

The costs of young stock rearing on dairy farms and its estimation by farmers in the Netherlands

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September 13<sup>th</sup> 2012

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## SUMMARY

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Young stock rearing is an important factor on dairy farms. However, the costs of young stock rearing are often unknown while most costs are contributed to the dairy cows. In addition to that, most farmers have great difficulties in estimating the costs of young stock rearing. Previous research shows that the costs of young stock rearing can be up to €1540 per successfully bred heifer or 13% of the cost price of milk (Mohd Nor *et al.*, 2012). In order to calculate the young stock rearing costs on Dutch dairy farms, 43 farms were visited and a calculation of their young stock rearing costs was made using JonKos, a module designed by WUR Livestock Research, DLV and WUR Business economics (WUR Livestock Research *et al.*, 2011).

The average costs of young stock rearing on dairy farms according to this research project were €1559 per successfully reared heifer. Young stock rearing farms had lower average rearing costs than dairy farms (€1273 versus €1606 resp.), although this proved not to be significant ( $p=0.056$ ;  $B=-0.294$ ). The total hours spent on young stock rearing had a significant effect on the total young stock rearing costs per heifer on dairy farms ( $p=0.049$ ;  $B=0.326$ ). In addition, a rise in the average age at first calving did lead to a significant rise the costs of young stock rearing per 100 kg milk ( $p=0.01$ ;  $B=0.426$ ).

The farmers that participated in this research project estimated their rearing costs to be €994 per successfully reared heifer, thereby underestimating the young stock rearing costs by €312 per heifer. There was no significant relation between the calculated young stock rearing costs on a farm and the estimation by the farmer, which leads to the conclusion that the farmers that participated in this project were not able to make an educated guess of their young stock rearing costs.

All farmers that participated in this research project wanted more information on young stock rearing and the costs accompanied with the rearing period. In addition, all farmers would recommend calculating the costs of the young stock period to other farmers.

## SAMENVATTING

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Jongvee-opfok is een belangrijke factor in de melkveehouderij. Echter, de kosten van jongvee-opfok zijn vaak onbekend omdat de meeste van deze kosten worden toegeschreven aan het melkvee. Mede hierom hebben veehouders vaak moeite met het schatten van de kosten van jongvee opfok op hun bedrijf. Onderzoek heeft uitgewezen dat de kosten van jongvee opfok tot €1540 per vaars kunnen bedragen, waarmee de opfokkosten op een bedrijf 13% van de kostprijs van melk vormen (Mohd Nor *et al.*, 2012). Om de opfokkosten op Nederlandse melkveebedrijven te berekenen zijn 43 bedrijven bezocht. Hier is een berekening van de jongvee-opfokkosten gemaakt door middel van de module Jonkos, ontwikkeld door WUR Livestock Research, DLV en WUR Business Economics (WUR Livestock Research *et al.*, 2011).

De gemiddelde kosten van jongvee-opfok op de melkveebedrijven in dit project zijn €1559 per vaars. Gespecialiseerde opfokbedrijven hebben gemiddeld lagere opfokkosten dan melkveebedrijven (respectievelijk €1273 en €1606), hoewel dit geen significant verschil bleek te zijn ( $p=0,056$ ;  $B=-0,294$ ). Het aantal uren dat besteed wordt aan jongvee heeft een significant effect op de totale opfokkosten per vaars op melkveebedrijven ( $p=0,049$ ;  $B=0,326$ ). Daarnaast zorgt een stijging van de gemiddelde afkalftijd vaarzen (ALVA) voor een significante stijging in de jongvee-opfokkosten per 100 kg melk ( $p=0,01$ ;  $B=0,426$ ).

De veehouders die deelnamen aan dit onderzoek schatten de kosten van jongvee-opfok op hun bedrijf op €994 per vaars, wat staat voor een gemiddelde onderschatting van €312 per vaars. Er is geen significante relatie gevonden tussen de schatting van de veehouder en de werkelijk berekende jongvee-opfokkosten. Dit leidt tot de conclusie dat de veehouders in dit onderzoek niet in staat zijn om een onderbouwde inschatting te maken van de opfokkosten op hun bedrijf.

De deelnemende veehouders gaven aan meer informatie te willen over de jongvee-opfok en de bijbehorende kosten. Daarnaast zouden alle veehouders in dit onderzoek het gebruik van JonKos aanraden aan collega's om een beter beeld van de jongvee-opfokkosten op hun bedrijf te krijgen.

## INTRODUCTION

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Young stock rearing is the foundation of a well-managed dairy farm. However, not all farmers seem to acknowledge the fact that today's young stock will be tomorrow's dairy cows. That is, in the farmers' defense, hard because young stock does not provide any direct income.

With an average productive life of 3,5 years per dairy cow in the Netherlands (CRV BV., 2011), the average yearly culling percentage on a Dutch dairy farm is around 30%. In 2009, the average culling percentage per dairy farm was 26,4% (Bedrijven informatienet van het LEI, 2012). Consequently, the young stock on a dairy farm forms at least 52% of the total stock size, considering that not every calve will become a successfully reared heifer and that the rearing period from calve to heifer takes about 26 months (CRV BV., 2011; Brickell *et al.*, 2009). Realizing this, it is surprising how little research is done on- and the costs accompanied with young stock rearing.

Most of the Dutch dairy farmers rear their own heifers. Little data are collected to follow the calves through time and it is mostly an experience-based decision whether or not calves are ready to be bred. While research shows that the optimal insemination date varies amongst animals and is best defined as a developmental feature rather than age, a lot of farmers decide to inseminate their heifers at a set age.

In addition, it may be noticed that a lot of farmers rear all their young stock rather than selecting the calves of cows or bulls with features the farmer wants in a cow before starting the rearing period. With an average costs of €1540 per successfully reared heifer (Mohd Nor *et al.*, 2012), the decision whether or not to rear a calve should not be taken too lightly. Mohd Nor *et al.* also showed that approximately 13% of the cost price of milk consists of costs for young stock rearing (Mohd Nor *et al.*, 2012). Considering the low margins in modern day dairy, the fact that dairy farmers are ignoring one eighth of the total costs seems hard to understand.

When a farm is seen as a profit organization, the costs of young stock rearing may be seen as a long-term investment. A logical aim for any business is to improve their return on investment. However, in dairy farms there are no clear guidelines to monitor the development from calve to heifer, let alone any insights on where efficiency can be improved and costs can be cut (Mourits *et al.*, 2000).

Improving the return on investment can be done in several ways. First of all, improving the quality of reared heifers is one way to increase efficiency. By maintaining the same costs while increasing the quality of reared heifers, total milk production per productive life will rise in the upcoming generation of dairy cows, thereby increasing the profitability of the investment in young stock. Higher total milk production per productive life can be achieved by increasing the age at culling or by increasing milk yield per cycle. Another way of improving the return on investment is by cutting the costs. The problem with this solution is that cutting the costs must not compromise the quality of the reared heifers. Optimizing the number of animals that are kept for rearing can be a more efficient way to improve profitability of young stock rearing (Tozer *et al.*, 2001).

Finally, reducing the age at first calving reduces the costs of young stock rearing. By doing this, not only the number of rearing days but also the total amount of animals kept for rearing is reduced. Macrina *et al.* have tried to induce lactation by administration estradiol-17B and progesterone at 15 months of age, but this proved not to be economically beneficial because of lower milk yields per day (Macrina *et al.*, 2011).

When taking measures to improve the return on investment on a dairy farm, the quality of reared heifers should constantly be evaluated in order to maintain high milk yields in the production cycle. However, an optimal balance between costs and benefits is hard to find.

Management is all about making the right decisions, but this can only be done by looking at the right parameters. Suggested data to be collected are body weight development, height,

body condition score, weight at first insemination and at first calving, age at first calving, number of inseminations per calve, frequently occurring diseases and feed costs (Mourits *et al.*, 2000; Bach *et al.*, 2008; Le Cozler *et al.*, 2008 ; Davis Rincker *et al.*, 2011). When the farmer is aware of these data, he will be able to adjust his young stock management in order to make his rearing program more efficient.

Research has shown that farmers are having great difficulties in estimating the costs of clinical mastitis (Huijps *et al.*, 2008). The aim of this research project is to create insight in the opinion of Dutch dairy farmers considering young stock rearing management and, in term, to create awareness on the costs of young stock rearing amongst dairy farmers in the Netherlands. Can Dutch dairy farmers make an appropriate estimation of their young stock rearing costs? What costs does the farmer expect, what are the real costs and what are the biggest contributors to these costs? And furthermore, is there a relation between, for instance, the average age at first calving and the costs of young stock rearing? This research project aims to collect data on- and create insight in this matter.

## MATERIALS AND METHODS

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### PARTICIPATING FARMERS AND JONKOS

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In order to build a dataset, 432 dairy farmers from the University Large Animal Practice (ULP Harmelen) were approached via e-mail in September 2011. The farmers were asked if they were interested in a free calculation of young stock rearing costs on their farm. A reminder was sent approximately one month after the first e-mail. Over a period of 7 weeks, 34 farmers responded.

In order to increase the dataset of this project, Veterinary Health Centre 'De Peuvers Esch' contacted 10 of their clients by telephone to ask them if they were willing to participate in this project. This resulted in 9 additional participants.

Amongst the total of 43 farms participating in this project, there were 37 dairy farms of which 2 were biological farms. The other 6 farms were young stock rearing farms.

All farms were visited and the farmers were asked to fill in a questionnaire (Appendix 1) before filling in the calculating model. The goal of the questionnaire was to provide insight in the farmers' estimation of his young stock rearing costs, the biggest contributors to these costs according to the farmer and the way he manages the rearing period.

Subsequently, a calculation of the young stock rearing costs was made using 'JonKos Melkvee sept 2011' (JonKos), a model designed by WUR Livestock Research, DLV and WUR Business economics (WUR Livestock Research *et al.*, 2011).

JonKos was designed as a model for farmers to calculate their own young stock rearing costs. It consists of a main sheet, where general data can be entered. The main subjects are:

- General information and number of animals: milk production and farm size
- Ration: number of grazing days, feed proposition and concentrates
- Crops, harvest and bought roughage
- Cattle costs: Health- and litter costs
- Land and buildings
- Manure
- Labor and installations
- Water, energy and charges

Filling in this sheet takes approximately 20 minutes. By giving this information, the farmer gets a rough estimation of his young stock rearing costs.

In other sheets, it is possible to enter more detailed information on the different main subjects. Providing this information takes more time and some preparation and perseverance of the farmer, but also gives a more accurate result on the specific young stock rearing costs on the farm. All but one farmers participating in this project chose to fill in the entire model.

When all information about the farm is filled in, the results are displayed on the main sheet. The calculated costs are:

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

These costs are displayed both with and without the labor costs included. This is done because of the fact that the farmer's wage is a fictive number on most farms and therefore not taken into account by some farmers.

The total young stock rearing costs per heifer are also divided into cost groups, so that the farmer can see what the biggest contributors to his young stock rearing costs are.

After the calculation, farmers were asked to fill in a second questionnaire in order to gather information about whether or not filling in JonKos increased the farmer's awareness on young stock rearing costs.

## DATA PREPARATION

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In order to analyze the data, additional calculations had to be made. The most important calculations that were used for further analyses are:

- The ratio between number of young stock and number of dairy cows on a farm.
- The calculated young stock rearing costs based on the farmer's estimation. Farmers had the choice which costs they included in their estimation. In order to compare the calculated young stock rearing costs with the farmer's estimation, a calculation of the rearing costs was made with the same costs included as in the farmer's estimation. For instance, when a farmer estimated his young stock rearing costs without labor and housing, the calculated young stock rearing costs without labor and housing were calculated.
- The difference between the farmer's estimation and the calculated young stock rearing costs in euros.
- The deviation of the farmer's estimation and the calculated young stock rearing costs as a percentage of the farmer's estimation.
- The percentage in which the different costs contributed to the total young stock rearing costs.
- The percentage of external costs as a percentage of the calculated young stock rearing costs.

## DATA ANALYSIS

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The collected data were processed using Microsoft® Office Excel 2010 and analyzed with IBM SPSS Statistics 20.0.0 for Windows. A linear regression test was used to determine statistical significance of the observed trends. An effect was interpreted as significant if  $p \leq 0.05$ .

Because of the unforeseen matter that 6 specialized young stock rearing farms participated in this project, for some analyses a subdivision into specialization (dairy vs. young stock rearing farms) had to be made. Some of the data obtained with the calculation or questionnaire were interpreted differently on dairy farms than on young stock rearing farms, thereby showing a greater spread. To exclude this spread and in order to gain significant and reliable results, for some analyses a subdivision was made between these two groups.

The output of JonKos was anonymized and subdivided into averages with minima and maxima per group, being all farms together, dairy farms and young stock rearing farms.



A univariate linear regression analysis was used to determine whether or not the calculated young stock rearing costs were dependent of the next variables, all believed to be independent:

- Average age at first calving (ALVA)
- The number of young stock
- The number of dairy cows
- The farm's total milk production
- The farmer's wage
- Time spent on young stock.

The calculated young stock rearing costs per heifer is used as an independent variable to see if this has an influence on the farmer's estimation of the young stock rearing costs per heifer. In order to create a good comparison model, the farmer's estimation was compared to the calculated young stock rearing costs per heifer, where the costs the farmer included in his estimation were taken into consideration. This way, the farmer's estimation of the young stock rearing costs on his farm was compared to the calculated young stock rearing costs per heifer with the same costs included.

## RESULTS

### PARTICIPATING FARMS

Table 1 gives an overview of the participating farms. The results were obtained after filling in the datasheets in JonKos.

The average milk production of the participating dairy farms was 747.722 kg milk per year, with a minimum of 340.000 kg and a maximum of 1.700.000 kg. The mean number of cows present at a dairy farm was 91, the smallest dairy farm having 40 dairy cows and the biggest having 177 dairy cows (table 1). In the Netherlands, an average farm produced 681.400 kg milk a year with approximately 82,7 dairy cows (Bedrijven informatienet van het LEI, 2012). Thus, the dairy farms analyzed in this study were on average approximately 10% bigger than the average dairy farm in the Netherlands.

	Average <sup>6</sup> (min-max)	Average dairy farms (min-max)	Average rearing farms (min-max)
<b>Milk production (kg milk/year)</b>	629.035 (0 - 1.700.000)	747.722 (340.000 - 1.700.000 )	21.750 (0 - 130.050)
<b>Dairy cows (n)</b>	79 (0 - 177)	91 (40 - 177)	2,5 (0 - 15)
<b>Calves (n)</b>	22 (0 - 57)	25 (7 - 56,55)	0,67 (0 - 4)
<b>Young stock needed (n)<sup>1</sup></b>	59 (19 - 115)	57 (19 - 115)	73 (50 - 90)
<b>ALVA (months)<sup>2</sup></b>	24,9 (20 - 29)	25 (23 - 29)	21,5 (20 - 24)
<b>Total rearing costs</b>	1559 (800 - 2862)	1606 (1057 - 2862)	1273 (800 - 2530)
<b>Feed costs<sup>3</sup></b>	211 (34 - 532)	224 (34 - 532)	133 (44 - 257)
<b>Cattle costs</b>	133 (28 - 198)	137 (77 - 198)	113 (28 - 167)
<b>Health</b>	34 (5,8 - 78)	34 (10 - 70)	41 (5 - 78)
<b>Insemination</b>	24 (0 - 71)	25 (0 - 71)	24 (0 - 49)
<b>Interest</b>	49 (0 - 72)	53 (23 - 72)	27 (0 - 40)
<b>Crops</b>	67 (-17 - 156) <sup>7</sup>	70 (-17 - 156)	52 (4 - 113)
<b>Contract work</b>	124 (0 - 388)	129 (0 - 388)	98 (13 - 174)
<b>Machines</b>	21 (0 - 548) <sup>8</sup>	10 (0 - 54)	91 (0 - 548)
<b>Buildings</b>	22 (62 - 498)	250 (89 - 498)	193 (62 - 377)
<b>Land ownership</b>	260 (0 - 444)	272 (0 - 444)	188 (27 - 295)
<b>Water</b>	11 (0,39 - 37)	12 (0,39 - 37)	10 (0,41 - 15)
<b>Manure<sup>4</sup></b>	3,47 (0 - 44)	4 (0 - 44)	1,63 (0 - 9,8)
<b>Labor<sup>5</sup></b>	438 (184 - 1184)	448 (184 - 1184)	378 (204 - 769)
<b>Culling and death</b>	22 (0 - 57)	25 (0 - 57)	10 (0 - 18)
<b>Rearing costs (€/100 kg milk)</b>	-	5,37 (1,72 - 9,03)	-
<b>Rearing costs (€/heifer/day)</b>	2,06 (1,14 - 3,78)	2,08 (1,45 - 3,49)	1,95 (1,14 - 3,78)
<b>Farmer's estimation of costs</b>	994 (400 - 1800)	1015 (400 - 1800)	867 (700 - 1000)
<b>Total rearing costs based on farmer's estimation</b>	1306 (532 - 2862)	1355 (611 - 2862)	1010 (532 - 2530)
<b>Total rearing costs</b>	1559 (800 - 2863)	1606 (1057 - 2862)	1273 (800 - 2530)

Table 1: Overview of farm sizes and rearing costs of the participating farms. All costs in €/heifer unless stated otherwise.

1: Number of young stock needed for replacement and growth per year; 2: Average age at first calving; 3: Feed costs per heifer, consisting of concentrates and milk powder; 4: Costs of disposing the surplus of young stock's manure; 5: The farmer's wage per reared heifer; 6: All farms included; 7: The farmer that earned money on crops reared his young stock on nature-pastures without paying rent and earned money by selling hay; 8: The €548 attributed to machine-costs was one young-stock rearing farm with no other activities than rearing.

The average age at first calving (ALVA) on the dairy farms varied from 23 to 29 months, with an average of 25 months (*table 1*). The average ALVA in the Netherlands was 796 days (approximately 26 months) in 2010 and is very consistent over the years (CRV BV., 2011). The average age at first calving on the participating farm was therefore a little bit better than the Dutch average.

Because young stock rearing farms are not common in the Netherlands, there are no clear data on average farm sizes. A comparison between young stock rearing farms participating in this project and the Dutch average is therefore not possible.

## TOTAL YOUNG STOCK REARING COSTS PER HEIFER

The average total young stock rearing costs per heifer based on the farms in this research project were €1559 per successfully reared heifer, with a spread between €800 and €2862 (*table 1*). On average, farmers estimated the total young stock rearing costs to be €994 per reared heifer, with a spread between €400 and €1800 per heifer. The costs included in this estimation varied, but when taking the included costs in consideration, the calculated costs were €1306 on average, with a spread of €532 to €2862 per reared heifer.

Young stock rearing farms had lower average rearing costs than dairy farms (€1273 versus €1606 resp.), although this proved not to be significant ( $p=0,056$ ;  $B=-0,294$ ).

When looking at the biggest contributors to the young stock rearing costs, it appears that the farmer's labor was the biggest post, followed by land-ownership and housing respectively (*table 2*). It must be said that the feed costs, with 10,5-15,6% contribution to the total young stock rearing costs, are just the costs of milk powder, concentrates and feed additives. The costs of roughage were not included in the feed costs, as the complex mix of multiple costs made the exact costs of roughage too hard to calculate. The costs that partially contribute to the costs of roughage, for example land-ownership, contract work and interest, are stated individually (*table 2*).

	Average	Average (dairy)	Average (rearing)
<b>Farmer's labor</b>	28,12%	27,92%	29,68%
<b>Land-ownership</b>	16,70%	16,94%	14,83%
<b>Housing</b>	15,52%	15,56%	15,22%
<b>Feed</b>	15,0%	15,6%	10,5%
<b>Contract work</b>	8,00%	8,03%	7,76%
<b>Crops</b>	4,32%	4,34%	4,11%
<b>Interest</b>	3,16%	3,30%	2,12%
<b>Health</b>	2,23%	2,10%	3,23%
<b>Other</b>	1,60%	1,59%	1,64%
<b>Fertility</b>	1,58%	1,53%	1,95%
<b>Death/culling</b>	1,45%	1,53%	0,82%
<b>Machines</b>	1,36%	0,61%	7,19%
<b>Water</b>	0,73%	0,72%	0,81%
<b>Manure</b>	0,22%	0,24%	0,13%

Table 2: Average contributions to the total rearing costs.

The first statistical analyses were made to determine which of the collected data had a significant impact on the total young stock rearing costs per heifer.

The age at first calving on young stock rearing farms was interpreted as the time that heifers were kept on the farm for rearing. Most of the young stock rearing farms got the calves a few weeks after birth and the heifer went back to the dairy farm approximately one month before calving. The total rearing period on dairy farms is therefore longer, so taking these two interpretations together for analysis is not correct. In order to determine if the average age at first calving had a significant effect on the young stock rearing costs, the farms were split into two groups (dairy farms versus young stock rearing farms). Although graphs seemed to show that more young stock on a dairy farm resulted in lower costs per successfully reared heifer (*figure 1*), this relation was not significant ( $p=0,125$ ). Also the ratio of total number of young stock per dairy cow did not prove to be significant

( $p=0,509$ ). The farm's total milk production ( $p=0,137$ ) and the number of dairy cows present on the farm ( $p=0,176$ ) also did not have a significant effect on the total young stock rearing costs per heifer. Therefore, the influence of scale in terms of young stock rearing costs per heifer on dairy farms proved not to be significant in this project. The average age at first calving ( $p=0,16$ ) did not have a significant effect on the young stock rearing costs per heifer on dairy farms, neither does the farmer's wage ( $p=0,801$ ). The total number of hours of labor spent on young stock, however, did seem to be significant on the total young stock rearing costs per heifer on dairy farms ( $p=0,049$ ;  $B=0,326$ ).

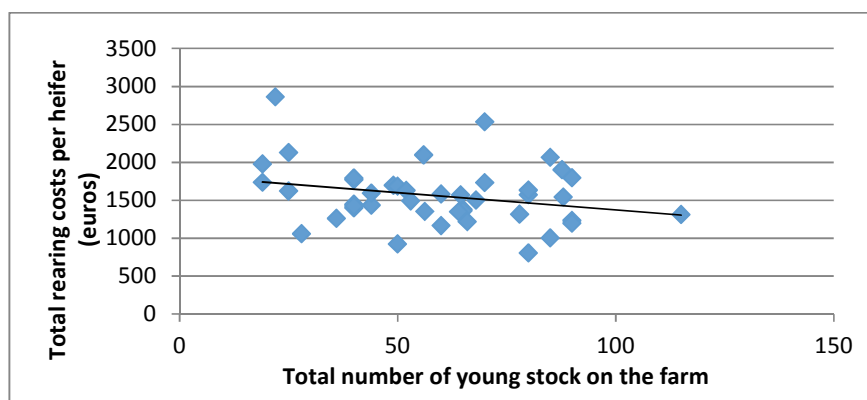


Figure 1: Total young stock rearing costs per heifer related to total number of young stock on dairy farms

On young stock rearing farms, no significant relations were found between the collected data and the calculated young stock rearing costs per heifer (table 3).

	Dairy farms		Young stock rearing farms	
	p-value	Beta	p-value	Beta
<b>Total milk production</b>	0,137	-0,249	-	-
<b>Total number of dairy cows</b>	0,176	-0,228	-	-
<b>Total number of young stock</b>	0,125	-0,257	0,951	-0,032
<b>Ratio young stock/cow</b>	0,509	-0,112	-	-
<b>Average age at first calving</b>	0,160	0,236	0,758	0,163
<b>Hours spent on rearing</b>	0,049	0,326	0,166	0,646
<b>Farmer's wage</b>	0,801	-0,043	0,479	0,363

Table 3: Statistical analysis of the effect of collected data on the calculated total young stock rearing costs per heifer.

## YOUNG STOCK REARING COSTS PER 100 KG MILK

To create awareness amongst dairy farmers, one of the outputs of JonKos stated the total young stock rearing costs per 100 kg milk produced. During the data collection it was noticed that this description of costs was one of the most practical ways of expressing the costs of young stock rearing to farmers.

	Costs per 100 kg milk	Costs per 100 kg milk (excl. labor)
<b>Average</b>	5,37	3,93
<b>Minimum</b>	1,72	1,20
<b>Maximum</b>	9,03	6,84

Table 4: Young stock rearing costs in euros per 100 kg milk produced.

Table 4 shows an average young stock rearing costs on dairy farms of €5,37 per 100 kg milk produced, with a spread of €1,72 to €9,03 per 100 kg milk. The total milk production on the farm was not significant ( $p=0,661$ ) on the young stock rearing costs per 100 kg milk, neither was the total number of dairy cows ( $p=0,317$ ) or the total number of young stock on the farm ( $p=0,06$ ). However, a rise in the average age at first calving did lead to a significant rise the costs of young stock rearing per 100 kg milk ( $p=0,01$ ;  $B=0,426$ ), also illustrated in figure 2.

Contrary to the total young stock rearing costs per heifer, the young stock rearing costs per 100 kg milk was not significantly influenced by the total number of hours spent on young stock rearing by the farmer ( $p=0,437$ ).

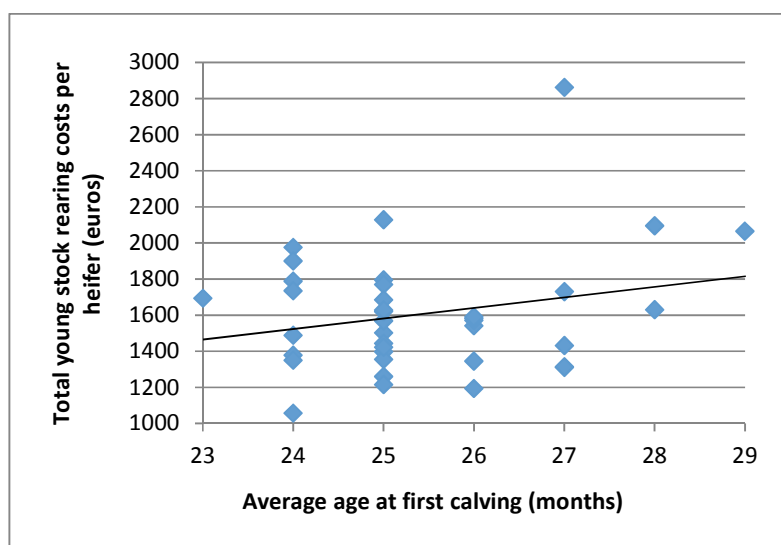


Figure 2: Young stock rearing costs in euros per 100 kg milk in relation to the average age at first calving in months.

With the farmer's labor costs excluded (table 4), not only the average age at first calving showed to be significant ( $p=0,001$ ;  $B=0,529$ ), also the total number of young stock on the farm had a significant effect ( $p=0,002$ ;  $B=0,504$ ) on total rearing costs per 100 kg milk produced. Total milk production ( $p=0,7$ ) and number of dairy cows ( $p=0,99$ ) on the farm did not seem to be significant. Rearing more young stock, independent of the farm's annual milk production, therefore seems to lower the young stock rearing costs per heifer. This result proves that scale does have a significant effect on young stock rearing costs per 100 kg milk when the farmer's labor is not included.

## YOUNG STOCK REARING COSTS PER HEIFER PER DAY

The total young stock rearing costs per heifer per day is especially interesting for farmers who are considering outsourcing their young stock rearing. Commercial prices in the Netherlands for outsourced young stock rearing vary from €1,50 to €2,00 per heifer per day. The realized costs of young stock rearing on dairy farms and young stock rearing farms are listed in table 5.

	Costs	Costs (excl. labor)
<b>Average</b>	2,06	1,48
<b>Minimum</b>	1,14	0,76
<b>Maximum</b>	3,78 <sup>1</sup>	2,63
<b>Average (dairy)</b>	2,08	1,49
<b>Minimum (dairy)</b>	1,45	0,95
<b>Maximum (dairy)</b>	3,49	2,15
<b>Average (rearing)</b>	1,95	1,37
<b>Minimum (rearing)</b>	1,14	0,76
<b>Maximum (rearing)</b>	3,78	2,63

Table 5: Young stock rearing costs in €/heifer/day.

On average, young stock rearing costs €2,06 per heifer per day. The average costs of young stock rearing on young stock rearing farms is €1,95 per day, in comparison to €2,08 on dairy farms, but the spread in young stock rearing farms is bigger: €1,14-€3,78 per heifer per day on young stock rearing farms versus €1,45-€3,49 per heifer per day on dairy farms (table 5). It must be noticed that the young stock rearing farm that had a cost price of €3,78 per heifer per day (table 5) was a farm that used an estimated value of the total machine park of €200.000,00 in the calculation of their rearing costs. This farmer was the only one who wanted to take the value of his machines into account in the calculation of his young stock rearing costs. This matter will be further discussed under ‘Discussion’.

When taking the farmer’s labor out of the equation, the average young stock rearing costs per heifer per day came out on €1,48 with a minimum of €0,76 and a maximum of €2,63 per heifer per day (table 5). Again, the average costs of young stock rearing on young stock rearing farms (€1,37 per heifer per day) was lower than the average on dairy farms (€1,49 per heifer per day), but also showed a bigger spread.

	All farms		Dairy farms		Young stock rearing farms	
	p-value	Beta	p-value	Beta	p-value	Beta
<b>Total milk production (kg/year)</b>	-	-	0,185	-0,223	-	-
<b>Total number of dairy cows</b>	-	-	0,153	-0,240	-	-
<b>Total number of young stock</b>	0,046	-0,303	0,026	-0,365	0,815	-0,124
<b>Ratio young stock/cow</b>	-	-	0,103	-0,272	-	-
<b>Average age at first calving (months)</b>	0,741	0,051	0,825	-0,038	0,962	0,025
<b>Hours spent on rearing</b>	0,026	0,339	0,065	0,306	0,184	0,626
<b>Farmer's wage (€)</b>	0,427	0,123	0,871	0,028	0,412	0,416

Table 6: Statistical analysis of the effect of collected data on the calculated total young stock rearing costs per heifer per day

Neither the average age at first calving, the total milk production, the total number of dairy cows nor the farmer’s wage had a significant effect on the young stock rearing costs per day on either dairy farms, young stock rearing farms or both groups together (table 6). The total number of young stock on the farm did have a significant effect on the costs per heifer per day on dairy farms ( $p=0,026$ ;  $B=-0,365$ ) as well on the entire group ( $p=0,046$ ;  $B=-0,303$ ), but was not significant when analyzing the young stock rearing costs per heifer per day on young stock rearing farms (table 6).

The total number of hours spent on rearing proved to be significant when analyzing dairy farms and young stock rearing farms together ( $p=0,026$ ;  $B=0,339$ ), but was not significant on dairy farms or young stock rearing farms alone (table 6).

## ACCURACY OF FARMER'S ESTIMATION

The first question in the questionnaire used for this project (Appendix 1), was 'What are the young stock rearing costs per heifer on your farm?'. This proved to be one of the hardest questions in the questionnaire. The average estimation of young stock rearing costs per heifer was €994, with a minimum of €400 and a maximum of €1800 (*table 7*).

	Estimation <sup>1</sup> (min-max)	Total rearing costs <sup>2</sup> (min-max)	Difference <sup>3</sup>
<b>Average</b>	994 (400 – 1800)	1306 (532 – 2862)	-312
<b>Average (dairy)</b>	1015 (400 – 1800)	1355 (611 – 2862)	-339
<b>Average (rearing)</b>	867 (700 – 1000)	1010 (532 – 2530)	-143

*Table 7: Accuracy of farmer's estimation.*

1= The farmer's estimation of the total young stock rearing costs per heifer on his farm; 2= The calculated total rearing costs per heifer, based on the costs the farmer included in his estimation; 3= The difference between the farmers estimation and the calculated costs.

Dairy farmers estimated their young stock rearing costs to be higher than young stock rearing farmers, although the spread in estimations is smaller (€700 - €1000).

The spread in these estimations is partially because of the fact that not all farmers included the same costs in their estimation of total young stock rearing costs per heifer. In the questionnaire, farmers were asked if they did or did not include labor costs and costs for housing in their estimation. Therefore, subdividing the estimations into these groups, as seen in *table 8*, gives a better view on the accuracy of these estimations.

		Estimation (min-max)	Calculated costs (min-max)	Difference (min-max)
<b>Labor and housing included</b>	22	1018 (750 – 1600)	1618 (1057 – 2862)	-600 (-1862 – 134)
<b>Labor excluded, housing included</b>	11	977 (500 – 1800)	1058 (532 – 1764)	-81 (-764 – 866)
<b>Labor and housing excluded</b>	8	925 (400 – 1300)	743 (565 – 1003)	182 (-211 – 585)
<b>Labor included, housing excluded</b>	2	1100 (1000 – 1200)	1492 (1424 – 1559)	-392 (-424 – -359)

*Table 8: Average estimations of young stock rearing costs per heifer versus the real young stock rearing costs per heifer subdivided in groups.*

1= Labor and housing included in the estimation and calculation; 2= Labor not included, housing included in the estimation and calculation; 3= Labor and housing not included in the estimation and calculation; 4= Labor included, housing not included in the estimation and calculation.

Farmers that included labor and housing costs in the estimation of their young stock rearing costs estimated the total costs per heifer to be €1018 per successfully bred heifer, with a spread between €750 and €1600. The average calculated costs on these farms were €1618, which leads to an average underestimation of the young stock rearing costs of €600 per successfully bred heifer (*table 8*).

The data suggest that the farmers who excluded labor costs from their estimation of young stock rearing costs were, on average, most capable of estimating these costs, with an average underestimation of €81. However, the spread between estimations is bigger and varies from €500 to €1800 per successfully bred heifer. Farmers that estimate the young stock rearing costs with labor and housing excluded overestimate their rearing costs per heifer with on average €182 (*table 8*).

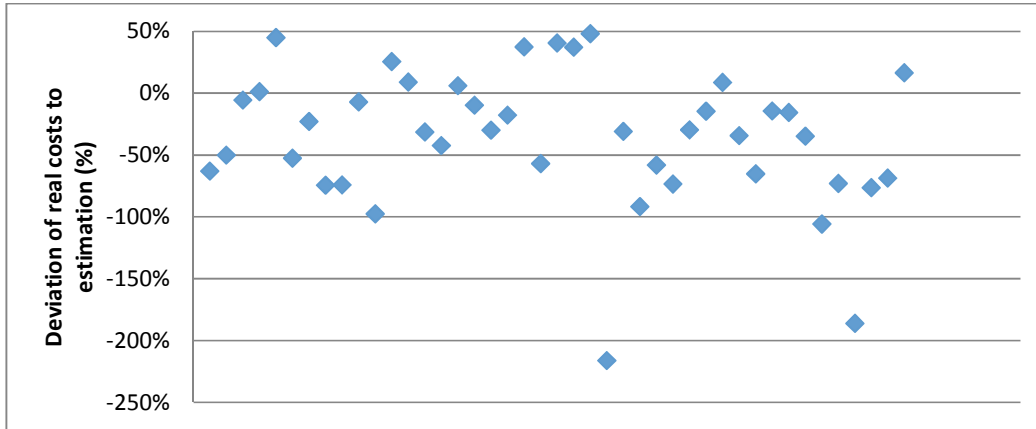


Figure 3: The accuracy of farmer’s estimations, deviation as a percentage of the calculated young stock rearing costs per heifer.

When expressing the accuracy of the farmer’s estimation in a percentage deviation as seen in figure 3, a total of 32 of the 43 farmers (74,4%) underestimated their young stock rearing costs per heifer. 55,8% of the farmers underestimated their costs by 25% or more. Furthermore, three of the 43 farmers underestimated their young stock rearing costs per heifer by more than 100% (figure 3).

To decide whether or not farmers are capable of estimating their young stock rearing costs per heifer, a calculation was made to determine the significance of the influence of the calculated young stock rearing costs on the farmer’s estimation of the total young stock rearing costs per heifer on his farm. This relation did not prove to be significant ( $p=0,225$ ). Furthermore, when splitting the dataset into dairy farmers and young stock rearing farmers, neither the estimation of the dairy farmers ( $p=0,255$ ) nor the estimation of the young stock rearing farmers ( $p=0,811$ ) showed a significant relation to the calculated young stock rearing costs on the farm.

## APPRECIATION AND EVALUATION

After calculating the young stock rearing costs, farmers were asked to evaluate JonKos. The scores given by farmers are listed in table 9.

	0	1	2	3	4	5
<b>Useful</b>	0	0	0	8	17	18
<b>Creates awareness</b>	1	0	2	17	16	7
<b>Became more critical</b>	0	3	7	12	15	6
<b>Will take action</b>	0	8	7	14	12	2
<b>Duration<sup>1</sup></b>		1	8	34		
<b>Recommend<sup>2</sup></b>	0	42				

Table 9: Results of the evaluating questionnaire on the effect of the calculation using ‘JonKos Melkvee’. Frequency of scores, where 0 is not applicable and 5 is totally applicable. 1= Duration of the calculation, scored on a scale from 1-3: 0-15 minutes, 15-30 minutes or >30 minutes; 2= Would the farmer recommend using JonKos to other farmers, where 0 stands for ‘No’ and 1 for ‘Yes’.

All farmers that participated in this research project claimed to find the calculation useful or even very useful. All but one farmer became more aware of the costs of their young stock rearing period and most of them (33 in total) will become more critical on their rearing management, in various extents. The farmers seem somewhat hesitant to take measures in order to optimize their young stock rearing management, as the scores lowered in the row ‘Will take action’.



Making the calculation of the young stock rearing costs in JonKos took more than 30 minutes in most cases. Of the 43 participants, one farmer did not fill in the last question on the questionnaire. The rest of the farmers would all recommend the use of JonKos to other farmers.

## DISCUSSION

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The farms used for the dataset of this research project produced on average approximately 10% more milk per year and had approximately 10% more dairy cows on the farm than the Dutch average. The influence of this difference on young stock rearing costs is hard to calculate. But while the calculations show that scale had no significant influence on the young stock rearing costs within the dataset, it is assumed that calculating the costs of young stock rearing on these dairy farms is not significantly different to the average Dutch farm.

The average age at first calving on the analyzed farms was one month lower than the Dutch average. This might have an effect on the calculated young stock rearing costs, as the average age at first calving had a significant effect on the young stock rearing costs per 100 kg milk produced. Therefore, the calculated young stock rearing costs on the farms that participated in this project might be an underestimation of the young stock rearing costs on dairy farms in the Netherlands.

The wide spread between calculated young stock rearing costs indicates that there is a lot of variation in costs between farms. This indicates that there is a lot of margin to lower the costs of young stock rearing. However, as stated before, the quality of reared heifers was not included in the analyses of this research project. It is therefore not known whether the farmers with higher young stock rearing costs also reared heifers of higher quality.

Although this project aimed for dairy farmers, 6 young stock rearing farmers also participated. When comparing the data on these rearing farms to data on dairy farms, young stock rearing farmers do not seem to be able to estimate their young stock rearing costs significantly better than dairy farmers. This might be explained by the fact that six farms with such a wide spread in estimations (*table 7*) are not enough to create significant results. More research on the costs of rearing on young stock rearing farms would be helpful in this matter.

In *table 2*, the average contribution of different costs to the total young stock rearing costs is stated. Feed costs, contributing on average 10,5-15,6% to the total young stock rearing costs, are often thought to be the major part of the young stock rearing costs. In this research project, this seems not to be the case. However, the feed costs in JonKos are just the costs of milk powder, concentrates and feed additives. The costs of roughage are not included in the feed costs, as the complex mix of multiple costs makes the exact costs of roughage too hard to calculate. The costs that partially contribute to the costs of roughage, for example land-ownership, contract work and interest, are stated individually. The real feed costs therefore contribute more to the total young stock rearing costs during than calculated in this project.

The results of this research project show that most farmers have difficulties in estimating their young stock rearing costs. The spread in estimations by farmers (*table 7*) indicate that most farmers think the rearing period of their heifers will cost around €1000, but the costs that are included in this estimation vary amongst farmers. It is noticed that the average estimation of young stock rearing costs per heifer without labor costs is just €41 lower than the average estimation where labor costs are included. This indicates that a farmer values his labor as €41 per successfully bred heifer. This is not a reliable appreciation of labor, considering the time invested in the total rearing period.

It is safe to say that most farmers can't make a substantiated estimation of the young stock rearing costs on their farm. The fact that there is no significant relation between the farmer's estimation and the calculated young stock rearing costs per heifer endorses this statement.

The reason why there is so little awareness amongst dairy farmers on young stock rearing costs might lay in the fact that only a small part of the total young stock rearing costs are external costs and are therefore paid costs. The farmer's labor, the housing and costs of landownership together form roughly 60% of the total young stock rearing costs on the

analyzed farms (*table 2*). Not getting bills for these costs makes them nearly invisible to farmers.

Roughage is often mass produced or bought in bulk. The costs are mostly attributed to the dairy cows, the same applies to litter. All these “invisible” costs together contribute to 76% of the costs on dairy farms and 70,2% on rearing farms respectively.

In the calculations of the total young stock rearing costs per heifer, two farms stood out from the rest because of their high rearing costs. The first is a young stock rearing farm with total young stock rearing costs of €2530 per successfully reared heifer. This comes down to €3,78 per heifer per day. A part of the explanation for these high costs is that this farmer wanted to take his machines into account when calculating the young stock rearing costs and did all the work on land by himself. With a total estimated value of €200.000, the machines contribute a total of €548 to the young stock rearing costs per reared heifer. While young stock rearing was the only activity on the farm, taking the costs of the machinery into account when calculating the young stock rearing costs was fairly easy. However, when calculating costs on dairy farms, the major part of the machinery is attributed to the dairy cows. Determining which part of the total machine park attributes to young stock would be hard.

During the period in which data was collected, the developers of JonKos were approached in order to explain why machinery is not included in the costs of young stock rearing on dairy farms. The given explanation was that the influence of young stock on the size and value of the machine park was negligible and it was too hard to determine which part of the machinery may be attributed to young stock. However, this might not be entirely fair. When the young stock rearing is outsourced, fewer acres will be needed for feed production and smaller machines might be bought.

The ratio between the total cut acres for young stock, as calculated in JonKos, and the total acres in use might be applied to the total value of the machine park to determine the contribution of machinery to the costs of young stock rearing. This leads to a more precise calculation of costs, as the costs of machinery were excluded from the young stock rearing costs as calculated during this project.

Another option might be to calculate the machine costs per Joules Net Energy for Lactation (J NEL) or the Dutch equivalent “Voedereenheid Melkvee” (“VEM”). The machine costs can then be expressed in relation to the total young stock rearing costs. Multiplying the machine costs per VEM with the total VEM fed during the rearing period gives an estimation of the total machine costs for young stock rearing.

The second farm that stood out from the rest was a dairy farm that had calculated total young stock rearing costs of €2862 per successfully reared heifer. Looking closer to the costs on that specific farm, labor was the biggest contributor with a total of €1184 per successfully reared heifer. The farmer had set his wage on €15 per hour, which is average considering the other farms in this project. The difference in the costs resulted from the total hours spent on young stock rearing. JonKos suggests, based on the number of young stock on the farm, that this farmer would have to spend approximately 29 minutes on the group of young stock up to one year and approximately 18 minutes on young stock older than one year until calving. However, the farmer stated that he spent 75 minutes per day on young stock up to one year of age. Furthermore, he spends 45 minutes per day on the young stock older than one year of age until calving. The fact that the farmer claims he spends 2 hours a day on a total of 22 calves can't be contradicted. However, it does give an explanation to the high young stock rearing costs per heifer on this farm and leads to very high young stock rearing costs.

All but one farmer, who did not fill in this question on the questionnaire, would recommend using JonKos to other farmers. However, this might give a distorted image of reality. As 34 of the 43 farmers were contacted via e-mail by ULP Harmelen, they had to respond actively to this e-mail in order to get a calculation made. This indicates that these farmers are interested in the young stock rearing costs on their farm. Some of the participating farmers were deciding whether or not it was wise to outsource their young stock rearing. The group of participating farmers is therefore likely to be more interested in the costs of young stock rearing than the average farmer in the Netherlands.

The 9 remaining farmers, recruited by Veterinary Health Centre 'De Peuvers Esch', were contacted by phone. This makes the decision to participate easier. However, they still had to invest approximately 1 hour of their time to make the calculation, so they would have to be motivated as well.

Altogether, it cannot be ignored that all farmers participating in the project are interested in more information on their young stock rearing and there will probably be more farmers like them in the rest of the Netherlands. Providing a tool to calculate the young stock rearing costs is one of many ways to reply to this request.

In most cases, filling in the datasheets in JonKos took more than 30 minutes and providing all information took quite some preparation on farmer's behalf and additional calculations. Therefore, farmers had to be highly motivated to complete all sheets. As JonKos was designed as a model for farmers to calculate their own young stock rearing costs, this goal might not have been met. Instructions of an expert that knows which data are requested in the different datasheets are useful, if not essential, while entering the data. This leads to the conclusion that calculating the young stock rearing costs using JonKos is probably more accurate when farmers are assisted in the process. Veterinarians might fill in this gap as part of their veterinary herd health management.

An interesting question might be whether the costs of young stock rearing relate to the quality of reared heifers. By looking at the BSK, a number in Dutch milk recording systems that gives an estimate of the average production per dairy cow, the 305-day production of dairy cows or other quality aspects of the dairy cows on a farm, a correlation might be found between the young stock rearing costs and the quality of reared heifers. Unfortunately, no data were collected on this matter in this research project. Thus, this might be an interesting subject for further research.

## CONCLUSION

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The average young stock rearing costs on the farms participating in this project were €1550 per successfully reared heifer, with a spread between €800 and €2862. The great spread indicates that there is room for reducing the young stock rearing costs.

Participating farmers were not able to make an educated guess on their young stock rearing costs. Considering the great spread in calculated young stock rearing costs, it would be interesting to increase the size of the dataset of this research project in order to get better insight in the costs of young stock rearing on dairy farms in the Netherlands.

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## APPENDIX 1: QUESTIONNAIRE (IN DUTCH)

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### Gegevens

Naam: .....

Adres: .....

Woonplaats: .....

UBN: .....

### Vragen vóór invullen JonKos

Hoeveel denkt u dat de opfok van een vaars op uw bedrijf kost? .....euro

Is dit inclusief uw eigen arbeid?                     Ja                     Nee

Is dit inclusief huisvesting?                        Ja                     Nee

Wat is volgens u de grootste kostenpost van jongveeopfok?

Voer                    Arbeid                    Huisvesting                    Gezondheidszorg  
 Inseminatie  Anders, namelijk .....

Wat is volgens u daarna de grootste kostenpost van jongveeopfok?

Voer                    Arbeid                    Huisvesting                    Gezondheidszorg  
 Inseminatie  Anders, namelijk .....

Hoe vaak bepaalt u het gewicht van uw jongvee?

- Nooit
- ..... keer per .....
- Op gezette leeftijd, namelijk .....

Hoe bepaalt u het gewicht van uw jongvee?

Schatting/op zicht                    Met een meetlint                    Weegschaal

Hoe vaak bepaalt u de kruishoogte van uw jongvee?

- Nooit
- ..... keer per .....
- Op gezette leeftijd, namelijk .....

Hoe vaak bepaalt u de conditiescore (BCS) van uw jongvee?

- Nooit
- ..... keer per .....
- Op gezette leeftijd, namelijk .....

Houdt u deze BCS ook bij?

- Ja
- Nee

Wordt er voor uw jongvee een apart rantsoen gemaakt?

- Ja, het jongvee krijgt een eigen rantsoen
- Nee

Op basis van welke informatie besluit u uw jongvee te insemineren?

- Leeftijd, namelijk minimaal..... maanden en maximaal.....maanden
- Gewicht, namelijk minimaal ..... kg en maximaal ..... kg
- Kruishoogte, namelijk minimaal.....cm en maximaal.....cm

Wat zou u ervoor over hebben om de activiteiten rond het jongvee uit te besteden?

- .....euro per vaars
- .....euro per uur

Is uw bedrijf op dit moment groeiende?  Ja  Nee

Alle inseminaties met melktypisch ras?  Ja  Nee

Zo nee, waarop is deze keuze gebaseerd?

.....  
.....

Alle vaarskalveren aanhouden:  Ja  Nee

Zo nee, selectiecriteria: .....

**Vragen na invullen JonKos**

In hoeverre kwamen uw verwachtingen overeen met de resultaten van JonKos?

- In lijn van de verwachting
- Ik had de kosten te laag ingeschat
- Ik had de kosten te hoog ingeschat

Indien een duidelijk verschil, kunt u dit verschil verklaren?

.....

.....

.....

Hoe zinvol vond u het invullen van JonKos? (0 = totaal niet zinvol, 5 = heel erg zinvol)

- 0
- 1
- 2
- 3
- 4
- 5

Bent u zich, naar aanleiding van de resultaten van JonKos, meer bewust geworden van de kosten van jongveeopfok? (0 = niet meer bewust, 5 = veel meer bewust)

- 0
- 1
- 2
- 3
- 4
- 5

In hoeverre acht u het waarschijnlijk dat u naar aanleiding van de resultaten uit JonKos kritischer gaat kijken naar uw jongveeopfok? (0 = erg onwaarschijnlijk, 5 = heel erg waarschijnlijk)

- 0
- 1
- 2
- 3
- 4
- 5

In hoeverre acht u het waarschijnlijk dat u naar aanleiding van de resultaten uit JonKos actie gaat ondernemen om uw jongveeopfok te optimaliseren? (0 = erg onwaarschijnlijk, 5 = heel erg waarschijnlijk)

- 0
- 1
- 2
- 3
- 4
- 5

Wat vond u van de vragen die gesteld worden in JonKos? Mist u vragen? Zijn er vragen overbodig?

.....

.....

.....

Hoe lang duurde het invullen van de gegevens in JonKos?

- 0-15 minuten
- 15-30 minuten
- >30 minuten

Zou u het gebruik van JonKos aanraden aan andere veehouders?

- Ja
- Nee