Economic Losses Due to Delayed Conception in Dairy Animals of Small Farmers in District Gujranwala

By

Sadaf Ali
B.Sc.(Hons.)
Agricultural and Resource Economics
2005-ag-2119

MASTER OF SCIENCE (Hons.)
IN
Agricultural Economics

DEPARTMENT OF AGRICULTURAL ECONOMICS
FACULTY OF AGRICUTURAL ECONOMICS & RURAL SOCIOLOGY

UNIVERSITY OF AGRICULTURE, FAISALABAD
PAKISTAN

2011

DECLARATION

I hereby, declare that the contents of this thesis “Economic losses due to delayed Conception in Dairy Animals of Small Farmers in District Gujranwala” are product of my own research and no part has been copied from any publication source (except the references, standard mathematical or genetic models/ equations/ formulate/ protocols etc.) I further declare that this work has not been submitted for award of any other diploma/ degree. The University may take action if the information provided is found inaccurate at any stage. (In case of any default the scholar will be proceeded against as per HEC plagiarism policy).

SIGNATURE OF THE STUDENT

Name: Sadaf Ali

Regd. No. 2005-ag-2119

Acknowledgements

*Up and above every thing, all glory to **Thee O' ALLAH**, The Beneficent, The Merciful, The Omnipotent, The Omnipresent and The Compassionate. Whose blessings and exaltations flourished my thoughts and thrive my ambitions to have a cherished fruits of my modest efforts in the form of this write-up from the blooming spring of blossoming knowledge.*

*I offer my humblest thanks from the deepest core of my heart to the **HOLY PROPHET MUHAMMAD** (peace be upon him), the most perfect and excelled among and ever born on the surface of earth, who is forever a torch of guidance and knowledge and wisdom for humanity as a whole.*

Acknowledgement is not simply a formality but it is backed by all emotional associations; I have the people who have helped me to complete my research work.

*I am greatly Indebted to my supervisor, **Prof. Dr. Muhammad Ashfaq**, Chairman Department of Agricultural Economics for his kind guidance and encouragement, which has really been a source of inspiration and motivation throughout my work. I have no appropriate words to manifest my feelings of respect, gratefulness and obligation for his valuable suggestions and cooperation, which enabled me to achieve my aim.*

*I would like to thanks **International Center for Development and Decent Work (ICDD),** Germany for their financial support in this regard. With this support all of my research work has been accomplished in a well-organised manner. I am very thankful to my supervisory committee, namely **Dr. Khalid Mushtaq** and Dr**. Khuda Bakhsh** for their guidance in this research work. Special thanks goes to **Dr. Khuda bakhsh** whose encouragement, advice and friendship have been invaluable in my graduate career thus far.*

*Heartiest gratitude to **Dr. Khaleel Ahmad**, Assisstant Director (ARES), Punjab Small Holder Dairy development, Gujranwala for his precious idea regarding this research work and his cooperation.*

*I would like to thank all of the graduate students and faculty with whom I have worked with at U.A.F. and who have been so helpful and supportive. Specially, I thank **Dr. Bakht Baidar** Khan, Senior Professor Faculty of Animal Husbandry on whom I can always rely, regardless of the task or time of day. **Mr. Bill MCD Stevenson**, Head of Milk Collection and Dairy Development, Nestle, Pakistan deserves special thanks for his help and continuous support with this work, especially with chapter 4. **Mr. Bill's** patience and time in helping with Chapter 4, especially, is greatly appreciated. I am also very thankful to **Mr. Rick Thompson, Dr. Faisal Nawaz** and **Dr. Azeem,** nestle, Pakistan for their willingness to helpand availability* *to bounce ideas off of. More generally, I would like to thank all of my friends for all of their support and encouragement.*

List of Contents

List of Tables

List of Figures

CHAPTER 1

INTRODUCTION

Livestock plays a considerable role in the life of farmers in Pakistan and also in other countries of the region. They provide food, income, employment and so many other things for rural development. Within the agriculture sector, livestock subsector plays a vital role in economic development of the country. However, despite the increasing contribution of the livestock sector, it has not yet attained the level needed to provide sufficient milk and meat for the growing population. The contribution of livestock to value added in the agricultural sector is around 53.2% equivalent to 11.4% of national GDP and has grown by 4.5% in 2009-10 as against 3.5% during the last year. Livestock sector employs approximately 35 million people and produces almost $500 million of products. Gross value addition of livestock at current factor cost has increased from Rs. 1304.6 billion during 2008-09 to Rs. 1537.5 billion in 2009-10 showing an increase of 17.8% as compared to previous year (Government of Pakistan, 2011).

Pakistan is among the most populous countries of the world. The human population is increasing at the rate of 2.1%, which is the highest among the countries of this region, such as China 0.5%, India 1.3% and Bangladesh 1.4%. Due to rapid increase in human population, requirements for milk and meat in addition to cereals have proportionately ancreased. To meet these requirements, we need to make the production performance of our livestock resources much more efficient (World Bank, 2010).

Apart from the above-mentioned factors, the increased pressure of urbanization, increased per capita income, better education level and nutritional awareness have resulted in gigantic increase in the use of food products of animal’s origin in daily diet. This increase in demand for food coupled with insufficient per capita availability of milk and meat has forced consumers to pay higher prices for these products. The migration of rural population to urban areas for better employment opportunities, health and living facilities are some of the additional factors that are causing more demands for food of animal's origin in urban areas. The higher prices of animal food products have changed the milk utilization and marketing behaviour in rural areas. An enormous and constant increase in milk flow from rural areas to urban areas has been reported.

Many efforts to improve the situation of the dairy farmers have been made by Government of Pakistan and international agencies (FAO, ADB , IFAD) over the past two decades but their impacts are not really encouraging as desired by the funding agencies (Teufel, 1998).

Pakistan is the 4th largest producer of milk in the world. Despite the well recognized importance of milk, its productivity per animal is too low as compared to its potential. Pakistan has very low milk yield per animal which is mainly due to underfeeding and low genetic potential of existing stock. Dairy sector in Pakistan is mostly unorganized and operates on non commercial basis while a bit part of this sector is contributing only a little portion of total production of milk in the country (Javed *et al.* 2000).

Table 1.1: Livestock population in pakistan **(000 heads)**

Years	Buffalo	Cow	Sheep	Goat	Camel
2001-02	24030	22858	24398	50917	758
2002-03	24754	23303	24566	52763	751
2003-04	25513	23757	24744	54679	743
2004-05	26295	24218	24923	56665	736
2005-06	27339	29564	26490	53789	921
2006-07	28146	30674	26794	55244	933
2007-08	29001	31829	27111	56741	945
2008-09	29883	33029	27432	58279	958
2009-10	30842	34310	27832	59972	100

Source: (Government of Pakistan, 2011).

This table shows that the population of buffaloes, cows and sheep has been increasing significantly with the passage of time. This picture probably is encouraging and shows the importance of this sector for the country's development.

Dairy sector in Pakistan plays a significant role in national economy. It is estimated that every third household in the country supports a milch animal and the average herd size is 2 to 3 buffaloes and 5 to 6 sheeps/goats in their backyards and are deriving 20 to 25 percent income from it. The annual milk production stands at about 37 billion litres, making Pakistan the 4th largest milk producing countryin the world. About 5.5 million landless/smallholder farmers are responsible for the bulk of milk produced in the country. However, 93% of these farmers have an average herd size of 2 to 3 milch animals and milk remains to be the mainstay of their household income. However, despite having great value, milk production per animal is less in Pakistan due to many factors like low genetic potential, late age at maturity, long calving intervals, high economic losses due to disease, unorganised marketing system, lack of extension services and farming on traditional lines. People in Pakistan have inherited traditions of rearing dairy animals and livestock production has remained a complementary activity to crop production. Dairy animals have a central position in livestock farming (Bilal, 2004).

The importance of the livestock sector to Punjab's economy is no secret. It employs about 75% of the rural work force in the province; the industry itself is highly scrappy with most farmers having less than five animals. This sector could benefit from investment in infrastructure that would update and manage some of the main processes involved. Punjab possesses the 2nd largest buffalo population in the world (Niaz, 2010).

The feeds and feeding of dairy animals account for more than 65% of the total production cost. Milk is the only saleable product that provides daily income to the farmers. The feed nutrients are first utilized for maintenance and those excess over maintenance requirements are utilised for growth and/or production. The maintenance cost is therefore a sort of tax on the dairyman. Though high producing dairy animals consume more feed than low producing animals, the additional milk they produce, pays much more than the extra feed cost incurred on high producing animals. Highly productive animals are therefore essential for an economic and efficient dairy productive system. An efficient feeding system not only helps in increase the milk production but can also save feed by encouraging early growth of dairy animals and thus reducing the age at first calving and providing sound reproductive health to obtain maximum yeild in their entire productive life.

Pakistan is sanctified by a large herd well adapted to the local environmental conditions. Pakistan is home tract of the finest buffalo breeds of the world i.e. Nilli-Ravi and Kundhi. Likewise, Sahiwal and Red Sindhi cattle are renowned milch breeds of zebu cattle with identified resistance to hot weather and ticks. Even though, Pakistan ranks 4th in the milk production in the world, low productivity per animal is the main issue of our dairy livestock. This low productivity can be credited to many factors including poor genetic potential of

90% of animals, poor nutrition, inadequate veterinary health services, delayed puberty, long calving interval, acute shortage of quality breeding bulls and inefficient marketing. Livestock sector is still largely dependent on low technology and capital investment. Most of the dairy animals (>50 %) are owned and reared by smallholders keeping less then six animals per family in subsistence production system. Hardly 5% have more than 100 animals and are busy in their farming business at commercial level (LDDB, 2010).

In Pakistan, the dairy sector has futile to draw the due attaraction of the policy makers. This dairy sector is steadily shifting from non-commercial to commercial sector. Pakistan is still importing powdered milk in order to fullfil the domestic needs even though after being one of the foremost milk producers in the world. At farm level the production of milk has the poorest connection of the Pakistan's dairy industry due to which stable fresh milk supply at reasonable prices can not be entertained. Several factors have been responsible for the relatively retarded growth of this sector (Burki *et al.* 2005).

In Pakistan, at present majority of the farmers keep their animals both for domestic and commercial purpose. Mixed farming (crop + livestock) is practiced in the Punjab province. In Punjab, almost every farmer has kept livestock along with other agricultural enterprises to fulfill their domestic needs, efficient use of farm wastes and surplus hours of farm labour. The landless farmers mainly keep their animals for earning livelihood and to meet the daily family requirements through sale of milk and animals. This category of farmers mostly depends on grazing their animals along canal banks and water channels; and feeding on fodder obtained in return of their services rendered for land owners; and in most of the cases their animals remain under fed. Only lactating animals get attention of their owners for proper feeding whilst dry animals are almost remain neglected. These types of feeding practices definitely lead to underfeeding and poor exploitation of their genetic potential.

Most of the households having dairy animals belong to the category of subsistence or near subsistence, having high risks in the milk production, because milk income entertain frequently as agriculture or labor income. Thus, tries to boost up the production of the dairy industry of small farmers are not only important to raise the yield of milk in the country, but can also turn into an helpful instrument to increase rural household incomes improvished.

Reproductive traits in dairy cattle are not only a measure of fertility but also of productivity and production potential of an animal for life. Fertility can be defined as the capability to conceive and produce a feasible calf following an aptly timed insemination (Royal *et al*. 2000). Efficiency of about fertility can be improved by means of better management (Biffani *et al*. 2003). Low fertility is of economic importance for dairy companies, because it results in a shift in calving pattern, higher levels of involuntary replacement, hormonal therapy, veterinary intervention, and reduction in annual production of milk (Esslemont and Peeler 1993). In Malawi, in an effort to improve milk production, dairy cattle production has sometimes been directed at increasing milk production per animal (Chagunda *et al.* 2004).

In order to determine the profitability of a dairy farm, the reproductive efficiency plays a key role. There are several factors that cause a decrease in reproductive efficiency like high age at first calving, longer calving interval, late maturity and dry period. Due to the involvement of these factors, the farm income is affected by the reduction in milk production and less number of calves is produced by the animals. The major cause for the late maturity is poor feeding which results in at least loss of one lactation per animal under local environmental conditions. According to the surveys report, the average calving interval is about 18 to 24 months which can be improved to 12 to 14 months with better management of the animals of the farm. It is anticipated that each animal losses 2 to 3 lactations due to poor reproductive efficiency, which largly change the economics of dairy farming in the country.

The issue of fertility in high yielding dairy cows is foremost in the minds of both pedigree breeders and commercial milk producers working in the global dairy industry. The 'Holsteiniziation' of the global dairy herd has resulted in attainment of unprecedented levels of milk output per cow per lactation. This should contribute to increased efficiency of production on farms by reducing maintenance and fixed costs per unit of milk produced. However, efficiency of reproduction is also a critical parameter in sustaining long-term profitability on any dairy enterprise.

Efficient and accurate oestrus detection is the most important factor limiting reproduction in most dairy animals/herds. Failure to observe animals in oestrus delays first service, lengthens oestrus interval, and is one of the primary factors lengthening projected average minimum calving to conception interval by increasing the number of days open. It contributes more to lengthy calving intervals than conception failure. In addition, inaccurate oestrus detection lowers conception rate. As many as 1/3rd of dairy herds have a significant oestrus detection accuracy problem.

1.1 Components and Mechanisms concerned with Economic Effects of the Reproductive Performance

Decreasing reproductive efficiency of a dairy herd affects its profitability through compact incomes and extra expenditures. Compact incomes are anticipated losses in comparison to a most favorable or a reference level in reproduction (Seegers *et al.* 1994).

1.1.1 Extra expenditures due to the low reproductive performance

These costs according to the extra expenditures indirectly result from terminology oftenly used by the economists of animal health (Seegers *et al.* 1994). Their estimation is not complicated from the data like pricing lists or bills. More in detail, such types of expenditures consist of:

- Exrat breeding costs
- Extra treatment costs
- Extra feeding costs
- Extra labor costs

1.1.2 Reduced incomes due to longer calving intervals

These are caused by lower productivity (i.e. lower output/input or outputs/fixed costs ratios in the production process). They are corresponding to the "preventable losses" in the terminology used by the economists of the animal health (Seegers *et al.* 1994).

- Calf cropreduction
- Milk yield reduction
- Lengthened calving intervals

As discussed above, poor reproductive efficiency is caused by high age at first calving, longer calving interval, delayed maturity and dry period. These factors lead to reduction in the milk production at the farm as well as curtail lactation period coupled with reduced calvings. Poor and underfeeding are the principal causes of delayed puberty resulting in at least loss of one lactation per animal under local management conditions. Under field conditions, the average calving interval is around 18 to 24 months which can be reduced to 12 to 14 months with improved management of the farm animals. It has been estimated that during productive life, each animal loses 2 to 3 lactations and among other things, it is usually caused by poor reproductive efficiency which badly affects the economics of dairy farming.

Low reproductive efficiency due either to delayed first service, missed oestrus, or multiple services per conception continues to be a major problem in dairy herds. Inefficient reproductive performance results in excessively late age at first calving and long lactations. Both of these things are costly to the dairy producers because of the high replacement costs, breeding expenses and fewer calves being born (Oudah *et al.* 2001). Several reports have showed that poor reproductive performance, manifested as lengthened calving intervals, can result in reduction of milk yield, increased replacement costs and culling rates (Pryce *et al.* 2000; Kadarmideen *et al.* 2003 and Sewalem *et al.* 2008). Beever (2006) reported that average dairy herd fertility is declining, with more services per successful conception, lengthened calving intervals and increased culling due to failure to rebreed, all adding considerable costs to milk production. Genetics, management and nutrition have all contributed to this decline in fertility.

What is the value of an increase (or decrease) in pregnancy rate? Depending upon milk price and milk yield, each 1% increase (or decrease) in pregnancy rate results in the gain (or loss) of approximately $12 to $25 per cow per year (Overton, 2001, 2005, 2008). Because as pregnancy rate increases, over time, the average days in milk for the milking herd will decrease, leading to higher average milk production per day of lactation, more time per lifetime spent in the most profitable portion of lactation, and less veterinary and breeding costs. As pregnancy rate decreases, average days in milk increases, leading to increased management, feed, and veterinary costs for cows in the least profitable portion of lactation (Joseph and Amin 2009).

All over the world, the poor reproductive efficiency of dairy animals has become a leading problem. Increase in calving intervals due to the decrease in rate of conception over the previous decades has been entrenched by different studies (Royal *et al.* 2000; Lucy, 2001; Hare *et al*. 2006). Nowadays in the field, it is not rare to encounter farmers having given up any pro-active managerial attitude towards reproduction, preferring to cope passively with what will happen: i.e. to cull more and more so called infertile cows, and to raise more and more heifers or to purchase more and more replacement stock. A sizeable proportion of farmers seem not to be aware of the losses due to suboptimal reproductive performance of their herd, or they behave like that. However, most of the farmers and advisors are still willing to work otherwise and they ask for relevant and consistent support.

1.2 Scope of the Study

In Pakistan, dairy farmers are now suffering a decline in their income due to the high cost of milk production of acceptable quality. In addition, fertility in terms of heat detection, submission rate and pregnancy rate is often seen as another concern of dairy farmers. Economic losses due to delayed conception in dairy animals were estimated in different countries. One day of delay in conception was calculated to cause $2.03 (Lineweaver, 1975), $1.24 (DeVries and Conlin, 2003) loss in the United States and £2.41 loss in the UK (Esslemont *et al.* 2000) for an average milking cow. Esslemont *et al.* (2000) also reported a loss of £6.52 per day for a high producing cow to become pregnant between 206 and 235 days post-calving (Kafi *et al.* 2007).

Regardless of significant improvements in the Pakistani dairy herd management during the last three decades, the opportunity of extensive usage of artificial insemination has remained a confront for the dairy sector. There is a stern need to explore factors restricting more widespread application of artificial insemination in Pakistani dairy herds. To our knowledge, no report has been published on the economic losses associated with delayed conception under Pakistani intensive dairy management and its impact on the income level of the farmers. Therefore, the following study will be carried out to determine the economic losses associated with delayed conception in dairy animals and its impact on the income level of the farmers.

OBJECTIVES

The objectives of the study are:

- To estimate the share of livestock income in the total income of the farm
- To estimate the composition of labor used in livestock
- To estimate the economic losses associated with delayed conception
- To investigate the reasons for delayed conception

CHAPTER 2

REVIEW OF LITERATURE

Louca and Legates (1968) estimated that a 12 month calving interval (CI) was best for second lactation and older animals and a 13 month CI was acceptable for first lactation cattle. In this paper, they cited the lack of experimental data that supported particular losses related with increasing days open. These authors also cited four papers, published by a variety of researchers over the period extending from 1929 to 1961, which held the same opinion:

> "…that the calving interval should not be the same for all cows, but the length should depend on the age of the cow and her producing ability, and that there was general agreement that a calving interval of 12 months was desirable."

Schaeffer and Henderson (1972) studied the genetic and environmental associations of days dry and days open with the production of milk. Age and calving month extensively influenced dry period length. Within herd heritability calculations of dry days were 0.15, 0.33, and 0.34 for 2nd, 3rd and later lactations. Within herd heritability calculations of days open were effectively zero. As the open period length increased, cumulative production of milk also increased at each succeeding stage of lactation.

Coppock *et al.* (1974) studied the effects of length of dry period on disorders at calving and subsequent milk production. Cows were assigned to treatment group dry periods of 20, 30, 40, 50, and 60 days by modulus 5 of their index numbers. Cows which averaged 10 to 40 days dry produced from 450 to 680 kg less milk in the following lactation than cows with average dry periods of 40 days or longer. Although there was some gain in milk production during the previous lactation from the longer lactation – shorter dry periods, it was less than half the loss in the following lactation. The depressing effect of the short dry periods did not carry over to the second lactation. Cows with dry periods of 40 ± 10 days produced as much as cows with 50 days dry or more.

Gill and Allaire (1976) studied the relationships of management and breeding factors to economic returns for dairy cows. A profit function was defined from production of milk, reproductive performance, body weight, herd life, and prices for milk, feed energy, salvage value, calves, and fixed costs. Statistics on individual cows were days in milk for each lactation, milk yield, weight at first calving, maturity and fat percent, number of artificial inseminations and age at each calving and at removal. Each trait values for maximizing a 2nd trait are defined as most favorable. Most favorable percent for open days and dry days were 31.0 and 10.5 for profit / day-herd life. A little larger percentage was optimal for total profit-life, milk-life, performance traits, and herd life. Optimal age at first calving was 22.5 to 23.5 months. Per day profit of herd life was $0.05 larger for cows calving in the 25th month of age than those calving before? Age at first calving, Days open and days dry accounted for 0.9, 4.5, and 10.0% of deviation in herd life; for 0.6, 18.8, and 4.3% in milk per day-life; and 5.2, 8.3, and 8.1% of deviation in per day profit of herd life. Correlations between percent days open and age at first calving and herd life were 0.05 and −0.10. Maximum profit per day-herd life was estimated for cows with 25 month of age at first calving, 124 days open and 42 days dry while maximizing milk per day-life and herd life.

Pelissier (1976) studied that low breeding competence had been documented as one of the serious problems disturbing the efficient production of milk. For this problem a study was done in California and the author recognized the two main factors responsible for that problem which were, delayed first service and low conception rates. Inefficiency of heat detection was the main reason for delayed first service and also it contributed considerably to the delay of following services.

James and Esslemont (1979) used a mathematical model to test the economic effect of calving interval's change under typical high yielding herd conditions at 1976 prices. The outcome of first calving month was tested in a herd where four lactations were supposed to follow at equivalent calving intervals. Under the given conditions, cows should calved at 320-day to 360-day intervals to maximize the annual margins over feed, but the month of initial calving affects the complete level of margins over feed markedly (Maximum: £382·10 for 365-day interval for calving in November, Minimum: £318·10 for calving in April). This means that absolute knowledge of the main input output factors is necessary before recommendations can be made for an individual animal. The change in margin over feed for each day's delay in conception varies broadly, with a loss as high as £1·80 per day's delay.

Olds *et al.* (1979) derived multiple regression equations from the data of 6,351 Holsteins for first lactations and of 17,978 Holsteins for later lactations. Within the herds each day open between 40 and 140 days during lactation resulted in an average of 4.5 kg less annual milk production during current lactations of first calf heifers and 8.6 kg less for cows in later lactations.

Holmann *et al.* (1983) estimated that the net value per day open was positive ($0.21 to $0.40) for all milking animals when calving interval was extended from 12 to 13 months and on the other side, the value per day open was negative (−$0.04 to −$0.23) when calving interval was extended from 13 to 15 months. So, the 13 month calving interval appears to be most favorable. Costs incurred with 13 months were small enough not to be a serious problem of management when cows were fed according to the milk yield and when dry period was 65 days.

Dijkhuizen (1984) estimated that an optimal calving interval of one year or less than one year was found, whereas the per day loss of lengthening the calving interval was estimated to 1–2 Dutch guilders (Dfl.). On an average, the estimated loss of per cow per year was Dfl. 63. Out of which Dfl. 35.50 were resulted from sub-optimal interval and Dfl. 27.50 were estimated due to reproductive failure by the forced replacement. Drugs cost and Veterinary treatment costs were not included in this study. On an average, the total loss due to the reproductive failure was estimated to about Dfl. 80 per cow per year. Lastly, loss differences between farms have been calculated. The difference between 20% of the farms with the highest estimated loss and 20% of the farms with the lowest estimated loss was greater than the average loss.

Din (1984) concluded that average cost of maintaining a buffalo was Rs.4267 and Rs.2705 for a cow per year. Average milk produced per lactation of buffalo was 1020 liters and 394 liters of cow. In this area, farmers were found to earn 751.53 net profits by maintaining a buffalo, but cow was found uneconomical. Farmer suffered a loss of Rs.286.83 on maintaining a cow for a period of one year. The cost of milk production per liter for buffalo and cow was Rs.3.14 and 4.69 respectively. The higher cost of milk production for cow was manly due to poor yield of milk.

Keown and Everett (1984) studied the factors that were estimated for days carried calf for milk, fat, and protein using a model that adjusted for the age-month and herd-year of freshening. Factors developed show a close relationship between protein and milk with fat factors being smaller. Factors also are smaller than others reported in the literature. First lactation factors differed from second and third lactation factors. Analysis of days dry indicated that optimum number of days dry between lactations 1 and 2, 2 and 3, and 3 and 4 for maximized subsequent yield was 51 to 60 d dry for all lactations. Calculated F values showed greater significance for days dry than age-month of freshening. Optimum freshening weight of a first calf heifer to maximize first lactation milk yield is between 544 and 567 kg. The F values for weight at freshening were more significant than age-month of freshening.

Britt (1985) reported that the reproductive efficiency is essential for the benefit of dairy farms, because it affects the production of milk per cow per day, voluntary and involuntary culling rate and the number of replacements. High-yield dairy cattle breed at a satisfactory pace if managed properly. There is a strong relationship between the reproductive efficiency of animals and herd management. Thus, reproductive efficiency and take advantage of the animal act positively in improving the detection rate of estrus, conception rate, and in the management of cows. Pharmacological methods are now found time control of estrus and insemination in groups of cows. It is reasonable to limit the breeding herd in a week of each interval of 3 weeks. The main advantages of controlled breedingare convenience and efficient use of labor for the detection of estrus and insemination. Biotechnical methods such as embryo transfer and insertion of specific genes can improve the rate of genetic improvement for economically important traits.

Bartlett *et al.* (1986) studied that a repeat-breeder cow with symptoms, defined as a cow that was inseminated three or more times within the same breast. Repeat-breeder symptom was found in 24% of 3,309 lactations of the cows. Cost related to unsuccessful inseminations included delayed development costs, the additional number of services in addition to the veterinary service and losses due to slaughter. Loss of milk with repeat breeder symptoms was about $ 385. A calculated extra cost of $140 was linked with a second insemination, $279 with third insemination, $429 with fourth insemination and $612 with fifth insemination.

Jansen *et al.* (1987) studied the interactions between herd fertility and financial losses due to reproductive failure in dairy herds. Financial losses connected with lengthened calving intervals and forced replacements from reproductive failure were calculated. Parameters used for herd fertility were calculated from artificial insemination and calving data (i.e. calving to first service interval, non-return rate 56 days after first service, percentage of correct inseminations carried out in the interval 18–24 days, fertility status, calving interval, an estrus index and number of insemination per average cow present in the herd. The herd fertility parameters were moderately-highly related to loss due to suboptimal calving interval (r=0.20−0.79 in absolute values), but only slightly related to losses due to forced replacement (r<0.17 in absolute values). Repeat abilities, calculated over a 3-year period, were high for the interval to first service, non-return rate and the estrus index (0.52−0.67) and moderate for percentage correct reinseminations, fertility status, calving interval and loss due to suboptimal calving interval (0.38−0.48). Repeatability of loss due to forced replacement was low (0.20). In a regression analysis no herd fertility parameter was fitted with respect to loss from forced replacement. Loss due to suboptimal calving interval at herd level was best estimated by the estrus index (R2=0.63), the addition of the interval to first service to the regression equation explained a further 10% of the variation between herds. It is suggested that the estrus index and the interval to first service should be presented as management aids to monitor herd fertility.

Kumar and Gupta (1988) worked on the economics of milk production among the various species of milk animal at different farming system with the seasonal fluctuation. The highest yield per day of crossbred animals was found to be 8.58 liter by large farmers. Whilst the milk production in case of upper medium, lower medium and small farmers ware 8.08, 7.24 and 6.2 liters, respectively. The average milk yield of local cow and buffalo was computed at 3.74 liters and 4.98 liters, respectively. With high genetic potential cross bred cow proved its economic superiority by minimum cost per unit of milk produced and viability over the others in the study areas.

Schmidt (1988) estimated that when the culling plan was based on age of the cow with $12 milk price and low feed prices, income over feed and variable expenses of cows for the period of a 13-months calving interval was slightly lesser than those for the period of a 12-months calving interval. Losses for each extra day of calving interval from 12 to 13 months are ranged from 0 to $13. By increasing the calving interval to 14 months increased the losses of associated with the animals per day open with a range of $.10 to $.71 in comparison with a 12-months interval. Losses per day open for a 15-months calving interval were ranged from \$.18 to \$.60 in comparison with a 12-months interval. Factors which reduce income over feed expenses, such as low milk production, low milk prices, high feed prices, and culling at an early age decrease the loss in income over feed and variable costs for 14- and 15-months calving intervals in comparison with a 12-months interval. When the strategy of culling was based on lactation number of the animals, extending the calving interval of the animals increased the income over feed and variable costs associated with the animals with the greater effect occurring between 12 and 13 months. From the above results, recommendations for a 12- to 13-months calving interval appear reasonable.

Bhogal *et el.* (1989) used a profit-maximizing linear program model to formulate most favorable crop and milk production tactics for marginal and small farmers in meerut district. The optimum plans developed suggest that the buffaloes, especially the murrah buffaloes, were the most suitable milch animals and their number could profitably be raised to three per farm. The considerable potential for increasing family income and employment through optimum integration of crop and milk production activities is also established.

Nieuwhof *et al.* (1989) studied the effects of calving ages and calving intervals for cows in first calving for five dairy cattle breeds. Mean age for Jerseys was lowest and was highest for Ayrshires and Brown Swiss. Registered cows usually were older in age than others in different parities. Important exception was that registered cows were younger than others at first parity. Trends were positive in calving ages over time for given parities; if parity was not included then trends were negative except for Jerseys and positive except for Ayrshires and Holsteins. The calving interval lengths were shortest for Jerseys and longest for Guernsey's and Brown Swiss. There was a decrease in mean calving intervals from first to second interval and then increased till sixth for all breeds. Calving intervals for Holsteins were ranged from 393 days, following second parity to 405 days, following sixth. Registered cows had longer calving intervals than others. Calving interval trends were generally positive for given parities and significant only for Guernsey's.

Erling *et al.* (1989) studied the result on net return per year by varying the conception time from 60 days to 220 days after calving of the cows for different combinations. Early conception was the very cost-effective for all combinations of characteristics. The consequences of one day of delayed conception on net return per year ranged from 0.3 Sw. kr to 11.6 Sw. kr keeping in view the calving month, lactation stage and lactation number, parity and production level of the animal. The cyclic deviation in price of milk had a strong impact on the association between net return per year and conception time.

Boichard (1990) used dynamic programming in order to estimate the economics of fertility in dairy animals. The anticipated cash flow of a cow in the future, given the herd's average conception rate, were determined and maximized with van Arendonk model, which was used to predict the replacement policy. The association of marginal cost with the decline in fertility of the animal was calculated as the ratio of the difference between the expected cash flow of a heifer at calving to the difference of respective average conception rates in the herd. The projected outcomes had minimum value but considered all the consequences of a change in fertility. Presently in the French conditions, the marginal value of 1% absolute change in conception rate was estimated to be between 10 and 20 FF. This value decreased if the average fertility level of the animal increased.

Weller and Folman (1990) studied the effect of days open and days to first insemination, cumulatively on calf and milk production in the current lactation and following lactations. For first group, most favorable days open were ranged from 110 days for low calf value (500 kg milk) to 91days for high calf value (4000 kg milk). For second group, most favorable days open ranged from 91 days for low calf value to 40 days for high calf value. Expected production which was a function of days to first insemination and probability of conception, which was varied from 0.4 to 0.6, and estrus detection, which was varied from 0.5 to 0.7. Most favorable days to first insemination as a function of calf value and reproductive management ranged from 95 to 65 days for first group and from 77 to less than 40 days for second group. Most favorable days to first insemination were higher with lower value of calf and better reproductive management. Expected losses from early first insemination (40 days in milk), as compared with the most favorable, ranged up to 780 kg of FCM for first group cows, while expected losses from late first insemination (120 days in milk) ranged up to 790 kg for second group cows.

Pardue and Bertrand (1990) concluded that milk prices, unstable market conditions and several recent summer droughts which resulted in high feed prices. If milk prices increase and South Carolina dairy producers continue to adapt to new technologies, they can share in growing milk market.

Olynk and Wolf (1991) reported that reproductive management has received a great attention in recent years. New programs and technologies have been developed to help dairy farm managers in order to efficient breeding of cows and heifers. Due to the negative correlation response of fertility and milk yield it becomes very difficult in order to get efficient breeding of cows and heifers. Results from dairy farm surveys were used to estimate the economic analyses of the programs of reproductive management. Programs related reproductive management had significantly affects the costs especially labor costs. For example, visual heat detection needs more labor hours per cow than the use of an estrus synchronization program. So, visual heat detection programs were more sensitive to the cost of labor than synchronization programs.

Shah *et al.* (1991) estimated the economic losses in Nili-Ravi buffaloes due to reproductive failure in Pakistan. The most favorable calving interval for dairy buffaloes was found to be 12 to 13 months. Losses caused by sub-optimal calving intervals were Pakistani Rs. 9–14 per extra day per calving interval. Losses for forced replacement as a result of reproductive failure average Rs. 133 per buffalo present on the farm.

Chaudhry and Chaudhry (1992) concluded that milk price showed a positive correlation with number of milk animals per farmer and negative relationship was observed with crop intensities. Animals contributed 32.65% to total gross margin. It was concluded that dairy animals were essential part of farm plans and were essentially needed for 3 main reasons: (1) to secure net cash return (2) to provide employment for some of the excess family labor and (3) to serve as useful outlet for crop byproducts. Increased net cash return can be achieved by mixed farming through effective allocation of resources and improved marketing practices.

Esslemont (1992) used the calving index as a measure of herd fertility and neglects the proportion of the herd that is culled and failing to conceive. On an average, calving interval of the herd was 380.3 days, with 23.1% of culling rate. As a result 92.1% of the cows were served and 85.3% of those which calved, conceived again, with an average of 1.9 services per conception. In order to assess the herd fertility on financial basis, with costs associated to calving interval, pregnancy rate and culling rate to give a fertility index, the average herd was suffering a loss of 62 pounds/cow/year, compared with target levels.

Shah (1992) found the nutritional impact of modern dairy development processes on the rural economy in India. It was a significant issue given that 70-80% of small and marginal farmers and agricultural laborers were involved in dairying. Malnutrition among these classes was widespread. However, a number of village studies have found that the food intake of landless farmers was greater in the village. The extra income generated by the sale of milk allows the purchase of other foods not produced by the farmers. On the other hand, it was also feared by some experts that by providing better marketing for the sale of surplus milk through cooperatives will further reduce the nutritional status of poor. Because at present available surplus milk or its products were distributed among poor free of charge but with the better marketing of the milk surplus than home consumption will be sold.

Tailor (1992) found in his study that average milk yield was 1300 liters, with lactation duration of 275 days, dry period of 136 days calving interval of 411 days. The average cost of milk product per kg in the two years, respectively, was Rs. 3.50 and Rs. 3.18 (having average Rs. 3.34), the higher cost in 1988/89 was attributed to the higher price of dry fodder in that year. The major contributor to maintenance cost of a sutri buffalo in all periods was dry fodder, which accounted for 31.18, 44.07 and 32.25% of maintenance cost during lactation, the dry period and inter-calving period, respectively. The net daily maintenance cost of per buffalo was Rs. 16.79, Rs. 15.81 and Rs. 16.46, during above mentioned periods. Profit during the inter-calving period was Rs.617 per buffalo producing 1600 kg of milk during lactation.

Plaizier *et al.* (1996) studied the relationships between reproductive performance and net revenue from dairy herds using statistics models. He used projected calving interval, adjusted calving interval and involuntary culling rate in this study. Adjusted calving interval was estimated by dividing the projected calving interval for pregnant cows by number of cows that were not culled for reproductive failure. "The regression of adjusted calving interval on net revenue had an R^2 of 0.72, which was higher than the R^2 of 0.59 obtained by the regression of projected calving interval on net revenue. Hence, the estimation of financial losses from suboptimal reproductive performance was more accurate when adjusted calving interval was used as a measure of this performance than when projected calving interval was used. This difference is because projected calving interval did not consider cows that were culled for reproductive reasons, but those cows contributed to a reduction in profit because of suboptimal reproductive performance. The highest R^2 (0.78) was obtained with a model that included projected calving interval and involuntary culling rate. However, use of that model might not be practical because herd operators differ in their ability to distinguish between involuntary and voluntary culling. The mean reduction in net revenue from a 1-d increase in adjusted calving interval was estimated at $4.7 (Canadian) per cow."

Chaudhry *et al.* (1997) studied the three groups of the dairy farmers subsistent, semi commercial and commercial. These workers pointed out that benefit cost ratio (BCR) was higher for commercial farmers than semi-commercial and subsistent farmers due to large capital and better managemental control.

Kulak *et al.* (1997) the objectives of this study were to evaluate and compare alternative measures of individual cow lifetime profitability and to determine what lifetime traits are significantly related to profitability of dairy cattle. Profitability measures considered were: 1) lifetime milk revenue minus lifetime feed costs (MMF); 2) lifetime profit (LP); 3) discounted lifetime profit (DLP); 4) annualized DLP per year of total life ($ADLP_{LTL}$); 5) annualized DLP per year of productive life ($ADLP_{LPL}$); 6) DLP adjusted for opportunity cost of postponed replacement (DLPOC), and 7) economic efficiency (EF). Data for this study consisted of 1112 lifetime performance records of Holstein cows from the National Cooperative Dairy Cattle Breeding Project, which was implemented by Agriculture Canada in 1972. Correlations were highest among MMF, LP, and DLP. EF had slightly lower correlations with MMF, LP, and DLP, but higher with $ADLP_{LTL}$ and $ADLP_{LPL}$. $ADLP_{LPL}$ and DLPOC had low correlations with all other measures. DLPOC was recommended as the best because it considered the opportunity costs of postponed replacement. For DLPOC, average milk revenue per lactation was found to be the most important income trait, followed by length of productive life. Days dry (average over completed lactations) had the greatest negative impact on profitability. Age at first calving and average number of veterinary treatments for reproductive diseases over lactations were both negative contributions to profit. Lifetime traits accounted for 65% of variation in DLPOC.

Nicholson *et al.* (1999) studied the livestock as a component of farm in the overall farming system. One feature of this study, which was usually not measured, was that the small farmers having less land holdings had numerous goals and these impel their decision-making power, especially when they had choice of technology and enterprise mixes. There was need to differentiate the dairy farming households not only in term of their resource availability but also in term of their characteristics and objectives, production and management system .

Agarwal and Chandra (2000) conducted a study in the Farrukhabad district of Uttar Pardesh. A sample of 100 households was selected with probability proportional to size of holding. The households were classified into four categories, viz. landless milk producers, small farmers, medium and large framers. The total gross cost per milch animal per day was Rs. 48.39 and Rs. 50.95 in crossbred cows and buffalos, respectively. Feed cost constituted two-third of total gross cost both in cows and buffalos. The over all net return per day per milch animal was Rs. 5.30 and Rs. 9.34 for crossbred cows and buffalos, respectively. Based on these findings, it was concluded that crossbred cows are more suitable for medium farmers and buffalos more suitable for large farmers.

Esslemont *et al.* (2000) estimated that per day loss due to per day of delay was £1.73 when the calving interval was extended from 85 days to 100 days post-calving. This loss had risen to £2.86 per day when calving interval was extended from 116 to 145 days post-calving and £3.55 per day when it further extended up to the day when no extra milk came from the current lactation. The loss of per day's delay varies broadly depending on the elements included in the calculation. The net final value of a lost day was calculated at £2.30. The costs cumulated over time reached at £253 when the calving interval extends by 3 months.

Jones (2000) performed an analysis by using a simple capital budgeting technique known as net present value that summarizes for the costs one incurs on economic returns that were received over time versus immediately. Consequences of this study were reliable with those of preceding analysis that concluded that maximum net economic returns were earned when the calving interval was 12 to 13 months instead of 18 months.

Khalid *et al.* (2000) reported that small scale dairy farms in India and Pakistan are not able to generate family farm income. There existed a significant element of economics of scale resulting in cost reduction by 30-50% between the small and large farms in India and Pakistan.

Arbel *et al.* (2001) conducted a prospective trial where cattle were managed to attain calving intervals of either 12 months or 14 months. They found that primiparous and multiparous cows with extended lactations were more profitable. There data illustrated that, during the first experimental lactation there were advantages of $0.19 per extra day of calving interval in first calf heifers and $0.12 per extra day of calving interval in older animals. When the first 150 days of the subsequent lactation was also included, the net return per day of CI was $0.21 and $0.16 higher with extended calving interval in primiparous and multiparous animals, respectively.

Lucy (2001) studied that the shift toward more productive cows and larger herds is associated with a decrease in reproductive efficiency. The cows who gave highest production of milk had the more incidence of infertility, but epidemiological studies suggested that, in addition to milk production, many other factors were perhaps declining fertility in our dairy herds. The physiology of dairy cows had changed over the past 50 years, and these physiological changes along with high milk production might explain the decline in the fertility of the dairy cows. New research had included critical areas in order to overcome such type of problems. It is not an easy task to solve the reproductive loss in dairy cows because there are not so many research studies regarding reproduction in postpartum dairy cows. So, the present research will provide a base in this area and will need to be expanded.

DeVries and Conlin (2003) estimated that the net returns per cow per year at 65% estrous detection efficiency were $1305.27 which at 35% of estrous detection efficiency decreased to $1253.34. The overall average losses in net return per cow per year per point decrease from 65% to 55%, from 55% to 45%, and from 45% to 35% of the estrous detection efficiency were $0.78, $1.71, and $2.71, respectively. Similarly, the average costs associated with extra day open were $0.73, $1.13, and $1.24, respectively.

González-Recio *et al.* (2003) estimated a quadratic relationship between FCOST and INS. Similar profitability was estimated for cows who needed one or 2 INS, but when >3 INS were needed, profit decreased by >$205 (US dollars)/yr per cow. Cows that needed more INS had higher milk yield per lactation, but also had a higher culling risk and lower productive life and lifetime production, therefore, lower profit. Calving interval (CI) and INS economic values were, respectively, −$4.90 and −$67.32 (US dollars)/yr per cow and per one unit of change. The economic values of productive traits were $4.04, $1.02, and $1.19 (US dollars)/yr per cow and per one unit of change for kg protein, kg fat, and days in milk, respectively. A mature body weight economic value of −$0.67 (US dollars)/yr per cow and per kg was estimated. The relative importance of fertility traits with respect to protein was 64% for CI and 24% for INS, although the CI economic value is highly influenced by phenotypic standard deviation considered.

Mayne *et al.* (2003) studied that poor reproductive performance is a major problem on dairy farms throughout the United Kingdom (UK) and has been identified as the single most important problem in dairy herd management in Northern Ireland (AgriSearch Farm Survey). In addition to the direct financial cost, estimated to be approximately £50 million per annum in Northern Ireland (or £9000 per farm), infertility can result in increased management complexity as a result of inability to achieve a compact calving pattern. This is a particular problem in seasonal production systems where compact block calving is of critical importance in maximizing milk production from grazed grass.

Österman (2003) showed that cows with a calving interval of 18 months had as high a production level, articulated as per day milk of calving interval as cows with a 12 months calving interval and concluded that an expansion of the calving interval would be vindicated. He also reasoned that an extended calving interval would result in better efficiency of feed and that a system with an extended calving interval was a less rigorous system with fewer risk periods for the cow.

Sørensen and Østergaard (2003) analysed the economic consequences of postponed first insemination of cows in dairy herds with different reproduction management, and to analyse the sensitivity of the results to a further decrease in beef prices, using a model simulating production and health in a dairy cattle herd. Three different period-to-first-insemination scenarios were analysed. Period to first insemination was defined as days post partum for initiating insemination at observed heat. The three scenarios consisted of a short period to first insemination (70 days for primiparous and 35 days for older cows), a 70 days postponed first insemination of primiparous cows and a scenario with 70 days postponed first insemination for all cows. At a 70 days postponed first insemination for primiparous cows a decrease in annual herd profit of 1% were found. A 70 days postponed first insemination for all cows led to a decrease in annual herd profit by 3% at good reproductive efficiency and 4% at poor reproductive efficiency. The herd profit was calculated as the profit to cover labour costs and fixed costs. Postponed inseminations might reduce labour per cow-year. The reduction in labour per cow-year need to be 3.2 h at good reproductive efficiency and 4.3 h at poor reproductive efficiency to counterbalance the reduction in herd profit by postponing first insemination for all cows by 70 days. In a situation with a 50% decrease in beef prices in a herd constrained by a milk quota (optimising profit per kg milk) herd profit was increased by 0.8% at good reproductive efficiency and 0.3% at poor reproductive efficiency by postponing first insemination for all cows by 70 days.

Syed *et al*. (2003) studied that average peak milk yield, lactation yield, yield per day of calving interval, lactation length, dry period and calving interval were 10.5+or-0.27 kg, 2004+or-30.13 kg, 4.83+or-0.26 kg, 279+or-2.31 days, 136+or-2.01 days and 415+or-4.04 days, respectively. Peak milk yield (r=0.91; p=0.001) and lactation length (r=0.20; p=0.001) were positively correlated with lactation yield. First derivative of the regression slope for peak milk yield, lactation yield and yield per day of calving interval revealed 16.9 kg, 2663 kg and 5.59 kg, respectively to be the optimal limits for higher most economical milk production. The positive sign of second derivative for lactation yield and yield per day of calving interval suggested improvement in net profit with increase in lactation yield or yield per day of calving interval. Better milk production performance of buffaloes was observed in district Peshawar as compared to that in district Charsadda. Similarly, buffaloes maintained in farms located in periurban area performed better as compared to those in rural areas. Longer dry period (196+or-2.1 days) and calving interval (458+or-9.2 days) was found for buffaloes maintained in district Charsadda than those in district Peshawar (88.4+or-1.4 days and 391+or-6.9 days, respectively). In urban areas farmers were following 100% stall-feeding practice, in periurban areas 30.2% and in rural areas only 3.67%. A higher proportion of the farmers (89.9%) in the rural areas were growing their own fodder as compared to urban areas (3.55%). Similarly, a higher proportion of the farmers (70.4%) in urban areas were found to give dry roughages to their buffaloes as compared to farmers in rural areas (2.10%). A higher proportion of the farms in urban areas were in poor condition (47.3%) as compared to rural areas (16.2%). It was concluded from the study that buffaloes maintained in farms located in urban and periurban areas had better performance than those in rural areas. Improvement in peak and lactation yield and growing own fodder crops would increase profit.

Beever (2004) realized some of the problems associated with inefficiencies in dairy farms due to which the dairy farms profit margins were eroding. Poor reproductive management led to very poor fertility in animals that caused many animals to be culled in premature age. At the same time as culling rate increased, the sub-optimal herd health also increased veterinary costs, reduction in total production and influence cow permanence. Increased culling certainly increased the number of heifer replacements required to maintain herd size, adding further costs.

DeVries (2004) estimated that the delayed replacement was not advantageous under policy A. Optimal delayed entering of heifer's increased net returns only for policy B by $1.66 per slot per year. The small increase for policy B showed that the default prices and seasonality in cow performance were near the point where optimal delayed replacement was advantageous over immediate replacement. Delayed replacement resulted in decreases in both returns and costs per slot per year. Annual cull rate due to delayed replacement was only 0.5% lower.

Groenendaal *et al.* (2004) described a user-friendly spreadsheet culling model that was constructed to support economical, optimal breeding and replacement decisions on dairy farms. The model was based on the marginal net revenue technique. Inputs for the model can be entered for specific farm conditions, and the output is easily accessible. In the model, the retention pay-off (RPO) value of individual dairy cows was calculated. The RPO value of a cow is equal to the total additional profits that a producer can expect from trying to keep the cow until her optimal age, taking into account the changes of involuntary removal compared with her immediate replacement. To calculate the RPO values, the future production, revenues, and costs of dairy cows at different levels of milk production with different numbers of days open (DO) were determined. Furthermore, the ranges of carcass value, calf revenues, and the range of involuntary disposal rates of cows within and across lactations were taken into account. To illustrate the model, parameters in the model were chosen to represent a typical Holstein dairy herd in Pennsylvania. The results of this model are very comparable with earlier, more complex models that are more difficult to use on the farm. In addition to using the RPO values to evaluate the decision to breed or replace a cow, the costs per additional DO were estimated. Early conception was most profitable with the costs per additional DO varying from $0 to more than $3/d. The model can be used as a decision-supporting tool for producers, extension personnel, veterinarians, and consultants. In addition, researchers, economists, and government organizations can use the model to determine the costs of culling dairy cows in a disease control program.

Anomynous (2005) stated that as calving interval of the animals increased, annual milk yield decreased and the number of dry days increased. Each extra day of calving interval costs from £1.30 to £5.00 keeping in view the milk yield and length of extended period. The losses from low yielding cows as a result of per day of delay were high than high yielding cows. For prolonged calving intervals to be feasible, animals need to have very constant lactations that entail very high standards of management. The breakeven point after which further breeding of individual cows was not valuable, was from 10 months after calving, but depends on milk yield.

DeVries (2006) studied that the profit of per cow per year had increased from $97 to $337 when the average days open decreased from 166 to 112 days along with pregnancy rates increased from 9% to 36%. The cost per extra open day varied from $3.19 to $5.41 and culling rates decreased from 47% to 32%. Heifer purchase cost increased from $2.11 to $7.46 per cow per year for each extra day open. Secondly, changes in milk sales ranged from an increase of $0.51 to a decrease of $1.24 per extra day open. Cow sales increased from $0.80 to $2.20 per extra day open and calf sales decreased from -$0.43 to -$0.23 per extra day open. Breeding cost and labor costs were also greater at greater days open. Feed costs varied with milk sales.

Kafi *et al.* (2006) estimated that the net cost due to one day of delay in conception for a cow producing 25 liters of milk in peak lactation was estimated at 40591.98 Rials (4.51 $US) when conception was delayed from 85 days to 100 days post calving. And this loss increased to 60120.89 Rials (6.68 $US) per day when conception occurred at 146 days to 175 days post calving.

Seeger (2006) estimated the economic concequences due to non optimal reproductive performance of a herd. He estimated the extra expenditures and losses in incomes due to this problem. He used the simultaneous models in order to assess the effects of longer calving intervals and extra expenses. In the literature, profit loss associated with a one-day increase of calving interval may vary from negative values till 5 € or 6 $, depending of a large number of factors. Given the quite absence of external validity of literature estimates, no universal set of values can here be used. Neverthless, several quite useful recommendations for practice have been stated from the results of the published studies.

Lee and Kim (2007) investigated the effects of the herd, cow parity, the insemination protocol and season on the incidence of pregnancy loss (PL) in dairy herds. Furthermore, we determined the downstream effects of PL on reproductive performance and its economic impact. The overall incidence rate of PL was 6.9% in 1,001 pregnant cows and its incidence peaked ($p < 0.01$) during the second trimester of gestation. GLIMMIX analysis revealed that cow parity was the important risk factor for the PL. The odds ratio showed that the likelihood of PL in cows with parities of 1 or 2 was decreased by 0.6 or 0.5 fold compared to the cows with a parity of 3 or higher. Following PL, the mean rate of endometritis was 23.2% and endometritis was more common ($p < 0.05$) when PL occurred during the third trimester than during the first and second trimesters. The mean culling rate was 46.4% and this did not differ with the period of PL. The overall mean intervals from PL to the first service and conception were 63.4 and 101.8 days, respectively. The mean interval from PL to first service was longer ($p < 0.01$) for cows with PL during the third trimester than for the cows with PL during the first and second trimesters. The economic loss resulting from each PL was estimated at approximately $2,333, and this was largely due to an extended calving interval and increased culling. These results suggest that cow parity affects the incidence of PL, which extends calving interval and causes severe economic loss of dairy herds.

Khan *et al.* (2008) studied the impact of delayed conception on calving interval of the animal. He stated that as the calving interval increased due to delayed conception, a steady trend was shown, in the low, moderate and high yielding buffaloes. There was a steady decline in milk yield per day of calving interval with delayed conception, associated with lengthend calving interval. An animal that conceive at a later stage of lactation showed a decline in financial returns by 24% to 27% than those that conceived earlier.

Inchaisri *et al.* (2009) estimated that the economic losses due to non-optimal fertility in an average reproductive performance cow were €34 per cow per year as compared to the losses of €231 per cow per year in a good reproductive situation cow. These losses were due to the decreased production of milk and increased non pregnant cows due to poor reproductive performance. In the end, conception rates and rates of estrus detection had the greatest effect on the loss of open days and on the calving interval.

Ansari-Lari (2010) showed that mean (+/-SD) days open, calving interval, and days to first service for study herds were 134 (+/-89), 403 (+/-86), and 67 (+/-38) days, respectively. Conception rates at the first service and the overall service-conception rate were 41.6% and 41%, respectively. The level of milk production and diseases had significant negative effects on days open and service per conception ($P < 0.05$); statistical analysis showed that for every 100-kg increase in milk yield, days open will increase by about 0.3 days. However, no significant effect of level of productivity was observed on days to first service. The results of this study indicate that high milk production is a risk factor for decreasing fertility in Iran, like many other parts of the world.

Yusuf *et al.* (2010) studied the effect of repeat breeding in dairy cows, including risk factors and reproductive performance. He supposed that normal fertility in cows was subjected to cows that become pregnant with three inseminations. On an average, first artificial insemination, conception rate, milking days at first artificial insemination, calving to conception interval and services per conception were 38.3%, 82+/-2 days, 125+/-3 days, and 2.0+/-0.1 times, respectively. In case of normal fertility, cows required 114+/-3 days to conceive and 1.7+/-0.1 inseminations per pregnancy. While repeat breeders required more days to conceive (211+/-10) and more numbers of inseminations per pregnancy (4.7+/-0.2). Analysis showed that 94 days were required to become pregnant after calving for 50% of normal fertility cows, compared to 155 days for repeat breeders. In case of repeated cows, 31.4, 50.0, and 58.1% of the cows became pregnant within 210, 300, and 435 days after calving, respectively. In the end, repeat breeder dairy cows had poor reproductive performance.

All the above studies showed the estimation of the economic losses due to delayed conception in livestock. However, almost such work has not been done in Pakistan.

Therefore, the present study will estimate the economic losses due to delayed conception in livestock, which will be an important thing regarding Pakistan.

CHAPTER 3

METHODOLOGY

A very important and significant thing in conducting any analytical study is to adopt a systematic and appropriate technique. After formulating the study and specific objectives, devising an appropriate methodology to conduct and complete the study is very important step. Data collection, various related values and trends present in any type of data (quantitative and qualitative) should carefully be applied and practiced. Presentation of data and dissemination lead to successful completion of study (Akhtar, 1999). This study is based on primary data collected from the field. In this chapter, the procedure used in drawing the sample, method of estimation of cost of each input is discussed.

3.1 Selection of the Study Area

The present study involves the economic losses due to delayed conception in dairy animals. Collection of primary data was done in Gujranwala District. Gujranwala District was selected as the universe of the study. It is a multi-crop area where wheat, rice, sugarcane and maize are grown and all types of fodder varieties were cultivated and fed to the animals.

3.1.1 Identification of the Small Farmers having Dairy Animals

Due to shortage of time and constraint of funds it was difficult to include all the dairy farmers of District Gujranwala. Therefore, the present study was confined to the two tehsils of District Gujranwala.

Table 3.1: Name of tehsils visited in the survey

Tehsil Name	Frequency	Percent
Gujranwala	40	50.0
Wazirabad	40	50.0
Total	**80**	**100.0**

Table 3.1 shows that two tehsils of district Gujranwala were selected randomly for this survey. One was Gujranwala and the other Wazirabad. From each tehsil a sample size of 40 respondents was selected. And from each tehsil three villages were selected at random.

Table 3.2: Name of villages and number of farmers visited in the survey

Village Name	Frequency	Percent
Ahmad Nagar	15	18.75
Boorywala	15	18.75
Dharowal	10	12.50
Kot Bhawani Das	15	18.75
Pupnakha	15	18.75
Waraich Wala	10	12.50
Total	**80**	**100.0**

Table 3.2 shows the village names included in the survey. From tehsil Gujranwala, three villages were selected randomly which are:

- Kot Bhawani Das
- Pupnakha
- Waraich Wala

Similarly, from Wazirabad tehsil, three villages were selected randomly which are:

- Ahmad Nagar
- Boorywala
- Dharowal

List of all livestock farmers was prepared in each village. Only the small farmers who had cultivated land less than or equal to 12 acres were included in this survey. From Kot Bhawani Das and Pupnakha villages, 15 farmers from each village were selected by simple random sampling technique and interviewed. From Waraich Wala village of Gujranwala, 10 farmers having livestock were interviewed. About 40 farmers having livestock from Gujranwala tehsil were interviewed. Similarly, from Wazirabad tehsil, 40 farmers having livestock were interviewed. From Ahmad Nagar, Boorywala and Dharowal villages, 15, 15 and 10 farmers respectively were selected by simple random sampling technique.

Data were collected through a farm level survey of the target area using a pre-tested questionnaire. The information about all the management practices was included in the schedule. Such information like land use, involvement of labor employed and variable costs associated with dairy production were the part of questionnaire.

3.2 Socio Economic Characteristics

Socio Economic Characteristics determine the status of an individual. These socio economic characteristics may be very useful to enhance the incomes of different crops and livestock. For the purpose of the present study, following socio economic indicators were used:

3.2.1 Land Holding

It means total area on which a farmer performs various operations in order to get income. Dairy farmers were categorized on the basis of their land holding. The criteria used for this were only the small farmers who had their land less than or equal to 12 acres.

3.2.2 Herd Size

Herd size indicates the number of milk animals kept by the dairy farmer. It is one of the most important indicators, as size of the herd affects the nature of dairy business by changing the scale of enterprise.

3.2.3 Milch Animals

Buffaloes and cows were the main milch animals in the study area. Although goat and sheep were also present in that area but their representation in the incomes of the dairy farmers was negligible. So, onlys cow and buffaloes were considered as milch animals in this study.

3.2.4 Age of the Farmer

It plays a significant role on the extent and efficiency of farmer’s participation in different farm and nonfarm activities. In the present study the age was counted by the year.

3.2.5 Educational Status

Education is considered as one of the most important indicator which affects knowledge, attitude and prestige of an individual. By using their knowledge, farmers can significantly increase the profitability of crops and livestock. In the present study, education means years that have been spent in school or college for the acquisition of knowledge.

3.2.6 Farming Experience

It is also an important factor, which has an impact on the farm production and profitability. It tells us how wisely the resources are being utilized by the farmers on the basis of their past experience. This factor is also important in relation to the productivity and profitability of the farm.

3.2.7 Household Size

The labor which is involved in performing different farming operations is mostly taken from the farmer's family. Therefore, household size of the respondents has also considerable impact on the income of the farmers.

3.3 Estimation of Dairy Farm Costs

Milk production costs have been estimated by multiplying the quantity of inputs with the field prices of the inputs. Main costs incurred in milk production were labor cost, feed (fodder + concentrate) cost, veterinary care cost and breeding cost. Total variable cost was calculated by using the following formula

Total variable cost = Labor cost + Feed cost + Veterinary care cost + Breeding cost

Total expenditures on raising animals consisted of fixed and variable costs. Fixed costs included interest and depreciation on the value of the animals, sheds and equipments. Variable costs consisted of cost of green and dry fodders, concentrates, breeding, veterinary care and labor. The procedure adopted to calculate the costs, their income and source and the statistical techniques applied to obtain the end results were discussed as follows.

3.3.1 Fixed Costs

Fixed costs are those that do not change with the level of sales. If sales increase or decrease but nothing else changes then fixed costs remain the same. Fixed costs included interest rate and depreciation on the value of the animals, sheds and equipments.

(a) Interest and Depreciation on Capital

Interest and depreciation on the value of milch animals was as follows. Depreciation charges for milch animals were arrived at by taking the difference in their values at the beginning and that at the end of the year. Depreciation charges at the rate of 5.5% on the average value of the animal during the milking period were estimated. Interest charge at 6% on the maximum or minimum price of the animals was estimated (Ahmed, 1982). Thus, the depreciation and interest charge on the capital were excluded in this study due to their equality according to above reference and due to the respondents being small farmers. These fixed costs were not included in this study because all the farmers were small and they had no well equipped farms.

3.3.2 Variable Costs

Costs that change in proportion to sales are variable costs. Variable costs consisted of cost of green and dry fodders, concentrates, breeding, labor, etc.

(a) Labor Cost

Labor cost was included as family labor cost and permanent hired labor cost in that area. These costs were further divided on gender basis. For family labor, opportunity cost of family labor was taken as equal to the earning of a permanent hired labor. While, for permanent hired labor, the actual payment in cash and kind was taken. Per day labor cost for adult animals and young stock was calculated by:

Per day labor cost = total labor cost during a year / 365 days

Per day labor cost for adults = per day labor cost * 65 /100

Per day labor cost for young stocks = per day labor cost * 30 /100

Per day labor cost per adult animal = per day labor cost for adults / No. of adult animals

Per day labor cost per young stock = per day labor cost for young stocks / No. of young stocks

There are a 65: 30 ratios in lactating animals and young stock according to the utilization of total expenses. Generally, 65% of the feed costs for a dairy herd that raises it own replacements will be for the lactating animals, 30% for the heifers, and 5% for the dry animals. We suggest using the market value for homegrown feeds fed to livestock. Feed harvested by the lactating animals or heifers from pasture can be valued based on the value of hay. Using the market value will help give a clearer picture of the competitiveness of the dairy enterprise (Shoemaker *et al.* 2008).

(b) Fodder Cost

Feed costs included the cost of green fodders, dry fodders, concentrates, etc. Total fodder cost per animal was calculated after determining the green fodder and dry fodder costs for the following periods

- Abundant period (maximum availability of green and dry fodder)
- Scarcity period (less availability of the green and dry fodder)
- Dry period (minimum availability of green and dry fodder)

Total quantities of green fodder and dry fodder were calculated for the abundant, scarcity and dry period and multiplied by the price of that quantity with abundant season fodder (Barseem) and dry season fodder (Sorghum). In the dry period the average of two prices was used because the dry period included two dry months from each period Rabi and Kharif. Per day prices of green fodder and dry fodder for abundant, scarcity and dry period were multiplied by the lactation length to get total green fodder and dry fodder costs in abundant, scarcity and dry period for the whole lactation length for milk yielding buffalo and cow. To get the total fodder and forage cost for milk yielding buffalo and cow the costs of green fodder and dry fodder in abundant, scarcity and dry period were accumulated.

Per day fodder cost = total fodder cost during a year / 365 days
Per day fodder cost for adults = per day fodder cost * 65 /100
Per day fodder cost for young stocks = per day fodder cost * 30 / 100
Per day fodder cost per adult animal = per day fodder cost for adults / No. of adult animals
Per day fodder cost per young stock = per day fodder cost for young stocks / No. of young stock.

(c) Concentrate Feeding Cost

It included the value of concentrates given to milk animals. Concentrate feeding cost was calculated by adding the value of following concentrates given to dairy animals:

Oil Seed Cake, Choker, Vanda, Wheat Grains, Gur, Salt and Oil.

Quantity of concentrate feeding for each factor was calculated on daily basis. Then it was multiplied with 30 to calculate the quantity for whole month. Then it was multiplied with number of months for which concentrate was fed to dairy animals to calculate the total quantity of concentrate given. Total cost of concentrate feeding was calculated by multiplying the total quantity of each concentrate with its value. Similarly above formulas were used to calculate the per day concentrate feeding cost for adult wet animals only.

(d) Veterinary Care Cost

Veterinary cost incurred per milch animal consisted of following costs.

- Vaccination cost
- Treatment cost

Total annual veterinary cost was calculated as:

Total Veterinary care cost = (Vaccinations / Doses * Unit price) + (Treatment numbers * Unit price) + Veterinarian fees

Per day veterinary cost was calculated as:

Per day veterinary care cost = Total veterinary cost per year / 365 days

Per day veterinary care cost for adults = per veterinary care cost * 65 /100

Per day veterinary care cost for young stock = per day veterinary care cost * 30 / 100

Per day veterinary care cost per adult animal = per day veterinary care cost for adults / No. of adult animals

Per day veterinary care cost per young stock = per day veterinary care cost for young stock / No. of young stock.

(e) Breeding Cost

Breeding Cost consists of payments made while practicing the natural or artificial breeding of animals.

Breeding cost in cows was calculated as:

(Total services per conception in heifers * charges per service) + (Total services per conception in adults * charges per service)

Similarly, breeding cost in buffaloes was calculated as:

(Total services per conception in heifers * charges per service) + (Total services per conception in adults * charges per service)

Total Breeding Cost = Breeding cost in cows + Breeding cost in buffaloes

3.4 Estimation of Milk Production

The total milk production was calculated for the whole lactation length of milking animals (buffaloes and cows).

Milk productivity of each animal was calculated as:

- Milk productivity in 1^{st} quarter of lactation length
- Milk productivity in the 2^{nd} quarter of lactation length
- Milk productivity in the 3^{rd} quarter of lactation length
- Milk productivity in the 4^{th} quarter of lactation length

To calculate the total milk production for the whole lactation length, daily milk yield in each quarter was converted into month's yield in each quarter and milk productivities for each quarter were added up to get milk production for the whole lactation length for dairy animals.

The milk income was calculated as:

Income from cow milk = Daily production * Price per kg * No. of milking months

Income from buffalo milk = Daily production * Price per kg * No. of milking months

Total milk income = Income from cow milk + Income from buffalo milk

3.5 Cost of Milk Production

Cost of milk production per liter was calculated by using the following formula:

Cost of milk per kg = Total variable cost / Total milk production per year

Maqsood (1993) also calculated the per liter cost of milk according to the above mentioned method.

3.6 Marketable Surplus

Marketable surplus is the quantity of milk produced which is available for sale by dairy farmers after meeting their household needs. It affects the income of a dairy enterprise by changing the amount of revenue generated from the sale of milk. Marketable surplus of a dairy farm could be calculated as:

Marketable surplus = Quantity of milk produced – Quantity of milk consumed at home

3.7 Gross Income from Livestock

Gross income of each farmer was calculated by multiplying the total production of milk during the whole lactation length with the existing milk prices.

Gross livestock income = (Total income from milk) + (Income from the sale and purchase of the animals)

3.8 Gross Income from Crops

Gross income from each crop was determined by the following procedure:

Gross income = Total production of each crop * Price of one unit of output

Fodder and by product incomes were not included in the gross income of the crops because these were used by the animals of the farmers and were included as the expenditures of the feed cost of the animals.

3.9 Gross Farm Income

It is the sum of the gross income from crops and gross income from livestock

Farm income = Crop income + Livestock income

3.10 Share of livestock income in the total farm income

Share of livestock income in the total farm income was calculated as:

Share of livestock income = (gross livestock income / gross farm income) * 100

Regression analysis was applied to find out the impact of different factors causing variation in the farm income due to livestock income.

3.11 Estimation of factors causing variation in livestock income of the farmers

Regression analysis was applied to find the impact of different factors causing variation in dairy incomes of the farmers was calculated by using following equations:

Model:

$LnY = f(LnX_1, LnX_2, LnX_3, LnX_4, LnX_5)$

LnY = f (Ln feed cost, ln breed cost, Ln labor cost, Ln veterinary cost, Ln milk yield)

$LnY = \delta_o + \delta_1 LnX_1 + \delta_2 LnX2 + \delta_3 LnX_3 + \delta_4 LnX_4 + \delta_5 LnX_5$

Where:

Dependent Variable

LnY = Natural logarithm of the livestock income of the respondents (Rs.)

Independent Variables

$Ln(X_1)$ = Natural logarithm of feeding cost

$Ln(X_2)$ = Natural logarithm of breeding cost

$Ln(X_3)$ = Natural logarithm of labor cost

$Ln(X_4)$ = Natural logarithm of veterinart cost

$Ln(X_5)$ = Natural logarithm of milk yield

3.12 Estimation of the Losses due to Delayed Conception

Delayed conception is defined as an interval of more than 90 days postpartum before a cow or buffalo becomes pregnant again. Delayed conception is a common problem in heifers and lactating animals in Pakistan due to several reasons.

3.12.1 Voluntary waiting period

In this study, only those animals are selected whose conception is delayed, those who have got conceived after a number of services per conception after their voluntary waiting period of 90 days after parturation. The aim of the study is to calculate the economic losses due to delayed conception in dairy animals. For lactating animals, a voluntary waiting period of 90 days after postpartum is defined as the base line which is a reasonable index for reproductivity. The lactating animals should normally get conceived in this time frame after parturation. This time frame is known as the voluntary waiting period.

3.12.2 Age of Maturity

Age of maturity is a very important parameter of reproductive efficiency in heifers. Different studies have been done in this perspective. (Kumar, 2004) studied about the age of maturity in cows and buffaloes. He found that, the age of maturity in cows was 20 months and in buffaloes it was 24 months of age which seems a bit on lower side. Thereforw, in this study, as reportedly some workers age of maturity for cows has been considered as 30 months and 36 months for buffaloes due to our local environmental conditions.

3.12.3 Number of Days Delayed

Numbers of days delayed in heifers was counted from the age of maturity. First of all, the age of the heifer at the time of first heat sign was noted and then the month in which first service was done and then month of conception was noted after services per conception. In this way, the number of days delayed were counted in heifers. Similarly, in case of lactating animals, first heat sign after the voluntary waiting period was noted along with month in which first service was done. And then the month of conception was noted after services per conception having taken place after every 21 days.

3.12.4 Extra Feed Cost

The feeding system for lactating animals and heifers is based on the information provided by the farmers on daily basis according to 65:30% shares in the overall feeding cost associated with the animals as discussed earlier. The extra feed cost due to delay in conception was calculated as:

Extra feed cost = Number of days delayed * per day feeding cost of the animal

3.12.5 Value of Milk Loss

When calving to conception period extends beyond 90 days, lactation period also extends. The average extension has been recorded to be 0.7 of a day per day (Pasman, 1994). It is also to be noted that due to extension in calving interval, the current milk yield period also extends but the overall milk yield declines due to the delay in the initiation of the next lactation (Kafi *et al,* 2007).

Milk price used was according to the information given by the farmers regarding per kg milk price in their area. The milk loss due to delay in conception of animals was calculated by the following formula.

Milk loss (kg) = (minimum milk yield + maximum milk yield) / 2

This milk loss varied according to the health and feeding conditions of the animals. The quantity of milk lost was then multiplied by the milk price and number of days delayed in order to get the value of milk loss.

Value of milk loss = Quantity of milk lost (kg) * Unit milk price * Days delayed

3.12.6 Extra Labor Cost

Extra labor cost in heifers and lactating animals due to delayed conception was calculated as:

Extra labor cost in heifers = Number of days delayed * per day labor cost per heifer

Extra labor cost in adult animals = Number of days delayed * per day labor cost per adult animal

3.12.7 Extra Treatment Cost

Extra treatment cost in heifers and lactating animals was calculated as:

Extra Treatment Cost = Number of days delayed * per day treatment cost of the animal

3.12.8 Extra Breeding Cost

Extra breeding cost in heifers and lactating animals was calculated as:
Extra breeding cost = Number of services per conception * Price per service

3.12.9 Value of calf loss

The value of calf loss due to delayed conception was calculated as:
Value of calf loss = (calf birth weight + 300-400 gm weight gain per day * number of days delayed) * Market price of beef.

3.12.10 Total Loss due to Delayed Conception

Total loss due to delayed conception was calculated as:
Total Loss = Extra feed cost + Extra labor cost + Extra treatment cost + Extra breeding cost + Value of milk loss + Value of calf loss

3.12.11 Per Day Loss due to Delayed Conception

Per day loss = Total loss / Number of days delayed
An unplanned involuntary culling of the animals due to conception failure was not included in present calculations.

CHAPTER 4

RESULTS AND DISCUSSION

Analysis and interpretation of data are the most significant steps in any scientific research. Without these steps generality and predictions can not be made which is the objective of the research. The broad objectives of this study were to estimate the economic losses due to delayed conception in dairy animals. In this chapter an effort has been made to discuss, analyze and deduce relavent results in order to draw conclusions and devise suitable suggestions in the field of study. If adopted the suggestions, may be helpful in improving the reproductive performance of the animals in the universe of this study.

4.1 Socio-Economic Characteristics

4.1.1 Relationship between farming experience and DCAs of the farmers

Table 4.1 shows relationship between farming experience and total animals that had delayed conceptions (DCA). The respondents having farming experience of up to 10 years, they had 40% of the delayed conception animals (DCA). Those with 11-20 years of farming experience had 22.63% of delayed conception animals (DCA). Farmers with 21-30 years of farming experience possessed 18.95% of DCA. Similarly, farmers with more than 30 years of farming experience had 18.42% of DCA. This table shows that as the farming experience of the respondents increases, the percentage of the DCA proportionately decreases. Since experience of keeping dairy animals has a proven effect on the reproductive performance of their animals, especially in enhancing the conception rate of their buffaloes and cows.

Table 4.1: Distribution of the respondents according to their farming experience

Farming Experience	No. of farmers (%)	%age of animals delayed
Up to 10 years	45.0	40.00
11-20 years	17.5	22.63
21-30 years	20.0	18.95
More than 30 years	17.5	18.42
Total	100.0	100.0

4.1.2 Relationship between age and DCAs of the farmers

Table 4.2 shows the association of the age of the respondents with the percent of DCA in each age group. In age group of 21-30 years, 34.22% of the animals had delayed conception. With more than 50 years old farmers, the percentage of DCA's reduced to only 11.58. Since advancing age helps gain more experience thus the farmers can better take care of their animals, including the overall reproductive performance as well.

Table 4.2: Distribution of the respondents according to their age

Age	No. of farmers (%)	%age of animals delayed
21-30 years	13.75	34.22
31-40 years	21.25	22.10
41-50 years	32.50	32.10
More than 50 years	32.50	11.58
Total	100.0	100.0

4.1.3 Relationship between education level and DCAs of the farmers

Table 4.3 shows that education of farmers does have favourable effect on improving conception rate of their dairy animals. About one-fourth of the animals had delayed conception when their owners had no education, whereas the percentage of such animals was reduced to 13.68 due to their owners who were educated to intermediate level.

Table 4.3: Distribution of the respondent according to their education level

Education Level	No. of farmers (%)	%age of animals delayed
Illiterate	25.0	23.68
Primary	18.75	21.60
Middle	20.0	19.47
Matriculation	21.25	21.57
F.A	15.0	13.68
Total	100.0	100.0

4.1.4 Relationship between occupation and DCAs of the farmers

Table 4.4 indicates wether the respondents are involved full time in farming or they devote some time to other occupations. When full time is devoted to farming, certainly the reproductive performance of such animals would be much better. 90% of the respondents were devoting their time only in farming which was their major occupation also and they had 85.8% of the DCAs. 6.3% of the respondents were engaged in their jobs as well as in farming. 3.7% of the respondents were engaged in the business like having shops in the village and also spending their time in farming activities also.

Table 4.4: Distribution of the respondents according to their major occupation

Occupation	No. of farmers (%)	%age of animals delayed
Farming	90.0	85.8
Farming + Shopkeeper	3.7	4.2
Farming + Job	6.3	10.0
Total	100.0	100.0

4.1.5 Relationship between working time hours and DCAs of the farmers

Table 4.5 shows about the number of working hours spent in fields by the respondents. 88.75% of the respondents were spending 6-10 hours in their fields and they had 91.05% of the DCAs. 7.5% of the respondents spent up to 5 hours in their farming activities and had 5.79% of the DCAs.

Table 4.5: Distribution of the respondents according to their working time hours in farming

Working Time	No. of farmers (%)	%age of animals delayed
Up to 5 hrs	7.50	5.79
6-10 hrs	88.75	91.05
11-15 hrs	3.75	3.16
Total	80	100.0

While only 3.75% of the respondents were spending 11-15 hours in their fields having 3.16% of the DCAs. Most of the respondents were spending 6-10 hours in agricultural activities.

4.1.6 Relationship between family size and DCAs of the farmers

Table 4.6 shows about the family size of the respondent. 32.5% of the respondents had their family size of 5-10 members and they had 12.10% of the DCAs which is the least one. As the family size increases, the percentage of DCAs also proportionately increases. With lesser number of family members they can better take care of their animals including the overall reproductive performance as well. With more than 15 family members, the percentage of DCAs increased to 52.64.

Table 4.6: Distribution of the respondents according to their family size

Family Size	No. of farmers (%)	%age of animals delayed
5-10	32.5	12.10
11-15	55.0	35.26
More than 15	12.5	52.64
Total	100.0	100.0

4.2 Farm Size and Income

Table 4.7 shows the minimum and maximum farm size of the respondents. The minimum area of the respondent was 0.5 acres while maximum farm size area was 12 acres. The mean farm size area of the overall farmers was approximate 7 acres. Table 4.7 also shows the descriptive statistics of the gross crop income of the respondents per year. All the respondents had mean gross farm income Rs.412452 per year. The minimum gross farm income earned by the farmer was Rs. 28000 and maximum gross income earned from crops was Rs. 891000 per year.

Table 4.7: Farm size and total crop income of the respondents

Farm Size and income	Minimum	Maximum	Mean	Std. Deviation
Farm Size (acres)	.50	12	7.0	3.60
Per Year Crop Income (Rs.)	28000	891000	412452	257048.15

4.2.1 Cultivated area of the respondents

Table 4.8 indicates that as the cultivated area increases, the number of DCAs also increases proportionately. When cultivated area was up to 4 acres, the percentage of DCAs was only 8.95, which showed that farmers with small piece of land can better take care of their animals regarding conception as well as reproductive management. While on the other hand, 48.95% of the DCAs were in the group of 9-12 acres of cultivated land.

Table 4.8: Total Cultivated Area of the Respondent

Farm Area (acres)	No. of farmers (%)	%age of animals delayed
1-4	13.8	8.95
5-8	40.0	42.10
9-12	46.3	48.95
Total	80	100.0

4.3 Share of various crops in Farm Income

Table 4.9 shows about the crops sown by the farmers in that area and their share in total cultivated area and total farm income. The mean area sown by the rice crop was 5.419 acres which had a share of 73.81% in the total cultivated area of the farmer. The mean per acre output of the rice was 38.30 monds in that area having price of Rs.1015.62 per mond of the output. Mean output of rice of the farmers in that area was 213.437 monds. The share of rice crop income in the total farm income was 30.03%. In case of Rabi and Kharif Fodder, the mean area under rabi and kharif fodder was 1.3594 and 1.3656 acres of the farmer having 24.31% and 24.36% of share in the total cultivated area. The mean per acre output of the rabi and kharif fodder was 633.87 and 602.12 monds having price of Rs.52 and Rs.63.25 per mond of the output. Mean output of rabi and kharif fodder was 855.63 and 819.87 monds. The share of both Rabi and kharif fodder in the farm income is missing in the table because fodder revenue is not included in the farm income due to its use for the animals which is a cost at the part of livestock. There is a significant difference in the prices of the Rabi and kharif fodders because in kharif season there is the shortage of fodder due to which the prices of the fodder goes up while in Rabi season abundant quantity of fodder is available. In case of wheat crop, the mean area cultivated was 5.419 acres having 73.44% of share in the total cultivated area. Mean per acre output of wheat was 35.11 monds with mean price per mond of Rs.903.62. The mean output of wheat of the farmers was 190.45 monds. Share of wheat in the total farm income was 21.73%. For sugarcane crop, the mean area cultivated was 0.18 acres with 1.83% of share in the total cultivated area. Per acre output of sugarcane was 101.25 monds with a price of Rs.32.50 per mond. Share of sugarcane in total farm income was 2.30%. Similarly, the case for other crops is also shown in the table below.

Table 4.9: Cropping Pattern and Farm Income

Crops		Mean area (acres)	Share in total area (%)	Per acre output (monds)	Output (monds)	Price per mond (Rs.)	Share in total farm income (%)
Kharif Crops	**Rice**	5.419	73.81	38.30	213.44	1015.62	30.03
	Fodder	1.3656	24.36	602.12	819.87	63.25	-
Rabi Crops	**Wheat**	5.419	73.44	35.11	190.45	903.62	21.73
	Sugarcane	1.12	11.32	623.1	684.62	200	14.1
	Fodder	1.3594	24.31	633.87	855.63	52	-
Other		.044	0.42	3.75	6.25	7.50	0.25

4.4 Livestock Situation

4.4.1 Adult cows

Table 4.10 shows that out of 80 respondents, 56 respondents had adult cows in their herds. 25% of the respondents had two cows in their herd. 23.2% of the respondents had three cows in their herds. 21.4% of the respondents had 4 cows in their herds. 12.5% of the respondents had only one cow in their herds. 7.1% of the respondents had five cows. 5.4% of the respondents had six cows. 1.8% of the respondents had seven cows and 3.6% of the respondents had nine cows in their herds in the study area. Overall, 70% of the respondents had cows in their herds.

Table 4.10: Total Number of Adult Cows

No. of Adult Cows	No. of farmers	Percentage
1	7	12.5
2	14	25.0
3	13	23.2
4	12	21.4
5	4	7.1
6	3	5.4
7	1	1.8
9	2	3.6
Total	56	100.0

4.4.2 Cow heifers

Table 4.11 shows that out of 80 respondents, only 29 respondents had female cow heifers at their farm. Further, 75.9% of the respondents had only one female cow heifer in their herds. 13.8% of the respondents had two female cow heifers. 6.9% of the respondents had three cow heifers and 3.4% of the respondents had five female cow heifers in their herds in theat study area. Overall, 36.25% of the respondents had female cow heifers in their herds.

Table 4.11: Total Number of Cow Heifers

No. of Cow Heifers	No. of farmers	Percentage
1	22	75.9
2	4	13.8
3	2	6.9
5	1	3.4
Total	29	100.0

4.4.3 Adult buffaloes

Table 4.12 shows that out of 80 respondents, all the respondents had buffaloas in their herd. 21.3% of the respondents had only one buffalo in their herd. 17.5% of the respondents had three buffaloas in their herd at that time. 15% of the respondents had two buffaloas, 11.3% of the respondents had four and five number of buffaloas each, 10% of the respondents had six buffaloas in their herd. Similarly, 7.5%, 2.5% and 3.9% of the respondents had 7,8 and 9 buffaloas in their herd at that time respectively. 100% of the respondents had buffaloas in their herd.

Table 4.12: Total Number of Adult Buffaloes

No. of Adult Buffaloes	No. of farmers	Percentage
1	17	21.3
2	12	15.0
3	14	17.5
4	9	11.3
5	9	11.3
6	8	10.0
7	6	7.5
8	2	2.5
9	3	3.9
Total	80	100.0

4.4.4 Buffalo heifers

Table 4.13 shows that out of 80 respondents, 51 respondents had female buffalo heifer in their herds. In detail, 41.2% of the respondents had only one female buffalo heifer in their herds. 19.6% of the respondents had two heifers, 27.5% of the respondents had three buffalo female heifers, 7.8% of the respondents had four female buffalo heifers and 3.9% of the respondents had five number of female buffalo heifers in their herds in that study area. Overall, 63.75% of the respondents had female buffalo heifers in that area.

Table 4.13: Total Number of Buffalo Heifers

No. of Buffalo Heifers	No. of farmers	Percentage
1	21	41.2
2	10	19.6
3	14	27.5
4	4	7.8
5	2	3.9
Total	51	100.0

Table 4.14: Sale and Purchase of Animals during the Last Year (Rs.)

Sale and Purchase of Animals (Rs.)	Mean	Std. Deviation
Sale and Purchase of the Animals	91490.91	79991.926

Table 4.14 shows the descriptive statistics of the sale and purchase of the animals of the respondents during the last year. 68.75% of the respondents were involved in the sale and purchase of the animals. The minimum value of the sale and purchase of the animals is -81000 Rs. which shows that there were only purchases of the respondent occurred in the last year. The maximum value of the sale and purchase of the animals was Rs. 310000 which shows that sales of the animals were greater than purchases in the last year. The mean value of the sale and purchase of the animals during the last year by the respondents was Rs. 91490.91 out of 80 respondents, 55 of the respondents sold and purchased animals during last year which were 68.75% of all the respondents.

4.5 Labor used in Livestock production

Table 4.15 shows the composition of labor used for keeping livestock. There were two types of labor used found in the area. Most people had their family labor engaged in livestock raising. Of 80 respondents, 52 were using their family labor for the purpose, which were 65% of the overall respondents. The mean number of family labor used for livestock was 1.08 persons. The mean family labor hours spent for managing livestock were 8.79 hours per day with mean family wage rate of Rs. 170.83 per day in the study area. The mean family annual labor cost paid by the respondents was Rs. 66576.92. Similarly, of 80 respondents, 32 were using hired labor in livestock raising, which were 40% of the respondents in the area. The mean number of hired labor used for livestock was 1.03 persons. The mean hired labor hours spent for the purpose were 11.66 hours per day with mean hired labor wage rate of Rs.175 per day. The mean hired annual labor cost incurred by the respondent was Rs. 64875. The mean per day labor cost for adult animals was Rs.35.20 per animal. Similarly, per day labor cost for young stock was Rs.20.08 per animal in that area.

Table 4.15: Discriptive statistics of composition of labor used in livestock

Composition of Labor		Min	Max	Mean	Std. Dev.
Family Labor	Farmers having family labor	1	3	1.08	0.33
	Family labor hours per day	4	13	8.79	2.5
	Family labor wage per month (Rs.)	4000	6000	5125	803.6
	Family labor wage per day (Rs.)	133.33	200	170.83	26.78
	Family labor cost per year (Rs.)	24000	198000	66577	25100
Hired Labor	Farmers having hired labor	1	2	1.03	0.20
	Hired labor hours per day	10	14	11.66	1.3
	Hired labor wage per month (Rs.)	4000	7000	5250	783
	Hired labor wage per day (Rs.)	133.33	233.33	175	26.1
	Hired labor cost per year (Rs.)	48000	120000	64875	13753.1
Per day labor cost for adults		9	100	35.20	18.8
Per day labor cost for young stock		5	60	20.08	11.3

4.6 Variable Costs in Animal Rearing

Table 4.16 shows the different costs associated with livestock raising. First, the animals feeding cost is shown in the table. Minimum annual feeding cost was Rs. 42400, while the maximum feeding cost was Rs. 504300. The mean annual feeding cost was Rs. 240131. This was the total cost incurred by the farmer during whole the year for keeping livestock. Mean per day per animal feeding cost for the adult animals was Rs. 104. Similarly, per day per animal mean feeding cost for young stock was Rs. 48. The mean veterinary care cost incurred by the farmer for raising livestock for whole the year was Rs. 19330. Per day mean veterinary care cost associated with adult animals was Rs. 7.71, while the same for young stock was Rs. 3.50. Finally, mean annual breeding cost paid by the farmers was Rs. 2073.

Table 4.16: Discriptive statistics of animal's feeding, veterinary care and breeding costs

Costs (Rs.)	Minimum	Maximum	Mean	Std. Dev.
Per day feeding cost for adults	70	173	104	20.153
Per day feeding cost for young stock	0	100	48	27.642
Total animal feeding cost per year	42400	504300	240131	119959.621
Per day veterinary cost for adults	2	23	7.71	3.953
Per day veterinary cost for young stock	0	15	3.50	2.801
Total veterinary care cost per year	2400	60000	19330	15755.585
Total breeding cost per year	400	7200	2073	1317.984

4.7 Compostion of Dairy Animals at the Farm

Table 4.17 shows the status of the respondent regarding dairy animals. Fifty-six of the respondents had cows as given in the table below. The mean numbers of cows which a farmer had were 3.30 cows. Fifty-two of the respondents had wet cows, which were 92.85% of the cows. The mean number of wet cows kept by the farmers were 1.34 cows. In case of dry cows, 26.78% of the respondents had dry cows in their herds. The mean number of dry cows present in farmer's herd were 1.20 cows. The mean number of cow young stock kept by the farmer was 1.93, while mean number of cow sucklers kept by the farmer was 1.25. Similarly, 100% of the respondents had buffaloes in their herds. The mean number of buffaloas kept by the respondents in their herd was 6.99. All of the respondents had wet buffaloes in their herd in the area. The mean number of wet buffaloas kept by the farmer was 2.85, which were the main source of income and home milk consumption of the respondents. In case of dry buffaloes, 47.5% of the respondents had dry buffaloes in their herds. The mean number of dry buffaloas of the respondent was 1.61. The mean number of buffalo young stock kept by the farmer for raising purpose was 2.78, while mean number of buffalo sucklers kept by the respondent in their herd in the area was 2.41.

Table 4.17: Status of the Respondent having Dairy Animals

Dairy Animals		Number of Farmers	Min	Max	Mean	Std. Dev.
Cows	Cows	56	1	9	3.30	1.808
	Wet cows	52	1	3	1.34	.557
	Dry cows	15	1	3	1.20	.561
	Cow young stock	40	1	5	1.93	1.248
	Cow sucklers	20	1	3	1.25	.550
Buffaloes	Buffaloes	80	1	17	6.99	4.373
	Wet buffaloes	80	1	8	2.85	1.616
	Dry buffaloes	38	1	5	1.61	.946
	Buffalo young stock	60	1	7	2.78	1.574
	Buffaloes sucklers	34	1	6	2.41	1.395

4.8 Milk Production and Consumption

4.8.1 Milk production and consumption of cow

Table 4.18 shows the milk production of dairy cows, milk consumption and other related characteristics. The average daily cow milk production was 14.62 litres. The daily mean consumption of the cow milk was 3.404 litres. The mean marketable surplus was 11.21 litres per day per farmer. The average per liter price of cow milk was Rs. 34. The average lactation

Table 4.18: Cow Milk Production and Consumption of the Respondents

Milk Production and Consumption	Min	Max	Mean	Std. Deviation
Daily milk production (ltr)	6	36	14.62	6.96
Domestic consumption (ltr)	.0	10.0	3.40	2.28
Daily sale/ Marketable surplus (ltr)	.0	31.0	11.21	7.18
Milk price (Rs./ltr)	32	40	34	1.75
Average lactation period (months)	7	9	7.25	.519
Lactation period (days)	210	270	218	15.58
Total income from cow milk (Rs.)	44100	302400	108159	53376.74

period of cows was 7.25 months (218 days). The cows remained in milk for 217.50 days. The mean total income of the farmer from the cow milk was Rs. 108159 per farmer per lactation.

4.8.2 Milk production and consumption of buffalo

Table 4.19 shows that the average daily production of buffalo milk was 25.74 ltr/day. While the minimum was 6 ltr/day and maximum daily buffalo milk production was 64 ltr/day respectively. The mean domestic consumption of buffalo milk was 5.2 ltr/day. Average daily sale of buffalo milk was 20.6 ltr/day in those villages. The average per liter price of buffalo milk was Rs. 37 per litre. Average lactation period of buffalo was 7.14 months (214 days). Cow lactation period is a bit longer than that of buffalo.

Table 4.19: Buffalo Milk Production and Consumption of the Respondents

Milk Production and Consumption	Min	Max	Mean	Std. Deviation
Daily milk production (ltr)	6	64	25.74	14.025
Domestic consumption (ltr)	.0	16.0	5.2	3.1880
Daily sale/ Marketable surplus (ltr)	.0	59.0	20.6	14.1498
Milk price (Rs./ltr)	32	40	37	2.036
Average lactation period (months)	7.0	9.0	7.14	.3748
lactation period (days)	210	270	214	11.244
Total income from buffalo's milk (Rs.)	44100	480000	204048	114297.056

4.9 Cost of production of milk (per liter)

Table 4.20 shows the cost of production of per kg of cow’s milk. The mean cost of production of per kg milk of cow was Rs.26.77. Similarly, the mean cost of production of per kg of buffalo’s milk was Rs.30.12.

Table 4.20: Cost of production of cow and buffalo milk (per liter)

Cost of Production (PKR)	Mini	Maxi	Mean	Std. Deviation
Cost of per liter of cow milk	20.03	48.58	26.77	7.03418
Cost of per liter of buffalo milk	22.12	72.08	30.12	9.44941

The per liter cost of production of cow milk is lower than that of buffalo because the lactation period of cow is slightly higher than the buffalo. The feeding cost associated with the cows is lower than that of buffaloes.

4.10 Share of Livestock Income in Total farm Income

Table 4.21 indicates the annual farm income of the respondents, which is the sum of income from crop and livestock. The mean annual total livestock income of the respondents was Rs. 259762, while annual mean total farm income was Rs. 672214 respectively. The share of livestock income in the overall income of the farm was 48%.

Table 4.21: Share of livestock income in total farm income

Share	Minimum	Maximum	Mean	Std. Deviation
Total livestock incomce (Rs.)	58800	624750	259762	121343.794
Total farm income (Rs.)	95000	1209000	672214	298286.953
Share of livestock income in total farm income (%)	10.06	94.94	48	19.01827

4.11 Economic Losses due to Delayed Conception

4.11.1 Economic losses due to delayed conception of heifers

Table 4.22 shows the losses due to delayed conception in heifers. The mean number of services per conception in heifers weas 3.81. The mean days delayed from the age of maturity of the heifers to their conception were 198.8 days. This shows that for how many days, the heifers were conceived after recommended age of maturity. The mean extra feeding cost related to the number of days delayed (DD) was Rs. 11024.23. Similarly, mean extra labor cost due to days delayed was Rs.3731.46. Extra treatment cost associated with heifers due to days delayed was Rs.671 and extra breeding cost was Rs. 555.8. Milk loss of the heifers in the next lactation due to days delayed was 7.19 liters with mean value Rs.30932 associated with this milk loss. Value of calf loss was Rs.17219.7 for the mean DD. Per day Loss to the farmer due to delayed conception of heifers was Rs.292.8 and per day loss per heifer in that study area was Rs.212.52. While total loss in heifers suffered by the farmers due to mean DD was Rs.51978.2.

Table 4.22: Economic Losses due to Delayed Conception of Heifers

Loss (PKR)	Minimum	Maximum	Mean	Std. Deviation
Number of heifers delayed	1	4	1.62	.80
Services per conception (No.)	2	9	3.81	1.7
Extra feeding cost (Rs.)	902	51198	11024.23	10486.9
Extra labor cost (Rs.)	286	17066	3731.46	3745.7
Extra treatment cost (Rs.)	44	2226	671	585.6
Extra breeding cost (Rs.)	200	1300	555.8	308.0
Milk loss (ltrs)	3	22	7.19	4.81
Value of milk loss (Rs.)	4488	97944	30932	22430.2
Value of calf loss (Rs.)	5712	42602	17219.7	9618.5
Total loss (Rs.)	8752	123000	51978.2	33114.1
Days delayed (DD)	22	604	198.8	149.51
Per day loss of farmer (Rs.)	149.5	469.1	292.8	81.94
Per day loss per heifer (Rs.)	84.96	469.09	212.5	99.1
Per month loss per heifer (Rs.)	2548.8	14072.7	6375.8	-

Figure 4.1 shows the relationship between number of days open due to delayed conception and value of loss associated with the days open. There is an increasing trend in the figure. As the number of days open increases, the value of loss is also increasing. Loss value is the sum of the extra feeding cost, breeding cost, treatment cost, labor cost, milk loss value and calf loss value.

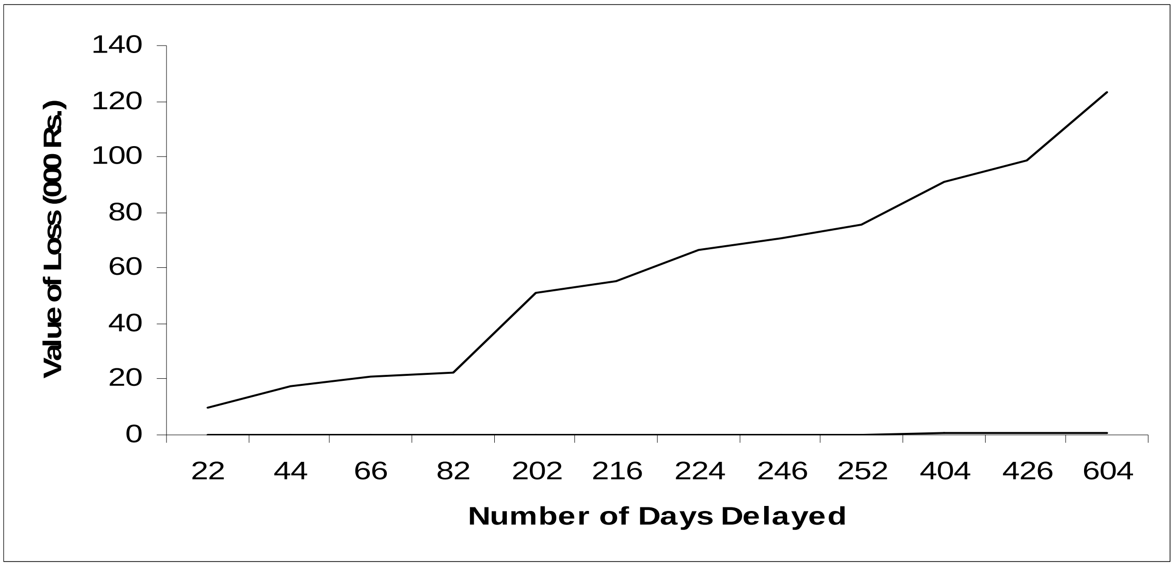

Figure 4.1: Delayed Conception Losses of Heifers Associated With Days Delayed

4.11.2 Economic losses due to delayed conception of lactating animals

Table 4.23 shows the losses due to delayed conception in lactating animals. The mean number of services per conception in lactating animals were 5.25. The mean number of days delayed after the 90 days recommended service period to the conception were 213.79 days. The mean extra feeding cost of the lactating animals associated with the farmers was Rs. 22891.1 for the mean number of DD. Similarly, extra labor cost due to DD was Rs. 7185. Extra treatment cost associated with animals due to DD was Rs. 1822 and extra breeding cost was Rs. 783. The mean milk loss of the farmers in the next lactation due to DD was 10.2 liters. The mean value of milk loss was Rs. 35608 per farmer. Mean value of calf loss was Rs. 24859.4. Per day Loss of the farmer due to delayed conception was Rs. 455.34 and per day loss per lactating animals in that study area was Rs. 261.1 per day. While total losses in lactating animals suffered by the farmers due to mean days open was Rs. 93147 per farmer.

Table 4.23: Economic Losses due to Delayed Conception of Lactating Animals

Loss (PKR)	Minimum	Maximum	Mean	Std. Deviation
Services per conception (No.)	2	12	5.25	2.366
Extra feeding cost (Rs.)	2156	103000	22891.1	19262.40974
Extra labor cost (Rs.)	792	49440	7185	7593.67810
Extra treatment cost (Rs.)	66	9888	1822	1791.69742
Extra breeding cost (Rs.)	150	2000	783	462.93307
Milk loss (ltrs)	4	25	10.2	4.34095
Value of milk loss (Rs.)	3630	138270	35608	25234.70976
Value of calf loss (Rs.)	5372	67932	24859.4	13123.70561
Total loss (Rs.)	13042	361400	93147	64443.041
Days delayed (DD)	22	860	214	159.26017
Per day loss (Rs.)	353	605	455.4	57.89104
Per day loss per animal (Rs.)	87.4	601.1	261.1	132.19876
Per month loss per animal (Rs.)	2622.9	18057	7833.71	-

Figure 4.2 shows the relationship between number of days open due to delayed conception and value of loss associated with the days open. There is an increasing trend in the figure. As the number of days open increases, the value of loss is also increasing. Loss value is the sum of the extra feeding cost, breeding cost, treatment cost, labor cost, milk loss value and calf loss value.

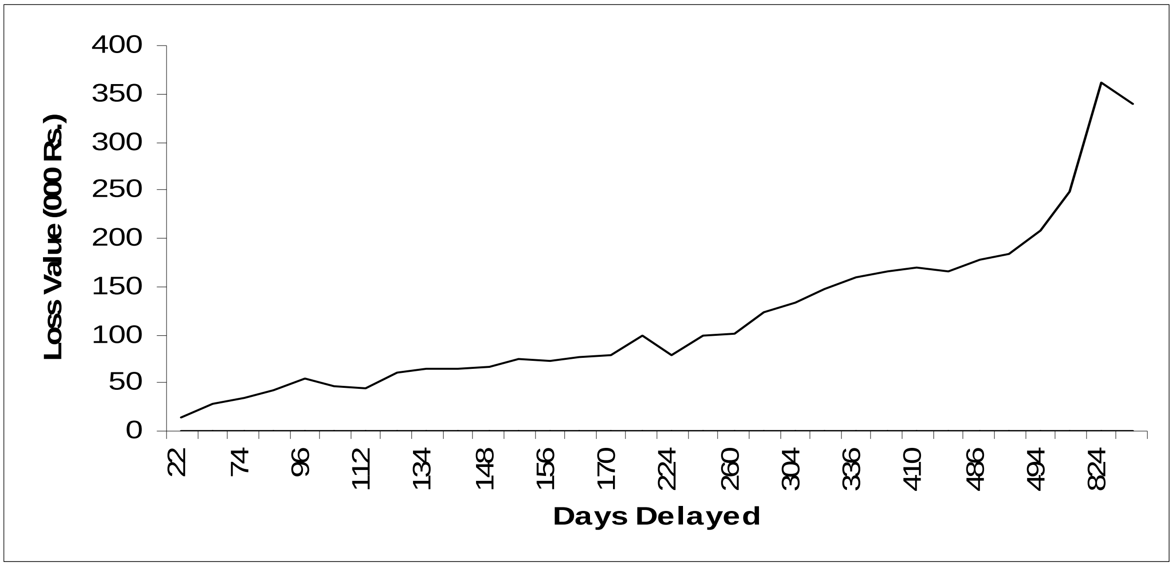

Figure 4.2: Delayed Conception Losses in Lactating Animals Associated With Days Delayed

4.12 Reasons for Delayed Conception (Farmer's Perceptions)

4.12.1 Reasons for Delayed Conception in Heifers

Table 4.24 shows the reasons for delayed conception in heifers. The major reason for delayed conception in heifers was poor feeding and 70% of the respondents reported that their animals were not fed up according to the requirements.

Table 4.24: Reasons for Delayed Conception in Heifers

Reasons	Number of Farmers	Percent
Poor Feeding	56	70
Diseased Condition	11	13.7
Poor Management	8	10.0
Inseminator Inefficiency	5	6.3
Total	80	100.0

After poor feeding the second most reason for delayed conception in heifers was diseased conditions and 13.7% of the respondents reported that their animals had many health problems. Animals were not healthy due to their genetics or some other diseases. Poor management was also a reason for delayed conception in the study area and 10% of the respondents reported that they had not too much resources in order to develop their farms according to the requirements of proper management. Inseminator inefficiency was also a critical reason and 6.3% of the respondents said that the inseminators were not trained and they used low quality semens.

4.12.2 Reasons for Delayed Conception in Lactating Animals

Table 4.25 shows the reasons for delayed conception in lactating animals. 42.5% of the respondents reported that the main problem for delayed conception in lactating animals was poor feeding. They were no fed up according to the given requirements due to financial constraints. 17.5% of the respondents give their answer of delayed in favor of diseased condition. 16.2% were in favor of the inefficiency of the inseminator. 10% said about the poor management. While 3.8% of the respondents said about the genetic problems in the animals that causes the delayed conception in animals.

Table 4.25: Reasons for Delayed Conception in Lactating Animals

Reasons	Number of Farmers	Percent
Poor Feeding	34	42.5
Diseased Condition	14	17.5
Poor Management	8	10.0
Heat Detection	11	13.8
Inseminator Inefficiency	13	16.2
Total	80	100.0

4.13 Factors causing variation in livestock income of the farmers

Regression analysis was applied to find out the impact of different factors causing variation in the farm income of the respondents regarding livestock. Results of the regression analysis are presented in the Table 4.26. Results reflect that the estimated livestock income is the function of the feeding cost, breeding cost, labor cost, veterinary cost and milk yield of the animals. Result shows that labor cost, veterinary cost and milk yield are statistically significant and have positive impacts on the farmer’s income from the livestock rearing. It means that any increase in these inputs would increase the farmer’s income.

Table 4.26: Coefficients of regression of the farmers

Variables	Coefficients	Std. Error	t-value	Significance
Constant	6.0466	0.8654	6.9869	0.0000
Ln (feed cost)	0.1027	0.0874	1.1748	0.2438
Ln (breed cost)	0.1149	0.0665	1.7278	0.0881
Ln (labor cost)	0.1951	0.0922	2.1163	0.0376
Ln (veterinary cost)	0.2398	0.0553	4.3355	0.0000
Ln (milk yield)	0.2193	0.1058	2.0720	0.0417
R^2	0.7395			
Adjusted R2	0.7219			
Std. Error	0.2856			
F Change	42.0222			

A one percent increase in labor cost, veterinary cost and milk yield would tend to increase the income by 0.19, 0.23 and 0.22 percent respectively. Labor cost has positive impact on livestock income because it directly affects the management of the dairy farm. As the number of laborers increase at the farm, the dairy farm would be managed in a proper way. When the management of the farm would be sured then the income from livestock also increases. Similarly, veterinary cost has also positive impact on livestock income due to the better health condition of the animals. Same was the case for milk yield. On the other hand, feed cost which includes the fodder and concentrate cost and breeding cost also has a positive impact on the livestock income but it is statistically insignificant.

4.14 Farmer's perception about dairy farming

Table 4.27 shows the farm related characteristics of the respondents. 98.8% of the respondents have no individual animal record in that area. All the farmers have their animals tied. There is no concept of free grazing for the animals. 98.8% of the respondents said that if animals are not tied, it has a positive impact on the health and productivity of the animals. While only 1.3% of the respondents stay against this statement. 53.8% of the respondents have no free access of water to their animals. They have to water their animals through buckets or some other sources.

Table 4.27: Farm Related Characteristics

Characteristics	Yes		No	
	Frequency	Percent	Frequency	Percent
Are animals tied?	100	100	0	0
If animals are not tied, it has positive impact on health and productivity	79	98.8	1	1.3
Free water access	37	46.3	43	58.7
Do you know that free water access contributes in productivity and health?	76	95	4	5
Have you farm fencing or not?	36	45	44	55
Farm has shed cooling system?	0	0	100	100
Have you taken dairy loan?	12	15	68	85
Do you visit any progressive/model livestock farm?	12	15	68	85
If you visit model farm, do you Follow model practices?	0	0	100	100

While 46.3% of the respondents has free water access to their animals. They have ponds at their farms in order to water their animals. 95% of the respondents said that free water access contributes to the health and productivity of the animals. While only 46.3% of the respondents were providing free water access to their animals. There are the respondents who put their answer against this statement; they are only 5% of the total respondents. 55% of the respondents have no farm fencing at their farm. They have open farms, no wall boundary, no fencing etc. while 45% of the respondents has farm fencing in that study area.There is no farmer in that area that has shed cooling system. The entire farms are made up on traditional basis. There are no as such equipments at their farms. 85% of the respondents are not taking dairy loan for their enterprise. Only 15% of the respondents are getting dairy loan from formal and informal ways. 85% of the respondents have never visited any progressive or model livestock farm in their area. They say that they have no need to go to their farms. Only 15% of the respondents have visited the model livestock farms. The farmers who have visited the model farms, they have not adopted the model farm practices due to financial constraints.

4.15 Reasons for not Visiting the Model Farm

Table 4.28 shows the reasons for not visiting any progressive or model livestock farm. 55% of the respondents gave the reason that model livestock farming is an expensive practice. 45% of the respondents had no interest in that activity due to financial constraints..

Table 4.28: Farm Related Characteristics: If you do not visit the model farm then give reason?

Reason	Number of Farmers	Percent
Expensive Practice	44	55.0
No Interest	36	45.0
Total	80	100.0

CHAPTER 5

SUMMARY AND SUGGESTIONS

5.1 Summary

The purpose of this study was to investigate the economic losses due to delayed conception in dairy animals, composition of labor in livestock, share of livestock income in the overall farm income and reasons for delayed conception of the small farmers in District Gujranwala of Punjab. Collection of primary data was done. It was a multi-crop area where wheat, rice and sugercane was grown and nearly all types of fodder varities were cultivated and fed to the animals. Two tehsils were selected and from each tehsil, three villaged were selected using simple random sampling technique. From each village farmers were selected by using simple random sampling technique.

Data was collected through a farm level survey of the target area using a pre-tested questionnaire. The information of all the management practices related to livestock was included in the questionnair. Information includes like variable costs associated with livestock, composition of labor, milk production, sale and purchase of the animals etc.

Only small farmers having less than or equal to 12 acres of land were interviewed in this survey. Average land holding of the farmers was 6.95 acres. Most of the farmers had the land size of 9-12 acres. Most of the farmers fall in the age group of 41-50 and above 50 years. In the age group of more than 50 years, the percentage of animals delayed was less than other age groups. In case of farming experience, most of the farmers had upto 10 years of farming experience. With the increase in the farming experience the animals delayed were less than the low farming experience. Most of the farmers were illiterate in that study area. Almost all the farmers were engaged in the farming activities but a few were engaged in jobs and business, such as shops in their houses for their daily income. Mostly farmers spent 6-10 hours were being spent in farm related activities. Most of the farmers had family size of 11-15 persons.

Out of total, only 56 of the respondents had cows. The mean numbers of cows were 3.30 cows. 52 of them were wet cows which were 92.85% of the overall cows. The mean wet cows kept by the farmer were 1.34 cows. 26.78% of the respondents had dry cows in their herds. The mean dry cows in farmer's herd were 1.20 cows. 71.42% of the farmers had cow young stock both males and females. The mean number of cow young stock was 1.93 young stocks per farmer. 35.71% of the respondents had cow suckers in their herds. The mean numbers of cow sucklers kept by the farmer were 1.25. Similarly, all of the respondents had buffaloes in their herds. The mean numbers of buffaloas kept by the respondents in their herd were 6.99 buffaloes. All of the respondents had wet buffaloes. The mean numbers of wet buffaloas kept by the farmers were 2.85 buffaloes which were the main source of income and home consumption of the respondents. 47.5% of the respondents had dry buffaloes in their herds. The mean numbers of dry buffaloas of the respondents were 1.61 buffaloes. 80% of the respondents had buffalo young stock in their herds. The mean number of buffalo young stock was 2.78 buffalo heifers of the farmers. Lastly, 42.5% of the respondents had buffalo young suckers in their herds. The mean numbers of buffalo sucklers kept by the respondents in their herd in that area were 2.41 suckers per farmer.

Average cow and buffalo milk production per day was 14.62 and 25.74 liters with average daily consuption of 3.40 and 5.163 liters. Average price of cow and buffalo milk was Rs.34 and Rs.36.86. Average lactation period for cow and buffalo was 217.50 and 214.31 days. The mean income of the farmer from the cow and buffalo milk was Rs.108158.65 and Rs.204048 during its lactation period. Average milk productivity was higher in case of buffaloes than cows. The share of livestock income in the total farm income was 48.48% which shows the importance of livestock sector in the farming system of the farmers. Mean cost of production of cow and buffalo milk was Rs.26.77 and Rs.30.11 per liter.

On an average per day loss due to delayed conception in heifers suffered by the farmer was Rs.292.81 with the average numbers of days delayed of 198.76. Mean services per conception in heifers were 3.81. Per day loss per heifer was Rs.212.52. In case of lactating animals, average per day loss per farmer due to delayed conception was Rs.455.34 with the average numbers of days delayed of 213.79. Mean services per conception in lactating animals were 5.25. Per day loss per lactating animal was Rs.261.12.

Main reason of delayed conception in heifers and lactating animals was only poor feeding. While inseminator inefficiency, disease conditions and heat detection problems had also been investigated in this survey. Similarly, other farm related characteristics were also mentioned in this study. The main cause for all these losses was poor management. They were following the traditional practices in order to rear their animals. They had no well equipped farms due to financial constraints. Credit availability was limited with complicated process that's why many farmers were refusing to avail this facility. Concentrates were fed up to the animals in limited quantity due to their high prices which those farmers can not bear after certain limit. The milk prices were not stable in that area. There was a lot of variability in milk prices due to which the milkmen were getting a greater portion of profit than farmers.

Regression results related facotrs causing variation in livestock income show that a one percent increase in labor cost, veterinary cost and milk yield would tend to increase the income by 0.19, 0.23 and 0.22 percent respectively and these factors are statistically significant. On the other hand, feed cost which includes the fodder and concentrate cost and breeding cost also has a positive impact on the livestock income but it is statistically insignificant.

5.2: Suggestions

- Different costs like labor cost, feeding cost, breeding cost and veterinary cost have a significant effect on the income of the farmers so there is a need to minimize these costs in order to get maximum revenue from the animals.

- Awareness must be created among the farmers regarding balanced rations and minerals in order to improve production as well as fertility.

- Livestock income is contributing a significant share in the income of the farmers in the current study area. So a core attention is needed to improve this sector by facilitating the basic needs and introducing better management practices.

- Farmers should be trained in order to detect the heat of the animal at the proper time with proper feed.

- In order to overcome the poor reproductive efficiency, the inseminator should be trained for insemination technique, semen handling and should be educated for semen selection.

- The habit among the farmers should be developed to maintain score cards which would assist the producer, planner and researcher in discerning the characteristics, fertility and performance of animals for future planning and improvement of production.

- Government should advise all scheduled banks to provide loan facilities to stock producers on low interest rate and easy installments in order to expand the livestock farming on scientific basis.

Literature Cited

Agarwal, O. and S. Chandra. 2000. A study of Milk Production Marketing Surplus and seasonal Variation in Price *The journal of Development studies*. XII-XII: 105-110.

Ahmed, B.1982. Cost of production Per Kg of Cow Milk on Small Farms in Khushab Zone. MS.c. (Hons) Thesis, Department of Agricultural Economics, University of Agriculture, Faisalabad, Pakistan.

Akhtar, M. 1999. Changes in the major food grain production in Bangladesh and their sources during the period from 1979/80 to 1998/99. *Bangladesh Journal of. Agricultural Economics,* 25: 1-16.

Anonymous, 2005. Dairy Herd Fertility Challenge Note C - The Cost of Extended Calving Intervals. CAFRE, 2005.

Anonymous, 2010. Reproductive Efficiency. Livestock and dairy development board, Pakistan (LDDB). http://lddb.org.pk/index.php?link=reintro.

Ansari-Lari, M., M. Kafi, M. Sokhtanlo, H. N. Ahmadi. 2010. Reproductive performance of Holstein dairy cows in Iran. *Tropical Animals Health and Production,* 42: 1277-1283.

Arbel, R., Y. Bigun, E. Ezra, H. Struman and D. Hojman. 2001. The effect of extended calving interval in high lactating cows in milk production and profitability. *Journal of Dairy Science,* 84: 600-608.

Bartlett, P. C., J. H. Kirk and E. C. Mather. 1986. Repeated insemination in Michigan Holstein-Friesian cattle: Incidence, descriptive epidemiology and estimated economic impact. *Journal of Theriogenology,* 26:309-322.

Beever, D. E. (2004). Opportunities to improve the performance and profitability of dairy farms through better nutrition. Knowledge Agriculture, Perspectives Towards a New Model of Milk Production, R Keenan & Co., Co Carlow, Ireland. 2004. pp. 6–8.

Beever, D. E. 2006. The impact of controlled nutrition during the dry period on dairy cow health, fertility and performance. *Animal Reproduction Science,* 96: 212-226.

Biffani, S., A. B. Samore, F. Canavesi and M. Marusi. 2003. Data quality assessment and preliminary investigations on fertility in the Italian Holstein Friesian. Interbull

Bulletin No. 30. Proceedings of the Interbull Technical Workshop. Beltsville, MD, USA. March 2-3, 2003. pp 89-95

Bilal, M. Q. 2004. Dairy farminr (an Urdu publication), Zaraii Digest Publication, University of Agriculture Faisalabad.

Boichard, D. 1990. Estimation of the economic value of conception rate in dairy cattle. Journal of Livestock Production Science, 24:187-204.

Burki, A. A., M. A. Khan and F. Bari. 2005. The State of Pakistan's Dairy Sector: An Assessment CMER Working Paper No. 5-34, Centre for Management and Economic Research, Lahore University of Management Sciences, Lahore.

Britt, J. H.1985. Enhanced reproduction and its economic implications. *Journal of Dairy Science,* 68:1585-1592.

Chagunda, M. G. G., E. W. Bruns, C. B. A. Wollny and H. M. King. 2004. Effect of milk yield-based selection on some reproductive traits of Holstein Friesian cows on large-scale dairy farms in Malawi. *Livestock Research for Rural Development,* 16: 55-62.

Chaudary, M. A. and A. J. Chaudary. 1992. Farming system and resources allocation ;use of liner programming model on small farm in Pakistan. *Journal of Rural Development. And Administration*. 24:18-29.

Chaudary, M. Z., R. E. McDdowells and S. K. Shah. 1997. Production and reproduction performance of three generations of Holsteinx sahiwal. Eleventh Annual report, Live stock production research institute, Bahadurnagar, Okara.

Coppock, C. E., R. W. Everett, R. P. Natzke and H.R. Ainslie. 1974. Effect of Dry Period Length on Holstein Milk Production and Selected Disorders at Parturition. *Journal of Dairy Science,* 57: 712-718.

DeVries and Conlin. 2003. Economic value of timely determination of unexpected decrease in detection of estrus using control charts. *Journal of Dairy Science,* 86: 3516-3526.

DeVries, A. 2004. Economics of Delayed Replacement When Cow Performance is Seasonal. *Journal of Dairy Science,* 87: 2947–2958.

DeVries, A. 2006. Determinants of the cost of days open in dairy cattle. Proceedings of the 11th International Symposium on Veterinary Epidemiology and Economics, 2006.

Dijkhuizen, A. A. 1984. Economic aspects of reproductive failure in dairy cattle. *Journal of Preventive Veterinary Medicine,* 3: 251-263.

Din, Z. U. 1984. Economics of livestock production in Dere Ismail Khan, Msc thesis, department of livestock management, faculty of Animal Husbandry, University of Agriculture Faisalabad.

Enevoldsen, C., and J. T. Sørensen. 1992. Effects of dry period length on clinical mastitis and other major clinical health disorders *Journal of Dairy Science,* 75: 1007-1014.

Erling, S., A. Pascal and Oltenacu. 1989. Economic Consequences of Different Calving Intervals. *Acta Agriculturae Scandinavica,* 39: 407-420.

Esslemont, R. J. 1992. Measuring dairy herd fertility. *Veterinary Record,* 131: 209-212.

Esslemont, R. J., and E. J. Peeler. 1993. The scope for raising margins in dairy herds by improving fertility and health. *British Veterinary Journal*, 149: 537-547.

Esslemont, R. J., M. A. Kossaibati, J. Allcock. 2000. Economics of fertility in dairy cows. *British society of animal science,* 26: 19-28.

Gill, G. S. and F. R. Allaire. 1976. Relationship of Age at First Calving, Days Open, Days Dry, and Herdlife to a Profit function for Dairy Cattle. *Journal of Dairy Science,* 59:1131-1139.

González-Recio, O., M.A. Pérez-Cabal and R. Alenda. 2003. Economic Value of Female Fertility and its Relationship with Profit in Spanish Dairy Cattle. *Journal of Dairy Science* , 87: 3053-3061.

Government of Pakistan (GOP) 2011. Economic Survey of Pakistan 2009-10, Finance Division Economic Advisor's wing, Islamabad.

Groenendaal, H. D., D. T. Galligan, H. A. Mulder. 2004. An economic spread sheet model to determine optimal breeding and replacement decisions for dairy cattle. *Journal of Dairy Science,* 87: 2146-2157.

Hare, E., H. D. Norman and J. R. Wright. 2006. Trends in calving ages and calving intervals for dairy cattle breeds in the United States. *Journal of Dairy Science*, 89:365-370.

Holmann, J., C. R. Shumway, W. Blake, B. Schwart and E. Max Sudweeks. 1983. Economic Value of Days Open for Holstein Cows of Alternative Milk Yields with Varying Calving Intervals. *Journal of Dairy Science,* 67: 636-643.

Inchaisri, C., R. Jorritsma, P. L. A. M. Vos, G. C. van der Weijden and H. Hogeveen. 2009. Economic consequences of reproductive performance in dairy cattle. *Journal of Theriogenology,* 74: 835-46.

James, A. D. and R. J. Esslemont. 1979. The economics of calving intervals. *British Society of Animal Science,* 29: 157-162.

Jansen, J., A. A. Dijkhuizen and J. Sol. 1987. Parameters to monitor dairy herd fertility and their relation to financial loss from reproductive failure. *Preventive Veterinary Medicine*, 4: 409-418.

Jones, L. B. 2000. Economic Consequences of Extending the Calving Intervals of Dairy Cows Treated With Recombinant Bovine Somatotropin. *British society of animal science,* 14: 11-17.

Joseph, C. and A. Amin. 2009. Heat Detection Accuracy and AI Technician Evaluation. *Western Dairy Management Conference,* 177-129.

Kadarmideen, H. N., R. Thompson, M. P. Coffey and M. A. Kossaibati. 2003. Genetic parameters and evaluations from single- and multiple-trait analysis of dairy cow fertility and milk production. *Livestock Production Science*, 81: 183-195.

Kafi, M., M. Zibaei, and Rahbari. 2007. Accuracy of oestrus detection in cows and its economic impact on Shiraz dairy farms. *Iranian Journal of Veterinary Research, University of Shiraz,* 8: 11-18.

Keown, J. F. and R. W. Everett. 1984. Effect of Days Carried Calf, Days Dry, and Weight of First Calf Heifers on Yield. *Journal of Dairy Science,* 69: 1891-1896.

Khalid, M. A. S., O. Gracia and T. Hemme. 2000 International comparativeness of small scale dairy farm in India / Pakistan. Institute of Farm economics, federal Agriculture research Centre (FAL), Bundesallee Braunschweing, Germany. www.pdffactory.com.

Khan, S., M. S. Qureshi, N. Ahmad, M. Amjed, F. R. Durrani and M. Younas. 2008. Effect of Pregnancy on Lactation Milk Value in Dairy Buffaloes. *Asian-Australian Journal of Animal Sciences,* 21: 523-531.

Kumar, P. and J. N. Gupta, 1988. Comparative cost of milk production from different species of milch animals in India. *Journal of Dairy Science*, 41: 411-419.

Kumar, S. 2004. Status of reproductive problems in Indian buffaloes and strategies for their management. Book: Buffalo Production under Different Climatic Regions. (S.S. Kundu, A.K. Misra and P.S. Pathak: Editors). First edition Lucknow, International Book Distributing Company.

Kulak, K.K., J.C.M. Dekkers, A.J. McAllister and A.J. Lee. Lifetime profitability measures for dairy cows and their relationships to lifetime performance traits. *Canadian Journal of Animal Science,* 77: 609-616.

Lee, J. and I. H. Kim. 2007. Pregnancy loss in dairy cows: the contributing factors, the effects on reproductive performance and the economic impact. *Journal of Veterinary Science,* 8:283-288.

Lineweaver, J. A. 1975. Potential income from increased reproductive efficiency. *Journal of Dairy Science,* 58: 780-787.

Louca, A. and J. E. Legates. 1967. Production Losses in Dairy Cattle Due to Days Open. *Journal of Dairy Science,* 51: 573-583.

Lucy, M. C. 2001. Reproductive Loss in High-Producing Dairy Cattle: Where Will It End? *Journal of Dairy Science,* 84: 1277-93.

Maqsood, M. 1993. Economics of Milk Production at various levels of livestock holdings in Okara District. Thesis. Department of Agricultural Economics, University of Agriculture, Faisalabad.

Mayne, C. S., M. A. McCoy1, W. J. McCaughey, D. R. Mackey, M. Verner, A. Gordon, B. W. Kennedy and F. J. Gordon. 2003. Dairy Herd Fertility - Examination of Effects of Increasing Genetic Merit And Other Herd Factors on Reproductive Performance. *Agri. Search,* 3: 1-20.

Nicholson, C. F., P. K. Thornton, L. Mohammed and R. W. Muinga. 1999. Small hold dairy technology in coastal kenya an adoption and impact study. ILRI, Nairobi, Kenya. Pp-49

Nieuwhof, G. J., R. L. Powell and H. D. Norman. 1989. Ages at Calving and Calving Intervals for Dairy Cattle in the United States. *Journal of Dairy Science,* 72: 685-692.

Olds, D., T. Cooper and F. A. Thrift. 1979. Effect of Days Open on Economic Aspects of Current Lactation. *Journal of Dairy Science,* 62: 1167-1170.

Olynk, N. J. and C. A. Wolf. 1991. Economic analysis of reproductive management strategies on US commercial dairy farms. *Journal of Dairy Science,* 10: 4082-4091

Österman, S. 2003. Extended calving interval and increased milking frequency in dairy cows: Effects on productivity and welfare. PhD thesis. Department of Animal Nutrition and Management, Swedish University of Agricultural Sciences, Uppsala, Sweden.

Oudah, E. Z. M., N. A. Shalaby and M. A. Mustafa. 2001. Genetic and non-genetic factors affecting days open, number of service per conception and age at first calving in a herd of Holstein-Friesian cattle. *Pakistan Journal of Biological Sciences*, 4: 740–744.

Overton, M. W. 2001. Stochastic modeling of different approaches to dairy cattle reproductive management. *Journal of Dairy Science,* 84: 268-278.

Overton, M. W. 2005. Dairy cattle reproduction: Measuring efficiency and economics. In: Proc. ABS Global and Balchem. *Western Dairy Management Conference* Symposium, 1-12.

Overton, M. W. 2008. Economics of dairy reproduction: An application of marginality. In: Reproduction for Profit and Success Pre-Conference Seminar, *American Association of Bovine Practitioners, Charlotte, NC.*

Pasman, E. J. 1994. The development of control prediction systems for milk yield and mastitis from field area. PhD Thesis. Department of Agriculture, The University of Reading.

Pardue, F. E. and J. A. Bertrand.1990 .Future Direction of the Dairy Industries in South Carolina. *Journal of Dairy Science*, 73;271-276.

Pelissier, C. L. 1976. Dairy cattle breeding problems and their consequences. *Journal of Theriogenology,* 6:575-583.

Plaizier, J. C. B., G. J. King, J. C. M. Dekkers and K. Lissemore. 1996. Estimation of Economic Values of Indices for Reproductive Performance in Dairy Herds Using Computer Simulation. *Journal of Dairy Science,* 80: 2775-2783.

Pryce, J. E., M. P. Coffey and S. Brotherstone. 2000. The genetic relationship between calving interval, body condition score and linear type and management traits in registered Holsteins. *Journal of Dairy Science*, 83: 2664–2671.

Royal, M. D., A. O. Darwash, A. P. F. Flint, R. Webb, J. A. Woolliams and G. E. Lamming. 2000. Declining fertility in dairy cattle:changes in traditional and endocrine parameters of fertility. *Journal of Animal Sciences,* 70:487-501.

Schaeffer, L. R., and C. R. Henderson 1972. Effects of Days Dry and Days Open on Holstein Milk Production. *Journal of Dairy Science*, 55:107-112

Schmidt, G. H. 1988. Effect of Length of Calving Intervals on Income Over Feed and Variable Costs. *Journal of Dairy Science*, 72: 1605-1611.

Seegers, H. 1994. A framework for animal health management. Vet. Res, 25: 165-173.

Seegers, H. 2006. Economics of the Reproductive Performance of Dairy Herds. World Buiatrics Congress, 2006.

Sewalem, A., F. Miglior, G. J. Kistemaker, P. Sullivan and B. J. Van Doormaal. 2008. Relationship between reproduction traits and functional longevity in Canadian dairy cattle. *Journal of Dairy Science*, 91: 1660–1668.

Shah, S., A. A. Dijkhuizen, A. H. Willemse and D. F. M. van de Wiel. 1991. Economic aspects of reproductive failure in dairy buffaloes of Pakistan. *Journal of Preventive Veterinary Medicine,* 11: 147-155.

Shah, D. 1992. Dairy Development as a mean of improving the nutritional status of rural poor. *Journal of Rural Development,* 11: 229-238.

Shoemaker, D., E. Maurice, D. Breece, J. Woodruff, D. Rader, D. Marrison. 2008. 15 Measures of Dairy Farm Competitiveness. The Ohio State University.

Sørensen, J.T. and S. Østergaard. 2003. Economic consequences of postponed first insemination of cows in a dairy cattle herd. *Livestock Production Science,* 79: 145-153.

Syed, H. K., M. Farooq, M. A. Mian, M. Syed and S. Jamal. 2003. Milk production performance and inter-relationship among traits of economic importance in buffaloes maintained at commercial dairy farms. Livest. Res. Rural Develop. 15(10).

Tailor, N. 1992. Forages and Livestock Production, pp. 273. Advent Book Publication, New York, USA.

Teufel, N. 1998. Village milk production in Pujab (Pakistan) GTZ: Vieh and Fisch, Eschborn<Germany: 1-13.

Niaz, S. 2010. Overview of Livestock Sector. Punjab board of investment and trade conference, 2010. www.pbit.gop.pk/.../0/.../livestock-sector-overview_mr-sudaif-niaz_pbit.pdf.

Waithaka, M. M., J. N. Nyangaga, A. W. Wokabi, D. Njubi, K. G. Muriuki, L. N. Njoragi and P. N. Wanjohi. 2002. Characteristics of dairy system in western Kenya region SDP collaborative research report MoARD/KARI/ILRI.pp73

Weller, J. I. and Y. Folman. 1990. Effects of calf value and reproductive management on optimum days to first breeding. *Journal of Dairy Science*, 73:1318-1326.

World Bank, 2010. Population growth (annual %). World development indicators.

http://data.worldbank.org/indicator/SP.POP.GROW.

Yusuf, M., T. Nakao, R. B. Ranasinghe, G. Gautam, S. T. Long, C. Yoshida, K. Koike, A. Hayashi. 2010. Reproductive performance of repeat breeders in dairy herds. *Journal of Theriogenology,* 73: 1220-1229.