

"The rearing costs of young stock on dairy farms compared with the net return of the heifers and the management skills of the farmers in the Netherlands"



*M.D. Verbruggen
3516474
January, 2014*

*Supervisors:
Dr. Ir. H. Hogeveen
Dr. I. de Vries*

*Department of Farm Animal Health,
Faculty of Veterinary Medicine, Utrecht University.*

Table of contents

Summary	p. 2
Samenvatting	p. 3
Introduction	p. 4
Materials and methods	p. 6
Collecting data	p. 6
Participating farmers	p. 6
Jonkos	p. 6
Remaining data	p. 7
Data analysis	p. 8
Results	p. 9
Description of the participating farms.	p. 9
Total young stock rearing costs per heifer	p. 9
Total young stock rearing costs per 100 kg milk	p. 12
Total young stock rearing costs per day	p. 12
Net returns of the heifers	p. 13
Score of the personal veterinarian	p. 14
Discussion	p. 16
Conclusion	p. 18
Acknowledge	p. 19
References	p. 20

Summary

An important part of a dairy farm is the rearing of young stock. This has to be done accurately, not only because the new dairy cows will replace the old ones, but also as a lot of money is involved. This has become clear in previous research, which has shown that the successful rearing of one heifer costs €1.540. This is 13% of the cost price of milk.⁹ To gain more understanding in young stock rearing costs, 40 farms from the Veterinary Centre Zuid-Oost Drenthe were visited. During this visit, calculations of young stock rearing costs were made with the spreadsheet Jonkos from , among others, WUR Livestock Research.

In this study, the average of the young stock rearing costs on the visited farms was €1.967 per heifer, with costs ranging from €919 to €3.307. It was also shown that increased scaling is beneficial for costs. An increase in scaling factors researched led to a lower total young stock rearing cost per heifer. An increase in milk production ($\beta=-0,337$; $P=0,028$), the number of dairy cows ($\beta=-0,360$; $P=0,037$) or the number of young stock ($\beta=-0,435$; $P=0,009$) were all significant factors leading to reduction of costs. The age at first calving (AFC) was vice versa: a increase in AFC lead to a significant rise in the rearing costs per heifer ($\beta=0,551$; $P=0,001$).

Comparing the net returns from the heifers with the AFC ($P=0,109$) also showed a remarkable result, namely that there was no significant link between the two. This is surprising, as a lot of farmers claim to experience otherwise. The net returns of the heifers compared with the score of the veterinarian was shown to be almost significant ($P=0,054$), suggesting that a higher level of management skills may lead to an increase in the net returns.

Samenvatting

Een belangrijk onderdeel van melkveebedrijven is het opfokken van jongvee. Dit moet uiteraard zorgvuldig gebeuren, niet alleen omdat zij de oude melkkoeien moeten vervangen, maar ook omdat er veel geld bij betrokken is. Dit is al gebleken in eerder onderzoek, waarbij werd berekend dat de opfok van één succesvol opgefokte vaars €1.540 kost. Dit is 13% van de kost prijs van melk.⁹ Om meer inzicht te krijgen in de jongvee opfokkosten, zijn 40 boerderijen van het Diergeneeskundig Centrum Zuid-Oost Drenthe bezocht. Tijdens dit bezoek is een berekening gemaakt met behulp van het spreadsheet Jonkos van onder andere WUR Livestock Research.

Het gemiddelde van de jongvee opfokkosten in deze studie bedroeg €1.967 per vaars, variërend van €919 tot €3.307. Ook is gezien dat het opschalen van bedrijven financiële voordelen met zich meebrengt. Een toename in de opschaal factoren die zijn bekeken leidde tot een lagere totale jongvee opfokkost. Een toename in melkproductie ($\beta = -0,337$; $P = 0,028$), het aantal melkkoeien ($\beta = -0,360$; $P = 0,037$) of het aantal stuks jongvee ($\beta = -0,435$; $P = 0,009$) bleken significante factoren die tot een afname in kosten kunnen leiden. De afkalfleeftijd van vaarzen (ALVA) was juist tegenovergesteld: een vergroting van de ALVA leidde tot een significante toename in de opfokkosten per vaars ($\beta = 0,551$; $P = 0,001$).

Een ander opmerkelijk resultaat bleek uit het vergelijken van de netto opbrengst van de vaarzen met de ALVA ($P = 0,109$), namelijk dat er geen significante link was tussen de twee factoren. Dit is verrassend, omdat veel boeren aangaven dit wel verwacht te hebben. De netto opbrengst van de vaarzen in vergelijking met het cijfer van de dierenarts was bijna significant: ($P = 0,054$). Dit wekt de suggestie op dat een hoger niveau van management kwaliteiten tot een hoger nette opbrengst kan leiden.

Introduction

In the Netherlands most farmers rear their own young stock so they can eventually replace their current dairy animals. Important reasons for rearing the animals themselves, is the fear of terrible diseases and of genetic inferiority of animals bought from other farmers. It is also possible to outsource rearing, which is often done because of the manure legislation or excessive work pressure.

The rearing of an animal is an important period in its life. Nevertheless, the calves are often neglected at this time. This is most likely because the young stock only starts to generate a profit for the farmer at a later point in time. Income is generated by these animals when they begin to lactate. Before lactation starts, the animals have to give birth to a calf, which in the Netherlands is the case at an average age of 26 months.³ The income generated by the animal must first earn back the rearing costs before the farmer can make profit. After this point we can generally state that the older the cow becomes, the more milk she will have produced, the lower the rearing costs will be per kilogram of produced milk and the more profit the farmer will make. The rearing period requires a large economic investment from the farmer,⁵ so it is worthwhile for farmers to consider this investment properly in order to produce good quality livestock.

From an environmental perspective, it is also advantageous to perform some kind of selection of the calves. Rearing extra heifers will lead to extra nitrate leaching in soil¹² and an increase in the emission of greenhouse gases, most particularly methane.² Selection of young stock and thus a decrease in the amount of heifers, will therefore have a positive environmental impact.

The average replacement rate is an indication of the amount of new heifers needed to keep the total amount of livestock stable. These animals replace the animals that are culled. Reasons for culling have been described in many studies and include a low milk yield,¹³ disorders of the reproductive status^{15, 18, 19} and health related conditions such as milk fever, ketosis, metritis, retained placenta, lameness, mastitis and teat injuries.^{6, 14} The association of these reasons with culling are known to differ depending on the stage of lactation of the dairy cow, parity and age.^{14, 16}

In the Netherlands the average replacement rate has fluctuated between 21 and 30 percent for years.^{1, 17} An average of 25 percent on a fictive farm of 100 cows would mean that every year 25 new heifers are needed to keep the herd at a total of 100 cows.¹¹ This means that 51 (25*2.02) calves should be maintained to be able to eventually add 25 heifers to the milking group. Of course, some extra reserve animals are also necessary to replace the animals that fall out by accidents, diseases and disorders of the reproductive status. In total, approximately 1/3 (100 dairy cows and 51+ young stock) of the livestock will consist of young stock. The farmers should be aware of this and be careful with these animals.

The averaged calving interval is 417 days³ in the Netherlands. These means that an average cow gives birth to 0.88 (356/417) calves each year. In the earlier mentioned fictive farm of 100 cows, this means that 88 calves are born each year. Approximately half of these will be males and thus will be discharged. The remaining approximate of 44 females can all be kept for rearing, but there is really only need for 25 of them (and a few additional reserve animals, because of the lost of 10 % of them). As the average rearing costs are €1.540 for each

successfully reared heifer, it is obvious that selection of right amount of calves can be beneficial to farmers.⁹ Also, as the cost price of milk consists of 13 percent of rearing costs, selection of calves can be beneficial for these costs as well.⁹ Especially now that the margin on milk is low and the milk prices fluctuate because of a liberalized market. To select between calves more easily, farmers could choose to put a meat bull on a dairy cow of which it is already clear the offspring should be selected out. This not only makes the selection more simple, but also generates more income as the discarded calves can be sold for more.

A frequently suggested solution to lower rearing costs, is lowering the age at first calving (AFC). As a result, less time is invested in rearing and income is generated sooner. It has been shown that reducing the rearing time by a month saved farmers between \$51 to \$116 dollars per heifer.⁵ This strategy also reduces the total amount of animals being reared at a given time, which saves money as well. Although research has shown it is possible to induce lactation in a heifer of 15 months of age using hormones, this is financially not attractive because these animals produce less milk per day.⁸ In another study, heifers were inseminated at different ages and gave birth to their calves in three group: low (< or =700 d), medium (701 to 750 d), and high (> or =751 d). The investigators studied the difference between rearing costs, the returns in the milk production and the amount of disease. The medium group had the best results, but the difference between the groups was not significant.⁴

Although it is desirable to lower the cost price of young stock as much as possible, it is not always necessary to look only at the costs. For instance, if a heifer stays in the rearing group longer or if a company has a expensive rearing method, but the heifers produce a lot of milk. This situation can be a beneficial one, even though the rearing period has high costs. It is also possible that the costs are not the main factor influencing the success of the young stock rearing, but that the management skills of the farmer could be making the difference. A deluxe and expensive stable is nice, but does not say anything about the quality of the management. It is plausible that good care of the young stock in combination with good stables result in less disease and increased growth. This in turn can result in a lower AFC and dairy cows that produce more milk, as it is in the rearing time that essential tissues are built in the body that have great influence during the animals' whole lives. Maybe there is indeed a relation between the costs of the rearing, the management skills of the farmer and the milk production in the first lactation. This would of course be very interesting for farmers.

So will the rearing costs of a heifer influence the net returns or are there any other factors, like the management skills of the farmer, that will have influence on the net returns?

Materials and methods

Collecting data

Participating farmers

To collect the necessary data for this research, 177 farmers from the Veterinary Centre Zuid-Oost Drenthe were contacted by e-mail in June 2013. This email was sent by the Veterinary Centre itself. The farmers were asked if they were interested in a free calculation of young stock rearing costs on their farm and could sign up themselves for this by email. A few weeks later, a reminder was sent by the Veterinary Centre. In almost a month 25 farmers were collected. 8 of them responded by themselves and the others were approached by their veterinarian.

In order to increase the dataset, the 152 not-responding farmers were approached by telephone. This additional approach led to at least 18 more farmers showing interest in the free calculation. During the collection of the data, 3 farmers were found not to be suitable because they had only young stock or because they had a normal business, but young stock to the age of one year. One farmer who was initially interested, eventually chose not to participate. An additional farmer, connected to a different veterinary clinic, was found through contact with one of the participants. In total, 44 dairy farmers were visited for this study, in July 2013. Because some of the calculations failed, the final study used data from 40 farmers. Data from five farmers was barely used because these farmers had rebuilt their rearing accommodation at some time during the last three years.

Jonkos

For the calculation of the young stock rearing costs, the tool ‘‘Jonkos Melkvee juni 2013’’ was used. This is a model created by the Wageningen UR Livestock Research, DLV, Wageningen UR Business Economics Group and the University of Utrecht’s Faculty of Veterinary Medicine.²⁰ By using this model, the farmer is able to calculate their own young stock rearing costs and thus make a well-founded decision to invest in the young stock rearing or not.

The spreadsheet consists of a main sheet where the general data can be entered. In this case, the program performs calculations with normative values, giving a rough estimation of the young stock rearing costs. The main sheet consists of the following data groups:

- General information and number of animals
- Ration
- Crops roughage
- Cattle costs
- Land and buildings
- Manure
- Labor and installations
- Water and energy

When a farm deviates from the norm or a farmer wants to introduce more details about their farm, this is possible by using the hyperlinks in the program. To insert this information into the model requires more time and a better preparation by the farmer, but the results will be more accurate than the rough estimation of the costs of the young stock rearing on the farm. In this study, all farmers participated in the detailed version of analysis.

After the calculation is performed, the final results are presented on the main sheet. The calculated costs are the total young stock rearing costs:

- Per heifer
- Per 100 kg milk
- Per heifer per day

These costs are normally displayed without VAT, but it is possible to change this manually. The costs can also be presented with or without inclusion of labor costs. However, in order to calculate this, farmers are required to assign a value to an hour of labor, making the calculated labor costs very subjective. The total costs of the young stock rearing of one heifer is divided into different cost factors, corresponding to the original data groups used to fill in the form on the main sheet. Farmers are thus able to compare the costs and discover where the major expenses are. This information makes it possible for farmers to respond with adequate management adjustment.

Remaining data

For data collection for this study, access was granted to PiR-DAP. This is a program which originated from a partnership between the KNMvD (Royal Dutch Society for Veterinary Medicine), CRV and Zoetis (formerly Pfizer Animal Health). All information from a farm is collected in this program. The loss of heifers was distilled from this program, but also the net returns of the heifers. The net returns are calculated after every sampling of the milk on the farm. This is the corrected efficiency of a lactation. The calculation is based on a realized or predictive lactation as determined at the last sampling. The net returns, which are visible on the Milk Production Registration (MPR)-result, are the average of all cows on the farm. There are three different groups for this result: the heifers, the second-calf cows and older cows. To be a part of the net returns the cows have to meet a number of requirements:

- A lactation longer than 13 days,
- The age at calving is more than 21 months (1.09 years)
- The production of lactation is known (predicted or calculated)

The net returns are calculated based on the production of kg milk, kg fat and kg proteins during a lactation. This production will be corrected for the expected calving interval, the age of calving and the season of calving. A fat correction is optional. The formula for the net returns is:

$$\text{Net returns} = P_m \times \text{EW1} + P_f \times \text{EW2} + P_p \times \text{EW3}.$$

In which:

P_m = Milk in kilograms

P_f = Fat in kilograms

P_p = Proteins in kilograms

EW1= Economic value of kg milk

EW2= Economic value of kg fat

EW3= Economic value of kg proteins

As milk, proteins and fat are all factored in this calculation, this is a proper way to gain insight in the farmer and his farm. This is because the height of the net returns will be linked to the milk production and is influenced strongly by the management skills of the farmer.

The personal veterinarian of each farmer was asked to assign the farmer a score between 1-10 for their management skills, with a 1 being very bad and a 10 being extremely good.

Data analysis

The collected data of all farms were brought together using Microsoft® Office Excel 2007. Using this program the average, the minima and maxima per group and the standard deviation were determined. Also, a comparison was made between the score of the veterinarian of the groups 'not rebuilt' and 'rebuilt young stock accommodation in the past three years'

The data was then imported to the program IBM SPSS Statistics 18.0 for statistical analyze. A linear regression analysis and one-way ANOVA test were used for this analysis to determine the statistical significance of relation in the collected data. Significance was reached if $P \leq 0.05$.

During the analysis, a univariate linear regression was used to determine if the following factors were associated on the rearing costs per heifer, per 100 kg milk and per heifer per day:

- The farms total milk production
- The number of dairy cows
- The number of young stock
- The average age at first time of calving (AFC)
- The time spent on the young stock
- The health costs
- The percentage culled heifers

These analysis methods were also used to determine if the factors mentioned above and those mentioned beneath were associated with the net returns:

- Total young stock rearing costs per heifer
- Total young stock rearing costs per 100 kg milk
- Total young stock rearing costs per day

The one-way ANOVA was used to determine if all factors mentioned above were associated with the score given by the personal veterinarian. All scores were categorically classified as followed: group 1 included the scores 5.0 - 6.0 ($n = 10$), group 2 included the scores 6.1 - 7.0 ($n = 16$) and group 3 included the scores 7.1 - 9.0 ($n = 7$).

Results

Description of the participating farms

An overview of the participating farms is given in table 1. The results are distilled from the Jonkos program which is filled in by the farmers.

In the Netherlands, the average milk production on dairy farms is 683.470 kg milk a year and farmers keep an average of 82 dairy cows.³ The farms in this study are slightly above these averages, with an average milk production of 852.298 kg milk a year (ranging from 420.000 kg milk to 1.850.000 kg milk) and an average of 104 dairy cows (ranging from 49 to 200 animals). They also own more young stock: on average the farmers owned 77 (ranging from 23 to 152), whereas the national average is 63.⁷ Thus, the farmers involved in this study are approximately 20 % bigger than the national average. On the other hand, the national average MPR-results of the heifers are better than observed on the visited farms. The national average is 8.530 kg milk with 4.34 % fat and 3.53% protein. The visited farmers in Drenthe produced 7.670 kg milk with 4.35 % fat and 3.47 % protein.(table 1) The average age at first calving in the Netherlands is 793 days³ (around 26 months). On the visited farms this average was 25.8 months, ranging from 24 to 28 months. The visited farms thus seem to have a slightly better AFC than the national average.

Total young stock rearing costs per heifer

In table 1 the average rearing costs of one successfully reared heifer are visible. In this study these costs are €1.967 per heifer. However, this ranges from €919 to €3.307. The average rearing costs without the farmers labor is €1471, with a range from €790 to €2335. The average rearing costs of one successfully reared heifer without the buildings is €1750 with a range from €703 to €3023.

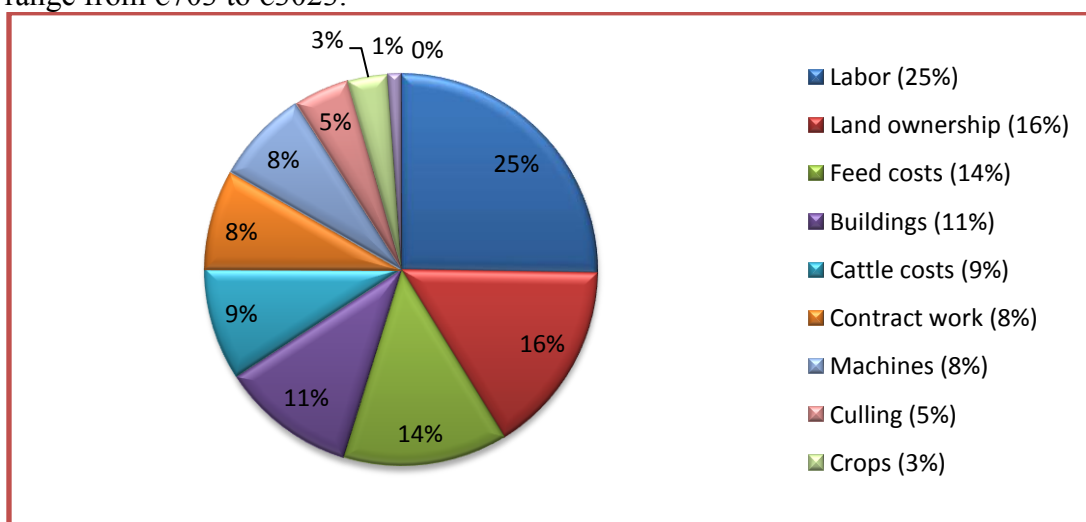


Figure 1. The average contributions to the total rearing costs.

In figure 1 a closer look at the points which create the amount of one successfully reared heifer show noticeable differences. In this figure, the largest contributors to the costs are the farmer's labor (25 %), the land-ownership (16%), the feed (14 %) and the buildings (11%). In reality the feed-costs should be a higher percentage. This is because only the costs of feed additives, concentrates and milk powder were included in this calculation. The roughage was not included as it is a complex factor dependent on many factors. However, the costs which partially participate in the costs of roughage, like contact work, land-ownership and interest are included separately.

			Average	Minimum	Maximum	SD
Company data	Milkproduction (kg milk / year)		852298	420000	1850000	323014
	Dairy cows (n)		104	49	200	39
	Young stock (n)		77	23	152	31
	AFC (months)		25,8	24	28	1,0
Rearing costs	Rearing costs (€ / heifer)		1967	919	3307	481
	Rearing costs (€ / 100 kg milk)		6,12	2,93	12,93	2,38
	Rearing costst (€ / heifer / day)		2,52	1,26	4,18	0,56
Division rearing costs (€ / heifer)	Feed costs		266	75	543	103
	Cattle costs		181	72	321	52
	Health		42	12	84	18
	Insemination		42	3	76	21
	Interest		61	28	107	20
	Remainder		36	2	192	32
	Crops		65	29	173	27
	Contract work		161	1	520	113
	Machines		152	5	516	109
	Buildings		217	29	493	87
	Land ownership		314	104	609	89
	Water		21	5	94	17
	Scrapers		0,4	0	11	1,9
	Labor		496	129	1661	321
	Labor (houres / heifer / year)		11,1	1,9	47,6	7,9
	Culling and death		91	18	322	58
MPR-results	Milk (kg)		7670	5694	9103	782,04
	Fat (%)		4,35	4,03	4,69	0,16
	Protein (%)		3,47	3,27	3,66	0,09
	Fat (kg)		334	229	404	37
	Protein (kg)		266,2	186	322	27
	Net returns (€)		2457	1698	3090	296
	Culled heifers (n)		4,7	1	13	2,7
	Culled heifers (%)		18%	3%	39%	8%
Input veterinarian	Score of veterinarian		6,779412	5	8,5	0,85

Table 1. An overview (of the average, minimum, masimum and the standaard deviation) of farm sizes and rearing costs of the participating farmers. All costs are in € / heifer unless stated otherwise.(n=35)

	Rearing costs per:					
	Heifer		100 kg milk		Heifer per day	
	Beta	P-value	Beta	P-value	Beta	P-value
Milkproduction (kg milk/year)	-0,377	0,028	-0,274	0,117	-0,370	0,031
Dairy cows (n)	-0,360	0,037	-0,171	0,335	-0,355	0,039
Youngstock (n)	-0,435	0,009	-0,301	0,079	-0,419	0,012
AFC (months)	0,551	0,001	0,661	0,000	0,432	0,012
Health costs (€)	-0,217	0,210	-0,151	0,387	-0,187	0,282
Labor (houres / heifer / year)	0,690	0,000	0,391	0,020	0,694	0,000
Culled heifers (%)	-0,096	0,600	-0,016	0,930	-0,117	0,523

Table 2. A statistical analysis of the effect of collected data on the calculated total young stock rearing costs.

After these descriptive analysis, the statistical analysis was performed. The milk production ($\beta=-0,337$; $P=0,028$), the number of dairy cows ($\beta=-0,360$; $P=0,037$) and the number of young stock ($\beta=-0,435$; $P=0,009$) were all shown to be significantly associated to rearing costs (table 2). This proves that in this research, an increase in scaling factors resulted in a lower total young stock rearing cost per heifer. However, it was also shown that a rise in AFC is related to a significant rise in the rearing costs per heifer. ($\beta=0,551$; $P=0,001$). This supports the earlier described benefits of shortening the AFC. The health costs ($P=0,210$) were not significant. This is quite logical, because it is only a small contributor to the total costs. The health costs are a part of the cattle costs depicted in figure 1. On the other hand, the farmer's labor ($\beta=0,690$; $P=0,000$) was proved very significant, most likely because of the great contribution to the total costs, despite on the strong variation (figure 2).

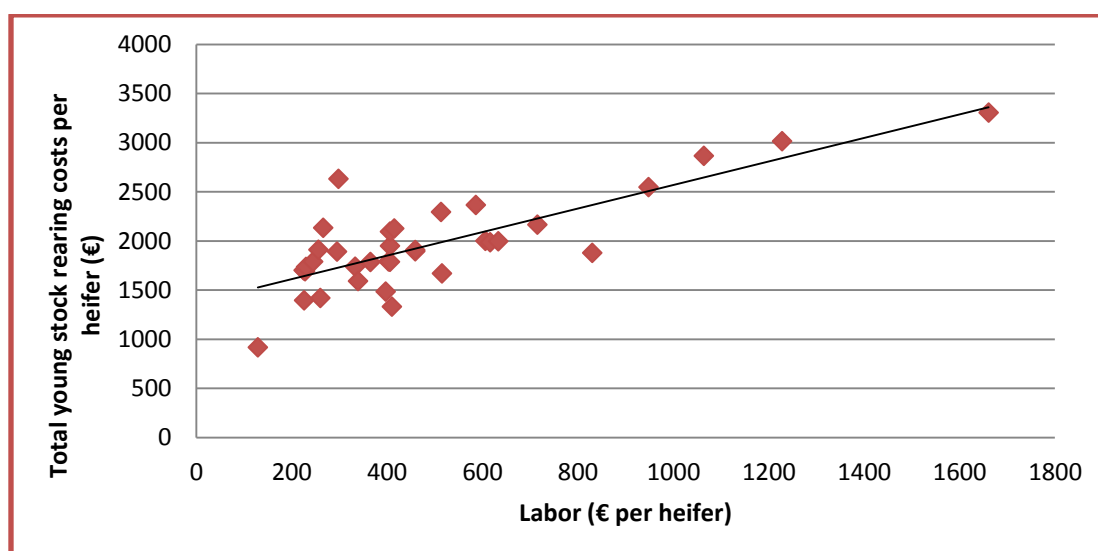


Figure 2. Total young stock rearing costs per heifer related to farmer labor per heifer

Total young stock rearing costs per 100 kg milk

This part of this study is especially interesting for farmers to compare between each other. The average of the young stock rearing costs per 100 kg milk is €6,12, with a minimum of €2,93 and a maximum of €12,93 (table 1). Unlike before, where the calculations were performed per heifer, the milk production per 100 kg milk ($P=0,117$) is not significantly linked to rearing costs. Neither is the number of dairy cows ($P=0,335$) or the number of young stock on the farm ($P=0,079$). The AFC ($\beta=0,66$; $P=0,000$) on the other hand was very associated with, meaning that the higher the AFC, the higher the rearing costs per 100 kg milk. (figure 3) Furthermore, the labor of the farmer ($\beta=0,391$; $P=0,020$) was quite significant, comparable to the calculation per heifer. The health costs ($P=0,387$) and the percentage culled heifer ($P=0,930$) were not significant.

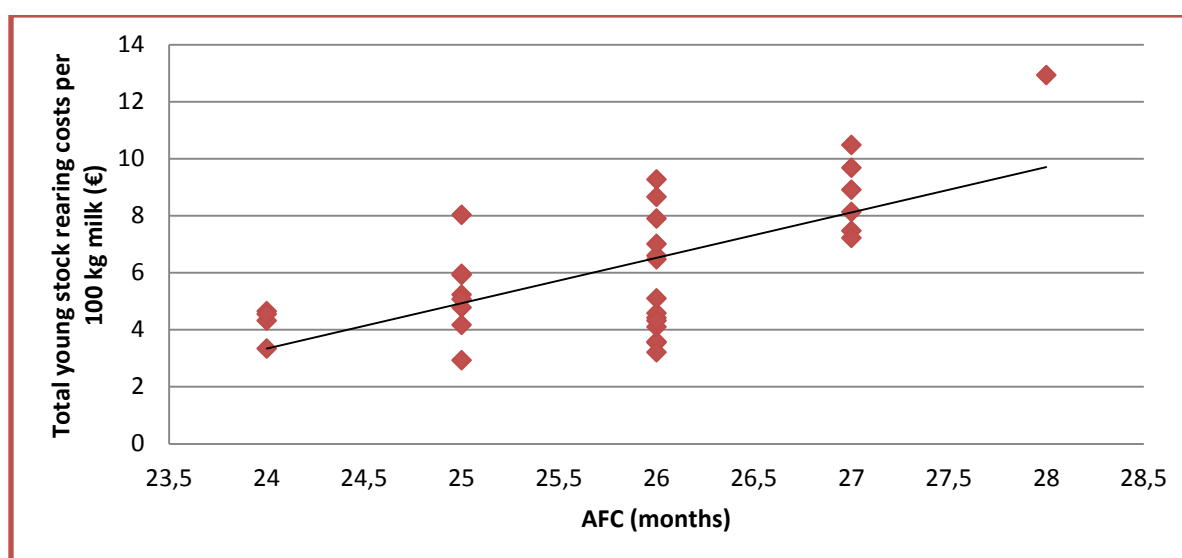


Figure 3. Total young stock rearing costs per 100 kg milk in relation to the AFC.

Total young stock rearing costs per day

In this analysis almost every factor proved significant: the milk production on the farm ($\beta=-0,370$; $P=0,031$), the number of dairy cows ($\beta=-0,355$; $P=0,039$), the number of young stock ($\beta=-0,419$; $P=0,012$), the AFC ($\beta=0,432$; $P=0,012$) and the labor of the farmer ($\beta=0,694$; $P=0,000$). Only the health costs ($P=0,282$) and the culled heifers ($P=0,523$) were not proved significantly linked to rearing costs.

Net returns of the heifers

The net returns of the heifers were also compared with a few different factors (table 3). Unfortunately, very little proved significant. An important factor to consider in table 3 is the AFC. When the net returns are compared with the AFC ($P=0,109$), there is no significance. Nevertheless, figure 4 shows a slightly falling trend.

		Net returns	
		Beta	P-value
	Milkproduction (kg milk/year)	0,165	0,368
	Dairy cows (n)	-0,010	0,955
	Young stock (n)	0,055	0,766
	AFC (months)	-0,294	0,109
	Health costs (€)	-0,156	0,393
	Labor (houres / heifer / year)	-0,160	0,380
	Culled heifers (%)	-0,036	0,846
	Heifer (€)	-0,180	0,326
Rearing costs per:	100 kg milk (€)	-0,434	0,013
	Heifer per day (€)	-0,153	0,405

Table 3. A statistical analysis of the effect of collected data on the net returns of the heifers.

Of all factors in table 3, the rearing costs per 100 kg milk ($\beta=-0,434$, $P=0,013$) is the only significant one. This is probably the result of up scaling.

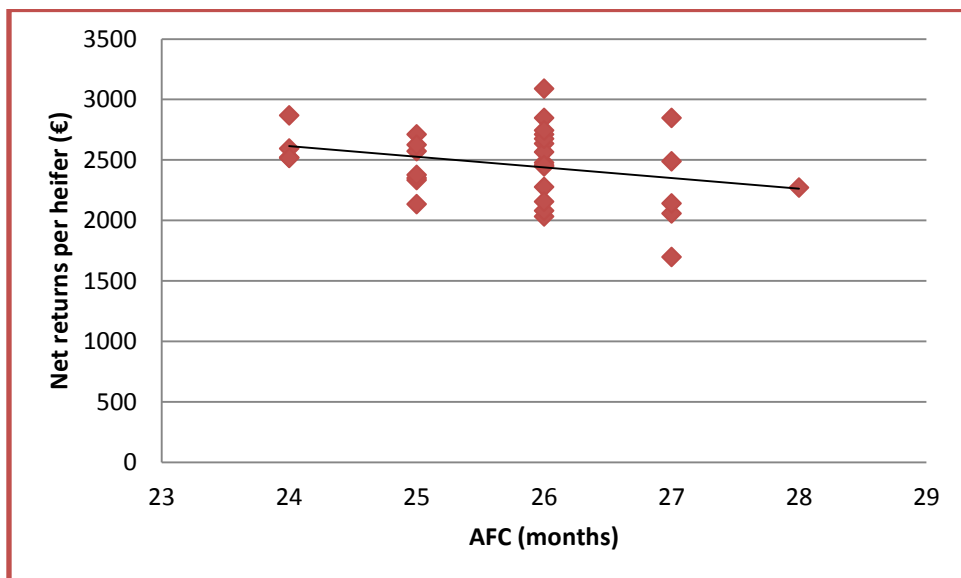


Figure 4. The net returns per heifer related to the AFC

Score of the personal veterinarian

The scores assigned by the veterinarians were divided in groups and compared with a few factors (table 4). None of the comparisons between the groups proved significant, besides the comparison between the milk production and the three groups of scores ($F=4,623$, $P=0,018$). Thus, the higher the milk production, the higher the score of the veterinarian. This could be the result of increased professionalization of farms as they increase in size. This is also suggested when comparing the scores to the number of dairy cows ($P=0,054$), as this result is almost significant.

		Score of their personal veterinarian				
		Between all groups		1 vs 2	2 vs 3	3 vs 1
		F-ration	P-value	P-value	P-value	P-value
	Milkproduction (kg milk/year)	4,623	0,018	1,000	0,016	0,090
	Dairy cows (n)	3,217	0,054	1,000	0,050	0,407
	Young stock (n)	2,874	0,072	1,000	0,069	0,459
	AFC (months)	0,668	0,520	0,825	0,470	0,506
	Health costs (€)	1,990	0,154	0,611	0,971	0,176
	Labor (houres / heifer / year)	0,124	0,883	1,000	1,000	1,000
	Net returns (€)	3,237	0,054	0,226	1,000	0,065
	Culled heifers (%)	1,144	0,333	1,000	1,000	0,425
Rearing costs per:	Heifer (€)	0,575	0,568	0,938	1,000	1,000
	100 kg milk (€)	1,588	0,220	0,272	1,000	0,725
	Heifer per day (€)	0,416	0,663	1,000	1,000	1,000

Table 4. A statistical analysis of the effect of the collected data on the score of the personal veterinarian of the farmer. (Group 1 = score 5-6 ($n=10$), group 2 = score 6.1-7 ($n=16$), group 3 = score 7.1-9 ($n=7$))

The net returns ($P=0,054$) are also almost significant (figure 5), suggesting that good heifer management is visible in net result of the first lactation.

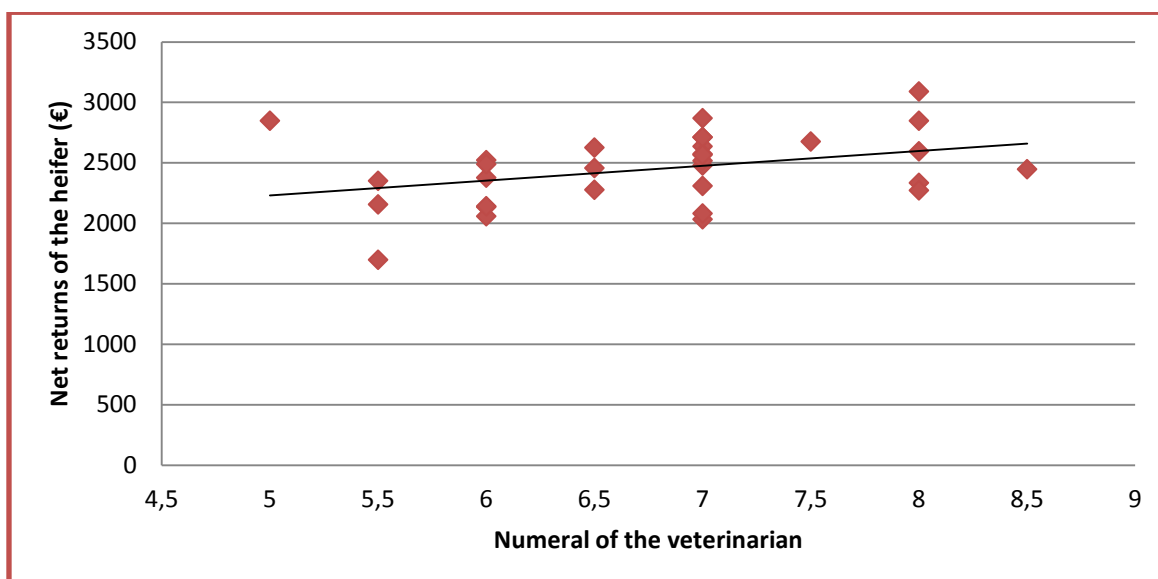


Figure 5. The net returns of the heifer related with the score of the personal veterinarian for the management skills of the farmer.

The health costs ($P=0,154$) is another interesting factor. There are two kinds of farmers with high veterinary costs: those that do a lot of prevention and those that have a lot of problems on their farms. Veterinarians tend to like the former more than the latter, because they are often a pleasure to work with. Although the latter generate more income for the veterinarian, the work on these farms is generally less pleasurable for veterinarians. The non-significance of this factor can be seen as a positive result in this case, because it indicates the unbiased approach of the veterinarians in this study.

Discussion

The calculated results are especially interesting for farmers who are considering to no longer rear their own young stock. For farmers that decide to stop doing this, there are a few options available. It is possible to sell all the calves born on the farm and to only buy new heifers when they are needed, but it is also possible to outsource the rearing. In the latter model, a fixed amount is paid per day for rearing of the animals, which are returned to the farm when they have to calf themselves. In the Netherlands, the commercial prices for outsourced young stock rearing range from €1,50 to €2,00 per calf per day. The average rearing costs per day in Drenthe by the visited farmers, who reared their own young stock, were €2,52, ranging from €1,26 to €4,18.

In this study the farmers were not randomly selected. As cooperation on a voluntary base was required for data collection, the results can be seen as an automatic selection of farmers who are interested in this research. Especially farmers with clear future prospects would be expected to participate in this study. These are generally the farmers who are young (beneath 40 years) or have a successor. This automatically leads to a selection of bigger farms, which have more dairy cows and produce more kilograms of milk per year. The visited companies were therefore almost 20 % bigger than the national average. It is therefore possible that these results are not the same for the Dutch average rearing costs, which probably will be higher.

There was a great variation in the rearing costs for the young stock of the farmers in this database. Thus a lot of variation in costs is present between farms. Possibly a lot of money can be saved by lowering the rearing costs. In this research there was hardly any significance between the net returns of the heifers and the young stock rearing costs. In other words: a decrease in the rearing costs might not automatically result in a lower quality of the heifers.

When the net returns are compared with the AFC ($P=0,109$), there is no significance. However, this is opposite to what the farmers said to have experienced. They seem to be of the opinion that it is better to increase the AFC, so the heifer has more time to develop and will eventually produce more milk. It is therefore quite remarkable that this research proves the contradiction. Nevertheless, figure 4 shows a slightly falling trend. It is therefore possible that the farmers' opinions are not entirely unjustified. The literature says about this point that earlier insemination without adjusting management to ensure sufficient development lowers the net returns.¹⁰ So when the farmer wants to bring forward the AFC, they should adapt their management first.

In this study all farmers received a score of their rearing skills from their personal veterinarian. Because the Veterinary Centre Zuid-Oost Drenthe is quite a large veterinary clinic, there are a lot of veterinarians working there. This means the participating farmers had different veterinarians, which most likely have different intrinsic values. Each veterinarian likely differs in which factor they think is most important in the rearing period. This could have influenced the height of the scores.

The program used in this study for calculating the young stock rearing costs, Jonkos, was not a very easy program to use. Filling in the datasheets required quite a lot of preparation from most of the farmers. Not all of them did this adequately, so sometimes it took a long time to fill in the sheets. The instructions of an expert were necessary to complete all sheets with the

data. It seems therefore that Jonkos has failed in its intention to be filled in by farmers themselves. Maybe is it possible to do this together with the veterinarian.

One of the most difficult parts of the program was determining the costs of the buildings. In the spreadsheets the expression "replacement value" is used, an expression which evoked a lot of discussion from the farmers. Many of them interpreted these words differently, resulting in a large range of the building costs.

As discussed previously, the feed costs, which contribute to 14 % of the total young stock rearing costs per heifer, seemed to be a smaller part of the total rearing costs than normally presumed. In reality, the feed-costs should be a higher percentage. This is because the roughage was not included in the calculation, because it is a complex factor depending on many factors. In this study, only the costs of feed additives, concentrates and milk powder are included. However, the costs which partially contribute to the costs of roughage, like contact work, land-ownership and interest are included separately.

Conclusion

The young stock rearing costs of the farms used for this study have a large range, being between €919 and €3.307 per heifer with a average of €1.967. This spread suggests that it is possible to reduce these costs on many farms.

No relation between the AFC and the net returns of heifers was shown to exist in this study, which should reassure a lot of farmers.

Although it is not significant, a relation between the scores of the personal veterinarians of the famers and the net returns of the heifers was suggested. This may indicate that a good management can result in financial benefit.

Acknowledgement

It would not be possible to write this paper without the support and help of all the kind people around me. I will give some of them a special mention here.

I would like to acknowledge my supervisor at the faculty, Dr. Ir. Henk Hogeveen, for his support and his knowledge about research. From both sides, the time management was not always adequately arranged, but with our flexible attitude this was never a problem. In addition, I am very thankful to his roommate Hans Vernooij, for his support and answers to hard questions about SPSS, a beloved statistics program.

This paper would also not have been possible without my local supervisor IJmert de Vries, his practical advice and provision of all the details from the farmers. I was also very pleased with his quick response to emails.

Before I started with the data collection, I had to learn to work with the spreadsheet JonKos. I would like to thank Thijs Derkman for the time he spent to help me understand the file. And thanks to the farmers Jacco Klaver and Klaas Kaan, I was able to train with the spreadsheet in a real farm environment.

In addition, I am very grateful to Hannah van Velzen for her help with the English writing in this paper. Despite her hectic life she saw time to help me. The same applies to Rick Baltus. Although he did not have much time, he helped me out with using Excel and SPSS. Also I want to thank my parents and my little sisters and brother for all their heart-warming and adorable questions to me.

Furthermore I am very thankful for all the help I received from all the employees and veterinarians at the Veterinary Centre Zuid-Oost Drenthe. Without you, I would never have been able to judge the management skills of your farmers. Some of you also helped me collect the farmers for my database and I am very grateful for that.

I would especially like to thank Gerrit and Ans Hegen for their kindness and support. You agreed to let me stay at your house for almost a month, without me even knowing. I was also allowed to accompany Gerrit on his night shifts and must say that I have learnt a lot in my month of living with a veterinarian.

Above all, I would like to thank all farmers who contributed to this study. I felt very welcome on your farms. You put yourself and your company in a vulnerable position and I am happy with your trust in me. On almost all the farms I was given a guided tour and I learned a lot from all your visions and ideas. I am deeply affected by your love and dedication for your farms.

I will never forget my wonderful summer in Drenthe.

References

1. Bell M.J., Wall E., Russell G., Roberts D.J. and Simm G., 2010: **Risk factors for culling in Holstein-Friesian dairy cows.** *Veterinary Record* **167**: 238-240.
2. Bell M.J., Wall E., Russell G., Simm G. and Stott A.W., 2011: **The effect of improving cow productivity, fertility, and longevity on the global warming potential of dairy systems.** *Journal of Dairy Science* **94**: 3662-3678.
3. CRV, 2012: **CRV Jaarstatistieken 2012.** (CRV yearly statistic) Accessed October 2013. <https://www.crv4all.nl/over-crv/publicaties/jaarverslagen/327327/>
4. Ettema J.F. and Santos J.E.P., 2004: **Impact of age at calving on lactation, reproduction, health, and income in first-parity Holsteins on commercial farms.** *Journal of Dairy Science* **87**: 2730–2742.
5. Gabler M.T., Tozer P.R. and Heinrichs A. J., 2000: **Development of a cost analysis spreadsheet for calculating the costs to raise a replacement dairy heifer.** *Journal of Dairy Science* **83**: 1104–1 109.
6. Gröhn Y.T., Eicker S.W., Ducrocq V. and Hertl J.A., 1998: **Effect of diseases on the culling of Holstein dairy cows in New York State.** *Journal of Dairy Science* **81**: 966-978.
7. LEI bedrijven informatienetwerk, 2011: Bedrijfsresultaten van land- en tuinbouwbedrijven. Accessed October 2013. http://www3.lei.wur.nl/bininternet_asp/index.aspx
8. Macrina A.L., Kauf A.C.W. and Kensinger R.S., 2011: **Effect of bovine somatotropin administration during induction of lactation in 15-month-old heifers on production and health.** *Journal of Dairy Science* **94**: 4566-4573.
9. Mohd Nor N., Steeneveld W., Mourits M.C.M. and Hogeveen H., 2012: **Estimating the costs of rearing young dairy cattle in the Netherlands using a simulation model that accounts for uncertainty related to diseases.** *Preventive Veterinary Medicine* **106**: 214-224.
10. Mohd Nor N., Steeneveld W., van Werven T., Mourits M.C.M. and Hogeveen H., 2013: **First-Calving age and first-lactation milk production on Dutch dairy farms.** *Journal of Dairy Science* **96**: 981-992
11. Mohd Nor N., Steeneveld W., Hogeveen H., 2014: **The average culling rate of Dutch dairy herds over the years 2007 to 2010 and its association with herd reproduction, performance and health.** *Journal of Dairy Research* **81**: 1-8
12. Mourits M.C.M., Berentsen P.B.M., Huirne R.B.M. and Dijkhuizen A.A., 2000: **Environmental impact of heifer management decisions on Dutch dairy farms.** *Netherlands Journal of Agricultural Science* **48**: 151-164.

13. Pinedo P.J., de Vries A. and Webb D.W., 2010: **Dynamics of culling risk with disposal codes reported by Dairy Herd Improvement dairy herds.** *Journal of Dairy Science* **93**: 2250-2261.
14. Rajala-Schultz P.J. and Gröhn Y.T., 1999: **Culling of dairy cows. Part I. Effects of diseases on culling in Finnish Ayrshire cows.** *Preventive Veterinary Medicine* **41**: 195-208.
15. Schneider M.D., Strandberg E., Emanuelson U., Grandinson K. and Roth A., 2007: **The effect of veterinary-treated clinical mastitis and pregnancy status on culling in Swedish dairy cows.** *Preventive Veterinary Medicine* **80**: 179-192.
16. Seegers H., Beaudeau F., Fourichon C. and Bareille N., 1998: **Reasons for culling in French Holstein cows.** *Preventive Veterinary Medicine* **36**: 257-271.
17. Sol J., Stelwagen J. and Dijkhuizen A.A., 1984: **A 3 year herd health and management program on 30 Dutch dairy farm. 2. Culling strategy and losses caused by forced replacement of dairy cows.** *Veterinary Quarterly* **6**: 149-157.
18. Stevenson M.A. and Lean I.J., 1998: **Descriptive epidemiological study on culling and deaths in eight dairy herds.** *Australian Veterinary Journal* **76**: 482-488.
19. De Vries A., Olson J.D. and Pinedo P.J., 2010: **Reproductive risk factors for culling and productive life in large dairy herds in the eastern United States between 2001 and 2006.** *Journal of Dairy Science* **93**: 613-623.
20. WUR Livestock Research, DLV and WUR Business Economics, 2013: **JonKos Melkvee.** <http://www.verantwoordeveehouderij.nl/show/JONKOS-1.htm>, visited on 28-06-2013