Wageningen UR and UC of Dublin

Veterinary herd health management on Irish dairy farms

Herd performance and economic aspects, including the perception of the farmers about the herd health management program from the UCD, on Irish dairy farms

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Foreword

My name is Kirsten Snels and I am a MSc Animal Sciences student at the Wageningen University, The Netherlands. For this research, focused on Agricultural business economics, I travelled to Ireland to investigate the veterinary herd health management program on Irish dairy farms, provided by the University College of Dublin. I started this research to gain more knowledge on the pasture based system, involving seasonal breeding, of Irish dairy farms. Thereby including my interest in the country Ireland. I could not have done this research without the good cooperation with my supervisors Dr. Ir. H. Hogeveen, Dr. M. Doherty and Mr. L. O'Grady, who helped me during the past half year of research. Besides that I also would like to thank Mr. J. Somers from the UCD and Mr. J. Patton from Teagasc for all the data they provided for this research.

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Abstract

In present study, an analysis was made on the herd health status and economic profitability of farmer participation in a veterinary herd health management program from the University College Dublin (UCD), for a group of six Irish dairy farms. This research investigated the advantages and disadvantages of using the UCD herd health management program in relation to potentially improved fertility and higher milk production, due to improved herd health status and reduced therapeutic input costs. The study also explored farmers' perception, goals and satisfaction with the program.

Data was obtained from the UCD, Irish Cattle Breeding Federation (ICBF) and Teagasc (The Irish Agriculture and Food Development Authority) and involved herd performance, fertility and financial data about the participating farms.

Milk production systems in Ireland are primarily pasture-based and involve seasonal calving. In a typical seasonal herd in Ireland, breeding starts on a fixed calendar date in spring between late April and early May. The key breeding objective is to achieve the highest pregnancy rate in the shortest period of time after the start of the breeding season in order to achieve a concentrated calving pattern during the following season. Thus, for a pasture-based system it is important to have the calving period as short as possible. A delay in conception due to poor fertility increases calving interval. In a strict seasonal calving herd this leads to increased involuntary culling from the herd.

Irish dairy farmers aim to get the maximum number of cows pregnant in a short breeding season often in the face of production disease challenges faced by pasture-fed dairy cows in Ireland including lameness, negative energy balance, sub-acute rumen acidosis and hypocalcaemia.

The results, formulated as an average of the six participating farms, show a reduction in calf mortality of 5.8% between the years 2009 and 2011. Overall fertility performance was improved in the three years of participation. The percentage of herd pregnant per year and the 21 day pregnancy rate increased respectively by 8.5% and 10.8%. The heifer age at first calving declined from 27 months to 26.2 months and the number of services per conception per cow reduced from 2.5 in 2009 to 2.1 services in 2011. The conception to first service rate declined from 41.3% to 45.8% between 2009 and 2011. The variable early service date (ESD) to conception rate did not improve during the years of participation. The ESD to conception rate increased with 0.449 over three year.

The program farms had on average a smaller farmland area and a higher number of cows in the herd than control farms, reflecting a higher farm stocking rate in general for the program farms. On average in 2011 the difference in milk yield per cow, between the program and control farms, was 31.6 litres of milk. On average, the program farms showed a lower somatic cell count and higher fat and protein percentages in the milk yield.

For the year 2011, comparing the average of the program farms with the average of the control farms, it was shown that the average total fixed cost, known as TFC, and the average gross output of the program farms were relatively higher than on the control farms. On average, the feed costs per litre were lower for the program farms (€4.16 c/litre) than for the control farms (€5.07 c/litre). While the costs for artificial insemination per breeding was higher for the program farms. The total costs per litre were, on average, higher for the program farms. The program farms had on average €1.52 c/litre more costs per litre. As a result the average net profit per litre was higher for the control farms (€13.28 c/litre) than for the program farms (€12.25 c/litre). It was shown that overall three out of five program farms maintained at a higher net profit level than the control farms in 2011. Because no financial data was available for more than one year of participation, it could not have been shown that the higher net profit per litre resulted from participation in the UCD-program.

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1. Introduction

Over the past decades, significant changes have taken place in dairy farming internationally. With a growing human population the demand for food, including milk and meat at a reasonable price, is increasing dramatically. Increased intensification of animal farming, with more animals per labour unit, has been a quick response to this growing demand.

This and increasing international competition has led to selective breeding of high producing cows under significant metabolic stress (de Kruif and Opsomer 2004). The metabolic imbalance resulted in greater susceptibility to disease and reduced fertility (Fahey, O'Sullivan et al. 2002; de Kruif and Opsomer 2004; van Knegsel, van den Brand et al. 2007). As Mee (2004) stated, there is a relationship shown between increasing genetic merit for higher milk yield and the reduction of fertility, which is influenced by management and the environment. Numerous epidemiological studies have suggested that environmental, individual cow and management factors influence reproductive efficiency (Buckley, O'Sullivan et al. 2003; Grimard, Freret et al. 2006).

The increase in the size of the dairy herd in Ireland per labour unit, increases the risk of under diagnosis of clinical and subclinical disease which is a key component of optimal herd health management (Fahey, O'Sullivan et al. 2002; Derks, van de Ven et al. 2012). Production losses often occur before diagnosis and treatment can be instituted and it is widely agreed that prevention rather than treatment is the most economical approach to disease control (de Kruif and Opsomer 2004). Because of energy demands placed upon dairy cows for milk production, they require more attention regarding their nutritional management and the environment (de Kruif and Opsomer 2004; Mulligan, O'Grady et al. 2006). The development and implementation of integrated systems of herd health management linking animal health, nutrition, environment and cost-benefit analyses are essential for optimal farmer profitability.

Research on herd health management programs began during the 1970's. The program was defined by Blood, Morris et al. (1978) as "A planned and coordinated approach to achieving and maintaining optimal herd health and efficiency in livestock: 'Optimal' being defined in relation to the objectives of the herd owner". One of the first researches about this topic, Magwood (1983), concluded that the management program applies for all livestock enterprises and the herd health management program can be adapted to every dairy farm and practices of veterinarian. One of the most fundamental components of the program, are the farm visits by the veterinarian at fixed intervals for inspection of herd health status, fertility and milk production. This generally happens following a review of the herd health and production data in relation to the previous visit (Sol and Renkema 1984). The regular herd health visits allows veterinarians to become very familiar with the operation of the dairy farm business resulting in being able to deliver of better advice to farmers.

Previous studies revealed that participation in any herd health management program has various benefits for both the farm business and herd. Sol and Renkema (1984) and Hogeveen, Dykhuizen et al. (1992) showed that farms participating in herd health management programs reduced involuntary culling (chronic lameness, chronic mastitis and infertility) of cows. Furthermore, a decrease in calf mortality rate (1,3%) was an outcome of herd health management programme on Dutch dairy farms (Hogeveen, Dykhuizen et al. 1992). Field observations in Canada confirmed that herd health programmes are associated with improved performance and better mastitis control (Magwood 1983).

Milk production systems in Ireland are predominantly pasture-based and involve seasonal calving (Dillon et al., 1995). Efficient milk production in Irish dairy herds is dependent upon producing the maximum amount of milk from grazed grass. Therefore, cows must calve compactly before turn-out to pasture in the spring. In a typical seasonal herd in Ireland, breeding starts on a fixed calendar date in spring between late April and early May. The key breeding objective is to achieve the highest pregnancy rate in the shortest period of time after the start of the breeding season in order to achieve a compact calving pattern during the following season (Evans, Buckley et al. 2002; Veerkamp, Dillon et al. 2002). A delay in conception due to poor fertility increases calving interval and, in a strict seasonal calving herd, leads to increased involuntary culling from the herd. Some of the production disease challenges faced by pasture-fed dairy cows in Ireland include lameness, negative energy balance, sub-acute rumen acidosis and hypocalcaemia (Mulligan, O'Grady et al. 2006).

Up to mid-1980s the predominant breed of dairy cattle in Ireland was the British Friesian. However, over the last 30 years in Ireland and the UK, North American Holstein Friesian (NAHF) genetics have become dominant. The popularity of the NAHF has been due to its substantial increased productivity compared to native breeds (Evans, Wallace et al. 2006). Aggressive selection for increased milk yield in the NAHF has resulted in a well-documented negative effect on cow fertility. As a result, Irish dairy herd fertility has been declining since the 1980s (Mee 2004; Evans, Dillon et al. 2006). Management of high producing herds may be sufficient to overcome adverse effects of high milk production on reproductive performance (Fahey, O'Sullivan et al. 2002). Therefore herd health management support in Ireland is mainly focused on fertility, focusing on calving pattern and performance, and high-priority animal health issues for cattle production in Ireland. These includes udder health/milk quality, Bovine viral diarrhoea (BVD), lameness, diseases of young calves, Infectious bovine rhinotracheitis (IBR) and Para tuberculosis (More, McKenzie et al. 2010).

For many years, the University College of Dublin has provided herd health management consultancy on different dairy farms in Ireland. In these years no research was done to see what progress the participating Irish dairy farms have made. Therefore in present study, an analysis was made on the herd health status and economic profitability of farmers' participation in a veterinary herd health management program for a group of Irish dairy farms. This research investigated the advantages and disadvantages of using the UCD herd health management program, concerning reduced therapeutic input costs in relation to potentially improved fertility and higher milk production, as a result of improved health status of the herd (Kanters 2011). The study also explored farmers' perception, goals and satisfaction with the program. To facilitate this, the following questions needed to be answered;

- How is the UCD herd health management program delivered?
- What are feasible traits for health status, milk production, fertility and farmer' attitude effects?
- Which economic indicators for measuring the relation of the different objectives on a dairy farm can be used?
- What is the opinion of the farmer about the program?
- What is the effect of the behaviour or perception of the farmer on the program?
- What are the benefits of using the program for the group of dairy farms in Co. Kildare, Ireland?
- What can be done to improve the UCD-program?

2. Background Information

Need for extra management support

There is a growing demand for safer, healthier and higher quality food, taking into account animal health and welfare and the environment. European dairy farmers need to adequately demonstrate to the authorities, dairy industries and consumer organizations that hazards and risks associated with animal health, animal welfare and food safety are being optimally managed at farm level (Kremer 2010). This is particularly important in the context of the rapidly changing agricultural environment with an increasing emphasis on sustainability. The former agricultural policy that was primarily concerned with increasing production, has been replaced by an EU rural development policy that focuses on agricultural-competitiveness, animal welfare, food quality and safety and environmental sustainability. Critical to the development of a sustainable dairy industry will be implementation of herd health planning. Health monitoring is an essential component of herd health planning and the earlier detection of both sub-clinical and clinical disease will facilitate disease prevention with a reduced need for inputs such as pharmaceutical therapeutics (Mulligan and Doherty 2008). This will require the veterinary profession in Ireland to engage in meaningful herd health planning to 'add value' to their current on-farm services; to act as herd health consultants instead of being exclusively individuals who treat sick animals and prescribe veterinary drugs.

Due to a growing demand for the world food production and the industrialization after World War II, livestock food production has become more and more intensive (de Kruif and Opsomer 2004). The farmer is almost forced to intensify his business even more to maintain profitable with the present low food prices (Kremer 2010). Veterinarians with the appropriate knowledge and skills are essential to address the herd health challenges of dairy farms that are increasing in size and complexity. The challenges facing the veterinary profession in Ireland in the changing international agricultural industry of the 21st century are to prevent disease, improve animal welfare and farmer profitability in the context of optimal food safety and environmental stewardship (Purvis 2012). This is why provision of a good management system for the farm business is becoming more and more important. Veterinarians should use their knowledge not only for treating animals but also for supplying a 'second view' on farm recording data and understanding of the overall farm business, with sometimes even including financial data and support. They should also start to broaden their boarders and break with tradition, for example supplying information on topical subjects in livestock production systems like animal welfare, sustainable production, environment including the emissions made by the farms and monitoring for the growing demand on food safety. The herd health management program, based around regular visits by a veterinarian providing a 'second view' on the herd health and production data, can be a part of the farmers' business from which they can benefit (Kremer 2010).

In the complex modern dairy farm, it is the interaction of diseases, their relationship with fertility, nutritional strategy, housing environment and the fundamental influence of social and attitudinal factors that make prevention and control such a challenge. The development, refinement, implementation and economic assessment of practical, integrated, blueprints of best practice help to meet this challenge. Ideally based upon principles of risk management, these blue-prints will assist farmers in providing reassurance regarding the health status of the farming enterprise, thus increasing trust, transparency and acceptability on issues of animal health and welfare to the dairy industry, retailers and consumers. Addressing this challenge will require an integrated, interdisciplinary team approach involving the farmer, the veterinarian, along with agricultural and food safety scientists (Doherty 2007; Mulligan and Doherty 2008).

The way that advice is adjusted to the goals and objectives of the farmer might have strong influence on farmers' compliance. To deal with this issue, the program should be provided by a (experienced) veterinarian who is able of combining the classic veterinary disciplines with the disciplines of business and management finances, as these services are requested by farmers, but are apparently not commonly available. Equally, changes in pre-graduate veterinary education directed towards 'whole farm' management are warranted (Magwood 1983; Kristensen and Enevoldsen 2008; More, Doherty et al. 2011).

Social research aspects

From previous research it is clear that participating in a herd health management program (HHMP) results in benefits in comparison with other farmers. It may result in less culling cows because of illness and reproductive failure (Sol and Renkema 1984; Hogeveen, Dykhuizen et al. 1992). Field observations in Canada confirm the research evidence that HHMP's are associated with improved performance and better mastitis control (Magwood 1983). Studies in Australia, New Zealand, and Great Britain involved an analysis of the total farm enterprise of paired program and surveillance farms. In all cases, the relative gains in productivity and economic efficiency were greater for program farms than for control farms. Showing for example that a higher milk production could be attained by improved feeding methods, reduction of calving intervals, using artificial insemination and other factors using a different form of management (Magwood 1983).

But one of the most important advantages, which emerged from these early studies on herd health management, had to do with farmers' attitude and perception (Kanters 2012). Due to the herd health management program farmers experienced the feeling that they were closer to the cows, especially the fresh cows were better controlled, and that there was more control on the management of recently calved cows. Farmers also considered the system as a pleasant way of keeping up with all the work, providing clear evaluation of sick and convalescent animals, more pleasure in work and better technical results (Kanters 2012). The study from Hogeveen, Dykhuizen et al. (1992) focused on the long term effects of herd health management on 15 program farms in the Netherlands, found positive results for participating in a herd health management program, like an increased gross margin. However there were no long-term effects shown when the program was finished and so it was concluded that the program should be maintained more than on a temporary basis for having better farm results.

In a study of Derks, van de Ven et al. (2012) on 466 dairy farms in the Netherlands, the main reasons for farmers not participate in a herd health program were; an absence of perceived problems, expected high costs, expected low returns and an expectation that it would be time consuming (Lievaart, Noordhuizen et al. 1999); (Magwood 1983). To deal with these expectations the farmer must be convinced of the high merit of the programme and of its cost effectiveness. However, it must be said that the success of a herd health program depends heavily on the farmers' skills and ability to comply with the recommendations of the veterinarian (de Kruif and Opsomer 2004).

Disadvantages of a management program are commonly due to insufficient communication between the farmer and advisor (Beekhuis-Gibbon, Devitt et al. 2011; Bergevoet, Ondersteijn et al. 2004; Kristensen and Enevoldsen 2008). When providing herd health management to farmers, veterinarians need to be aware of farmers' goals and priorities. In the research from Kristensen and Enevoldsen (2008) it is stated that the dominant view of veterinarians was that they thought that the main goal of farmers was to focus on financial performance and increased production, while the true dominant view of the farmers was that they value teamwork with shared ambitions and common goals with whole farm management more than production and profit. Cote (1980) stated that sometimes a recommendation made at the time of a herd health visit, will be more profitable to the owner than all the procedures carried out that day. In the study of Bergevoet, Ondersteijn et al. (2004), the 'non-economic goals' like enjoying work, working with animals and producing a good and safe product were ranked higher than the economic goals of achieving a maximum income, usually assumed in classical economic models of decision making. To overcome these miscommunications, veterinarians need to actively enquire about farmers' needs, since most farmers rarely indicate these themselves. Farmers' goals, objectives and attitudes are a determinant of strategic and entrepreneurial behaviour in dairy farmers. It is very important to know the goals, attitudes, perceived behavioural control and social norms of the farmer to facilitate the targeting of the advice towards the fulfilment of the farmer goals, both economic and non-economic (Cote 1980; Bergevoet, Ondersteijn et al. 2004; Beekhuis-Gibbon, Devitt et al. 2011). The farmer is challenged with the implementation of the given advice. The farmer is the one who makes the final decision, the veterinarian can give certain advice about these decisions (Cote 1980). Farmers will only coincide when they understand the relevance of the given advice, and if the advice meets their farm

goals. The content and communication of the given advice are therefore important contributors to the success of herd health management programs (Derks, van Woudenbergh et al. 2011).

Another important task of the veterinarian is to convince a farmer of their value in herd health management (Kanters 2012). Better communication will lead to an improved adaptation of suggested management practices by participating dairy producers. But also veterinarians experience difficulties advising farmers. Most often these difficulties involve communication strategies used to influence farmers' motivation to change their behavior. "Farmers indicated that veterinarians often make too many recommendations at once and provide too little background to show the added value of the advice" (Sorge, Kelton et al. 2010). By selling knowledge and advice, veterinarians should know how to provide communicate advice in the context of the goals of the farmer. Finally, once veterinary surgeons start to pay more attention to quality issues related to the farm management, strategy and the production process itself (production, health, welfare, environmental issues and quality), he/she may become more valuable to the dairy farmer as a whole farm consultant (Lievaart, Noordhuizen et al. 2008).

Another essential part of a herd health management program is education of the client. As a client becomes more knowledgeable he/she does a better job of health management and at the same time becomes more understanding of the problems of the veterinarian and is a more cooperative person to deal with (Cote 1980). Therefore education of the farmer can be provided in the health program, to get a better understanding of the problems on the farm. For example, results from the study of Beekhuis-Gibbon, Devitt et al. (2011) to decline mastitis incidents by providing a herd health management program, showed that farmers revealed different levels of awareness of the causes of mastitis and management practices required to address these causes. The discussions also revealed a poor understanding of the importance of subclinical mastitis and a perception that mastitis only became a 'problem' when acute cases arose. The impact of penalisation for high somatic cell count (SCC) served as a motivation to address mastitis; however, once SCC was below the penalisation mark (400,000 cells/ml) farmers felt there was less need to reduce the SCC further. "Given the need for cost efficient dairy production systems going forward, it is important that we try and reduce the levels of involuntary culling that currently occur on dairy farms across the world. This approach will prevent the leaking of profit in replacement and infertility costs and will improve the opportunity available to dairy farmers to increase profitability by increasing the herd genetic merit. For example dairy cattle that develop milk fever are eight times more likely to develop mastitis and have been shown to have a reduced fertility in the next lactation" (Mulligan, O'Grady et al. 2006). Mastitis can lead to a decrease in fertility and production, because the cow cannot get enough energy to maintain his energy demand for production and fertility while self-having a low health state (Leroy, Vanholder et al. 2008).

It happens very often that farmers stick to their original habits keeping the farm business and do not know how to handle the present day cattle. Farmers being told different recommendations from different advisors (nutritionists, veterinarian, financial advisor i.e.) have to make their choice for farm business every day by themselves, not always having the academic knowledge veterinarians and other advisors have (Derks, van de Ven et al. 2012). Suppliers of the herd health management program can supply a neutral, honest and above all objective view. They can supply understandable and clear, uncomplicated overview of the recording data the farmer provided (Kremer 2010).

3. Materials and methods

3.1 Farm selection

In December 2008, eleven herds were enrolled in the UCD herd health consultancy program. All farms were dairy herds located in the east of Ireland in counties Kildare and Wicklow (figure 1). All the farms used a pasture-based and seasonal calving farming system and the herd size ranged between 30 and 200 lactating animals. For this study farms were selected on the basis of: (i) enrolment in the University College Dublin (UCD) herd health management consultancy program (described below) from December 2008 to the end of December 2011, (ii) enrolment in a famer discussion group, (iii) the availability of regular recording of herd health management data associated with the UCD and (iv) a willingness to participate in the study.

Figure 1. Locations of the participating farms

Of the eleven initial herds, one farm was excluded as the data recording for 2009 was incomplete. Three farms left the program after one year (one stopped dairy farming and two left due to cost and data recording commitments). One farm was excluded from the study as the farmer was not willing to participate. Ultimately six farms participated in this study.

All six dairy farms were predominantly spring calving seasonal breeding dairy herds, with a pasture-based feeding system and kept as main breed Holstein Friesian in the herd. One participator also had Brown Swiss in his herd.

For each of the six study herds each year two to three control herds were selected from the herds participating in the Teagasc profit monitor program. These control herds had no involvement with the UCD program but where all enrolled in farmer discussion groups. They were matched based on milking platform stocking rate, calving season, milk quota and region. The milking platform stocking rate is based on the amount of dairy cows and grassland size in hectares. Because some farmers have side activities besides milk production, this was a good variable for the comparison between control and program farms.

The UCD program

In 2008, the UCD herd health group was approached by a dairy farm discussion group in Co. Kildare with a view to initiating a herd health management program. In this discussion group, the participating farmers from the Kildare area meet approximately once a month and discuss the topical problems of dairy farming in association with farm advisors and in particular those from Teagasc. After a number of initial meetings between the UCD Herd Health Group and the discussion group, eleven farmers started to participate into the UCD program. The farmers' private veterinary practitioners were also contacted and individual meetings arranged at the local practices. The private veterinary practitioners were happy to support the initiative, did not perceive it as a threat but as an opportunity to increase their own knowledge of herd health management.

This all resulted in a major change of recording data, visits to the farm and extra support.

Depending on the farmers' goals, a report and annual goal settings were made. Given the importance of fertility to the dairy herd, goals to improve fertility included increasing submission rates and pregnancy rates, decreasing number of services per cow per conception and keeping costs per conception minimal. The herd health program provided a computer program to fill in all the obtained recording data. In this way the advisor has in an easy access to the recording data of the farmers.

In the UCD Herd Health programme, each farm was visited by the UCD Herd Health Group approximately every 21 days during the calving and breeding seasons. During these visits the main focus is on the fertility performance of the cows and nutritional management.

All data was recorded by farmers using a herd management software program (Herd Master, Irish Farm Computers) and emailed to UCD fortnightly during the calving and breeding seasons. The data was then analysed by UCD using Microsoft Excel.

The following data were recorded as part of the UCD herd health management program;

Milk Records
All participating farmers are obliged to milk record monthly. The data shown below are then downloaded to a Microsoft Excel spread sheet from the central national Irish Cattle Breeders Federation (ICBF) website:

- Lactation Number; Date Calved; Status (in milk / dry); Days in Milk (DIM); SCC (latest recording); Milk Yield Milk fat (% and Kg), Protein (% and Kg) (for current recording, to date and predicted 305 day production); number SCC recordings over 250,000 cells/ml for current lactation; Economic Breeding Index (EBI); Herd Rank

Feed Analysis
All farmers are obliged to have silage analysis performed. These data, together with details of current ration and available feeds are entered into a database created by the UCD Herd Health Group.

Fertility Events

- Cow Number; Calving Date; Calving Difficulty (1=no assistance, 2=manual pull only, 3=calving aid assisted, 4=veterinary assisted, 5=caesarean); Body Condition Score (BCS) data (at calving, day(s) of service; Pre-breeding examination; Pregnancy diagnosis; Dry off date); Service data (dates, sire, method, operator), findings from reproductive examinations.

Transition Cow Health Events

- Cow number; Date; Milk Fever; Retained Foetal Membranes (RFM) 24 hours; RFM 72 hours; Displaced Abomasum (surgery performed); Recumbent after calving; Acute severe mastitis; Other

Treatment Records

- Cow number; Drug administered; Volume; Route; Reason

Milking Cow Mastitis

- Cow number; Date; Cow sick Y/N; Quarter(s) affected; Treatment used; Response to treatment (Y/N)

The content of the program is that the veterinarian visits the farm at fixed intervals for inspection of herd health status, fertility, milk production and other problem issues. This mostly happens first reviewing the herd health and production data since the previous visit; thereafter the veterinarian will inspect the whole farm with a detailed observation on the farm and stock. At the end of the visit, advice and examination and/or treatment of cattle on the basis of what the veterinarian saw or what the farmer had seen in the past few weeks, will be given (Sol and Renkema 1984). Every herd health management program is adapted to the farm and farmers goals. The programs are all very different depending on country, system and persons who apply it. In the UCD program the advisor from the UCD is not the veterinarian from the herd, but focusses mainly at management level on the recording data and farmers' goals. The UCD advisor mostly not provides the medicines or treatments for the herd, so all the farmers have their own veterinarian who is not involved in the program. The UCD program also set general farm goals and start projects, for example, to improve calf health. It's up to the farmer's choice to participate in these projects.
The regular visits by the veterinarian or program advisor are the most essential part of the program, because most health problems on the farms are a result of ignorance or carelessness of the farmer. By frequently

presence on the farms, veterinarians become more familiar with the operation and are therefore better able to advice owners. Keeping strict routine is thereby a very important aspect of the program, to derive maximum benefits from the various examinations (Cote 1980).
In 2008 a detailed investigation was conducted to assess farm performance of the eleven participating farms. Data concerning the herd (named above) was gathered. Together with the UCD advisor, goals were set for every farm. These goals maintained mainly fertility improvement and mastitis control. In the first year of the program the UCD started monitoring the farms with a focus on the most common bio secure diseases like BVD, IBR, Neospora, Salmonella and mastitis problems. This was followed by continued monitoring of infectious and parasitic diseases in the second year. In the third year of the program the main focus was on improving calf health. After the goal was set, the advisor collected and analysed the data from ICBF and farm-specific problems were identified. Thereafter the farmer and advisor chose which management approach to apply on the farm. Every year the farmer receives a fertility report from the UCD advisors which contains all different kinds of fertility measurements, including the following;
Part 1 cow, calving and pre-breeding dates; including calving dates, 305 day yield, number of lactations, EBI (breeding index), graphics of calving pattern, calving performance, pre-breeding examinations,
Part 2 breeding performance; including breeding dates, target and actual performance(number of cows being pregnant)
Part 3 heat detection dated; including submission rates, inter service intervals, cystic disease detection,
Part 4 service performance; including conception rates, number of services per cow, conception intervals,
Part 5 pregnancy performance; including percentage pregnant through the breeding season, calving pattern,
Part 6 BCS Analysis; including BCS at calving, BCS loss after calving,
Part 7 Milk recording analysis; including milk solids, 305 yield,
Part 8 An interpretation of all the data recorded for that year.
With this report presented to each of the farmers every spring, the UCD talks with the farmer about the goal settings and performance of the herd. The UCD provides advice on what the farmer can do to improve his or her farm performance and to achieve the farm goals stated.

Materials
In the present study different aspects referring to the UCD herd health management program were taken into account. General farm-, herd performance-, fertility and production data were taken into account to measure if there were any changes made over the last 3 years due to participating in the management program. The data that was be analysed was dependent on what the farm holder recorded at ICBF. Based on that data, data analyses were made.

3.2 The UCD data

Data provided by the UCD from the six participating farms were based on the data from ICBF and focused on the spring breeding season. An explanation of the meaning for the following variables is provided in chapter 5.1 choice of data. The data of the following variables were all based on the years 2009 to 2011.

<u>General farm data:</u>
Average number of breeding cows
Average number of heifers
% Spring breeding
% Winter breeding
Calf mortality %

<u>Fertility data:</u>
Submission rate, 21 days from the early service date (ESD) from all lactating cows (%)
Conception to first service (%)

Average ESD to conception (days)
21 day pregnancy rate (%): Average incidence rate for pregnancy over the breeding season, calculated as (total number of pregnant animals/ total number of days open for all breeding animals)*21 days
Percentage of herd pregnant
6 weeks calving rate (%)
Number of services per cow per conception
Average heifer age of first calving (months)
Percentage of herd eligible at the mating start date (MSD)
Average somatic cell count (SCC) (,000 cells/mL)

The percentages of the herd used for spring and winter calving was contributed from the annual report from ICBF. This report provided an overview of the calving date, the end date of lactation period, fat%, protein%, fat (kg), protein (kg), fat + protein (kg), completed lactation/extended lactation/ lifetime production, SCC (cells/ ml) and Early Breeding Index (€), cows currently in herd, calving interval and the lifetime in days for every dairy cow in the herd per year.
The percentage of calf mortality was calculated based on the stock analysis as follows: calf mortality (%) = died/((born + bought) - sold)*100%. The stock analysis showed the number of died, born and sold cows and calves per year.

3.3 The Teagasc data

From Teagasc the following farm data was provided for the year 2011. From five out of the six program farms data was used. One farm was excluded because of incomplete data. Teagasc provided per program farm an average of two to three control farms. The data of the years 2009 and 2010 were incomplete and could therefore not been taken into account. The data of Teagasc was focused on the whole year. From the data provided by Teagasc the following variables could be taken into account;

General farm data:
Farmland area (ha)
Farm stocking rate
Milking platform (Stocking rate)
Number of cows

Production data:
Total milk produced
Average yield per cow
Protein %
Fat %

Fertility data:
6 Weeks calving rate
Replacement rate (heifer calves born as a proportion the herd per year)

Economic data:
The economic variables were purchased from profit monitors made by business economic advisors from Teagasc. Also the economic dataset was based on data from five out of the six program farms. For each program farm the same control farms as for the herd performance data from Teagasc were included. All costs were displayed in euro per litre. Costs involved in the program were;

- Gross output
- Total variable costs

    - Feed costs
    - Fertiliser
    - Veterinary fees
    - Artificial insemination
    - Contractor
    - Other variable costs
- Gross margin per litre
- Total fixed costs;
    - Machinery
    - Depreciation
    - Hired labour
    - Other fixed costs
- Total costs per litre
- Net profit per litre

3.4 Perception of the farmer

To look at the perception of the farmer about how the program is applied, a questionnaire was developed. In this way the perception of the farmer was counted in to see whether the farmer stick to the advice of the advisor or not and to get a better knowledge on the attitude of the farmer about the program. The questions in the questionnaire were formulated using open-, multiple choice-, 5-point Likert-scale and score questions, based on the questionnaire from Derks, van de Ven et al. (2012) and adapted to the Irish dairy farms. The questionnaire contained six parts reflecting to the farm description, participation in the program, advantages and disadvantages of the program, content and structure, the role of the advisor and financial management. At the beginning of each item specific fill-in instructions were provided (e.g. explanation of the Likert-scale questions). The questionnaire took about one hour per person and was interviewed and recorded by the same person who did not know the farmers before. All interviews were taken on the farm and extra information was given if questions were unclear. The questionnaire is attached in appendix 1.
Before the questionnaire was used, it was tested and rewritten by the program advisors from the UCD. This way some questions were deleted, because there was no use for it or rewritten, because they were too vague. Some questions were added, because they were considered important to gain knowledge on the perception of the farmers about the UCD-program.

Analysis

The data from UCD and Teagasc were managed in Microsoft Excel 2010. All statistical tests were performed in the computer program SPSS (IBM version 19, United States). In all cases, the accepted significance level was $P< 0.05$.
For the data analysis of the herd performance the research was divided into two groups, based on the source of data. To see if there had been made changes in herd performance over the three participating years, the UCD-data obtained from ICBF was analysed using descriptive statistics (SPSS). For the visual analysis of the herd performance histograms and graph is were made. The graph is were made for the variables percentage of herd pregnant and the percentage of herd eligible at MSD (mating start data, see chapter 4.1. choice of data). For the percentage of herd pregnant the formula and R^2 of the mean trend line was provided.
The herd performance and economic data from Teagasc for the year 2011, was used to show if there were significant differences between the control and program farms. To see if the mean program and mean control farms significant differ from each other a paired sample T-test was performed in SPSS. To see if there were significant correlations between the herd performance variables and economic variables from Teagasc, Pearson correlation tests in SPSS were made. For example between replacement rate and yield per cow.
From the profit monitors from Teagasc the gross output, total variable costs and total fixed costs were calculated by Teagasc. The gross output was calculated by; sales (of milk, calves, cows i.e.) + transfers

(replacements dairy) – transfers (replacements heifers) – purchases (dairy cows and stock bulls)+/– inventory (dairy cows and stock bulls).

The total variable costs contained the costs of; sundry variable, straw, levies and transport, silage additive & polythene, milk recording & parlour, seed and spray, contractor, artificial insemination/ breeding, veterinary, lime, fertiliser, purchased forage, home grown concentrate and purchased concentrate.

The total fixed costs contained the costs of; hired labour, quota lease, land lease, sundry fixed, insurance, repairs and maintenance, depreciation of machinery, depreciation of buildings, phone (farm), car (farm), loan interest, od & credit interest, machinery leases and machinery running. Only the variables that accounted for the greatest part of the total costs (total variable costs and total fixed costs) were taken into account separately in this research. The costs that were not included separately, were summed and included in the 'other variable costs' and the 'other fixed costs'. The gross margin was calculated by the gross output minus the total variable costs. The net profit was calculated by the gross margin minus the total fixed costs.

A Spearmans' rho correlation test was performed to see if there was a correlation between the net profit and the questionnaires Likert-scale, satisfaction measurement (question 14, part 4) of the program farms. A Spearmans' correlation test was performed to see if there was a correlation between the economic farm performance data and the Likert-scale question if the advice of the UCD was understandable (question 11, Part 3). Correlations made between variables, were considered as relative strong if the correlation coefficient provided was about 0.8 and 0.9.

The answers to the questionnaire were also managed in Microsoft Excel 2010. Data retrieved from the returned questionnaires was summarized using descriptive statistics in SPSS (IBM version 19, United States), giving minimum, maximum, mean and standard deviation. The questionnaire was answered by six participants. Some questions were answered using a 5-point Likert-scale (for example; *strongly disagree, disagree, neutral, agree and strongly agree*). Other questions were multiple choice and open questions.

A Pearson correlation test was performed to see if there was a correlation between farm size and hours spent by the UCD advisors on the farms.

4. Results

The results found in this research are separately shown per kind of dataset. Separately the data from the UCD concerning herd performance and the data from Teagasc concerning herd performance and financial data, will be shown.

4.1 The UCD data; herd performance

Table 1 summarizes the UCD data obtained from ICBF. It summarizes general farm data and the performance of the six program herds for the years 2009, 2010 and 2011, mainly focused on the spring breeding season.

Variable	2009	2010	2011	N	Source	Difference '11-'09
Average nr of breeding cows	80.333	80.667	91.5	6	UCD	11.167
Average nr of heifers	23.667	24.167	28.167	6	UCD	4.5
% Spring breeding	0.68	0.79	0.75	6	Annual	0.075
% Winter breeding	0.32	0.21	0.25	6	Annual	-0.075
Calf mortality %	0.195	0.133	0.137	6	Stock analysis	-0.058
Submission rate % 21 days from ESD	0.773	0.783	0.788	6	UCD	0.015
Conception to first service rate %	0.413	0.393	0.458	6	UCD	-0.031
ESD to conception (days)	32.19	34.69	32.64	6	UCD	0.449
21 day pregnancy rate %	0.402	0.394	0.509	6	UCD	0.108
Percentage of herd pregnant	0.728	0.752	0.813	6	UCD	0.085
6 weeks calving rate %	0.489	0.536	0.515	6	UCD	0.026
Nr. services per cow per conception	2.526	2.564	2.121	6	UCD	-0.406
Heifer age of first calving (months)	27.063	26.614	26.194	6	UCD	-0.87
Herd eligible at MSD %	0.611	0.630	0.616	6	UCD	0.005

Table 1. An overview of general farm data and herd performance data, provided by the UCD for all the 6 program farms, based on the data from ICBF. Given the difference between the years 2011 and 2009 and the source were the data is obtained.

In table 1 it is shown that the average number of breeding cows increased over time, with a difference of +11 cows between 2011 and 2009. The average number of breeding cows, per year for the participating farms is shown in table 2.

Year	N	Minimum	Maximum	Mean	STD.
2009	6	40.00	142.00	80.333	35.970
2010	6	37.00	120.00	80.666	30.137
2011	6	41.00	149.00	91.500	37.553

Table 2. The average number of breeding cows per year for the program herds, including minimum, maximum, mean and standard deviation.

The amount of heifers in the herds increased from 23 heifers, on average, in 2009 to 28 heifers in 2011. Table 1 shows some improvements the program farms made, comparing the years 2009 and 2011. The program herds shown a reduction in average calf mortality of 5.8% over three years. Concerning the fertility variables; it is shown that in the three years of participation the percentage of herd pregnant, on average, increased with 8.5%.

The variable 21 day pregnancy rate increased by 10.8% over the three years of participating. The 6 weeks calving rate increased from 0.489 to 0.515 and depends on the culling rate from the previous year and amount of heifers in the herds. Heifer age of first calving declined from 27 months to 26.2 months, on average. In this research no correlation is shown between the 6 weeks calving rate and the amount of heifers in the herds ($P>0.05$).

The number of services per conception per cow reduced from 2.5 in 2009 to 2.1 services per conception in 2011. No replacement rate and average age of the herds from the ICBF data is provided, but due to the increase in amount of heifers, decline in heifer age of first service and calve mortality, it could be that the herds during participation overall declined in age, which have positive effects on the other fertility variables. These positive changes of herd performance could all have a positive effect on the net profit. In the next chapter it will be shown which herd performance variables have a significant impact on the economic data.

The conception to first service rate increased from 41.3% in 2009 to 45.8% in 2011. Which means that, on average more first inseminations resulted in a successful conception.

The only variable that did not show improvements for the participating farms was the ESD to conception rate, see table 1. ESD to conception rate is increased with 0.449 between 2009 and 2011. This means that the amount of days between the ESD and the day that the cows are ready to be inseminated increased, on average.

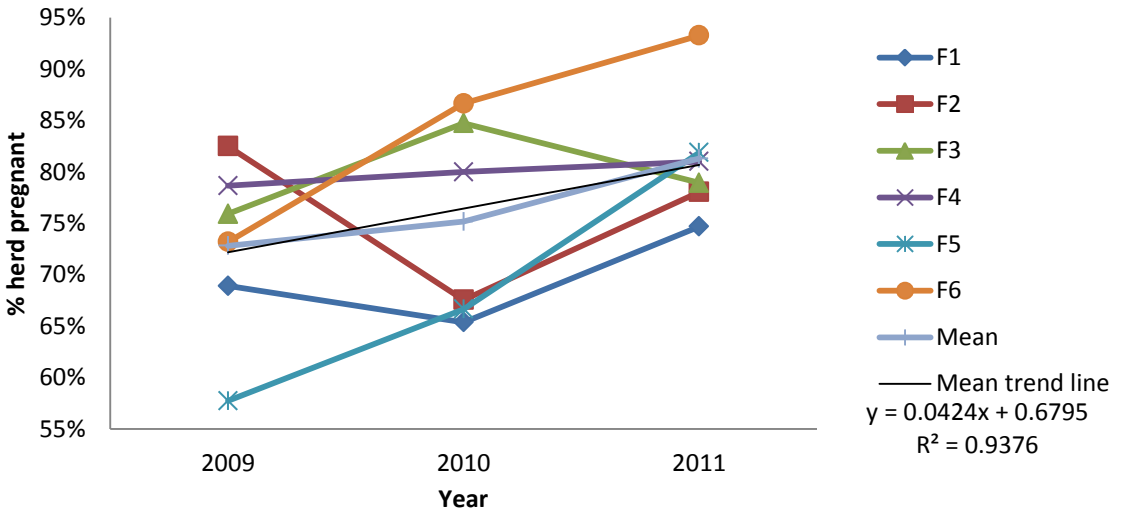


Figure 2. A graphic of the percentage of the herd pregnant for the program farms, including trend line and formula of the mean. For the years 2009, 2010 and 2011.

Five out of the six program farms show a higher percentage of herd being pregnant in the year 2011 than in the year 2009 (figure 2). A linear trend line of the percentage of the herd fitted; $Y_M=0.6795+0.0424x$ with a R^2 of 0.938. This means that the average percentage of herd being pregnant increased over time with 4.24% per year.

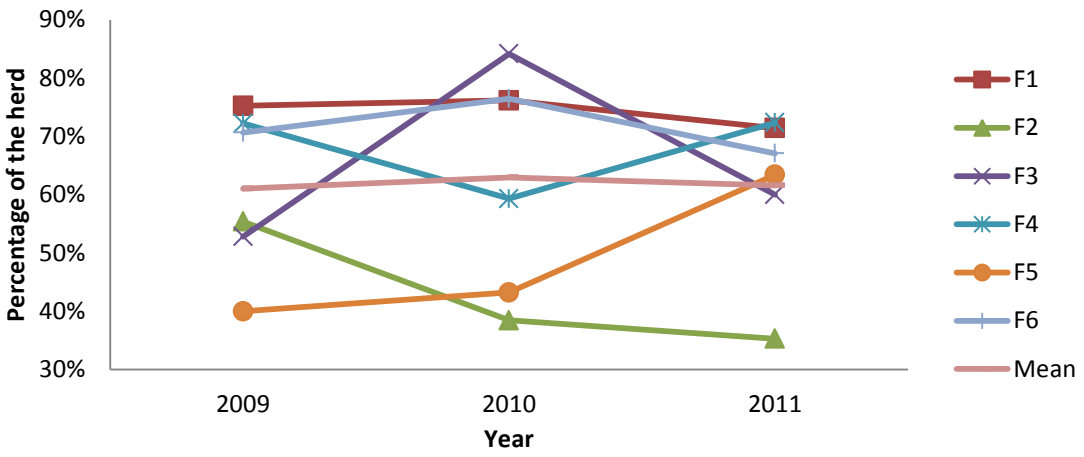


Figure 3. Graphic of percentage herd eligible at the mating start date for the program farms.

To see if farmers can keep their calving pattern as planned, the variable percentage of herd being eligible at MSD was used (see figure 3). For two farms this percentage is higher in 2011 than in 2009 (farms 3 and 5). One farmer maintained the same percentage (farm 4, 72%). The mean percentage of herd being eligible at MSD shows a positive difference between 2011 and 2009 of 0.5%.

All participating farms use a pasture-based system and have a higher percentage of the herd used for spring breeding than for winter breeding, in all three years. Mostly, the goal of the farmer is to have a higher percentage of the herd eligible for the spring breeding season than for winter breeding season and to keep the breeding season as narrow as possible. Over the years the percentage of spring breeding increased from 68% in 2009 to 75% in 2011. In 2011 this difference was 75% in spring and 25% winter breeding on average, see figure 4.

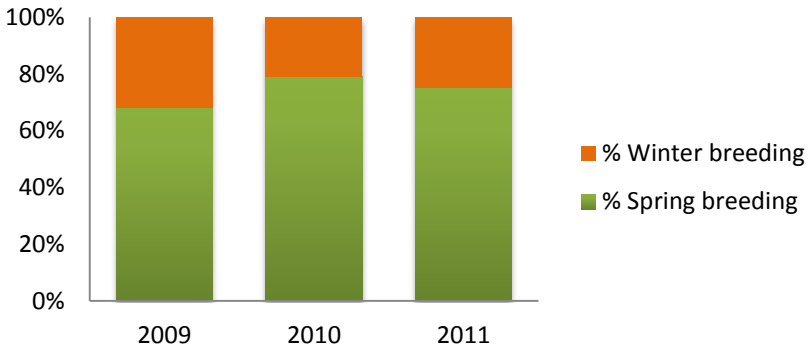


Figure 4. A histogram showing the average percentage of the herds used for the winter and spring breeding season, for the years 2009 to 2011.

4.2 The Teagasc data; herd performance

The data provided by Teagasc only concerns the year 2011. The data consist of year figures for both program and control farms. To see if the program farms differ significantly from the control farms a paired sample T-test of P-C in the year 2011 for every variable of Teagasc was performed. An example of the comparison between program and control in SPSS is shown in appendix 3, table 1, for the variable farmland (ha). Also an example of the SPSS-output for analysing the mean, minimum, maximum and standard deviation of the variables is given in appendix 3, table 2 for farm size in hectares.

	Program farms					Control farms					
Variable 2011	**Mean**	**N**	**Min.**	**Max.**	**STD**	**Mean**	**Min.**	**Max.**	**STD.**	**P-C**	**P-value**
Farmland area (ha)	75.46	5	38.3	119.0	33.75	90.73	60.090	110.750	22.90	-15.27	0.101
Farm stocking rate	2.11	5	1.4	2.6	.50	2.074	1.900	2.250	.13	0.036	0.857
Milking platform rate (SR)	2.27	5	1.77	1.96	.35	2.31	1.96	2.88	.37	-0.04	0.593
Nr of cows	113.8	5	70	175	43.92	108.8	69	165	39.35	5	0.132
Total milk produced x10.000	69.626	5	39.68	71.41	24.07	66.425	39.698	102.904	26.68	32.01	0.367
Yield per cow	6074.4	5	5512	6810	517.21	6042.8	5382.0	6677.0	528.15	31.6	0.515
Protein %	3.39	5	3.32	3.52	.08	3.354	3.31	3.41	.05	0.04	0.179
Fat %	3.94	5	3.77	4.13	.13	3.868	3.76	4.00	.10	0.07	0.279
6 Weeks calving rate %	46.2	5	28.0	63.0	15.80	15	2.0	25.0	9.62	31.2	0.008*
Replacement rate	28	5	15.0	44.0	11.34	25.8	23.0	32.0	3.63	2.2	0.612
SCC (x 1000 per ml)	200.83	6	154.0	298.0	66.78	246.33	94	264	61.76	-45.5	0.138

*significant different (P<0.05)

Table 3. Overview of the general farm and herd performance data 2011 from Teagasc. Including the mean, maximum, minimum and standard deviation (STD) of the program farms and control farms. The term P-C gives the difference between the two means. With a paired sample t-test the P-values are calculated to see if the differences between the two means are significant. A significant difference is shown for '6 weeks calving rate' (P<0.05).

In table 3 it is shown that farmland (ha) (P=0.101), number of cows (P=0.132) and the SCC (P=0.138) have relative low P-values for the differences between program and control farms, compared to the other variables from Teagasc. Only the 6 weeks calving rate shows a significant difference between the program and control farms for the year 2011 (P=0.008). On average the farmland was larger for the control farms than the program farms. The farmland (ha) of the program farms has a mean of 75.46 ha within the range of 38.3 to 119 ha. The control farms have a mean of 90.73 hectares for farm size, within a range of 60.09 to 110.75 ha (see table 3). The 6 weeks calving rate is, concerning the data from Teagasc, 46.2% for the program herds and 15% for control herds, on average.

The difference in farm stocking rate of 0.036 is not very large (P=0.857). The farm stocking rate is a variable that can be described as the number of cows per hectare farmland and is therefore dependent on the amount of farmland (ha) and the number of animals in the herd (including bull, dry cows, calves, heifers and milking cows). The program farms have on average a smaller farmland area and a higher number of cows in the herd, reflecting a higher farm stocking rate in general for the program farms. The higher farm stocking rate has positive effects on the use of grassland and therefore use of own grass for feed, needing less additional grass which will reduce feed costs. In this research no correlation between farm stocking rate and feed costs is found (P=0.640). The milking platform in stocking rate (SR) is established from the number of milking cows and the size of farmland in hectares. On average the milking platform is higher for the control farms (2.31 milking cows

per ha) than for the program farms (2.27 milking cows per ha). No significant difference is found between program and control farms (P=0.593), because milking platform (SR) was one of the variables for the control farms to resemble a program farm. The milking platform concerns only the milking cows per farmland size (ha). Because some farms maintain side activities besides the production of milk (for example beef production), this variable is a good indicator for the feeding system/intensity of milking cows using grassland. In this research no correlation is found between the milking platform (SR) and feed costs per litre (P=0.711).

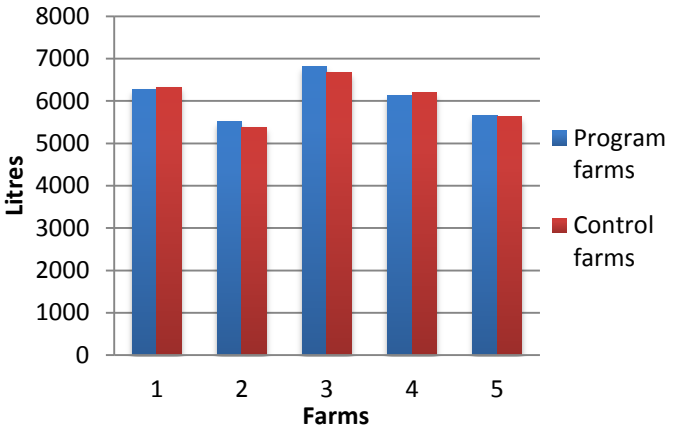


Figure 5. Histogram of the average yield per cow for five program farms with paired control farms. No significant difference was found between program and control farms (P>0.05).

There was a big difference in the amount of the average total milk produced, between the program and control farms. On average the program farms produce 32010 litres more per year than the control farms. This difference could be due to the difference in amount of dairy cows (P-C=5 cows) and the yield per cow per year (P-C= 31.6 litres), both higher for the program farms. For a more appropriate view on production performance than the total milk yield, the variable yield per cow per program farm with control farms is shown in figure 5. The average yield per cow on program farms is 6074.4 litres within a range of 5512.0 and 6810.0 litres. For the control farms this is 6042.8 litres per year within a range of 5382.0 and 6677.0 litres. The difference between the program and control farms for the yield per cow is 31.6 litres per year on average. No correlation was found between the farm stocking rate and the yield per cow (see appendix 3, figure 1). A negative correlation was found between yield/cow and the costs for artificial Insemination, (P=0.037, r= -.662), see appendix 3, table 5. This means that when the total average yield per cow rises, the costs for artificial insemination can decrease as a consequence. No correlation between yield per cow and the economic variables net profit or total costs per litre were found (P>0.05).

The replacement rate was relative higher for the program farms than the control farms (P-C=2.2). This means that on average the program herds have more heifers born as a proportion of the total herd, compared to the control farms. This could mean that if the herd size stays the same that the new heifers born replace older cows that will be culled. This provides a younger average herd age. No correlation is found between replacement rate and net profit or total variable costs (P>0.05).

On average the SCC was lower for the program farms (200,83 x1000 cells per ml within a range between 154 and 298 x1000 cells per ml), than for the control farms (246,33x1000 cells per ml within a range of 94 and 264x1000 cells. The UCD holds the norm of 200.000 cells to measure the change of mastitis. In figure 6 it is shown that four out of six program farms stay under the norm. Two averages of comparable control farms stay under this norm from the UCD (see figure 6). Three program farms showed a lower SCC in comparison with the average of the comparable control farms. In this research no correlation was found between SCC and yield per cow (P= 0.206 with r=-0.427). Also no correlation between SCC and net profit or feed cost was found (P<0.05).

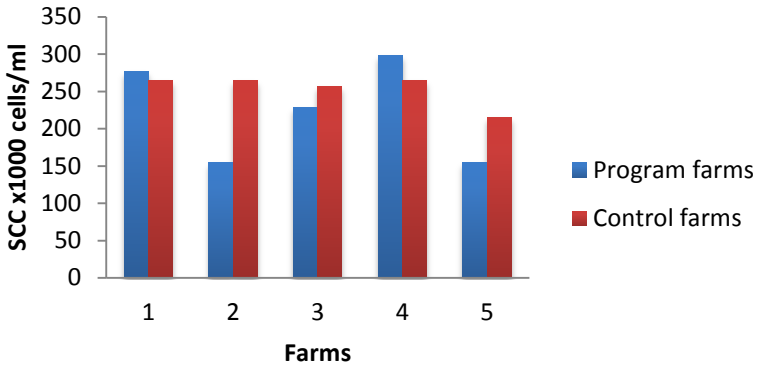


Figure 6. Histogram of SCC for the program farms and comparable average of control farms.

The percentages of protein and fat in the milk are both higher for the program farms than for the control farms. Both showing an almost equal minimum average for fat and protein. The percentage of protein for program farms is, on average, 3.39% within a range of 3.32% and 3.52% and for the control farms this is 3.35% within a range of 3.31% and 3.41%. A higher percentage milk solids has a positive effect on the profit made by the farmer. Therefore a high percentage milk solids is desirable. In this research no correlation between protein% and net profit is shown (P=0.232). Also no correlation between fat% and net profit is shown (P=0.089).

4.3 The Teagasc data; financial

Variable 2011 (c/litre)	Program farms					Control farms				P-C	P-value
	Mean	N	Min.	Max.	STD.	Mean	Min.	Max.	STD.		
Gross output	36.46	5	33.820	40.230	2.479	35.970	35.190	36.440	.538	0.49	0.732
Feed costs	4.162	5	1.710	7.840	2.276	5.070	2.930	7.500	1.647	-0.91	0.535
Fertiliser	1.748	5	1.220	2.180	.377	1.930	1.390	2.500	.434	-0.18	0.561
Veterinary fees	1.22	5	.780	1.730	.381	1.134	1.030	1.240	.082	0.09	0.63
Contractor	1.446	5	1.550	2.600	.457	1.296	1.030	1.520	.200	0.15	0.655
Artificial insemination (per breeding)	0.508	5	.380	.740	.144	.472	.380	.500	.052	0.04	0.575
Other variable costs	2.134	5	1.550	1.620	.457	1.526	1.160	1.800	.298	0.608	0.092
Total variable costs	11.218	5	8.590	14.970	2.379	11.386	10.210	12.590	.903	-0.17	0.902
Gross margin	25.238	5	18.840	28.640	4.061	24.584	23.060	26.230	1.208	0.65	0.779
Hired labour	2.222	5	.040	3.500	1.413	1.730	.400	2.440	.780	0.49	0.448
Depreciation	2.976	5	.000	4.770	1.841	2.214	1.950	2.750	.328	0.76	0.414
Machinery	1.532	5	.540	2.260	.681	2.176	1.640	3.400	.698	-0.64	0.339
Other fixed costs	4.132	5	1.620	7.280	2.139	2.980	2.520	3.340	.368	1.152	0.808
Total fixed costs	12.99	5	11.530	14.180	1.342	11.304	10.440	12.260	.659	1.69	0.102
Total costs	24.21	5	21.560	29.010	3.138	22.692	21.260	24.850	1.457	1.52	0.437
Net profit	12.25	5	4.810	15.140	4.307	13.280	10.800	15.180	1.620	-1.03	0.681

Table 4. Overview of economic data 2011, Teagasc. Mean, minimum, maximum and standard deviation of program farms (P) and control farms (C) are given. P-C gives the difference between the two means. With a paired sample t-test the P-values are calculated to see if the difference between the two means is significant. No significant differences are found.

For none of the economic variables the difference between program and control farms is significant, see table 4. Only the total fixed costs (TFC) (P=0.102) and other variable costs (P=0.092) have relative low P-values. In table 4 it is shown that the TFC of the program farms are relatively higher than the TFC of the control farms (P-C=€1.69 c/Litre). The gross output in 2011 is for the program farms on average higher. For the program farms this is 36.46 c/litre within a range from €33.8 to €40.23 c/Litre. For the control farms this is €35.97 c/Litre within a range of €35.19 to €36.44 c/Litre.

On average the feed costs per litre are lower for the program farms (€4.16 c/Litre) than for the control farms (€5.07 c/Litre), see figure 8. For the feed costs large ranges are shown (P, €1.71;€7.84 and C, €2.93;€7.50 c/Litre). This means that the amount of feed costs differ a lot between the different farms. The feed costs are strongly dependent on the pasture based system and involving breeding season. Depending on which percentage of the herd is used for winter milk production and therefore need to be additional fed more than the percentage of the herd for spring breeding who eat primarily grass from the land. Also different kinds of food and the energy content have impact on the amount of food that is fed and the feed costs. In this research no correlation is found between the milking platform (SR) and the feed costs per litre (P=0.711).

Average costs for artificial insemination (AI) per breeding are higher for the program farms (€0.508 within a range of €0.380 and €0.740 per breeding per litre) than for the control farms (€0.472 within a range of €0.380 to €0.500 per breeding per litre produced). The artificial insemination costs depend on cost for semen, insemination costs, cost for using a bull or not, i.e. Therefore it is hard to say which factor caused the difference between program and control farms, concerning the artificial insemination costs.

Although the program farms have higher contractor- and AI costs per breeding, per litre, the total variable costs are on average lower for the program farms (€11.218 c/Litre) than for the control farms (€11.386 c/Litre).

This resulted mainly from the lower fertiliser costs (P-C=€-.91) and feed costs (P-C=€-0.18). Causing a difference of €-0.17 c/Litre in the TVC between program and control farms.
The gross margin is established from the gross output minus the TVC. Also known as revenue minus the TVC. The gross margin per litre is, on average, higher for the program farms (€25.23 ranging from €18.840 to €28.640 c/Litre) than for the control farms (€24.584 ranging from €23.060 to €26.230 c/Litre). This is mainly due to the relative higher average gross output and lower total variable costs per litre for the program farms.

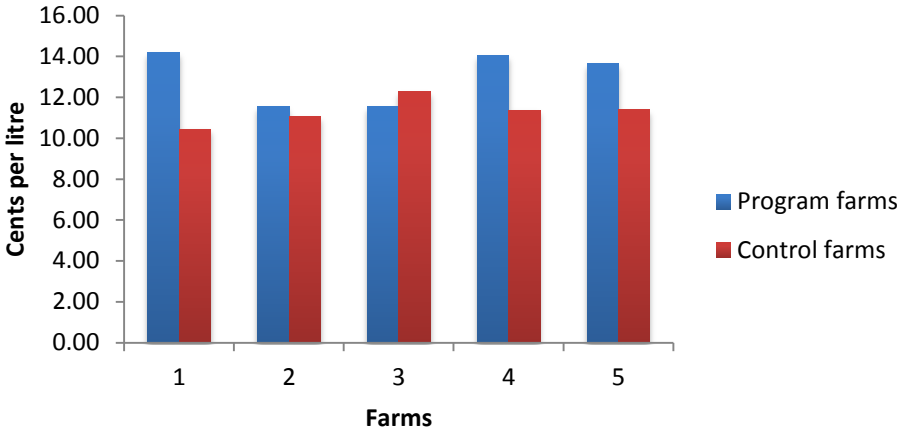


Figure 7. Histogram of the total fixed costs in euro per litre for the program and comparable control farms.

The largest differences between program and control farms for the TFC are due to the depreciation of machinery and buildings (P-C=€0.76) and the other fixed cost (P-C=€1.15). Depreciation will not directly affect the cash flow of a company as it is a non-cash expense. The farm is not spending money as a result of asset depreciation, it just wouldn't be worth as much should the company be liquidated. The other fixed cost include costs for quota lease, land lease, sundry fixed, insurance, repairs and maintenance, phone (farm), car (farm), loan interest and od & credit interest. Overall a higher TFC is shown for the program farms, see figure 7. These costs for the program farms were €12.99 c/Litre, while for the control farms this was €11.30 c/Litre in 2011. The average difference of the TFC is €1.69 c/Litre. As a result this means that the total costs per litre are higher for the program farms (€24.21 ranging from €21.56 to €29.01 c/Litre) than for the control farms (€22.69 ranging from €21.26 to €24.85 cents per litre). The program farms have on average €1.52 more costs per litre.

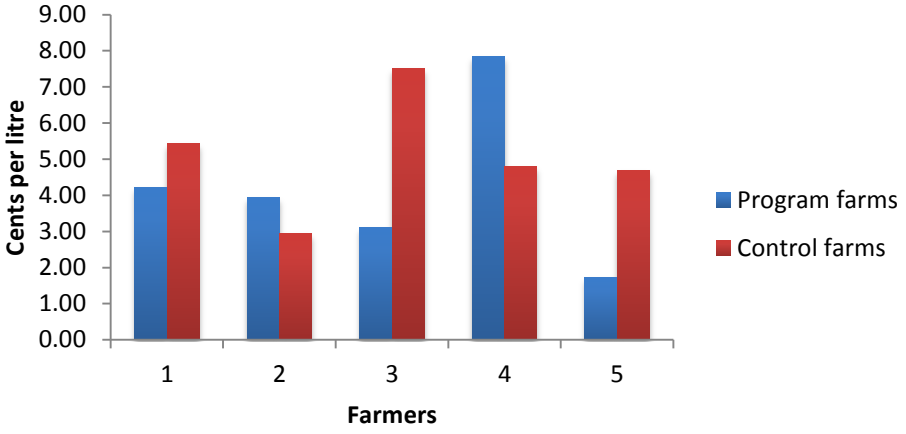
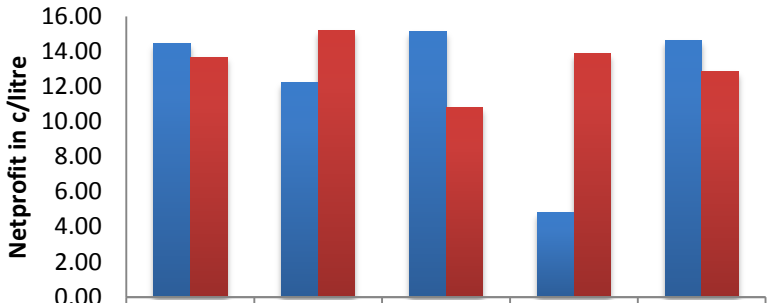


Figure 8. Histogram of feed costs per litre milk produced in euro per litre. Only farm 2 and 4 showed higher feed costs per litre than the compared control farms.

As a result the average net profit per litre is higher for the control farms (€13.28) than for the program farms (€12.25). Figure 9 shows that overall three out of five program farms maintain at a higher profit level than the control farms. The largest difference of €9.09 is shown between farm 4 and it's average of comparable control

farms, which may have had a big impact on the average difference in net profit between the program and control farms.



	1	2	3	4	5
Program farms	14.460	12.220	15.140	4.810	14.620
Control farms	13.680	15.180	10.800	13.900	12.840

Figure 9. Histogram of the net profit in c/litre for program and the paired control farms, based on the data from Teagasc 2011. Farm 2 and 4 show a lower net profit per litre, on average, compared to the control farms.

A Spearman's' rho correlation test was performed to see if there is a correlation between the net profit 2011 and the questionnaires Likert-scale, satisfaction measurement (question 14, Part 4) of the program farms. No significant correlation was shown between net profit per litre and the value of satisfaction of the UCD herd health program ($P>0.05$), see appendix 3, table 3. Also no correlation was found between the yield per cow and the same satisfaction measurement ($P>0.05$) for the program farms. In this research no correlation is found between economic farm performance data like the net profit and yield per cow and the likert-scale question if the advice of the UCD is understandable (question 11, Part 3), see appendix 3, table 4.

4.4 Perception of the farmer

Part 1. The description of the farms

Five out of the six farms keeps only dairy cattle and all participators use a loose housing system with cubicles. All farms were mainly devoted to spring calving and is planning to expand the herd size in the future. The herd size in October 2012 were on average 110 dairy cows, with a standard deviation of 37 dairy cows in a range of 69 to 170 dairy cows. The amount of heifers was on average 65, with a standard deviation of 38 within a range of 22 to 125.

Part 2. Content and structure of the program

All farmers (100%) started participating in the UCD program from the farmers discussion group. Depending on the season of the year (breeding season or not) the advisor of the UCD visits the farm on average every three weeks, in breeding season. This average is within the range of two to four weeks for six program farms. According to Pearson correlation test, there was no significant correlation between the amount of cattle and visits on the farm (P>0.05).

Reasons why the farmers started to participate in the program is shown in table 5. The questions were answered by a 5-point Likert-scale, from 1= totally disagree to 5= totally agree. Here it is shown that the main reasons to participate, were to obtain a higher profit and better structured working practices.

Besides the given options, farmers stated that the main reason to participate were to take care of the fertility problems (100%) and to gain better knowledge (33%). During the program, farmers concluded that there were a lot of advantages to participate in the UCD-program. All answered the questions about the advantages of participation in the UCD-program with a ranking of four and five on the Likert-scale, see appendix 2, table 1. The farmers stated that they maintain a structured approach for problem solving, regular control and support in the program due to participation. Besides that, an advantage of being in the program is that farmers are fully informed of new developments and topical subjects (mean=4.50).

	N	Min.	Max.	Median	Mean	SD.
To have a second view on the production data	6	1	5	4.00	3.50	1.643
By advice of my local veterinarian	6	1	1	4.00	1.00	.000
To obtain a higher profit	6	4	5	4.50	4.50	.548
Because of health and/or management problems on the farm	6	1	5	4.00	3.50	1.643
To obtain better structured working practices	6	3	5	4.50	4.33	.816
Reduce the incidence of clinical mastitis	6	1	5	2.50	2.83	2.041

Table 5. Likert-scale; reasons to participate in the UCD- program (n=6).

The disadvantages of participation were given in a broad range on the Likert-scale. The main disadvantage is that collecting data cost a lot of time for the farmer to accomplish (mean= 3.50), see appendix 2, table 1.

For most farmers record keeping is improved due to the program. The UCD provided a computer program to insert all the recorded data. The farmers started to record more variable data and one farmer stated that he learned how to use the supplied software program to record all the data and in this way improved his record keeping.

All the participators (100%) stated that due to participation in the program, problems were discovered sooner, efficiency improved and that another approach for problem solving is carried out, see appendix 2.

In figure 10, it is shown that fertility (100%) and nutrition were discussed the most frequent during a farm visit, according to the farmers. How darker the bar, the subject is discussed more.

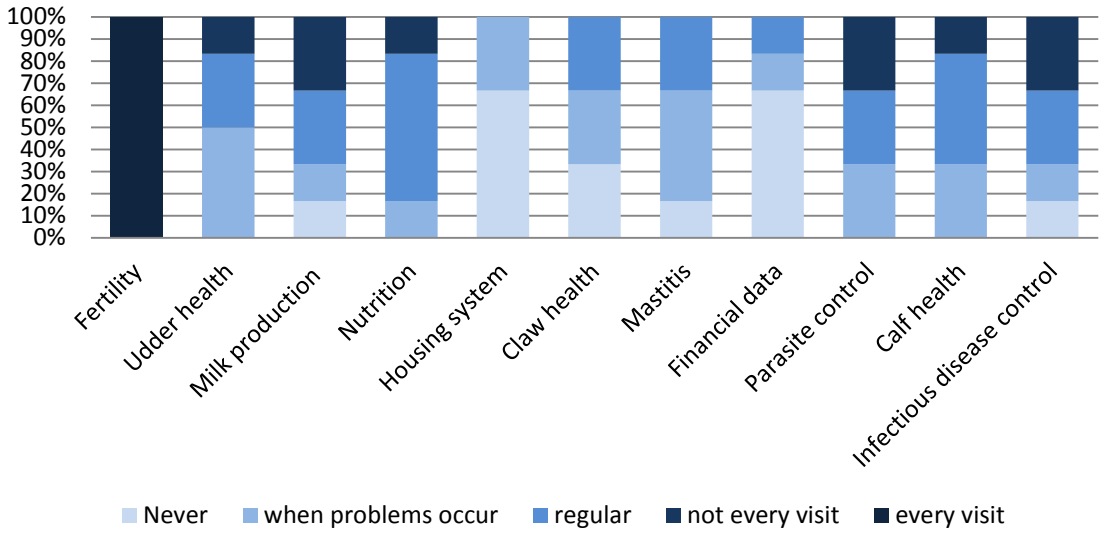


Figure 10. Histogram of the frequency of subjects discussed during visits of the UCD advisor.

2/6th of the farmers stated that the UCD set the goals for the farm and provides the advice to achieve these goals. 4/6th of the farmers states that they set the goals themselves and that the UCD gives them management advice on that. One comment given, was that the UCD set the targets to achieve the goal and gives management and advice to achieve these targets on a most efficient way. Five out of the six farmers stated that only the farmer self decides in what way the goals will be achieved. One farmer told that the UCD decides in what way the goals will be achieved.

All farmers (100%) had as one of the goals for the farm, to improve fertility with the UCD-program. Other goals were; improve body condition score, reduce SCC, improve disease control, reduce lameness, reduce breeding season, improve nutrition, increase conception rate and have more cows in calve. With most common fertility, improve body condition score, reduce SCC and improve disease control.

To achieve these goals the UCD used different approaches. In the first year the farmers started to participate, record keeping was broadened and the first focus was on disease control. Blood testing, screening and monitoring herd health diseases like mastitis and BVD, was the first focus. For example, to control mastitis and decrease the SCC advice on milking routine, machine maintenance was given, teat condition was examined and , milk sampling was done and there was a focus on the nutrition to reduce negative energy balance. When the farms got rid of the most severe diseases then UCD was focused on what the farmers were doing wrong, like not recording data or not in the right way. The UCD made the farmers aware of problems on the farm and obtained a focused second view on the production data.

Part 3. The role of the advisor

All the farmers had for the past three years a maximum of two different UCD-advisors. All farmers stated that the UCD has always been aware of the goals the farmers wanted to reach.

Their opinion about the knowledge level of the UCD advisors was positive for all advisors. Containing; excellent, very good, better than own veterinarian and knowledgeable. One farmer stated that there was a small dip in knowledge level when a different advisor started to take over the UCD-program, because the new advisor did not had all the experience on his farm the other had. 50 percent of the farmers stated that, during a visit of the UCD-advisor topical subjects have priority to be discussed. 2/6th indicated that the farmer will decide what problems will be discussed during the visit. 100% of the participators indicate that they receive enough support to gather all the data easier.

Five farmers answered the question what the cause was if advice did not work out. 3/5th stated that some of the advice did not work out because of the quality of the advice and 2/5th stated that the advice was not suitable for the farm and therefore not followed.

In appendix 2 it is shown that there is an even percentage of the advice that is asked (47%) for and the advice is given without asking (53%) by the UCD-advisor.
For the question if the farmers receive advice from other advisors than the UCD advisor, all farmers answered to receive advice from some other advisor(s). For five out of the six farmers this was from the agricultural advisor. Besides that farmers received advice from a nutritionist (2/6), local veterinarian (2/6), accountant (1/6) and other farmers (2/6). Two out of six participators mentioned that advisors sometimes contradict to each other. This contradiction was mostly between the UCD-advisor and other farmers, the local veterinarian, the agricultural advisor and farming journal. In appendix 2, it is shown in what way the advice from the UCD is given to the farmer. The answers on the 5- point Likert-scale questions were scored from 1= totally disagree to 5= totally agree.

Part 4. How the program is applied

In this part of the questionnaire, questions were asked about the content of the advice and the program. Therefore the farmers gave their opinion about the advice received and applied, some improvements that should be made or contents that they were satisfied with. The questions were scored from 1= should be much better, 2= can be better, 3= neutral, 4= good and 5= cannot be better. The participators were all very content with the way advice was given, answering all questions between the range from four to five. Overall the preparation time was very good scoring five out of six times a four or more. The advice from the UCD is well explained to the farmer and it was directed at the problem involved (mean=4.67). Overall the UCD had no or not much cooperation with the local veterinarian (mean=2.80).
Appendix 2 shows what the opinion of the farmers is about how the program is applied by the UCD. The questions were ranked from 1=totally disagree, 2= disagree, 3= neutral, 4= agree and 5= totally agree. All farmers (100%) felt they were in charge for setting the farm goals and felt the UCD advisor showed enough compassion with the farm business. The mean value for how satisfied the participators are with how the UCD-program is applied is 4.33 ranging from neutral to totally agree. This shows that on average the participators are very satisfied on how the program is applied and that there is some room for improvement in the program.
Different aspects that are already taken into account are ranked from being not important (1), not so important (2), neutral (3), important (4) to very important (5). All aspects from the program were ranked from neutral onwards. The farmers valued day to day monitoring (mean=4.83), recording data (mean=5.00) and the farmers discussion (mean= 4.83) group as the most important aspects of the UCD-program.
For the question if the farmers would like to change something about the program on a short term basis, three farmers would like to plan more visits by the UCD. To improve the way how the farmers collect data in a more efficient way. It is wanted to have more visits spread over the year to have more control, the security of doing right, to look at the livestock and talk about problems concerning the farm business. One participant indicated to want to map out what to do with the business for the future and look at the figures to see what to achieve to maintain a higher profit. Other aspects that could improve the program are; concentrate more on nutrition and financial data, including more forward planning.
On a long term basis it is suggested to expand the program with more UCD-advisors and participants and to have only one advisor per farm during the program. Furthermore some farmers indicated the willingness to improve the genetics of the herd and for this to expand the program with advice on which bulls should be used and get advice about the genetics of the herd, on a long term basis.
For the question what have been good additions in the past three years of the program the participants answered that the herd health status is improved (lower somatic cell count) and that knowledge about the disease level is broaden. The farmers feel the health status of their young stock, like calves and heifers, is improved over the past three years. Focus on scanning of the herd and record keeping is improved with an improvement in fertility and herd health as result. Overall the farmers are very content with the program. Some bad additions have been made the past three years. There was an extra focus on the health status of the calves and heifers. Therefore the farmers had to weight all the young stock and some farmers indicated that

weighing the young stock took too much time and that the extra work did not weigh up against the extra work. Another farmer would like to see more focus on lameness at record keeping.

Part 5. Financial management

All farmers participate at the same executor, so the same payment system, all in one fee, is applied for all of them. It is not shown on the invoice how the program is constructed, therefore the call out charge and preparation time are not identified separately, but taken into the total price. Some additional costs are associated with the program, such as cost for drugs and some of the testing. Five out of six farmers are satisfied on how the payment system is provided. One farmer indicate that it would be better to pay a fixed tariff per cow per year. Overall the estimated costs per year for the program are €1.475,- per farm, ranging from €1.400,- to €1.600,- per year.

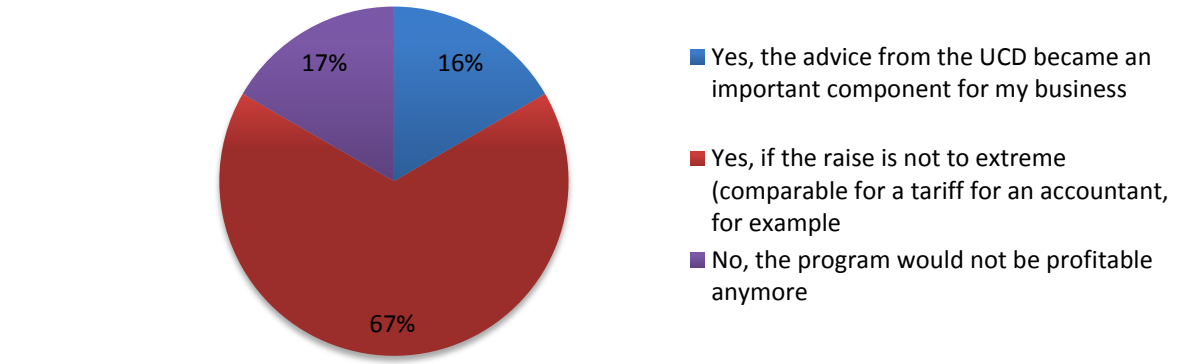


Figure 11. A percentage pie of the farmers consequences if the costs of the UCD-program would raise (n=6), multiple choice question.

In figure 11 it is shown that five out of six participants would still be interested in participation if the costs of the UCD-program would raise. For one farmer, a raise in costs would mean to stop with the program, because it would not be profitable anymore to keep on participation. The choice for 'yes, but I would have less aspects involved, because of the costs so I will decrease the time spend or frequency of the visits' has never been chosen and therefore left out of the figure.

Overall the estimated average amount the farmers would pay for the program is €1.875,- per farm, ranging from €1.000,- to €3.000,-.

Three farmers indicated to always be interested in the newest innovations according to dairy cattle, shown in figure 12. Four farmers showed the willingness to take risks in new investments and two farmers did not. Three out of four farmers who answered to be interested in newest innovations also showed the willingness to take risks in new investments.

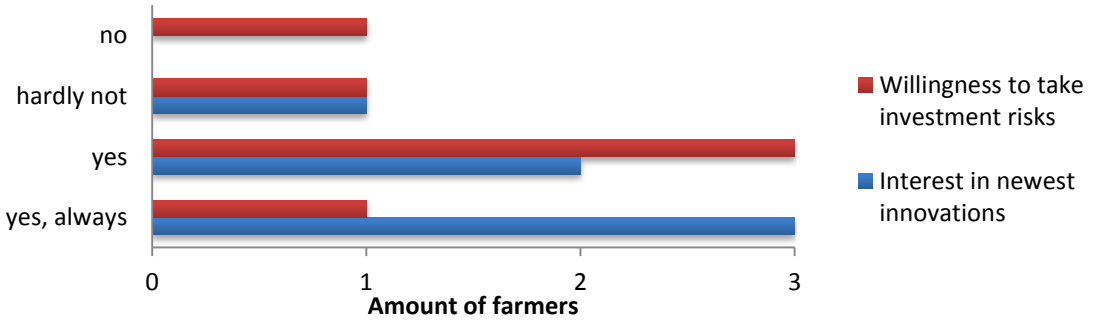


Figure 12. Histogram of the characteristics of the participators, the willingness to take risks and interest in newest innovations according to dairy farms.

Part 6. Future perspective

In this part of the questionnaire the participators answered questions about their perspective about future plans for the UCD-program. Some additions that the farmers would like to be made are keeping record about the timing of cows according to heat detection, keeping record and a better focus on lameness and farm business data and provide a more genetic basis for the herd to see which daughters of cows perform the best and have the highest production.

Concerning the future plans of the hours spend by the UCD for the farm, 50% of the participators indicated to have the plan to get time spend by the UCD for their farm. This mostly because they plan to increase the herd size. The other 50% has no plans in changing the amount of hours spend by the UCD-program.

All participators answered 'yes' to the question if they would continue with the program on a long-term basis. Some good ways to improve the program is to expand the program with other subjects such as nutrition etc. (45%) and spend more time to the prevention of animal diseases and current problems on the farm (both 22%), see figure 13.

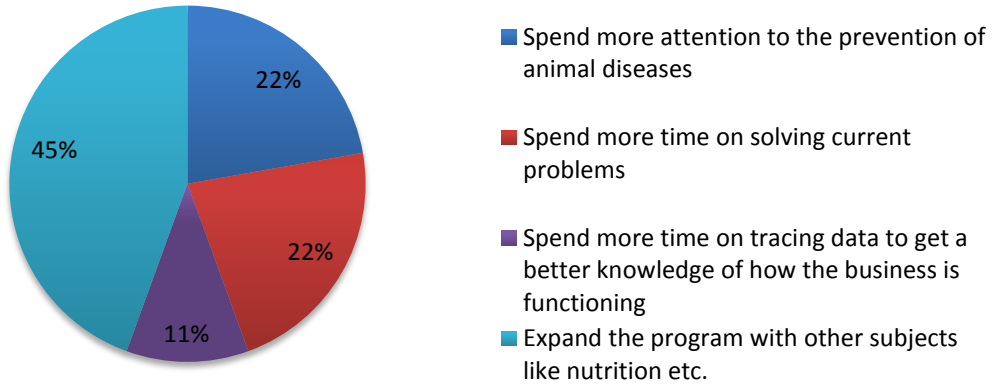


Figure 13. Percentage pie based on a multiple choice question, of farmers opinion on what will be a good way to improve the UCD-program.

5. Discussion

In this part of the research the results will be discussed. First an explanation of the used variables will be given, concerning herd performance and economic data. After that, the results found will be discussed including literature from other researches.

5.1 Choice of data

Because the Irish pasture based system, involving seasonal breeding, is so different from other systems (for example loose housing system) the variables that measure herd performance should be adapted to the system as well. In this research variables like 21 day submission rate and 21 day pregnancy rate are much more important indicators for herd performance than for example, calving to conception interval, which is a good indicator for performance in other researches. The following variables are chosen to be included in the research for being good indicators in herd- and fertility performance for the typical Irish dairy system. A description of the meaning of the variable is included.

In present study the herd size was included, because housing system, management strategies and routines often differed with herd size (Enevoldsen, Hindhede et al. 1996). The kind of breed of the herd was included, because the kind of breed probably influence several biologic responses, such as feed conversion efficiency and health (Enevoldsen, Hindhede et al. 1996). All control and program farms kept as main breed Holstein Friesian in the herd. One participator also had Brown Swiss in his herd.

The farm stocking rate is traditionally defined as the number of animals per unit area of land (livestock units/hectare (ha)) and is best considered as a balancing act between feed supply (the amount of grass grown and the level of feed purchased) and herd demand (the number of cows needed to eat the available feed). Many Irish dairy farmers have the capacity to grow milk output through intensifying existing land use (more cows on the milking platform). The milking platform (stocking rate) is established from number of milking cows and farm size in hectares. A higher farm stocking rate has positive effects on the grassland use and therefore use of own grass for feed, needing less additional grass which will reduce feed costs (Teagasc).

Since 1984, Irish milk producers have been producing milk under quota constraints, which might have affected management strategies. Whether the milk quota actually affected herd management was difficult to assess (Enevoldsen, Hindhede et al. 1996). In this research no data on milk quota was available and could therefore not be included.

Relative importance of fertility indicators is higher in Ireland than reported by others, because milk production in Ireland is to a large extend dependent on seasonal calving pasture-based systems and therefore calving's are restricted to a very limited period of the year (Veerkamp, Dillon et al. 2002). Dillon, Crosse et al. (1995) showed that delaying the calving date to coincide with the beginning of the grass-growing season, reduced milk yield per cow significantly.

The calving interval is generally accepted as a very important fertility indicator (Enevoldsen, Hindhede et al. 1996), but in this research calving interval is not included because it is not a sufficient variable for a pasture based system were the farms are dependent on seasonal breeding.

The 21 day pregnancy rate is a very important time- sensitive variable to measure dairy herd reproductive performance. It indicates the percentage of cows in a herd that become pregnant every 21-day period after the voluntary waiting period (VWP). The pregnancy rate is an overall variable were heat detection rate and conception rate have been taken into account. It is the multiplication of the heat detection rate (also called insemination rate, calculated by dividing the number of cows inseminated over a 21-day period by the total number of cows available to be inseminated over the same period) over a period of 21 days and conception rate (dividing number of cows confirmed pregnant from those breeds by the total number of cows inseminated) (Infodairy 2011).

In seasonal calving herds in Ireland, breeding starts on a fixed calendar date (the mating start date (MSD)). Typically this occurs in spring, between late April and early May (Evans, Buckley et al. 2002). The MSD is set by the farmer based on the desired calving pattern for the following year. Prior to the MSD the farmer will not inseminate any animals. Additionally, the famer will not serve cows before a given number of days post calving.

This is termed the voluntary waiting period (VWP). Generally a VWP of 42 days is given to allow completion of uterine involution and onset of ovarian activity. The MSD and VWP ultimately define the first date on which a cow may be eligible to be bred. This is referred to as the early service date (ESD). The ESD is different for each individual cow and is dependent on the VWP and calving date. A cows' ESD will either be: The MSD, if the cow has calved longer than the VWP prior to the MSD; or for animals that have not calved longer than the VWP, the ESD will be the date the cow has calved longer than the VWP.

The submission rate, also known as the heat detection rate, is the proportion of the cows eligible to be served that were served during a 21 day period after a defined date. This rate can be defined either by using the MSD or the ESD. Using the MSD gives an indication of the heat detection efficiency for the first 21 days of the breeding season only. Calculating the 21 day submission rate from each cows' ESD allows assessment of the entire breeding herd performance. This variable is used to define how efficiently cows are being detected in oestrus. Also influenced by how quickly cows return to oestrus. A target for Irish dairy farmers is 90% submission (Teagasc April 2011).

The variable ESD to conception interval, is the average number of days that conceiving cows took to conceive after their individual ESD. This variable however does not include data from the cows that did not conceive.

The percentage herd eligible at MSD is the proportion of the breeding herd that were calved longer than the VWP by the MSD. This percentage reflects the suitability of the current calving pattern with respect to the desired calving pattern the following season.

Concerning the herd health data, SCC in milk are commonly used as indicators of mammary health on the basis that they reflect an immune response and therefore the presence of infection in the mammary gland (Green, Bradley et al. 2008; Emanuelson and Funke 1991). A SCC <100,000 cells/mL is reported to be normal in a healthy mammary gland, whereas an SCC >200,000 cells/mL is suggestive of bacterial infection. Management practices, including some dry period policies, have been found to influence the magnitude of herd SCC throughout lactation (Green, Bradley et al. 2008). This means that the herd health management program can have impact on the SSC which is highlighted for mastitis control and is therefore taken into account in this research.

The percentage of calf mortality is calculated for the female calves prior to 6 months of age, by the formula calf mortality %= died/((born + bought) - sold)*100%. A time period of 6 months is chosen to take out the bull calves that will be sold and culled after one month.

Economic variables

The gross output is the total output of the farm business. In this research the gross output includes; income from sales (of milk, calves, cows i.e.) + income from transfers calves (replacements dairy and cattle) – cost of transfers (replacements heifers) – cost of purchases (dairy cows and stock bulls) +/- inventory (dairy cows and stock bulls).

The total variable costs (TVC) involve every cost associated with variable inputs dependent on the amount of output produced. In this research the TVC contains the costs of; sundry variable, straw, levies and transport, silage additive & polythene, milk recording & parlour, seed and spray, contractor, artificial insemination/ breeding, veterinary, lime, fertiliser, purchased forage, home grown concentrate and purchased concentrate. The total variable cost can be calculated as; total variable cost = total quantity of output x variable cost per unit of output. Because average variable costs differ widely among industries, comparisons with TVC are generally most meaningful among companies operating within the same industry.

The gross margin is the difference between revenue and cost, before accounting for certain other costs (like the TFC). It is calculated by gross output minus the total variable costs. The gross margin is a company's profit before operating expenses, interest payments and taxes. The gross margin is also known as gross profit and is important, because it reflects the core profitability of a company before overhead costs, and it illustrates the financial success of a product or service. Therefore it is included in present research to measure the economic aspect of the farms.

The total fixed costs (TFC) correspond to the cost of using or hiring fixed inputs and are not under the control of the manager in the short run. They have to be paid regardless of the amount of output produced. In this research the total fixed costs contains the costs of; hired labour, quota lease, land lease, sundry fixed, insurance, repairs and maintenance, depreciation of machinery, depreciation of buildings, phone (farm), car (farm), loan interest, OD & credit interest, machinery leases and machinery running. With the 'OD & credit interest' meaning the bank overdraft and merchant credit interest as well as bank charges (Teagasc).

A company with a relatively large amount of variable costs may exhibit more predictable per-unit profit margins than a company with a relatively large amount of fixed costs. This means that if a farm has a large amount of fixed costs, profit margins can really get squeezed when sales fall, which adds a level of risk to the stocks of these companies. Conversely, the same high fixed costs farm will experience magnification of profits, because any revenue increases are applied across a constant cost level. Thus, fixed costs are an important part of profit projections.

The net profit represents the number of sales remaining after all operating expenses, interest, taxes and preferred stock dividends (but not common stock dividends) have been deducted from a company's' total revenue. It is calculated as; total revenue -total expenses = net profit.

Shareholders look at net profit closely, because it is the source of compensation to shareholders of the company, and if a company cannot generate enough profit to compensate owners, the value of shares will plummet. Conversely, if a company is healthy and growing, higher stock prices will reflect the increased availability of profits.

5.2 Results found

The objective of this research was to obtain a better view in the changes of the farms who participate in the UCD-program compared to similar control farms. Including the economic consequences of participation and the perception of the farmer about the UCD-program. Because of the low number remaining farms (n=6) out of the eleven farms that started participating in 2008 and a willingness to keep the sample size as large as possible, no random subset was made. Therefore sampling bias could have occurred in this research.

In the research from Derks, van de Ven et al. (2012) some non-response bias occurred due to a higher response level of larger farms. Since larger farms are often more complex in terms of management, support by the veterinarian may become increasingly important, and thus interesting, for this group of farmers. Therefore stated that participation in the program in Holland resulted in better farm results, but could not prove that the program caused these results, because it could have been that larger and higher producing farms take on the veterinarian management sooner than smaller farms with a lower productivity level. In the present study this could have occurred, because only six out of the eleven farms that started the program, were accounted in this research. Therefore it could be that only the better performing or larger farms kept on participating. Some caution is therefore recommended interpreting the results on the difference between participants of the UCD-program and control.

The data from the UCD and Teagasc could not be compared to each other because, the UCD data obtained from ICBF was only focused on the spring breeding season and the Teagasc data is yearly based. Therefore the difference for some farmers between ICBF and Teagasc data shows a bigger difference than other farmers, depending on how the ratio spring and winter breeding of the herd is formed.

In a study like this it is very difficult to have a sufficient management evaluation for a large number of herds, because data was scarce and sometimes not available. A herd is a complex and dynamic system in which input and output are related to management strategies and animal status in a complex manner. Consequently, many management indicators are strongly interrelated, which makes it difficult to specify those variables that are dependent and those that are independent in a traditional statistical analysis (Enevoldsen, Hindhede et al. 1996). Herd performance data from the UCD previous to the years of participating in the program were not available, but can be obtained in the future. Also the data from Teagasc over the years 2009 and 2010 can be provided in the future. Therefore further research is recommended.

The UCD data; herd performance

Participation in the UCD-program resulted in positive effects on the fertility performance of the herd over three years. The percentage herd eligible at MSD, 6 weeks calving rate, 21 day pregnancy rate and percentage of the herd being pregnant all increased over the three years of participation, and will be described below. When started, all farmers (100%) maintained as main goal to improve fertility with the UCD-program. The improvements of the fertility performance found in this research could be due to the extra management practices and support the UCD provided for the program farms. Concerning the variables of herd performance, the program farmers are better able to keep calving pattern, than prior to the program, which was formed in cooperation with the UCD.

Efficient milk production in Irish dairy herds is dependent upon producing the maximum amount of milk from grazed grass. To coordinate peak milk yield with maximum grass growth, cows must calve compactly before turn-out to pasture in the spring. Therefore it is very important for the farmer to keep track of the calving pattern (Dillon et al., 1995). In this research the percentage of the herd eligible at MSD was the most important indicator to see if the farmer can succeed in the calving pattern. An increase of 0.5% was shown between the years 2009 and 2011.

The 6 weeks calving rate increased with 2.6 % over three years of participation. This variable is dependent on the amount of heifers in the herd and the culling rate. No data of culling rates were available in this research, but the amount of heifers in the was provided. Having a higher proportion of heifers in the herd could have a positive impact on the 6 weeks calving rate, because heifers become more easily pregnant for the first time (Kuhn, Hutchison et al. 2006). No data was available of the mean herd age. Also the proportion of heifers in the

herd was not available, but there was no correlation found between 6 weeks calving rate and number of heifers in the herd.

The key breeding objective of most Irish dairy farmers, using a pasture based system, is to achieve the highest pregnancy rate in the shortest period of time after the start of the breeding season, in order to achieve a concentrated calving pattern during the following season. A delay in conception due to poor fertility increases the calving interval and, in a strict seasonal calving herd, this may lead to involuntary culling (Evans, Buckley et al. 2002). The pregnancy rate in this research increased with 10.8 % over three years of participation in the UCD-program. It indicates the percentage of cows in a herd that become pregnant every 21-day period after the voluntary waiting period (VWP). From previous research it is shown that raising the pregnancy rate means that reproductive culling can be reduced, lower replacement costs occur, production of more milk because cows are at peak lactation more often; have more calves born per year and keep the number of cows in the milking string consistent throughout the year (De Vries 2006). Pregnancy rates are dependent on many factors concerning the dairy herd, like conception rates, 21-day service rates and the start and end of the eligible insemination period of individual animals. In the UCD herds a 21 day pregnancy average of 50.9% was shown for the year 2011. Following De Vries (2006) the pregnancy rate indicate economic opportunity for improvement in dairy cattle reproduction. Improvements in reproduction typically translate in increased pregnancy rate and increased profitability.

During the three years of participation, an overall decrease in number of services per cow per conception and heifer age of first service has been found. These variables could have influenced each other. In the research of Berry and Cromie (2009) the objective was to quantify, using the Irish national database, the association between age at first calving and subsequent milk production, calving performance, fertility and survival in grazing, seasonal-calving Holstein–Friesian dairy cows. From a population of 196 animals. In present study the average heifer age of first calving was declined from 27 to 26 months. In the research from Berry and Cromie (2009) it was shown that significant differences existed among some age group categories for calving interval and calving to first service interval. Heifers calving at 22 months of age had longer calving intervals than heifers calving at 24, 25, 29 and 34 months of age; heifers calving at 23 months of age had longer calving intervals than heifers calving at 25 and 34 months of age. Previous research show that concerning heifers, the heritability for the first service is higher than the heritability for all services combined (Kuhn, Hutchison et al. 2006). The higher heritability for first service for heifers could therefore resulted in the lower number of services per conception.

The variable ESD to conception did not improve during the three years of participating in the UCD program. An increase of the ESD to conception rate was shown in present study. This means that the average number of days that conceiving cows took to conceive after their individual ESD, was increased. Because the ESD to conception rate is different and dependent for every single cow. An increase could mean that there were in 2011 more cows that did not already calved before the 42 days of VWP before the ESD and therefore had the MSD as the official, by the farmer chosen, start of the breeding season, compared to 2009. The average of days for all the dairy cows in the herd concerning ESD till conception is the ESD to conception interval.

The mean trend line of percentage herd pregnant show a positive trend over the three years of participating. The R^2= 0.9376 which suggest that the data does closely conform to a linear relationship.

The study from Hogeveen, Dykhuizen et al. (1992) on long term effects at 15 program farms found a decrease in calf mortality rate (1,3%) in the two years of participating in a HHMP. In present study also a decrease of calf mortality was shown (5.8%). No control data was available for the UCD-data. This means that there was no data available of comparable not-participating farms. It could not be measured if program farms perform better than the control farms. Therefore it is hard to say that the changes in herd performance over the years 2009 till 2011 for the program farms, are all due to the extra management support. All farmers maintained a pasture based system with season calving and are therefore highly dependent on climate and seasons of the year. Therefore the changes could also for a part be due to climate, grass production i.e.

The Teagasc data

The improvements in herd performance and fertility could have impact on the economic state of the program farmers. From the results of the present research it is shown that the program farms maintained a higher milk yield and yield per cow than the compared control farms. The total variable costs per litre were, on average, much lower than the control farms, but no higher average net profit was found. The dataset from Teagasc, concerning herd performance and economic data, was only complete for the year 2011. Therefore no trend line or improvements in performance over more years could have been measured. Therefore it is possible that the differences between program and control already occurred before the program.

To see if the improvements in herd performance resulted in changes of the economic parameters from Teagasc, different correlation tests were performed which will be discussed below. Keeping in mind that only a small number of herd performance parameters were available from Teagasc.

Changes in fertility performance have great impact on the economic data of Irish dairy farming businesses (González-Recio, Pérez-Cabal et al. 2004; Evans, Wallace et al. 2006). Due to a decrease in fertility the farmer will probably have a higher replacement rate which results in higher variable costs. From earlier research it is stated that cows that needed more inseminations per period of time had a higher milk yield per lactation, but also had a higher culling risk and a shorter productive life and lower lifetime production and therefore, resulting in lower profit (González-Recio, Pérez-Cabal et al. 2004; Mulligan, O'Grady et al. 2006)). This cannot be confirmed in current research. No correlation was found between replacement rate and the total variable costs.

Previous research showed that a higher milk production could be attained, for example, by improved feeding methods, reduction of calving intervals, using artificial insemination and other factors using a different form of management (Magwood 1983). In this research no correlation was found between feed cost and yield per cow, but this research can confirm that there is a relation between different management practices and yield per cow. A negative correlation is found between yield/cow and the costs for artificial Insemination, ($P=0.037$, $r= -.662$). This means that when the total average yield per cow rises, the costs for artificial insemination can decrease as a consequence. Also Overton (2005) found positive consequences for the net profit using artificial insemination in comparison with net profit using natural services, compared with using partial budgeting. In this research the higher costs for AI weighted up against the net return from artificial insemination. Subtraction of the cost of the artificial insemination program from the cost of the natural services program showed that the use of artificial insemination resulted in savings of US$ 10.27 per cow per year as compared to using natural service sires.

The percentages of winter and spring breeding are important for the Irish pasture based system. Using a pasture based system involving breeding season has a lot of consequences, for herd health but also for economic variables like feed costs and the price a farmer get for the spring milk and winter milk. For the Teagasc data it was not known what percentage of the herd and total milk yield the farms maintain for spring or winter breeding, for the control farms. Therefore the higher average feed costs per litre of the control farms could mean that these farms also maintain a higher percentage of winter breeding on average compared to the program farms. Which in terms would have an impact on the net profit per litre.

There were no significant differences found between the program and control farms for the economic variables. Only the total fixed costs (TFC) had a relative low P-value. The TFC of the program farms was relatively higher than the for the control farms. This was partly due to average higher other variable cost and the difference in depreciation of machinery and buildings. Overall the program farms had more cows and more hectares of farmland than the control farms and could therefore need more employees. No number of labor equivalents was available.

From previous research it is known that management practices, including some dry period policies, have been found to influence the herd SCC throughout lactation (Green, Bradley et al. 2008). Also Beekhuis-Gibbon, Devitt et al. (2011) revealed in a case study that three out of six program farms experienced a significant decrease in herd milk recorded SCC during the implementation of the control program, in a study on six Irish dairy farms perceiving extra management support.

From the research of Hall, Ehui et al. (2004) on 100 dairy farms in Thailand, where the economic impact of herd health improvements was measured, an increase in net profit was mainly a result of higher milk production per cow per year, a decrease in feed cost per litre milk produced and a lower SSC (indicating a better udder health). Also Hogeveen, Dykhuizen et al. (1992) showed that the program farms maintained a higher gross margin due to higher milk production and lower feed costs. In present study it was visually shown that the program farms maintained at higher production level, having a higher milk yield and yield per cow. Also lower average feed cost- and SCC per litre was shown for the program farms. Three out of five program farms maintained a higher net profit than the compared control farms. In this research it is also shown that the feed costs per litre were higher for the same program farms that did not maintain a higher profit than the compared control farms. Though many other factors could have influenced the difference in net profit. In this research no higher average net profit is shown for the program farms.
Concerning the SCC, Emanuelson and Funke (1991) shows that the highest SCC were observed in herds that sold the least milk, whereas the lowest mean SCC were in the herds that sold the most milk. This can be visually confirmed in current research, where the program farms having lower SCC and higher milk yield. Statistically no correlation between SCC and the economic variables net profit, total variable costs and feed costs per litre were found ($P<0.05$).

Perception of the farmer

To take the perception of the farmer into account to value the importance of a management program of the UCD for farmers, a questionnaire is included in current research. The research of Beekhuis-Gibbon, Devitt et al. (2011) focused on the reduction of mastitis incidents on Irish dairy farms providing HHMP on six program farms in Ireland, showed that farmers motivation to participate in his study related to a desire to reduce the incidence of clinical mastitis on their farms, reduce SCC below the level of penalization thereby reducing the subsequent financial impact, and improve milk quality. Also Lievaart et al. (2008) described that 'easy access to routine screening of the herd' and 'providing solutions to problems' are the most important reasons to participate in a HHMP. In a recent Policy Delphi study from More, McKenzie et al. (2010), who was examining the opinion of experts and farmers about non-regulatory animal health issues facing Irish livestock industries, showed that both milk quality (mastitis) and fertility were each identified as among the most important animal health issues facing Irish dairy farmers, in terms of costs to farms and agribusiness. In current research this can be confirmed. Farmers following the UCD-program started to participate to improve fertility (100%) and to obtain better working practices. Due to the focus on mastitis for four out of six program farms the average SCC was below 200,000 cells per ml for the year 2011. The UCD holds the norm of 200,000 cells per ml to measure the change of mastitis.
From the research of Beekhuis-Gibbon, Devitt et al. (2011) it was concluded that only three out of six farms were milk recording monthly prior to the project. During the project, all farmers conducted monthly recording. As well as gauging their SCC levels, the results allowed farmers to identify high risk cows subsequently informing segregation practices, and assess levels in SCC levels - identifying outcomes/progress made while informing prevention practices and/or culling strategies. This resulted in a significant decrease of high SCC cows and an easier management performance to separate the cows. More thorough investigation of these results facilitated a greater awareness of sub-clinical mastitis by the farmers. The use of documentation and identification of outcomes was supported by continued data analysis during the project. All farmers from the UCD-program (100%) stated that they receive enough support to gather all the data easier. For most UCD-farmers record keeping was improved due to the program. Also the UCD provided a computer program to insert all the recorded data. The farmers started to record more variable data and one farmer stated that he learned how to use the supplied software program to record all the data and in this way improved his record keeping. All the participators (100%) stated that due to participation in the program, problems were discovered sooner, the efficiency is improved and that another approach for problem solving is carried out, see appendix 2. Confirming the results from Beekhuis-Gibbon, Devitt et al. (2011).

Lievaart et al. (2008) indicated that the most important advantage of HHMP was that the farmers got the feeling that they were closer to the cows; especially the fresh cows were better controlled. Other things named were a pleasant way of keeping up with all the work, good evaluation of diseased and treated animals, more pleasure in work and better technical results. Kanters (2012) described that access to routine screening of the herd and solutions to problems are most important reasons to participate in a HHMP. During the UCD-program, farmers concluded that there were a lot of advantages to participate in the UCD-program. All answered the questions about the advantages of participation in the UCD-program with a ranking of four (agree) or five (totally agree) on the Likert-scale, see table 2. The farmers stated that they maintain a structured approach for problem solving and regular control and support in the program due to participation. Besides that, an advantage of being involved the UCD-program is that farmers are fully informed of new developments and topical subjects (mean=4.50), stated by the program farmers. Also (Cote 1980) stated that sometimes a recommendation made at the time of a herd health visit will be more profitable to the owner than all the procedures carried out that day.

The success of a HHMP depends heavily on the farmers' skills and ability to comply with the recommendations of the veterinarian (de Kruif and Opsomer 2004; Cote 1980; Derks, van Woudenbergh et al. 2011). This is shown in a research from Bergevoet, Ondersteijn et al. (2004), where the outcome was that reasons for not following veterinary advice were; not being able to fit it in daily work (44%), the unpractical nature of the advice (36%) or considering the advice as useless (20%). The research from Sorge, Kelton et al. (2010) on the producers compliance with suggested management practices, showed that the farmers who did not follow the advice of the veterinarian did not see the necessity or importance of doing so and were therefore not willing to pay the costs of the program. In current research there were five farmers that answered the question what the cause was if advice did not work out. 3/5th stated that the advice did not work out because of the quality of the advice and 2/5th stated that the advice was not suitable for the farm and therefore not followed. Overall they stated that they do follow the advice given by the UCD advisors. In this research no correlation was shown between economic farm performance data and the 5-point Likert-scale question if the advice of the UCD is understandable (question 11, Part 3). Although the P-value was relative low (P=.058) and the correlation coefficient relative high (r=0.866) for the correlation between net profit and yield per cow and the likert-scale question if the advice of the UCD is understandable (question 11, Part 3).

In this research no statistical correlations between herd- and economic performance variables and value of satisfaction and/or explanation of the advice were found. However visually it was shown that farmers who scored a five (totally agree) on the question if they were satisfied on how the UCD-program was applied had a lower SCC overall (SCC<230,000 cells/ml) than the farmers 1 and 5 who scored a three (neutral) on the same question, were the SCC was between 270,000-300,000 cells per ml. In the research from Derks, van de Ven et al. (2012), there was also shown a disparity between the satisfaction with herd health management programme and farm performance. The calving interval was significantly shorter when farmers were satisfied with the support and explanation of the given advice and problem approach the program offers. When farmers felt there were problems involved, however, they had significantly higher somatic cell count. This means that some differences might be attributed to differences in type of farmer. Unlike current study and the study of Derks, van de Ven et al. (2012), in a pilot study of a mastitis control programme in Ireland the farmer who was most compliant (94%) experienced no significant change in SCC and another farmer, who was least compliant with the programme (59%), experienced a significant reduction in bulk milk tank SCC (Beekhuis-Gibbon, Devitt et al. 2011). But because of the small sample size of this study it can be questioned if the study of Beekhuis-Gibbon, Devitt et al. (2011) is a good measure to resemble a bigger population.

Lievaart et al. (2008) reported that the farmers thought on forehand that the biggest disadvantages of a HHMP were the costs and the time a visit takes. The main disadvantage in current research was that collecting data costs a lot of time for the farmer to accomplish (mean= 3.50), see table 1, appendix 2. No such disadvantages were shown as frustrations about the working lists and increased preventive costs cannot be denied. Some farmers wondered if there isn't another way of achieving goals and why it was so expensive if it doesn't work well (Lievaart et al. 2008). Previous researches Cote (1980) and Kristensen and Enevoldsen (2008) stated that

disadvantages of a management program are commonly due to insufficient communication between the farmer and advisor. Farmers may feel that their advisor is less qualified to handle management aspects of the farm and farmers perceive a general lack of knowledge on farm management and, more specifically, a lack of knowledge on strategy on the part of their veterinarians. Furthermore, veterinarians have been criticised for giving too many advices at once, or do not explain the added value of the advice to the farmer (Magwood 1983; Kristensen and Enevoldsen 2008; Sorge, Kelton et al. 2010). This was also shown in a research from Bergevoet, Ondersteijn et al. (2004) where the outcome was that reasons for not following veterinary advice, were not being able to fit it in daily work (44%), the unpractical nature of the advice (36%) or considering the advice as useless (20%). Sorge, Kelton et al. (2010) studied producers' compliance with suggested management practices and showed that the farmers who did not follow the advice of the veterinarian did not see the necessity or importance of doing so and were therefore not willing to pay the costs. For example, they did not see the need to change their timing of removal of the new-born calf or they liked leaving the calf with the dam for a while because they felt it was better for the general health of the calf. When providing herd health management to farmers, veterinarians need to be aware of farmers' goals and priorities. In current research this cannot be confirmed, because all farmers (100%) felt they were in charge for setting the farm goals and felt the UCD advisor showed enough compassion with the farm business. The advice from the UCD is well explained to the farmer and it was directed at the problem involved (mean=4.67). The mean value for how satisfied the participators are with how the UCD-program is applied is 4.33 ranging from neutral till totally agree.

6. Conclusions

In 2008, the UCD herd health group was approached by a dairy farm discussion group in Co. Kildare with a view to initiating a herd health management program. Depending on the farmers' goals, a report and annual goal settings was made and the farms are visited every 21 days approximately. The participating farmers were obliged to monthly record keeping, therefore the UCD provided a computer program. In this way the advisor has an easy access to the recording data of the farmer.

Because milk production in Ireland is to a large extend dependent on seasonal calving pasture-based systems and therefore calving's are restricted to a very limited period of the year, the variables that measure herd performance were adapted to the system. In this research the variable percentage of the herd eligible at MSD was used to see if the farmer can keep up the calving pattern.

The economic variables used in this research were; gross output, total variable costs, feed costs, fertiliser cost, veterinary fees, artificial insemination cost, contractor cost, other variable costs, the gross margin per litre, total fixed costs, total costs per litre and the net profit per litre. The dataset from Teagasc, concerning herd performance and financial data, was only complete for the year 2011. Therefore no trend line or improvements in performance over the more years, could have been measured. So it could be that the differences between program and control already occurred before the program.

In current research no statistical correlations between herd- and economic performance variables and value of satisfaction and/or explanation of the advice were found. However visually it was shown that farmers who scored a five (totally agree) on the question if they were satisfied on how the UCD-program was applied had overall a lower SCC (SCC<230,000 cells/ml) than the farmers who scored a three (neutral) on the same question.

During the UCD-program, farmers concluded that there were a lot of advantages to participate in the UCD-program. The farmers stated that they maintain a structured approach for problem solving and regular control and support in the program due to participation. Besides that, an advantage of being involved in the UCD-program was that farmers are fully informed of new developments and topical subjects. For most farmers record keeping was improved due to the program and problems were discovered sooner, the efficiency was improved and that another approach for problem solving was carried out. The 5-point Likert-scale question to measure how satisfied the farmers were with the UCD-program was valued with 4.33 from a scale one to five.

Although in this research the sample size was very small and therefore the results found could not be proven statistically, current research shows on average some improvements in herd performance for the farmers who participated in the UCD-program in the years 2009 to 2011. The results showed a reduction in average calf mortality of 5.8% over three years. The percentage herd pregnant per year, on average, increased with 8.5%. The 21 day pregnancy rate increased by 10.8% over the three years of participating. The six weeks calving rate increased from 0.489 to 0.515. Heifer age at first calving declined from 27 months to 26.2 months, on average. Number of services per conception per cow reduced from 2.5 in 2009 to 2.1 services per conception in 2011. The variables ESD to conception rate and conception to first service rate did not improve during the years of participation. ESD to conception rate increased with 0.449 between 2009 and 2011.

The program farms had on average a smaller farmland area and a higher number of cows in the herd, referring to a higher farm stocking rate in general for the program farms. The difference between program and control farms yield per cow was 31.6 litres more for the program farms, per year, on average. On average, the SCC was lower for the program farms than for the control farms. The percentages protein and fat in milk were both higher for the program farms than for the control farms. Concerning the economic aspect in the year 2011, comparing the average of the program farms with the average of the control farms; It was shown that the TFC of the program farms were relatively higher than the TFC of the control farms. The gross output was for the program farms, on average, higher. On average, the feed costs per litre were lower for the program farms (€4.16 cents per litre) than for the control farms (€5.07 cents per litre) and the costs for artificial insemination per breeding were higher for the program farms than for the control farms. The program farms made on average €1.52 more costs per litre. As a result the average net profit per litre was higher for the control farms

(€13.28 c/litre) than for the program farms (€12.25 c/litre). It was shown that overall three out of five program farms maintain at a higher net profit level than the control farms.
Aspects that could improve the program were; concentrate more on nutrition and financial data including more forward planning. On a long term basis it was suggested to expand the program with more UCD-advisors and participants and to have only one advisor per farm during the program. Furthermore some farmers indicated the willingness to improve the genetics of the herd on a long term basis. From this research could be concluded that the farmers goals for improving fertility, wherefore the farmers wanted to start the herd health management in first place, were for the largest part, improved over the three years of participating. Resulting in a high satisfaction value and a willingness to increase the intensity of the UCD-program.
For further research on this topic it will be useful to have more sufficient data and a larger sample size. Data previous to the program and control farms were not available but can be obtained in the future. With sufficient profit monitors for years previous and present years for every participating farmer a more detailed case study could be performed with the data from Teagasc. Therefore further research on the progresses the UCD-program farms made is recommended.

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Appendix 1. Questionnaire

This questionnaire contains six parts referring to descriptive, participation in the program, advantages and disadvantages of the program, content and structure, the role of the advisor, financial management and satisfaction with the program. Each part contains open-, scale (bad to good) and score questions (1 to 5). The questionnaire will take about one hour. I want to assure you that all the data will be considered confidential. Let us start the questionnaire.

Part 1: General farm

1. **Farm type:**
   - □ Only dairy cattle
   - □ Beef and dairy cattle
   - □ Dairy cattle and other than beef

2. **What housing system do you use?**
   - □ Loose housing: Cubicles
   - □ Loose housing: straw yard
   - □ Loose housing: Cubicles and straw
   - □ Tie stall
   - □ Other;……..

3. **Number of dairy cows:…….**
   Number of heifers:.....
   % Autumn calving:…….
   % Spring calving:……..

4. **What are your plans for the future?**
   - □ Keep herd size the same
   - □ Increasing the amount of dairy cattle
   - □ Decrease the number of animals
   - □ Pass on hand duties to a successor
   - □ I'll quit farming
   - □ Other; .....

Part 2: Content and structure of the program

To get a precise description of how the program is applied on your farm, the next questions are taken into account.

1. **How did you find out about the UCD herd health program?**
   - □ From my local veterinarian
   - □ From the farmers' discussion group
   - □ From another farmer
   - □ I've read about it in a paper or journal

2. **Did you subscribe yourself or were you invited for participation in the program?**
   - □ subscribed myself
   - □ I was invited

3. **How frequently does the UCD visit the farm?**
   - □ Once every week
   - □ Once every two weeks
   - □ Once every three weeks
   - □ Once every month
   - □ Once every six weeks
   - □ Once every two months
   - □ Other; ……

Some scale questions:

1=totally disagree, 2= disagree, 3= neutral, 4=agree, 5= totally agree

	1	2	3	4	5
4. Why did you start participating in the program?:	↓	↓	↓	↓	↓
To have a second view on the production data	□	□	□	□	□
By advice of my local veterinarian	□	□	□	□	□
To obtain a higher profit	□	□	□	□	□
Because of health or management problems on the farm	□	□	□	□	□
To obtain better structured working practices	□	□	□	□	□
Reduce incidence of clinical mastitis	□	□	□	□	□
Other;					
5. What are the advantages of participating in the program?:					
I maintain at a higher production level	□	□	□	□	□
To receive extra support conducting the business	□	□	□	□	□
Maintaining a regular control of the production data	□	□	□	□	□
Have a first knowledge of the latest veterinary developments	□	□	□	□	□
To have a structured approach for problem solving	□	□	□	□	□
Other;					
6. What are the disadvantages of participating in the program?:					
High costs (veterinarian fees, medicine etc.)	□	□	□	□	□
It costs a lot of time	□	□	□	□	□
It is difficult for me to gather all the data	□	□	□	□	□
It is difficult for me to carry out the advice given	□	□	□	□	□
The UCD is too involved in my management system	□	□	□	□	□
Other;					
7. My record keeping is improved due to the program:	1	2	3	4	5
Yes, I keep a record now for sick animals and treatments, ect.	□	□	□	□	□
Yes, I keep a record of more production data and index numbers	□	□	□	□	□
No, I already fulfilled the necessary data needed	□	□	□	□	□
No, for another reason;	□	□	□	□	□
8. I received positive results with the program: the incidence of problems is reduced					
Yes, I got rid of the most severe diseases	□	□	□	□	□
Yes, I maintained a low occurrence of diseases	□	□	□	□	□
Yes, my production is improved	□	□	□	□	□
Yes, problems are discovered sooner	□	□	□	□	□
Yes, I have a different approach for problems now	□	□	□	□	□
Yes, my efficiency improved	□	□	□	□	□
No, the overall given advices did not work for me	□	□	□	□	□
No, I did not followed the advice yet	□	□	□	□	□

9. Which subjects are discussed more frequently at a farm visit?

1.never, 2. when problems occur, 3. regular, 4. not every visit, 5. every visit.

Fertility	□ □ □ □ □
Udder health	□ □ □ □ □
Milk production	□ □ □ □ □
Nutrition	□ □ □ □ □
Housing system	□ □ □ □ □
Claw health	□ □ □ □ □
Mastitis	□ □ □ □ □
Financial data	□ □ □ □ □
Parasite control	□ □ □ □ □
Calf health	□ □ □ □ □
Infectious disease control	□ □ □ □ □

Other:…….

10. Who sets the goals for the farm?

□ I do and the UCD gives me management advice on that
□ The UCD set the goals and gives advice
□ The local veterinarian set the goals and the UCD gives me advice on that
□ Other;……

11. Who decides in what way the goals will be achieved?

□ The UCD
□ The local veterinarian
□ Only me (farmer)
□ My agricultural advisor
□ Other:…….

12. What were your goal(s) with the UCD program?

……
……
……
……
……

13. How did the UCD program help you achieve the goal(s)?

……
……
……
……
……

Part 3: The advice given

1. **Is there one specific advisor from the UCD who is given you the advice for the program all the long?**
   - □ Yes
   - □ No

2. **Is the UCD aware of the goals you want to reach?**
   - □ Yes, and they are used in the program
   - □ Yes, but they are ignored during the program
   - □ No, I have goals but the veterinarian is not aware of them
   - □ No, I have no goals

3. **What is, in your opinion, the knowledge level of advisors on average?**

   ……

4. **Who decides what will be discussed during the visit of the farm?**
   - □ Topical subjects have priority
   - □ I decide what problems will be discussed
   - □ The local vet decides what is important at the moment
   - □ We continue discussing about topics from the previous visit

5. **Do you receive enough support from the UCD to make gathering data easier?**
   - □ Yes, we use a computer program and protocols now
   - □ N, I gather data in my own way
   - □ No, the UCD gathers data him-/herself
   - □ No, I don't gather data myself
   - □ Other; ……

6. **What is the cause if advice does not work out the way you wanted it?**
   - □ I did not followed the advice because, …?
     - o It was not possible to do
     - o The advice did not suites the activities on the farm
     - o The advice wasn't useful
     - o It was not the right approach for this problem
   - □ The quality of the advice, namely:
     - o We used the right approach and performance, but it just not worked out
     - o The advice was not clear to me
     - o

7. **At a rough estimate, what percentage of the given advice did you ask for and what was given to you without asking?**
   - □ …% asked: during a visit or when problems occurred
   - □ …% not asked. The advisor came up with it himself

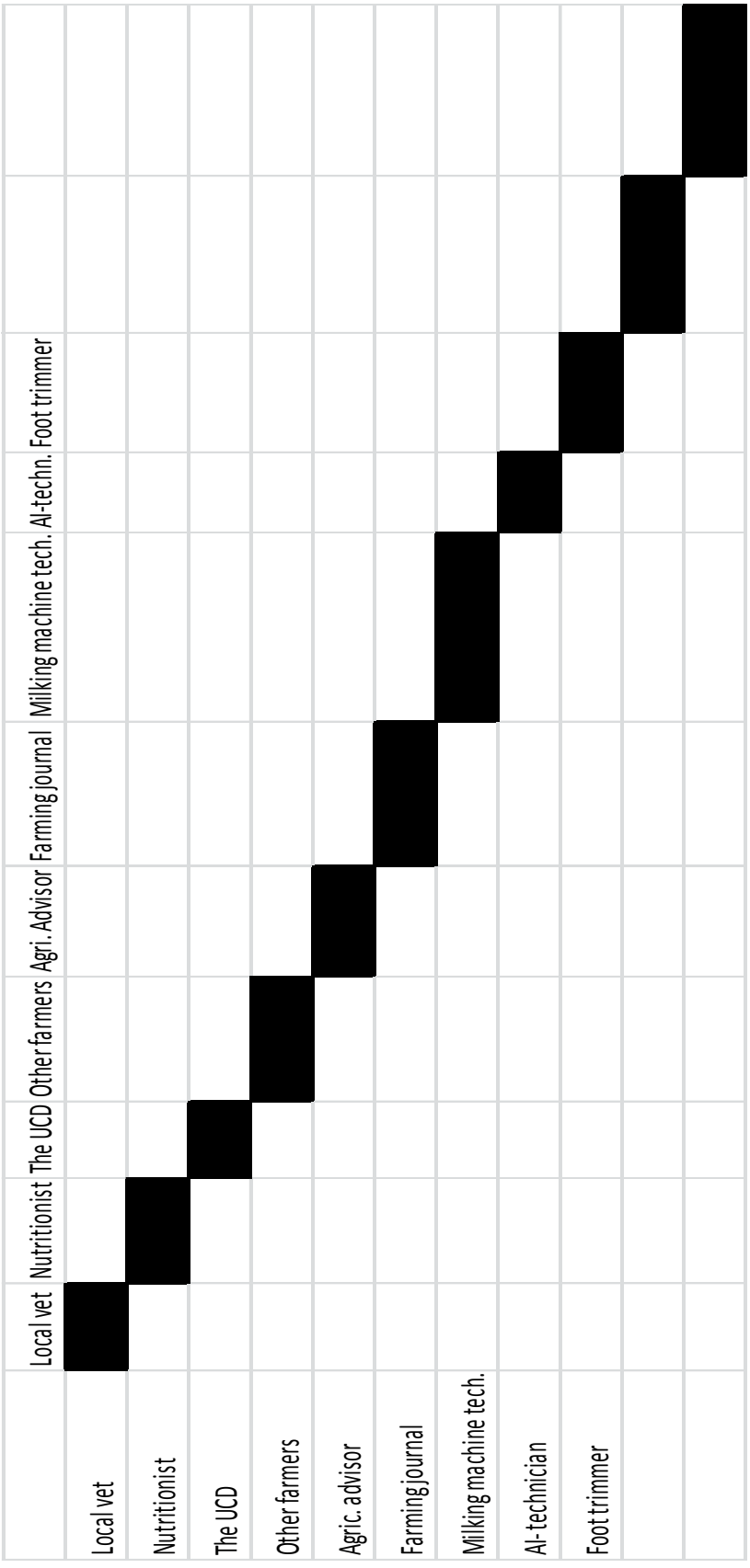
8. Do you get any advice from other persons on farm management?

- □ Yes, from my nutritionist
- □ Yes, from other farmers
- □ Yes, from my accountant
- □ Yes, from my agricultural advisor
- □ Yes, from my local veterinarian
- □ Yes, from others, namely; .....
- □ No

8b. If yes, do advisors contradict to each other?

- □ Yes, the advice is about the same aspects and contradict
- □ The advices are not comparable to each other, because they contain different aspects
- □ No, they contain the same aspects and mainly agree with each other
- □ Other……..

8c. And who contradict the most to each other?



The following questions are about the way advice and support is given to you. It will be scored from 1 strongly disagree; till 5 strongly agree.

1=totally disagree, 2= disagree, 3= neutral, 4=agree, 5= totally agree

	1	2	3	4	5
	↓	↓	↓	↓	↓
9. The given advice from previous visit will be discussed again at a next visit	□	□	□	□	□
10. The background of the advice is explained to me	□	□	□	□	□
11. The content of the advice is good to understand	□	□	□	□	□
12. The advice is adapted to my farm	□	□	□	□	□
13. The advice is feasible for my farm	□	□	□	□	□
14. The possibility for a good result weights up for the demand to follow the advice	□	□	□	□	□

Part 4: What is your opinion of how the program is applied?

The following questions are about the present program which is applied on your farm. You can give a score from 1 should be much better, till 5 cannot be better (very good) to see if there are any improvements to be made.

1=should be much better, 2=can be better, 3=neutral, 4=good, 5=cannot be better

	1	2	3	4	5
	↓	↓	↓	↓	↓
What do you think of:					
1. The preparation of the advisor prior the visit	□	□	□	□	□
2. The content of the program	□	□	□	□	□
3. The way the program is structured	□	□	□	□	□
4. Talking about my goal settings and priorities on the farm	□	□	□	□	□
5. The advice suites me, they are directed to the problem	□	□	□	□	□
6. The explanation of the advice	□	□	□	□	□
7. The cooperation between the local vet and the UCD	□	□	□	□	□
8. The costs/benefit rate of the program is	□	□	□	□	□

Some scale questions

1=totally disagree, 2=disagree, 3=neutral, 4=agree, 5= totally agree

	1	2	3	4	5
	↓	↓	↓	↓	↓
What is your opinion about the following sentences?					
9. I feel I'm in charge for setting the farm goals	□	□	□	□	□
10. The UCD should be more involved, setting the goals for my farm	□	□	□	□	□
11. The UCD should show more compassion with my farm	□	□	□	□	□
12. I feel I'm supported enough in taken decisions about setting goals for the farm	□	□	□	□	□
13. The I feel I'm supported enough in taken decisions about changing my farm management	□	□	□	□	□
14. I'm satisfied on how the UCD program is applied	□	□	□	□	□

15. Rank the value of the following aspects

1, Not important, 2. Not so important, 3. Neutral, 4. Important, 5. Very Important

	1	2	3	4	5
Education in the UCD program	□	□	□	□	□
Day to day monitoring	□	□	□	□	□
Recording data	□	□	□	□	□
Understanding of problems that worry you ('Peace of mind')	□	□	□	□	□
Social interaction with the UCD vets	□	□	□	□	□
Long term planning (strategic)	□	□	□	□	□
Security knowing that I'm in control	□	□	□	□	□
The farmers' discussion group	□	□	□	□	□

Open questions

16. What would you like to change on a short-term basis about the program?

……

……

……

……

……

17. What would you like to change on a long-term basis about the program?

……

……

……

……

……

18. What have been good or bad additions in the UCD program in the past three years?

……

……

……

……

……

Part 5: Financial management

This part contains questions about how the bill is formulated. I remind you that the answers will be kept confidential.

1. **Can you tell from the invoice how the cost of the program is constructed?**

- □ Yes
- □ Partly; .....
- □ No

2. How do you pay for the program?

- □ Fixed tariff per hour including performed acts
- □ Fixed tariff per hour with a separate charge for performed acts
- □ Fixed tariff per cow/ year
- □ Packages, like an udder health package
- □ All in one fee

3. Is the call out charge identified separately on the bill or included in the total price?

- □ Announced separately
- □ Already in the total price
- □ Others;

4. Are the preparation time and time for data analysis by the advisor formulated separately on the bill?

□ Yes □ No

5. Are there any additional costs associated with the UCD program?

□ Yes □ No

Namely;.....

6. Are you satisfied with the payment system for the UCD program?

- □ Yes
- □ Partly
- □ No

6b. If not, what would be your preference?

- □ Fixed tariff per hour including performed acts
- □ Fixed tariff per hour with a separate charge for performed acts
- □ Fixed tariff per cow/ year
- □ Packages, like an udder health package
- □ All in one fee

7. What, on average, are the costs for the program, every year or per hour, on average?

....

8. If the costs of the program would raise more, will you still be interested to keep on participating?

- □ Yes, the advice from the UCD became an important component for my business
- □ Yes, if the raise is not to extreme (comparable for a tariff for an accountant, for example
- □ Yes, but I would have less aspects involved because of the costs, so I will decrease the time spend or frequency of the visits
- □ No, the program would not be profitable anymore
- □ No, because; .....

9. **What is the maximum amount that you would pay for the program in (€/year of €/hour)?**

.....

10. **Are you interested in the newest innovations according to dairy cattle?**
    - □ Yes, always
    - □ Yes
    - □ Neutral
    - □ Hardly not
    - □ No
    - □ Other

11. **Are you willing to take risks for new innovative investments?**
    - □ Yes always
    - □ Yes
    - □ Neutral
    - □ Hardly not
    - □ No
    - □ Other;……

Part 6: Futures perspective

For this part we would like to hear what your future plans are concerning the program.

1. **Are you planning to change the number of hours spending by the UCD?**

□ I'm planning to increase the number of hours in total
□ I want the frequency of the visits to decrease (longer period of time between two visits)
□ I want the frequency of the visits to increase (shorter period in between visits)
□ I'm planning to decrease the number of hours in total
□ No

2. **What will be a good way to improve the program?**

□ Spend more attention to the prevention of animal diseases
□ Spend more time on solving current problems
□ Improve the quality of the business and/or expand the yield of production
□ Spend more time on tracing data to get a better knowledge of how the business is functioning
□ Expand the program with other subjects like nutrition etc.
□ Other; .....

3. **Are there any subjects' who are not yet taken into account, but you would be interested to work on within the UCD program? If yes, which ones?**

.....
.....
.....
.....
.....

4. **Are there any aspects you would like to pay more attention to with the program? If yes, which ones?**

.....
.....
.....
.....
.....

5. **Are there any subjects or recording data you think are unnecessary to spend time on and can be deleted from the program? If so, which ones?**

.....
.....
.....
.....
.....

6. **Do you think you will continue with the program, long term?**

.....
.....

Appendix 2. Likert Scale questions from the questionnaire

Table 1. Likert-scale questions from the questionnaire (n=6)

Advantages of participation in the UCD-program	N	Min.	Max.	Mean	SD.
I maintain a higher profit level	6	2	4	3.50	.837
To receive extra support conducting the business	6	4	5	4.67	.516
Maintaining a regular control of the production data	6	4	5	4.50	.548
Have a first knowledge of the latest veterinary developments	6	4	5	4.50	.548
To have a structured approach for problem solving	6	4	5	4.67	.516
Disadvantages of participation in the UCD-program	N	Min.	Max.	Mean	SD.
High costs (veterinarian fees, medicine etc.)	6	1	4	2.17	1.169
It costs a lot of time	6	1	5	3.50	1.761
It is difficult for me to gather all the data	6	1	2	1.50	.548
It is difficult for me to carry out the advice given	6	1	4	2.00	1.095
The UCD is too involved in my management system	6	1	2	1.17	.408
Improvement of keeping record due to the UCD-program	N	Min.	Max.	Mean	SD.
Yes it is improved, I keep a record now for sick animals and treatments, ect.	6	2	5	3.67	1.211
Yes it is improved, I keep a record of more production data and index numbers	6	4	5	4.50	.548
No improvement made, I already fulfilled the necessary data needed	6	1	4	2.00	1.095
Receive more positive results due to the UCD-program	N	Min.	Max.	Mean	SD.
Yes, I got rid of the most severe diseases	6	1	5	2.83	1.472
Yes, I maintained a low occurrence of diseases	6	3	5	4.17	.753
Yes, my production is improved	6	3	5	4.17	.753
Yes, problems are discovered sooner	6	4	5	4.67	.516
Yes, I have a different approach for problems now	6	4	5	4.33	.516
Yes, my efficiency improved	6	4	5	4.33	.516
No, the overall given advices did not work for me	6	1	2	1.50	.548
No, I did not followed the advice yet	6	1	2	1.17	.408
Percentage of advice asked for and given.	N	Min.	Max.	Mean	SD.
Asked for	6	0	100	46.67	38.816
Not asked for	6	0	100	53.33	38.816
The way advice is provided	N	Min.	Max.	Mean	SD.
The given advice from previous visit will be discussed	6	4	5	4.5	0.548
The background of the advice is explained to me	6	4	5	4.5	0.548
The content of the advice is good to understand	6	4	5	4.5	0.548
The advice is adapted to my farm	6	4	5	4.33	0.516
The advice is feasible for my farm	6	4	5	4.17	0.408
The possibility for a good result weights up for the time spend	6	4	5	4.5	0.548

Possible improvements made on the farm by the UCD-program	N	Min.	Max.	Mean	SD.
The preparation of the advisor prior the visit	6	2	5	4.17	1.169
The content of the program	6	3	5	4.17	0.753
The way the program is structured	6	3	5	4	0.632
Talking about my goal settings and priorities on the farm	6	3	4	3.83	0.408
The advice suites me, they are directed to the problem	6	4	5	4.67	0.516
The explanation of the advice	6	4	5	4.67	0.516
The cooperation between the local vet and the UCD	5	2	4	2.8	0.837
The cost/benefit rate of the program is	6	2	5	3.17	1.329
Opinion on how the program is applied	N	Min.	Max.	Mean	SD.
I feel I'm in charge for setting the farm goals	6	5	5	5	0
The UCD should show more compassion with my farm	6	1	2	1.83	0.408
I feel I'm supported enough in taken decisions about setting goals for the farm	6	2	5	4	1.095
I feel I'm supported enough in taken decisions about changing my farm management	6	2	5	3.5	1.225
I'm satisfied on how the UCD program is applied	6	3	5	4.33	1.033
Importance of the aspects included in the program	N	Min.	Max.	Mean	SD.
Education in the UCD program	6	4	5	4.5	0.548
Day to day monitoring	6	4	5	4.83	0.408
Recording data	6	5	5	5	0
Understanding of problems that worry you (‘Peace of mind’)	6	4	5	4.67	0.516
Social interaction with the UCD vets	6	4	5	4.5	0.548
Long term planning (strategic)	6	3	5	4.17	0.753
Security knowing that I’m in control	6	4	5	4.5	0.548
The farmers’ discussion group	6	4	5	4.83	0.408

Appendix 3. SPSS tests

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
P - C	-15.27400	16.06061	7.18252	-35.21588	4.66788	-2.127	4	.101

Table 1. Example of a Paired sample T-test of P-C, to see significant difference between program and control farms. Variable farm size (ha), no significant difference is shown for this variable (P>0.05)

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Program	5	38.30	119.00	75.4600	33.75216
Control	5	60.09	110.75	90.7340	22.90010
Valid N (listwise)	5				

Table 2. Average farm size (ha) for control and program farms

Correlations

		yieldcow	stockingrate
yieldcow	Pearson Correlation	1	-.387
	Sig. (2-tailed)		.269
	N	10	10
stockingrate	Pearson Correlation	-.387	1
	Sig. (2-tailed)	.269	
	N	10	10

Figure 1. A pearson correlation test for the correlation between farm stocking rate and yield per cow. No significant difference is shown

Correlations

			Profit	Satisfaction
Spearman's rho	Profit	Correlation Coefficient	1.000	-.866
		Sig. (2-tailed)	.	.333
		N	5	3
	Satisfaction	Correlation Coefficient	-.866	1.000
		Sig. (2-tailed)	.333	.
		N	3	5

Table 3. Spearman's rho correlation test between Net Profit and Likert-scale satisfaction value from the questionnaire. No significant correlation is shown (P>0.05)

Correlations

			Adviceunderstand	Profit	Yieldcow
Spearman's rho	Adviceunderstand	Correlation Coefficient	1.000	.866	.289
		Sig. (2-tailed)	.	.058	.638
		N	5	5	5

	Profit	Correlation Coefficient	.866	1.000	.500
		Sig. (2-tailed)	.058	.	.391
		N	5	5	5
	Yieldcow	Correlation Coefficient	.289	.500	1.000
		Sig. (2-tailed)	.638	.391	.
		N	5	5	5

Table 4. Spearman's rho correlation between Net Profit, Yield per cow and Understand the advice

Correlations

		Yield /Cow	AI / Breeding
Yield /Cow	Pearson Correlation	1	-.662*
	Sig. (2-tailed)		.037
	N	10	10
AI / Breeding	Pearson Correlation	-.662*	1
	Sig. (2-tailed)	.037	
	N	10	10

*. Correlation is significant at the 0.05 level (2-tailed).

Table 56. Pearsons' correlation test for the measurement of the correlation between Yield/cow and costs for AI-breeding, (P=0.037, r=-0.662)