Study on the adaptation of Artificial Insemination Techniques in Batticaloa District Sri Lanka

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Abstract

Tremendous level of productivity of dairying has been successfully achieved using technologies like Artificial Insemination (AI). Sri Lanka is one of the tropical countries consisting sufficient land in its most of the Dry Zone where the peak population of cattle and buffalo contributed to the production performance is still below their potential. Therefore, this study was carried out in Batticaloa District in order to understand the efficiency on AI.

A pre-structured questionnaire was developed to find out the significant relationship among the variables which are directly linked to the efficiency on AI and data at the veterinary offices and collected data were analyzed using SPSS (version 22) software and interpreted. At the study location, non-descriptive local breeds (90.42%) were reared more while comparing with the Indian (6.13%) and European Crosses (3.45%) where mean ± SD of the environmental temperature and relative humidity were 28.12 ± 2.08 $^{\circ}$C and 77.29 ± 5.64%, respectively. In addition, majority of the farmers (46-55 years) were with the Primary Level of Education (52.7%) and their income level (p<0.01, r=0.893) was optimal in livestock sector while enrolling it in full time basis. Further, 59.3% of the farms were solely devoted to cattle rearing and depicted towards the draft purposes (12%) and house hold needs (28.7%). Approximately, 69.3% of the farmers utilized AI services where rearing system was mainly Intensive and Extensive with the respective value of 30.7% and 50%. However, 81.3% of the total respondents who adapt AI were not with much awareness on adapting sexed semen where only 18.7% have adapted it previously. Around 55% of the breeds are Sahiwal and its Crosses and there was a negative significant relationship obtained between the success rate of AI and European Crosses (p<0.01, r = 0.747), as well. In sum, Success Rate was positively correlated with the experience (p<0.01, r = 0.486) and literacy (p<0.01, r = 0.814) of the AI Technician. It was confirmed that the Breed of Sahiwal (p<0.01, r = 0.543) reared under the Intensive System (p<0.01, r = 0.589) showed a positive significant relationship with the success rate. However, relationship was negative (p<0.01) with the number of cattle available in the extensive systems which led to the poor performance (p<0.01, r = 0.877) in AI. In conclusion, ANOVA test for perception revealed the positive significant relationship with the adaptation of AI Techniques (p<0.01, r = 0.747). However, these conditions are below the potential of AI at Dry Zone where further enhancement, consideration and training are needed to reach high success rates.

Key words: Artificial Insemination, dry zone, Batticaloa district, Dairy cattle, sexed semen, Success rate

1. Introduction

Livestock plays a substantial role in the economic, social and the cultural values of Sri Lanka where it takes part the greatest head role to the households' income and food needs to the growing population of the country. And also, the country's population has reached around 21.8 million (Department of Census and Statistics, 2018) where the supplementation of food products mainly by milk and milk by products from the livestock is in concern, as well. The population of cattle and buffalo in Sri Lanka is 1,086,110 and 298430, respectively where the cattle contribute more on the socio- economic status of the individuals than the buffalo do. It could be seen that the livestock is highly utilized for food such as milk, milk by products, meat and agricultural purposes (draft power by buffalo) with the availability on each part of the country. Further, the annual milk production of Sri Lanka is reached approximately 31, 167, 996 and 6, 130, 530 liters for cattle and buffalo, respectively (Department of Census and Statistics, 2019) where the percapita availability is 45.16 kg/ year and 1.55 kg/year with the respective status of milk and milk by products and beef production within the country.

Moreover, the above-mentioned values are supported with the export and import marketing nature of the country for the foreign exchange where the National GDP is in vital concern. Milk and milk products (595, 063 kg) and beef and beef products (79, 969 kg) are exported to the foreign countries, simultaneously importing also occurs. While considering imports, around 71, 026, 843 kg and 36, 107 kg, milk and milk products and beef and beef products, respectively are being imported from the other countries (Department of Animal Production and Health, 2018). However, among the many other reasons for imports and dependency on the other countries: availability of land for the agricultural activities is quite lower than the other sectors such as industries and institutes in Sri Lanka. Among the total, 30% of the land belongs to the agricultural activities and also, among the 30% of the agricultural land: 70% is solely devoted to the crop production. The remainder consists of a mixture of crops and livestock where a very small proportion of the farmland is solely dedicated to the livestock production. It is also the reason for the very less contribution of the livestock sector to the National GDP (1.2%), in Sri Lanka (Department of Census and Statistics, 2018/19). Therefore, the needs are higher to promote the livestock sector towards the highest production (milk) in Sri Lanka. Further, the right improvement of livestock sector includes the identification of location where the density of cattle and buffalo population is higher and the newly adapted techniques are considerably higher to utilize the available resources in a confined area, as well. According to the reports from the Agriculture and Environment Statistic Division (2015), livestock population density is higher in the District of Kurunegala, Anuradhapura, Ampara, Batticaloa, Jaffna, Puttalam, Trincomalee, Badulla, etc., with the distributional value of 106470, 97580, 95140, 75700, 62800, 60720, 50310, 49230, respectively where other districts' values are considerably lower in number (<46,000).

According to the previous studies, results revealed that the number of cattle is considerably higher in Dry Zone of the country where the topographical features are highly fitted with the indigenous cattle for their survival in most of the Dry Zone of Sri Lanka. Commonly, dry low lands fall under the elevation of <450 m and with the precipitation of 100- 1750 mm. Not only that the temperature is slightly higher (21- 38 Degree Celsius) while comparing with the other part of the country. And also, indigenous cattle, zebu cattle and their crosses and buffalo are reared under the free grazing systems, large nomadic herds, and sedentary small herds in irrigated schemes with the tremendous availability of grazing lands for cattle and buffalo. However, the average daily milk production is higher in Up Country than the other production systems of Sri Lanka even the land availability is higher in other systems of the country. Based on the management systems; Hill Country, Mid Country, Coconut Triangle, Low Country Wet Zone are practiced with Intensive, Semi-Intensive, Tethered and Tethered, respectively while the Low Country Dry Zone is practiced with the Extensive Systems. Therefore, the factors which contribute more on the production

performance of the animal are not based on the land availability for the grazing. There would be some other reasons (Breeding Nature) for the production attributes in both cattle and buffalo.

1.1 Scope of the study

And also, the breeds which are chosen for the production criteria, is an essential issue for the best production performance in the country. According to that, exotic breeds are adopted to incorporate in dairy herd composition in all four sectors where exotic cross breeds are common based on the climatic conditions, except in the Dry Zone. And also, the climatic conditions are also well suited with the livestock production in the all four sectors and the Dry Zone is less beneficial in climatic aspects too. However, it can be promoted with the best management practices within the confined area (Intensive System) with the suitable breeding techniques with the exotic characteristics, as well. When the management practices are well fitted with the livestock sectors, which is ultimately same as in every rearing system Animal Factors should be enhanced in order to gain the peak in its performance.

Since much investment has been made intensively in the dairy sector to improve the productivity, genetic upgrading of local cattle and buffaloes have been considered a lot in order to have the local contribution in the dairy sector. Therefore, both natural breeding and artificial insemination were used as means of implementing the breeding policy but the latter strategy was pursued vigorously over the former, particularly in the recent past. Even after 50 years of consistent efforts, the institutions responsible for implementing genetic upgrading of cattle and buffaloes have been able to reach only a part of the national population, particularly in the wet zone and to a limited extent in the intermediate zone, leaving the larger portion of the dry zone relatively untouched (Abeygunawardena, 1998). Approximately, 60% of the cattle in the dry zone produce 45% of the total cow's milk, whereas in the wet zone 20% of the cattle produce 40% of the milk and in the intermediate zone 19% of the cattle produce 15% of the milk (MLDRI, 1995).

The recent reduction in the cattle population may become a serious constraint for future dairy development in the country (Department of Animal Production and Health 1999). Cattle breeding has been recognized as a critical issue for the dairy sector (MLDRI, 1995) with many programs and schemes implemented during the last few decades. However, the expected improvements have not yet been seen. Consequently, these issues need to be examined more carefully to see how these programmes can be made more effective (Ibrahim *et al.,* 1999). Based on the fact that the vast majority of the cattle population is concentrated in the dry zone of Sri Lanka and though there has been implementation of breeding programmes to upgrade the cattle population in this zone, there has been no significant improvement in the production potential of the animals, an attempt is going to be made to study the breeding activities and adoption of artificial insemination in the dry zone, of Sri Lanka.

Among the areas consisted into the Dry Zone, Batticaloa is one of the districts located in the Eastern Region of the country where the cattle population and the adaptation of the improved livestock scheme is predominantly higher. Among the three Districts named as Ampara, Batticaloa and Trincomalee, livestock density is higher in Ampara followed by the Batticaloa District. However, the cultural and livelihood expectations via the cattle are dominated in the Batticaloa District. Moreover, the Divisional Veterinary Divisions are higher in Ampara (19) followed by Batticaloa (15) and Trincomalee (11) Districts. However, the number of farms raised for the cattle rearing is higher in Batticaloa District (8,731) than the Ampara (8,702) and Trincomalee (6,129) (Department of Census and Statistics, 2018). Based on the farm size and number, Batticaloa District is chosen for the current study, in order to develop a better strategy for the future enhancement through the AI Techniques, in Sri Lanka. Therefore, this present study is going to be undertaken, in order to determine the coverage and performance of AI at different veterinary levels in the

Batticaloa District and the success rate and factors affecting the success rate of AI Techniques in the Dry Zone are especially focused in Batticaloa District. Further, the objective is going to be designed to implement remedial measures and/or determine future studies necessary to improve the efficiency of AI services, at the study location.

1.2 Objectives of the study

With those above backgrounds, present study was formulated in order to:

1. To determine the coverage and performance of AI at different veterinary levels in the Batticaloa District.

2. To calculate the success rate and the factors influencing on the AI Techniques in Batticaloa District, Sri Lanka.

3. To understand the prevalence of Sex-Semen adaptation and the factors influencing on AI techniques at the study location.

4. To formulate the future studies in order to minimize the gap between Wet and Dry Zones of the country.

2. Materials and Methods

Present study was carried out in order to have the better understanding on the present status of the Artificial Insemination Technique prevailed in the Batticaloa District, Sri Lanka.

2.1 Location of the study

A baseline study was conducted with the farming families who rear livestock as their one of the main incomes generating sources in Batticaloa District in order to find out the usage of artificial insemination techniques with the support of frozen semen and sexed semen.

Based on the preliminary data, three (3) Veterinary Ranges named as Batticaloa, Chenkalady and Karadiyanaru were selected out of the 15 Veterinary Services (VS) Ranges (Vaharai, Rithithenna, Oddamavady, Valaichenai, Kiran, Chenkalady, Karadiyanaru, Eravur, Batticaloa, Vavunathevu, Kattankudy, Arayampathy, Kokkaddicholai, Thumpankerny and Kaluwanchikudy) for the study which are dominant in the livestock farming in terms of intensive farming system, semi intensive and extensive farming nature with the adaptation of AI and production, as well.

2.2 Data Collection

At the current study, primary and secondary data were collected from the selected Veterinary Ranges for the further concern.

2.2.1 Primary Data Collection

A semi-structured questionnaire was designed based on five sections. The first section supposed with the personal and demographic information such as Gender, Age, Education, Income and nature and

type of farming activities, etc. The second section was used to collect the information on farms where the management factors (farming system, nature of rearing, feeding patterns, and willingness on the newly adapted AI Techniques) were focused more in conditions. In the third and fourth sections, the respondents were asked regarding their cow information (breeds) and the technician who do the AI at their locations.

At last, respondents were requested to rate the statements according to their preferences which was aimed to get the details about the future concerns related to the adaptation of sexed semen.

And also, direct interview was carried out with the Livestock Development Officers, and the AI Technicians (both private and public) for further evaluation.

2.2.2 Sampling Procedure

The survey was carried out in a random sampling method with the sample size of 150 targeting the farmers who have the livestock in a small, medium and large numbers and adapting AI frequently at the study location. Records were utilized to choose the spots for the structured questionnaire in each of the veterinary ranges.

2.2.3 Secondary Data Collection

At the present study, secondary data was collected from each veterinary range (Monthly records and Annual records), Annual Reports of Department of Animal Production and Health (DAPH), Census and Statistical Report from the Ministry of Agriculture, etc.

2.3 Data Analysis

The collected data was statistically analyzed in order to produce the study's main research questions and objectives. The data collected from the questionnaires were summarized and analyzed by using SPSS (version 22.0). Frequencies and descriptive statistics were carried out to summarize main data of respondents to get an overview and to conduct further analysis. Then, Associative analysis one way ANOVA was carried out among dependent and independent variables to identify the significance at 5% and 1% level. Based on the results, relationship was interpreted.

3. Results and Discussions

Present study was designed in order to understand the current nature of adapting Artificial Insemination (AI) Techniques in Batticaloa District, Sri Lanka. The following results were gathered from the structured questionnaire and the records which were available at the study location and each of the selected Veterinary Services (VS) Ranges (Batticaloa, Chenkalady and Karadiyanaru), as well.

3.1 Background of the study location

Study was conducted in Batticaloa District where 15 VS Ranges provide the services to the whole profile of the Batticaloa District, Sri Lanka to have the best understanding on adapting the AI Techniques. This study area has been supposed with Vaharai, Rithithenna, Oddamavady, Valaichenai, Kiran, Chenkalady, Karadiyanaru, Eravur, Batticaloa, Vavunathevu, Kattankudy, Arayampathy, Kokkaddicholai, Thumpankerny, Kaluwanchikudy where total number of cattle and buffalo farms are 21889 and 3391, respectively. And also, the number of cattle and buffalo is 231,882 and 66,569 respectively (DAPH, 2016).

It was common that the local breeds (90.42%) were reared a lot while comparing with the Indian (6.13%) and European Crosses (3.45%). Further, the management systems were intensive (5.12%), semi-intensive (4.76%) and extensive (90.12%), at the study area. The average total milk production was 458,243.93 litters and 311,202.67 litters for the January to June and July to December, respectively (DAPH, 2015).

3.2 Common Breeding program in the study location

According to the records available at the study location, January to July; a total of 1784 AIs were done successfully where 10.7%, 5.1% and 16.2% of them were carried out in Chenkalady, Karadiyanaru and Batticaloa VS Range, respectively. The successful Pregnancy Diagnosis (PD Tests for the year 2016) of that particular study period was around 3.95%, 5.3% and 20.2% and nearly 10%, 0% and 9.8% were the Calving Performance in Chenkalady, Karadiyanaru and Batticaloa VS Range, respectively. It was common that the successful PD Test perhaps led to the unsuccessful nature on its calving performance which meant that the gap between rate of PD and calving is quite higher. However, a total of 1064 pregnancies were diagnosed but only 590 were maintained until term in the Batticaloa District, Sri Lanka. Even though, Artificial Insemination was playing a significant role, there was a reduction in the conception rate and the rate of calving, at the study region. It might be the influence of environmental parameters at the time of insemination and the calving period in the study location. Therefore, natural breeding was followed in both cattle and buffalo at the study location where the conception rate was quite higher while the production (milk) performance is very lower.

3.3 Analysis of Questionnaire Survey

In order to have the proper understanding regarding the prevalence of the efficiency in Artificial Insemination Techniques in Batticaloa District, three VS Ranges were undergone to the survey where 150 farmers were purposively selected for the analysis. Batticaloa (20%), Chenkalady (30%) and Karadiyanaru (50%) VS Ranges were selected among the total of 15 VS Ranges for the study purposes.

3.3.1 Demographic Data of the Respondents

Structured questionnaire itself consisted the age, gender, education, occupation, average monthly income (in Rupees), period of residency (years), interest and type of farming activity, nature of farming, purpose of farming and the main household need of the farming activity, etc. And also, it was separated into different sectors which highly influence on the adaption and the success rate, as well. At the study, around 72.7% of the total were male respondents while rest were female respondents (27.3%). And also, their age category was in between 15 and 60 years (Figure 3.1).

Education level is one of the most important criteria which measures the adaptation of new techniques and its beneficial impacts in the livestock sector. According to the study, most of the respondents were educated up to their primary level (52.7%) in most of the rural areas while 38.7% and 8.7% of the total were with their secondary and tertiary level of education. Based on the education level, respondents were engaged with the different types of occupation in the study location. And also, whole female respondents were house wives (24.7%) where they have been engaged not only in household attempts but also in the rearing systems as well.

Not only that, but the business (16%), farming (16%), government (12%), labour (13.3%), private (9.3%), NGO (5.3%) and the rest were self-employees among the respondents. As shown in the Figure 3.2, farmers who were in the rural area were recognized with the lower income and it was supported by around

40% of the respondents (Rs< 10,000) during the study period. Moreover, it was obvious that there are higher number of cattle and buffalo which is under the optimum utility at the circumstances. Even though, availability of land and labor resources are higher in the Karadiyanaru VS Range; people are much reluctant to utilize those at the proper way and it was the critical situation at the present scenario in all the veterinary ranges of the Batticaloa District.

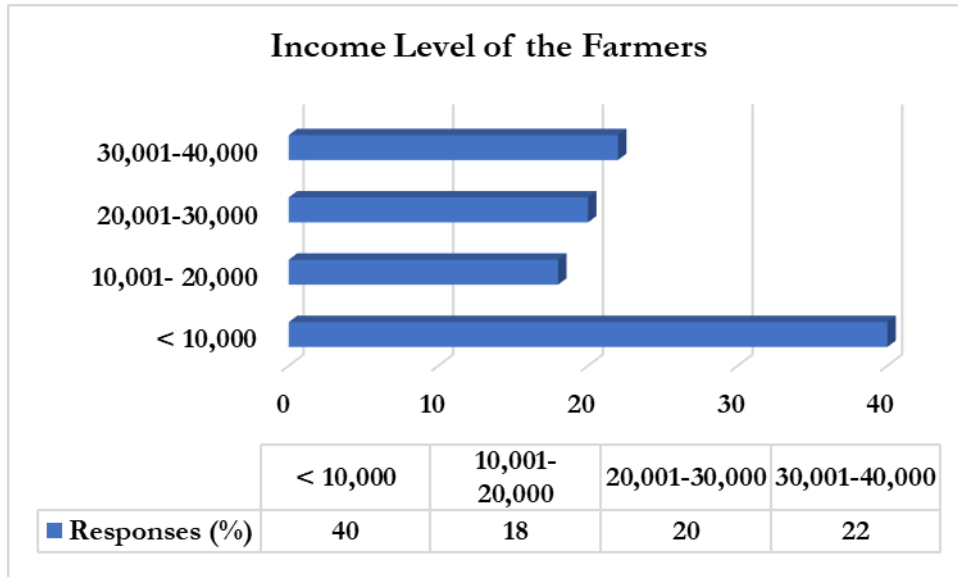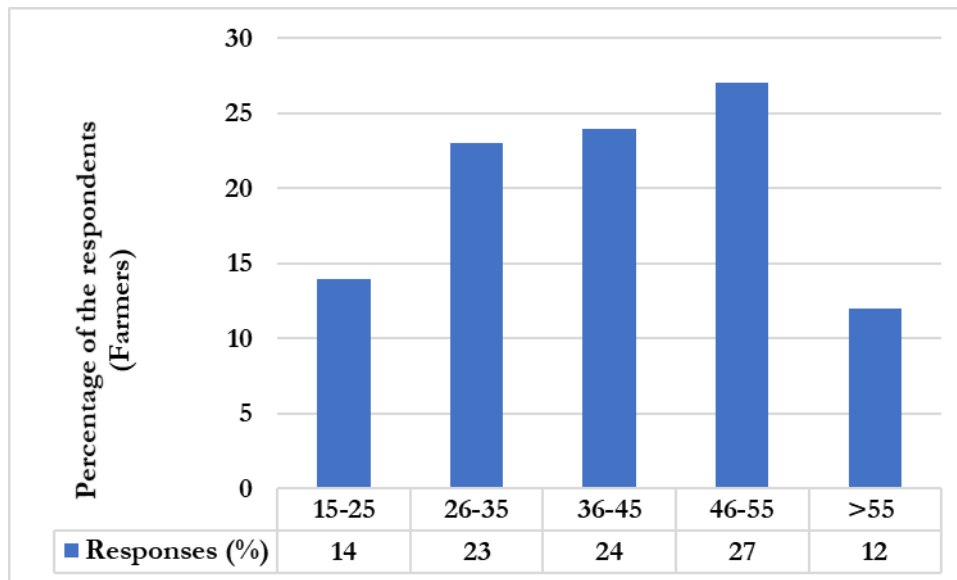**Figure 3.1: Age category of the Farmers (respondents)**

Income Level of the Farmers

	< 10,000	10,001-20,000	20,001-30,000	30,001-40,000
■ Responses (%)	40	18	20	22

Figure 3.2: Income level of the farmers

	15-25	26-35	36-45	46-55	>55
■ Responses (%)	14	23	24	27	12

Livestock rearing is highly based on the proper management conditions which can be controlled even the environmental conditions are not in the acceptable level. It has been clearly evidenced in several articles that the animals must be suitable for the environment in which they are to be raised. And also, must be managed and fed in accordance with their genetic makeup and production potential (Perera and Abeygunawardena, 2000). At the present sets of survey analysis, assumptions were taken regarding the

management conditions where it can be significantly influenced by the percapita income of the family and also the educational level of the farmers.

Table 3.1: Nature of farming activity

Survey (Questions)	Activity	Responses in %
How long have you been living at the study location	Since Birth	94%
	Recently Settled (<10 years)	6%
Are you interested in farming activity	Yes	100%
	No	-
Type of Farming activity	Crop Farming	10%
	Livestock Rearing	53.3%
	Both crop & Livestock	30.7%
	Integrated Farming System	6%
Nature of Farming activity	Full time	57.3%
	Part Time	37.3%
Purpose of farming	Income generation source	59.3%
	Household needs	28.7%
	Agricultural activities	12%

Further, management condition depends on the income of the farmers and when the income level raises farmers prefer to do their farming activities in full time basis. The data from the present study, showed the positive responses on the adaptation of the farm in full time basis (p<0.01, r=0.893) when the income level is increased due to dairying. Moreover, around 94% of the respondents were dwelling since their birth while 6% of the respondents were recently settled at the study location (<10 years). However, whole respondents (100%) were very interested on continuing the farming activities. While focusing on various types of farming activities, 53.3% and 30.7% were with solely livestock rearing and both crop and livestock rearing during the study period. As a whole, nearly 57.3% of the respondents contributed in farming as full time and 37.3% were engaged as the part time activities in order to accomplish their needs. Results revealed that 59.3% of the respondents engaged in farming activities as their income generation source while 28.7% and 12% were engaged with the purpose of household needs and agricultural activities (draft purposes). However, the overall need for the milk production was significant as well.

3.3.2 Information on Farm Data

As shown in the Figure 3.2, around 62.7% of the respondents of Karadiyanaru were rearing livestock in large scale where the availability of land and resources were higher. Study was focused mainly in Urban, Sub-Urban and Rural areas where the number of cattle varied with the value of 5 to 200. Therefore, a range was formulated to simplify the study with the respected value of <10, 10-25 and >25 cattle as small, medium and large-scale farms.

However, farmers who owned huge number of cattle mainly adapted extensive rearing (50%) and very few semi-intensive systems were observed (19.3%). Further, around 30.7% of the respondents

mentioned that they follow intensive rearing system and it is mainly in the urban areas of the Batticaloa VS. In the dry zone, which covers nearly two-thirds of the land mass and carries nearly half the cattle population, the coverage is less than 10% with a negligible level of coverage in many areas, particularly in the North Central Province (NCP), Uva Province (UV), Southern Province (SP), Eastern Province (EP) and Northern Province (NP). These areas have remained underdeveloped with the respect to roads, transport and communication due to their low population density and harsh climatic conditions. Cattle is reared under the extensive systems with dependence on communal grazing grounds which are often located far away from the farmers' dwellings (Abeygunawardena, 2001).

Further, the predominant genotypes are non-descriptive (Local breeds) and the expression of heat signs is not well marked. Farmers in these areas rely on traditional knowledge rather than on modern technologies. This creates a problem for AI services as the intended recipients are not well motivated to get the benefits of such a service and are unable to detect heat signs and get the animals served on time. This clearly shows that the farmers need to be educated (Abeygunawardena, 2001).

Feeding is important for maintenance of the appropriate Body Condition Score (BCS) where the success of AI is obtained in most of the studies with the range of 3-4.5 BCS. While the animal is identified with the pregnancy, it should be ensured with the concentrate feed with the right formulation. Feeding requirements for growth are determined by actual weight, average daily gain (growth rate), weight at maturity, and composition of gain (John, 2009). Composition of gain simply means whether cattle are putting on more muscle or more fat. For example, protein requirements will be higher for young cattle because they are gaining more muscle than fat. When cows need to gain weight to increase their body condition score, this is also considered growth. However, around 58% of the respondents practiced both roughages and concentrate feeding while majority of the extensive system farmers only practicing with the free grazing and the roughages (42%). The sub-optimal feeding of animals was reflected in BCS, with most animals recorded at the study period. In general, all the farms are needed to practice a regular systematic culling programme on the basis of age, productivity and reproductive performances as reflected in the heterogeneity of the cattle population in terms of parity (Abeygunawardena, 2001) which is ultimately helpful to maintain a productive population and healthy population in the herd size.

Figure 3.3: Nature of Livestock rearing System at the study location

	Small level of Farms	Medium level of Farms	Large level of Farms
■ **Responses (%)**	28	12	60
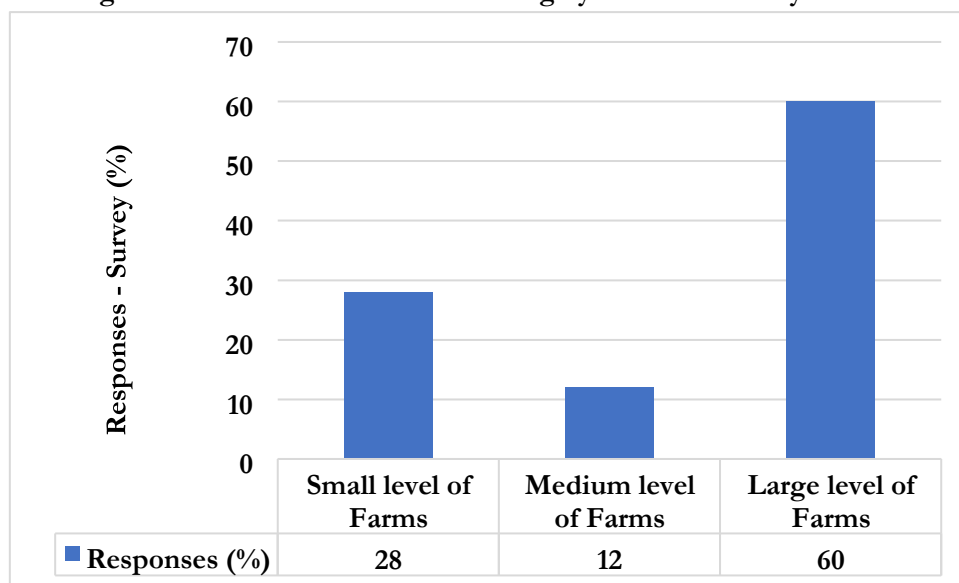
With the support of available resources and the management practices, animals can be promoted to have their optimum productivity by adopting fewer techniques over the climate, diseases and parasites, and nutrition. The nutrition will be divided into two sections, the first deals with the effect of seasonal weight loss (SWL), the major drawbacks to animal production in tropical and Mediterranean climates, and the second details on adaptation of ruminants to different diets and particularly the difference between browsers and grazers in the adaptations to poor quality diets. Here the examples suggested that the nourished animals with balanced diets will support on the productivity performances of the cattle and buffalo (Lamy *et al.,* 2012). Through which, the right BCS will be attained which will courage the reproductive performance and success of the cattle, as well. Hence, the animals are practiced with different for cross breeding programs; AI is the only tool adapted well in most of the regions of the country. AI is commonly done due to the beneficial impacts where disease resistance is arguably one of the important traits possessed by these indigenous breeds and is an important attribute of livestock in low-input livestock production systems. Such traits, if identified, are useful in breed improvement programs involving crossbreeding of productive exotic breeds with indigenous breeds (Jonsson, 2006).

The data indicated that the 37.3% of the respondents still focusing more on the natural service and they have very large-scale farming and practice extensive rearing system. However, 38.7% of the total focused more on the AI while 24% of the respondents adapted both natural and artificial insemination in rotation. Further, cattle farmers who do not use AI were focused more and questioned as follow. In the present study, respondents were questioned whether they are interested on AI or not in future. For this question, 69.3% of the respondents mentioned that they are interested on AI Techniques in future. However, 30.7% of the total were not interested on the adaptation since the failures are higher in their experiences. Moreover, they are not with much awareness on the management conditions such as health care facilities, feeding, breeding, vaccination and regular monitoring on the extensive rearing since the herd size is in comparatively higher at their nature (Lamy *et al.*, 2012).

Figure 3.4: Adoption of Insemination Techniques
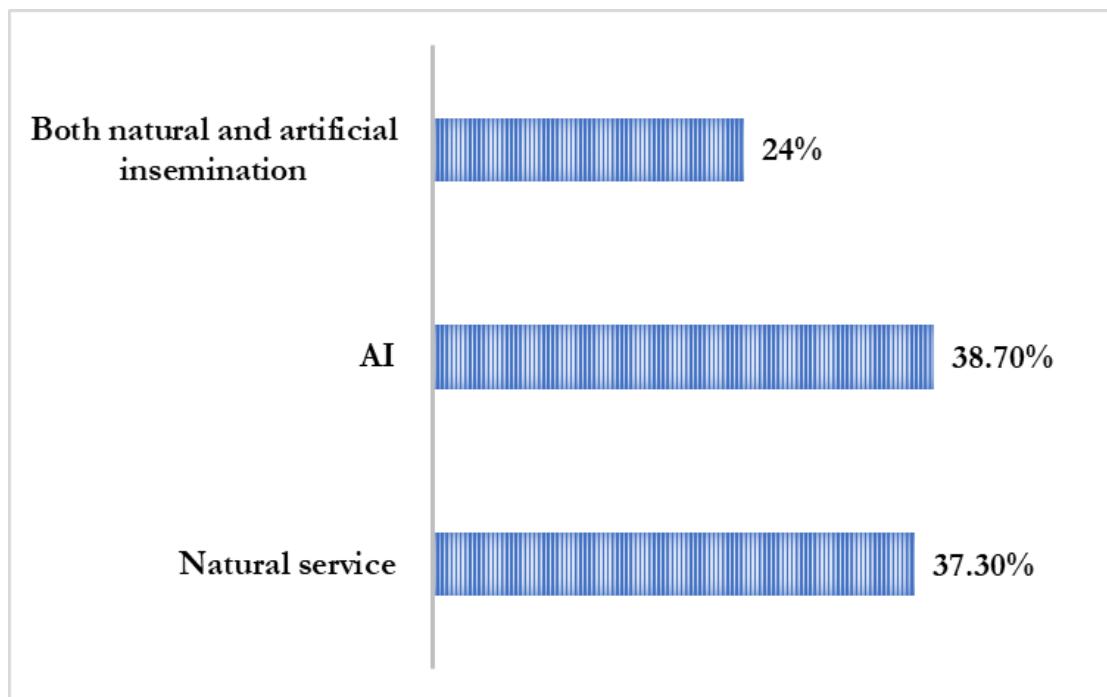
To promote AI Techniques, sexed semen is used well in most part of the country. Recent reports suggest that on average fertility of sexed semen is about 75% (70 to 80%) of the fertility of conventional semen in virgin heifers (a decrease of 20 to 30%) (De Jarnette *et al.,* 2007). However, it can be influenced by the climatic conditions and the management practices as well. In the present study, more than half of the respondents (55.3%) knew well about sexed semen and 44.7% of the respondents did not know anything about sexed semen. Among the total farmers who knew well about sexed semen, only 18.7% of them adapted AI on their cattle with the sexed semen while rest were not having much awareness on it. However, willingness was scaled towards the respondents where 35.3% of the respondents mentioned that they will practice AI with sexed semen, in the future. Among the total, 40% of the respondents disagreed with the use of sexed semen in the future. As the whole, 44.7% of the respondents mentioned that there was a success in delivering female calf through the AI with sexed semen in past years. And also, all most all the farmers (100%) gained extension services at the study location too.

Figure 3.5: Types of breeds – Available breeds
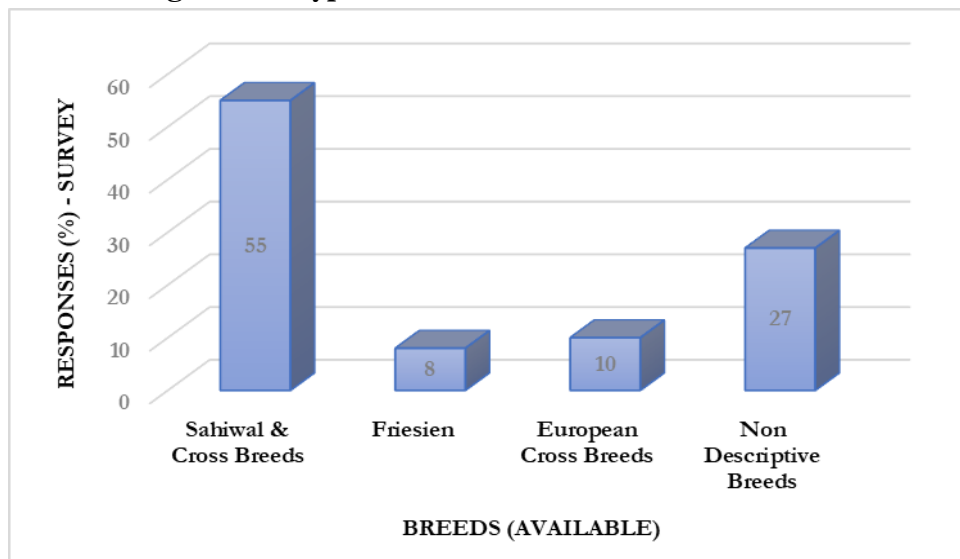
3.3.3 Information on the available Breeds (Survey)

At the study, Sahiwal cow was highly adapted to the particular climatic conditions and respondents also interested to rear Sahiwal than the other cows (Friesian and Jersey and their crosses).

According the data, AI was successful in tropical cattle (especially Sahiwal Cattle and its crosses) than the different exotic breeds (Friesian, Jersey) due to the well adaptation of those cattle to the particular harsh climatic conditions in the dry zone of the country. As shown in the Figure 3.4, around 55% of the total were Sahiwal while 18% were Friesian and its cross breeds. Moreover, method of reproduction (whether AI or natural) is not based on the interest of the farmers and it was determined by the availability of the technicians at the time of heat detection (67%). According to the analysis, there was a negative significant relationship between the method of reproduction and the personal interests ($p<0.01$, $r = 0.747$). At the present scenario, few numbers of AI Technicians have been approved with their practical skills by the government sectors. However, number of skilled technicians and their availability made the cattle farmers to have less concern on AI Techniques.

3.3.4 Information of the AI Technicians

At the study, success rate was assumed with different parameters including environment, cow physiological parameters and management factors. In the management tool, AI Technician also influences more on the determining cause for the success. Therefore, study was designed to collect the information of the AI

Technicians. Number of trained AI technicians were lower in Batticaloa District which is comparatively lower than the AI Technicians trained in private sectors. At the selected study location, only four government AI Technicians provided the services regarding AI for three VS Ranges. However, number of trained private technicians are increasing while comparing the past (Annual Report of DAPH, 2015).

And also, the relationship between the age category (indirectly to measure their experiences/services on AI Techniques) were analyzed and it resulted as 54%, 33.3% and 12.7% were with the age category of 46-55, 36-45 and 26-35, respectively. Education level of the technicians were 50.7%, 34% and 15.3% with the group of tertiaries, secondary and higher education (Diploma), respectively. Therefore, the experience of the skilled technicians determined the success rate of AI Services where 50.7%, 16% and 33.3% were with the years of five, ten and fifteen of the AI Techniques, as well.

3.3.5 Effect of Perception on adapting Artificial Insemination Techniques

Study was conducted to determine how the perception towards the Artificial Insemination influences the adaptation in the selected study location. Likert scale (1-5) was used to measure the statements (strongly disagree, disagree, not sure, agree and strongly agree) and obtained mean value for each statement. The statements were designed to analyze the respondents' perceptions towards the Insemination (AI) Techniques via assessing the convenience and interests over the natural services. Average mean score was calculated to obtain the overall perception value in the adaptation of both natural and artificial services. The following table shows (Table 3.2) the mean values obtain for each statement from the respondents.

One of the factors influencing the consumer perception is that Artificial Insemination is convenient than the natural services. Studies have shown that increasing trends on Artificial Insemination is related to a negative perception of natural services. According to the Table 3.2, majority of the respondents agree with most of the statements explaining the perception regarding the Artificial Insemination.

However, nearly 63.7% respondents were not very much concern about the quality of semen which is used in the straw and mentioned as better because of the processing is done with the right preservative techniques. The perception of the farmers is highly relied on the positive beliefs which the respondents have about AI Techniques such as success, convenient, safety, reliability than natural services which is strongly agree by the respondents (46.7%) too. The ANOVA test for the perception reveals that there is a significance relationship between the perception of farmers and adaptation of the technique ($p < 0.01$, $r = 0.747$).

3.4 Results of the Sexed Semen Usage in Veterinary Range

As mentioned above, three different categories (Physiological, Management and Environment) mostly determine whether the animal will provide the success or failures to the farmers in nature. According to the results obtained via the primary and secondary data collection, 19.5% of the total were supported with the pregnancy diagnosis of the Cow/ Heifer while 80.5% of the total mentioned as its non-Pregnant

status, during the study period. It might be because of the sorting process of semen, while effective, damages the sperm resulting in decreased motility and damage to the cell and acrosome membranes (Carvalho *et al.*, 2010).

Among the 19.5% of the Pregnancy Diagnosis, 9.8% of the responses were succeeded with its female calves while the rest were not recognized with the calves, as well. Increasing sperm number in the straw seems like a plausible solution to increase fertility. However, several studies clearly demonstrated only modest gains (5% to 7%) in pregnancy rates by doubling or tripling sperm numbers (Schenk et al., 2009). One of the biggest limitations for seed stock breeders is that a relatively small percentage of AI bulls are available as sexed semen. This severely limits the breeder's options for genetic selection. However, while animals are totally under the intensive rearing in Batticaloa VS Range, around 73% of the animals showed the pregnancy via the sexed semen usage. Therefore, at the whole study location; selected animals are expected to undergo with the sexed semen application in future.

Table 3.2: Frequency results of the respondents' perception (n-150) of Artificial Insemination and Natural Services

Statements	Strongly Agree (1)	Agree (2)	Unsure (3)	Disagree (4)	Strongly Disagree (5)	Mean
AI is better than the Natural Service because it is convenient.	28%	33%	21%	13%	5%	2.3
It is easier to access with AI because number of VS Ranges provides its services at the time our needs.	29%	28%	21%	17%	4%	2.4
AI is safe to cow because it does not deal with the physical stress.	29%	47%	17%	5%	3%	2.0
I like AI more because it is adapted well with our climatic conditions.	6%	27%	27%	26%	14%	3.2
AI causes stress to cow while the heat detection fails in nature.	42%	33%	15%	7%	4%	2.0
AI is not harming the animal because it is done on the spot of heat stress.	4%	19%	39%	29%	9%	3.2
The quality of semen which is used in the straw is better because the processing is done with the right preservative techniques.	7%	21%	63%	9%	0	2.7
It is safer to the farmer because it is available with the convenient price.	7%	21%	8%	0	0	1.4
Natural Service is comfortable.	7%	27%	12%	31%	23%	3.4
Natural mating does not stress the animal while it is in heat stress.	41%	35%	21%	4%	0	1.9
Success rate is higher in AI	6%	21%	33%	27%	12%	3.2
Success rate is lower in AI	1%	7%	19%	53%	21%	3.9
Success rate is higher in Natural Service	24%	32%	27%	15%	2%	2.4
Success rate is lower in Natural Service	1%	5%	37%	41%	17%	3.7
Sexed semen usage is beneficial one	25%	15%	52%	5%	3%	2.5

(Source: Survey (n=150), 2019)

4. Conclusions

Based on the pre-structured questionnaire survey and the secondary data available at the study locations, efficiency of the Artificial Insemination is higher in Batticaloa veterinary service (VS) Range than the other two (Chenkalady and Karadiyanaru) VS ranges. Although, those VS Ranges are quite nearby in its distance, deviation on the results were ultimately higher since its micro climatic and management attention varied with the farming patterns. Batticaloa, Chenkalady and Karadiyanaru VS Ranges fall under the urban, suburban and rural categories where the farming systems also varied as intensive, semi-intensive and extensive in most of the farming nature.

However, the adaptation of AI was significantly varied with the socio-economic conditions and needs of the respondents who are mostly depended on the livestock rearing. And also, the success rate was obviously high in Batticaloa VS Range where the feeding, management and health care services were given in the confined intensive conditions. Moreover, the usages of sexed semen was quite lower in Chenkalady VS Range and none in Karadiyanaru VS Range even the land and number of cattle was higher there. Therefore, farmers are needed to be educated more than the current regarding the adaptation of sexed semen for the above VS Ranges.

According to the data, there were positive significant relationship (p<0.01) obtained between the success rate of AI and the cow factors (breeds), AI Technicians (experience, education) and the nature of farmers (systems of rearing, concentrate feeds and knowledge on cross breeding techniques). Further, the relationship was negative (p<0.01) with the number of cattle available in the extensive systems which led to the poor performance in an inefficient way. And also, Sahiwal and its crosses showed high success rates with the AI and their rate of success was increased during the study period.

5. Suggestions

The following recommendations can be indicated to promote the success rate of AI in the future.

- While the animals are bred with AI; animals should be carefully monitored to overcome the factors which influence more on its success rate such as management (feeding, watering, health care, etc.) and environmental issues (sheltering for excessive cold and hot).

- Farmers should be educated through the proper training facilities regarding the animal breeding especially the benefits of AI/ Sexed Semen.

- Number of AI Technicians should be increased and they should be trained well according to their educational level.

- Gradual adaptation on cross breeding program for the insemination of European Breeds must be motivated rather than immediate way of insemination by the semen of European Breeds in the excessive hot environment.

- Farms should be easily accessed by the Veterinary Surgeon/ Doctors at the need of emergency.

- ▪ Through which efficiency and the success rate of the Batticaloa District can be promoted in future and the percapita income and the milk satisfaction also can be enhanced well in most of the Dry Zone of Sri Lanka.

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