A RETROSPECTIVE STUDY OF ARTIFICIAL INSEMINATION SUCCESS RATES AT KANYARIRI VETERINARY FARM

A project report submitted to University of Nairobi in partial fulfilment of Bachelor of Veterinary Medicine degree program.

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DECLARATION

This project is my original work and has not been presented for the award of a degree in any University

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ACKNOWLEDGEMENT

I wish to acknowledge Dr.Kipyegon for the advice and assistanceprovided during my research.My appreciation also goes to Dr.Abuom, the Veterinary farmmanager for allowing me research on his facility.I also acknowledge my family for financial support I was given and not forgetting my colleagues for giving me humble time for my write up and assistance.

GOD BLESS YOU ALL.

DEDICATION

I dedicate this document to farmers and trainers who would like to read and utilize the information thereof.

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ABSTRACT

Conception success rates of artificial insemination depend on the fertility of both the recipient and the male (semen), heat detection accuracy, handling of semen and insemination technique.

A 10 year retrospective study was carried out in the Kanyariri veterinary farm to establish AI success rates of the dairy cows and its effects on reproductive performance.

The study involved analysis ofthe Artificial Insemination records to determine the conception rates (Non-return rates) ofboth cows and heifers.

Data was stored in Microsoft excel and presented in tables and graphs. The success rates were compared between heifers and adult cows to determine the effects of age on AI success.

The findings of this study indicate/ suggest that conception rates are below the recommended levels therefore documentation of this information will be beneficial to the farm management.

The success of Artificial Insemination is subject to triad of factors involving the bull, semen collection and handling and the female factors and any break in either result in low success rates.

Artificial Insemination record keeping and regular analysis is very vital in herds that use AI as this gives early warning of the impending deviations of reproductive performance. A creation of

database of information on AI in large herds is both effective and efficient way of determining its success

CHAPTER ONE

1.0 Introduction

The ability of semen to be stored outside the body either chilled or cryopreserved has made artificial insemination to spread widely. The technique is more common in domesticated animals e.g. cattle, horses, sheep, goats, fowls, turkeys, pigs and dogs. It is widely used in cattle as the fertile period of the female is easily identified. AI has made importation of desired genetic materials from overseas affordable.

Perpetuation of certain desired genes from a particular sire has also received widespread use through artificial insemination (Wenkoff, 2003). Semen collection, handling and storing, to a great extent influence its viability and therefore the conception.

Documentation of artificial insemination success rates at Kanyariri veterinary farm gave precise reproductive performance and may be used to estimate the economicsignificance of artificial insemination services.

Justification;

Assessing the conception rates of dairy cows was important so as to provide a basis of decision making for reproduction and reproductive performance, and as such there was need to conduct this study which focused only on Artificial Insemination success rate for documentation.

It is recognized that the dairy industry has the potential to produce more if breeding performances are well documented and the recommended programs are followed.

1.1 OBJECTIVES;

1. To determine the conception rates of dairy cows in the farm between 2004 and 2014
2. To compare AI efficiency of both heifers and adult cows at the farm in the study period

CHAPTE TWO

2.0 Literature review

Artificial insemination is a reproductive technology that involves introduction of semen into the female reproductive tract in a way other than the natural method. It relies upon; sperm survival outside the body; the introduction of sperms into the female genital tract in a way that resultsin conception and the easily identifiable fertile period of the female (Wenkoff, 2003) and these have influenced the use of AI in domestic animals.

Spermatozoa after cryopreservation can be preserved indefinitely. AI has receivedwidespread use in cattle as compared to other species that do not meet the qualities above. AI regimes have been developed for most domestic species, cattle, sheep, goats, fowl, turkey, horses, pigs, fish and dogs. AI has helped to improve genetic make-up of domestic animals.

It has also increased the intensity of selection as about 1-3% of male progeny are selected to become sires of the next generation. It also allows rapid dissemination of new breedse.g in in United Kingdom, it was the main means of displacing indigenous British dairy breeds with Fresian breeds i.e it can be used to change the gene pool of a national herd rapidly.

Artificial insemination has the advantage of being both affordable and simple, for local distribution of extended room temperature, chilled or cryopreserved semen from small numbers of imported sires and is within the economic capabilities of even the poorest country.

Transmission of venereal diseases can be controlled through AI (Geofry et al., 1989). National Association of Animal Breeders hasestablished governing rules for member organization for the isolationand testing of bulls inorder to provide assurance that the semen is free from specific viral, bacterial and protozoal organisms (Mac Donald's *et al.,* 1984) but AI also can be a source of infection for venereal diseases (Roberts, 1986).Inbreeding can also occur if the sires and their progeny are not well recorded.

Detection of heat in the female oestrous cycle is the most problematic aspect of artificial insemination programs (Foote, 1996)

The value of AI as a rapid means of transmission of genes of superior sires has already been

identified but corresponding disadvantages can also exist for example dissemination of genetic faultsespecially the recessive traits like achondroplasia, transmitted as simple recessive gene,

(Marlowe,1964) and Spastic paresis, (Keith, 1981) in cattle.

The objective of Artificial Insemination was to deposit an adequate number of normal andmotile spermatozoa in the female tract so that they can reach the oocyte at the most appropriate time to ensure spermatozoa capacitation and subsequent fertilization.

The use of AI gives generally similar fertility to that achieved at natural service with a calving

rate to a simple insemination of around 50% (Barrets*et al.*, 1948). The true fertilization rate is

much higher than this around 90% but subsequent embryonic losses bring the apparent figure

to lower value, (Ayaton*et al.*, 1968). Therefore, the number of animals that fail to return, rather those that are thought to be pregnant is an overestimation of calving rate which is usable for monitoring fertility.

Unsatisfactory conception rates identified in a herd can arise from several possible causes that Includecow fertility, bull (semen) fertility, heat detection accuracy and insemination technique. Attest system for cattle has been developed to evaluate pregnancy results in relation to the AI Technique used, ovaries of cows inseminated 7-18 days previously palpated to determine which ovary has corpus luteum. This test does not affect pregnancy rate, as 46% of 116tested cows and42%of 110cows conceived, and palpation does not affect the interestrous interval in the non-pregnant cows,(Wenkoff, 1989). More corporalutealocated on the right ovary than on the left, 58.1:41.9 ratio. Pregnancy ratio therefore can be used as an indicator of herd's performance as this has the greatest economic significance in a dairy herd.

Regulation of artificial insemination in cattle varies from country to country but is under state control

CHAPTER 3

Materials and methods;

3.0 Study area

This study was carried out at Kanyariri veterinary farm, a three hundred and seventy five acre piece of land in Kanyariri village, four kilometreswest of Upper Kabete campus, University of Nairobi, nineteen kilometers from Nairobi city astride the Fort-Smith road. The farm had a herd of 196 dairy cattle, flock of Dorper sheep, a piggery unit and a layer poultry unit.

3.2 Study design

The reproduction records of dairy cattle were retrospectively analysed in the farm from the year 2004 to 2014.

The data was stored in a computer and files and was then analysed using graphs and tables

CHAPTER 4

4.0 Results

Table 1: No. of services/conception

AGE (YEARS)	NO.OF COWS	MEAN NUMBER OF SERVICES/CONCEPTION
10	3	2.93
9	7	2.93
8	5	2.18
7	22	2.68
6	14	2.42
5	10	3.54
4	18	2.33
3	3	5
2	2	2

Records of 84 cows were studied in thefarm between the years 2004 and 2014. The study involved two areas. One was taking the records of all the cows that were served in the farm in the above period and the second was grouping cows based on their ages from 2004 to 2014.

The records showed that there were three cows of ten years old,seven for nine years, five for eight years, twenty two for seven years, fourteen for six years, ten for five years, eighteen for four years, three for three years and two for two years.

The largest population was taken by cows of four to seven years, 76 % (64 cows out of 84).The average number of services per conception on each age group of cows was calculated andfound to be: 2.93, 2.18, 2.68, 2.42, 3.54, 2.33, 5 and 2 from 2004 to 2013 respectively.

Those that were born in 2013/2014 had no records since they have not yet reached the age of first service.

Table 2: percentage success rate at different services

YEAR	1^{ST} SERVICE	% S R	2ST SERVICE	% S R	>2 SERVICES	%SUCCESS RATE	TOTAL SERVED
2004	67	77.01	11	55	6	66.67	87
2005	94	80.34	9	39.13	11	78.57	117
2006	66	76.74	16	80	3	75	86
2007	68	73.91	13	54.17	11	100	92
2008	43	72.88	10	62.5	6	100	59
2009	40	70.16	9	52.94	5	62.5	57
2010	42	60.87	19	70.37	7	87.5	69
2011	52	68.42	20	83.33	4	100	76
2012	42	62.69	20	80	4	80	67

2013	43	70.49	9	50	9	100	61
2014	40	66.67	23	95.83	1	100	64
Average		70.93		65.75		86.39	

The number of cows served in the study period was recorded in the table above together with the calculated numbers of conceptions after the first, second and more than two services.

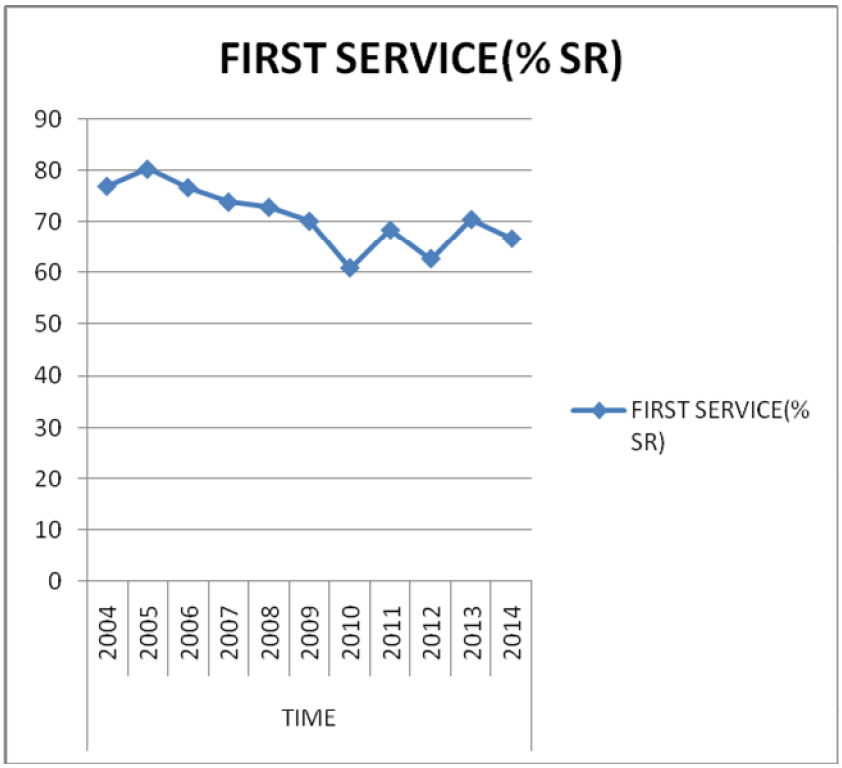
The average conception success rate for the entire period of study was found to be 70.93 % for those that conceived after being served once, 65.75 % that conceived after repeat service and 86.39 % conceived after being served more than two times.

Percentage success rate of cows that conceived after the first service was calculated by dividing the number of confirmed pregnancy by the total number of cows served in that particular year and multiplied by 100. For example, in the year 2004, 67 out of 87 cows served conceived on the first service, giving a percentage of 77.01 success rate.

Percentage success rate of cows that conceived after the second service was calculated by first obtaining the number of cows that conceived and dividing it by the total number of cows that failed to conceived on the first service for example in the year 2004, 20 cows failed to conceived on the first service (87-67) and 11 of them conceived on the second service, thus percentage success rate was 55,(11/20×100)

Percentage success rate of cows that conceived after the third or more services was calculated by first obtaining the number of cows that conceived and dividing it by the total number of cows that failed to conceive on the second service. For example in the year 2004,9 cows failed to conceived on the second service and out of this, 6 of them conceived after being repeatedly inseminated giving a success rate of 66.67% (6/9×100). Three cows in this year completely failed to conceive and were culled.

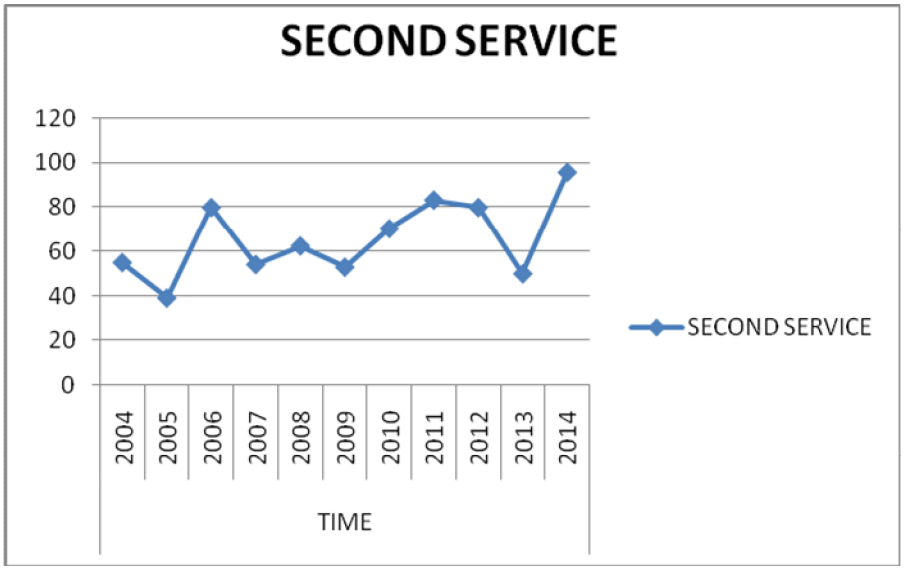
	TIME										
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
SECOND SERVICE	55	39.13	80	54.17	62.5	52.94	70.37	83.33	80	50	95.83



The above graphical representation of the number of cows that conceived on thefirst service showed gradual decrease of the success rate of Artificial Insemination in the farm. The recommended success rate on the first service should be more than 70% (Mac Donald, 2003) and this was met from the years 2004 to2009.

The success rate has been fluctuating from the year 2009 to 2014 ranging from 60-70%. The highest success was recorded in the year 2005 of 80.34% followed by agradual decrease over years to the lowest of 60.87% in 2010.

	TIME										
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
SECOND SERVICE	55	39.13	80	54.17	62.5	52.94	70.37	83.33	80	50	95.83

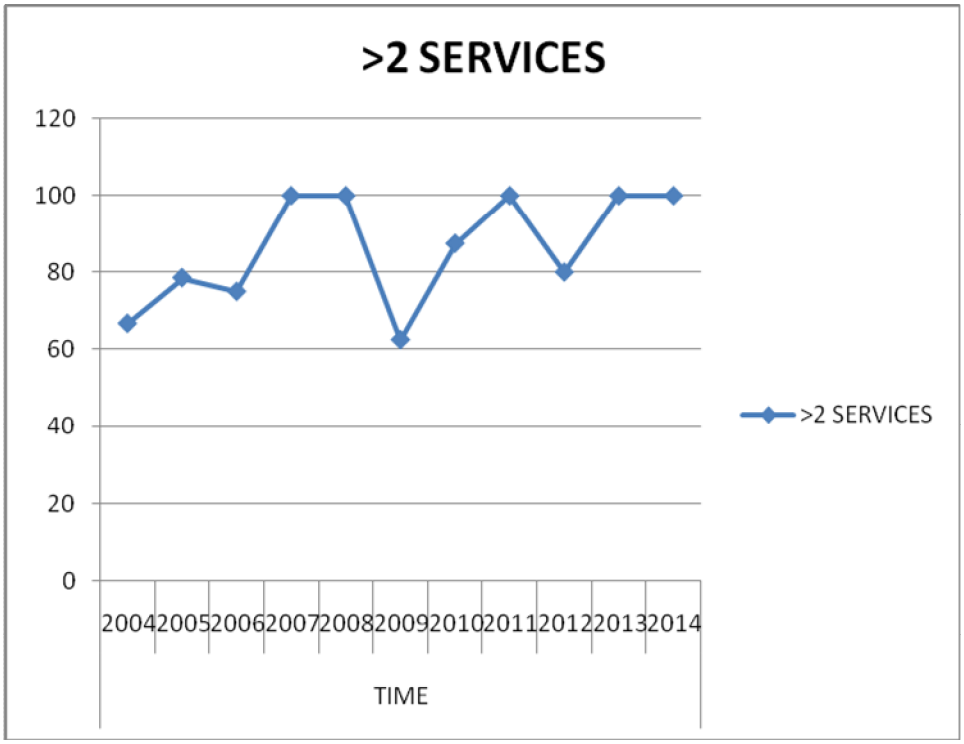


Graph 2

This graph shows the Artificial Insemination success rate after the second service. The graph is

irregular and unpredictable with the lowest rate recorded in the year 2005 of 39.13% and the highest rate of 95.83 in 2014. The recommended success rate on the second insemination should be greater than 80%(Wenkoff, 2003). This was met only in the years 2006, 2011, 2012and 2014, the rest, six years recorded lower success rates than the recommended

	TIME										
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
>2 SERVICES	66.7	78.57	75	100	100	62.5	87.5	100	80	100	100



Graph 3

This graph shows the Insemination success rate after more than two inseminations were given. The rates range from 60-100% with four years recording 100% and the rest of the years recording figures below the recommended success rate (of more than 90%) after more than two services.

The lowest rate was in the year 2009 of 62.50% while the highest were in the years 2007, 2011, 2013 and 2014 of 100%.

The low success rate was brought about by the failure of some cows to conceive even after several services that lowered the total success rate and they had to be culled.

The average conception rate of cows based on age was also calculated and was found to be 34.8, 46.16, 41.58, 49.82, 41.19, 47.17, 44.27, 20 and 20 percentages from those born in 2004 to those of 2012 respectively.

4.1 Discussion

If cows are cycling normally, the factor that causes most failures is the problem of detecting cows on heat (Smith et al., 1986). In well managed program, the conception rate of about 70 % (Wenkoff, 2003) can be achieved at first insemination, about 85% at the second and more than 90% at third insemination. For example, if 95% of animals are accurately detected in heat and bred at the appropriate time and the fertility level of the herd is 70% (first service conception rate) then 67 of 100 heifers will become pregnant. If, however, only 50% of the animals are properly detected as in estrus, only 35 of 100 heifers will become pregnant (Mac Donald et al., 2003).

In this study, conception rates are low on older cows, ten years, 34.80 % and also on heifers, two years, 20 %.

A study byNygaard, 1997 showed that one fixed AI at a synchronized ovulation provided similar pregnancy rates as per AI as did AI following A.M/P.M rule after estrus had been induced by prostaglandin F2 alpha in lactating cows, but the fixed AI was not effective for heifers because of the lack of synchronization. Evaluation of serum progesterone concentration at each hormonal injection indicated that the first injection of GnRH synchronized luteal function in dairy lactating cows but not in heifers.

Kumar and Bhat (1979) noted that Haryama heifers needed more services per conception than cows.

Higher producing dairy cows have reduced expression and duration of estrus (Lopez et al., 2004) which is exacerbated by poor estrus detection by personnel, especially in large herds. An inverse relationship between milk yield and reproductive performance has been documented (Washburn et al., 2002)

For successful AI program, cows/heifers should be cycling normally and have no reproductive abnormalities and cows preferably had one heat since calving and of good plane of nutrition.

Cows that have just calved for the first time at two years are under stress coping with lactation and are still growing and therefore register low success rates.

The conception rates achieved from AI in cows or heifers comparing the use of natural occurring heat and those induced by hormonal intervention/synchronized heat should be the same if insemination procedure is adhered to.

Regardless of how well planned the IA program is, if the animals are not detected in estrus and inseminated at the proper time (Edwards et al., 1980), it just does not work. Cows come on estrus every 21 days and heat last for 18 hours in cows and 6-12 hours in heifers. The best time to inseminate cows is 12-24 hours after the onset of heat as they ovulate 28-32 hours after the onset of estrus (Trimberger, 1948; Walker et al., 1996), cows first seen in estrus in the morning are inseminated in the evening and those first seen in the evening inseminated the following morning. However research with large number of cows indicates that maximum conception rates may not be achieved using the a.m/p.m rule (Foote, 1979). Research from Virginia suggests that cows should be bred earlier than the a.m/p.m rule, since highest conception rates for AI occurred 4 to 12 hours after the onset of estrus (Dransfield et al., 1998). Cows inseminated 16 hours after

the onset of estrus had lower conception rates than cows bred between 4 and 12 hours after the onset of estrus.

The viable lifespan of a sperm in the reproductive tract is estimated to be 24 to 30 hours (Trimberger, 1948). To achieve maximum sperm viability, straws must be properly thawed and protected from sunlight (Aamdal J, 1960).

Artificial Insemination success rates below the recommended values show that there is a problem with either semen quality or handling, inappropriate nutrition, incorrect AI technique or reproductive diseases (Sprott, 1998).

Number of services per conception (NSC) depends largely on the breeding system used. It is higher under uncontrolled natural breeding and low where hand-mating or AI is used. A range of greater than 2.0 should be regarded as poor and can be contributed by season, lactation length, milk yield and placental expulsion (Choudheri et al., 1984)

CHAPTER 5

5.0 CONCLUSION

Artificial Insemination being the most widely used in cattle requires a well documentation and record keeping. The success of AI depends on several factors including the method of collection and handling of semen, storage, accuracy of heat detection and reporting, technique of insemination as well as the health of the cow inseminated. Infectious diseases especially those that affect the reproductive system provide harsh uterine conditions leading to failure of fertilization/conception. Pregnancy is a function of both successful service and conception. Correct timing of services is easily manipulated by implementing estrus or ovulation synchronization protocols.

In bovine diseases like Trichomoniasis and campylobacteriosis (Wenkoff, 2003) cause early embryonic death and the cow return to estrus but in days slightly longer than the normal 21 days.

5.1 RECOMMENDATION

Record keeping was actually below standard as they were poorly entered and therefore recovery was a problem. I therefore recommend a better way of data storage especially computerized to ease entering and retrieval and this also would give early warning on the impeding deviation of reproductive performance or disease prevalence from the set targets and goals. Proper and strict culling procedures should also be followed to the later as this affects the general success rates of Artificial Insemination.

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