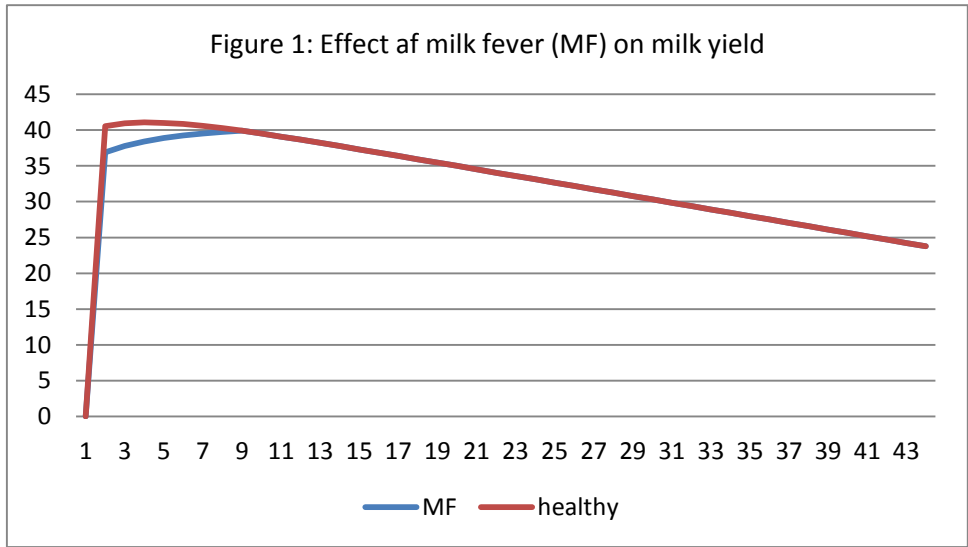
Disease	Parameter	Value	Unit
Reproduction and Culling Milk yield	1006	D1 parameter, effect on milk yield, primiparous cows	0 days after calving
	1007	D2 parameter, effect on milk yield, primiparous cows	200 days after calving
	1008	D3 parameter, effect on milk yield, primiparous cows	50 days after calving
	1009	Y1 parameter, effect on milk yield, primiparous cows	0.055 kg per day
	1010	Y2 parameter, effect on milk yield, primiparous cows	1 proportion
	1011	Y3 parameter, effect on milk yield, primiparous cows	0.6 proportion
	1012	Y4 parameter, effect on milk yield, primiparous cows	0 proportion
-Control and Settings -Repro -Feeding -Yield -Youngstock -Milk fever -Dystocia -Retained placenta -Metritis -Displaced abomasum -Ketosis -Mastitis -Digital dermatitis -Foul in the foot -Claw and leg problems -Somatic cell count	1013	D1 parameter, effect on milk yield, multiparous cows	0 days after calving
	1014	D2 parameter, effect on milk yield, multiparous cows	200 days after calving
	1015	D3 parameter, effect on milk yield, multiparous cows	50 days after calving
	1016	Y1 parameter, effect on milk yield, multiparous cows	0.055 kg per day
	1017	Y2 parameter, effect on milk yield, multiparous cows	1 proportion
	1018	Y3 parameter, effect on milk yield, multiparous cows	0.6 proportion
	1019	Y4 parameter, effect on milk yield, multiparous cows	0 proportion

In case you want to simulate that the effect of this disease is **twice as large** (or half as large) as specified with the “three-line-spline” parameters, you should use a value for the Y1 that is double (or half) the default value of 0,055 (see screendump above). The figure below shows a graphic presentation of the three-line-spline parameters (for both primiparous and multiparous cows) for claw and leg problems when using a value for Y1 of 0,055 and 0,11 (double the value of 0,055). On page 7 you can see what a lactation curve of a cow looks like, when a cow has had a case of claw and leg problems compared to a healthy cow (the value for the Y1 parameter equals 0,055 for the figure on page 7).



It is also possible to specify different distributions of severities for each disease; you can for example specify that 50% of all diseases are mild and, 25% are moderate and 25% are severe. See [chapter 10 in the scenario-catalogue](#) (In Danish only).

In figures 1 to 10 it is presented how milk yield of a third parity cow is affected by the 10 production diseases simulated in SimHerd (Y-axis=kg Energy Corrected Milk, X-axis= weeks after calving). Milk loss furthermore depends on the time of occurrence of the disease.



As shown above and in table 1, a case of dystocia does not affect milk yield directly. However, the figure presented on page shows how dystocia is an important risk factor for e.g. Retained Placenta. The cows risk for retained placenta is 3 times higher in case the cow has had dystocia.

Figure 3: effect of Retained Placenta (RP) on milk yield

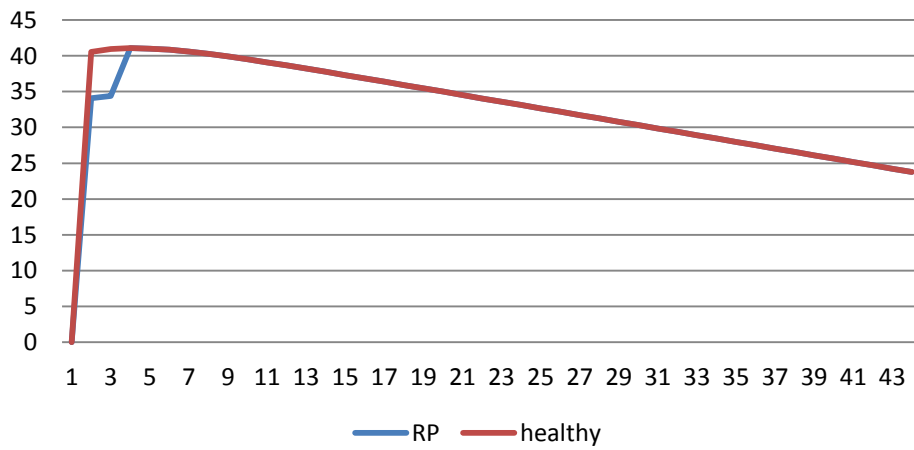


Figure 4: effect of metritis (MET) on milk yield

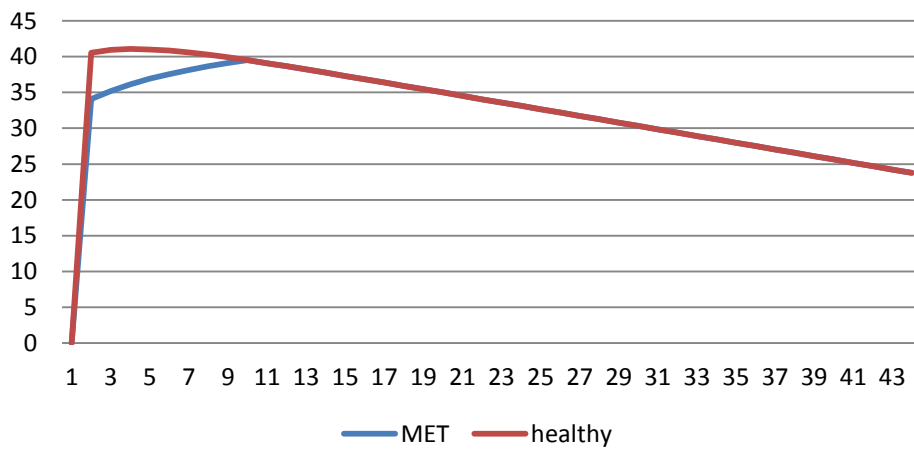


Figure 5: effect of displaced abomasum (DA) on milk yield

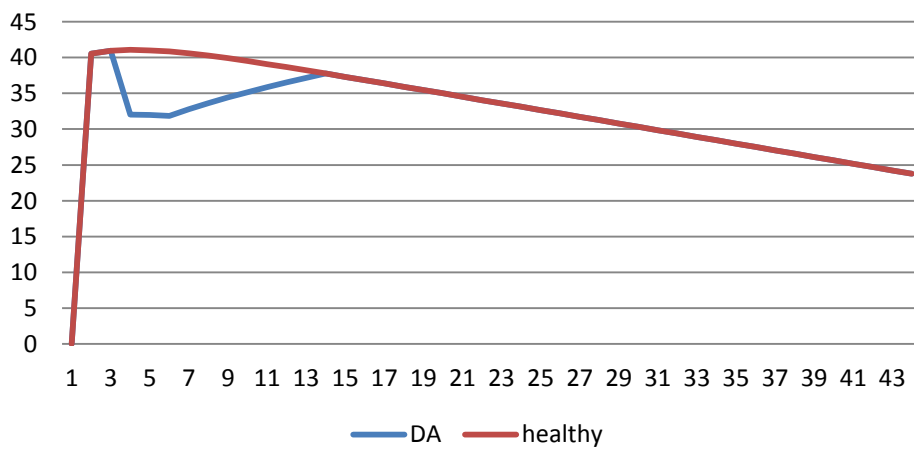


Figure 6: effect of ketosis (KET) on milk yield

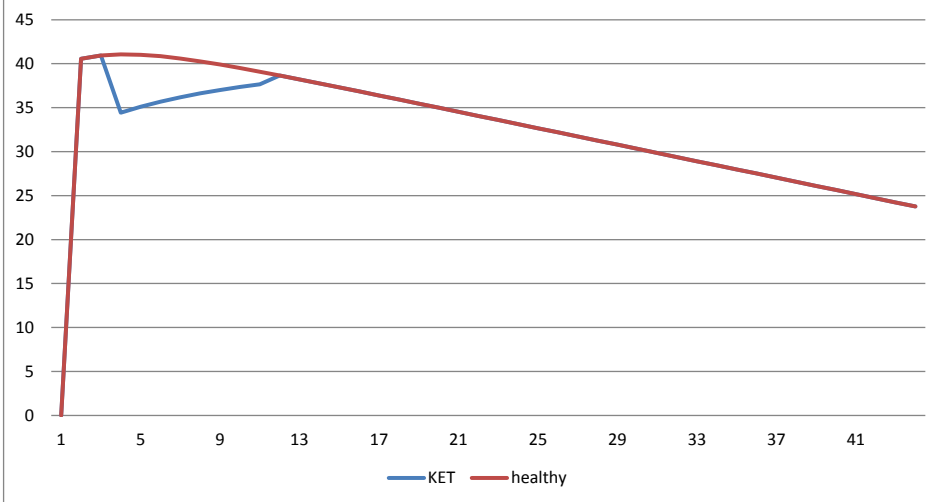


Figure 7: effect of mastitis (MAS) on milk yield

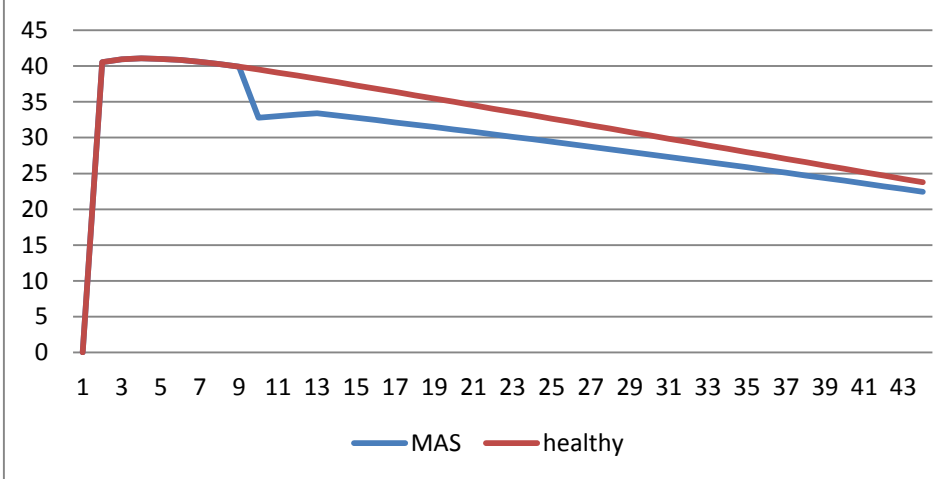
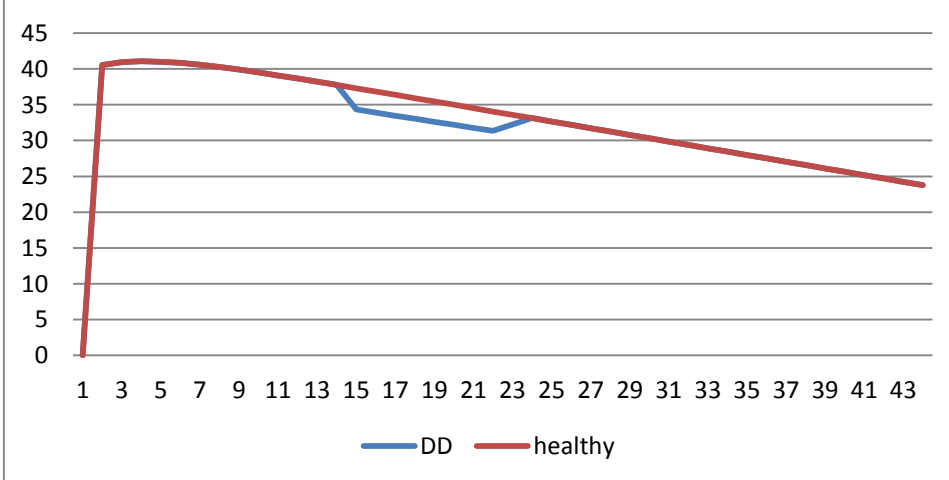
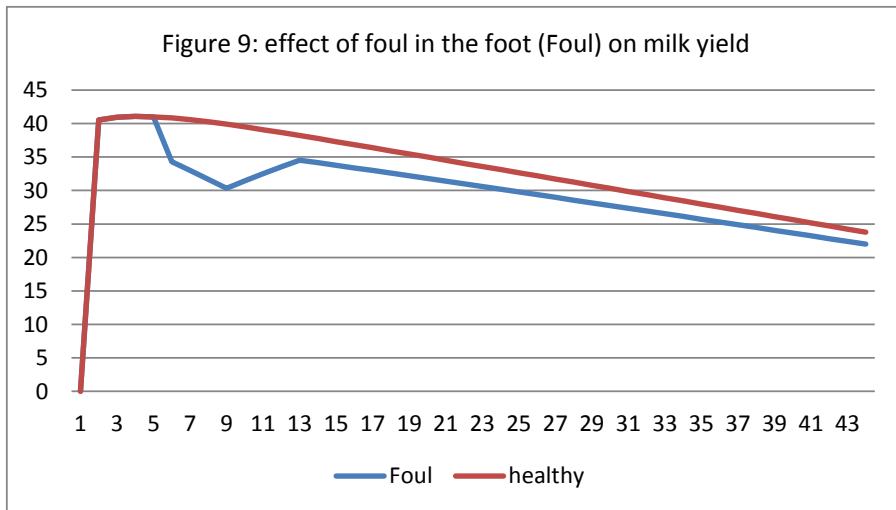
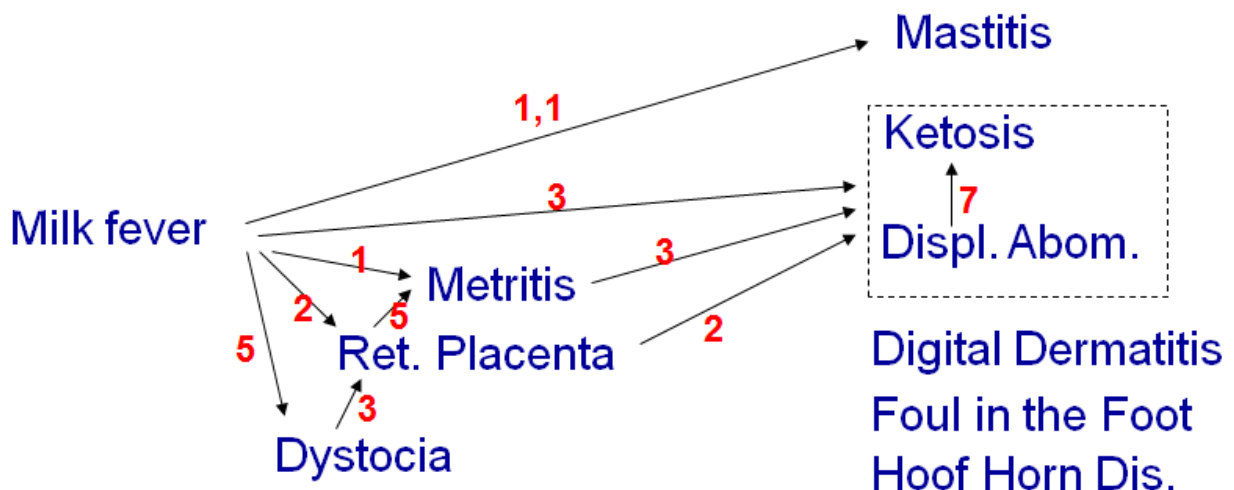
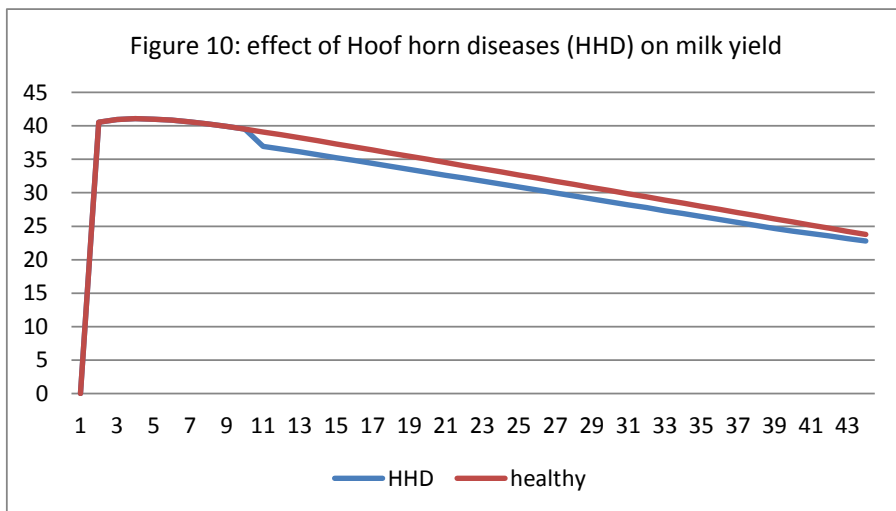


Figure 8: effect of Digital Dermatitis (DD) on milk yield





Hoof Horn Diseases=Claw and Leg problems.



Network describing the interrelationship between diseases; the odds of getting retained placenta are three times higher in case the cow has had dystocia. Not all edges are shown in the graph above; metritis is for example a risk factor for both Ketosis (3) and Displaced Abomesum (2,5).