

Investigation of efficiency on Artificial Insemination Techniques in Batticaloa District (Dry Zone), 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 (Dry Zone) in order to understand the efficiency on AI and its adaptation. And also, collected data were statistically interpreted to understand the relationship between the success rate of AI via the SPSS (version 22) software. According to the results revealed that the non-descriptive breeds (90.42%) (n=132,679) were higher in number while comparing with Indian (6.13%) (n=8990) and European Crosses (3.45%) (n=5062) and also mean \pm SD of the environmental temperature and relative humidity were 28.12 ± 2.08 °C and $77.29 \pm 5.64\%$, respectively too. Approximately, 69.3% of the farmers utilised AI services where rearing system was mainly Intensive and Extensive with the respective value of 30.7% and 50%. Here, around 55% of the breeds are Sahiwal and its Crosses. However, there was a negative significant relationship obtained between the success rate of AI and European Crosses ($p < 0.01$, $r = 0.747$), as well. 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. Moreover, the relationship was negative ($p < 0.01$) with the number of cattle available in the extensive system which led to the poor performance ($p < 0.01$, $r = 0.877$) in AI. In conclusion, perception revealed the positive significant relationship with the adaptation of AI Techniques ($p < 0.01$, $r = 0.747$) by the present farmers. However, these conditions are below the potential of AI in Dry Zone where further enhancement, consideration and training are needed to reach high success rates, as well.

Keywords - Artificial Insemination, Dry Zone, Batticaloa District, Dairy cattle, Sexed Semen, Success rate

I. 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 towards the growing population of the country. And also, the country's population is reached around 20.77 million^[1]

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 1,118,089 and 375,562, respectively where the cattle contributes more on the socio - economic status of the individuals than the buffalo do. It is highly 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 305,391,600 and 69,051,600 litres for cattle and buffalo, respectively^[1] 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. And also, breeding of animals artificially is the quickest and rapid income generating approach in Sri Lanka where the introduction of reproductive techniques such as Oestrus Synchronization and artificial insemination (AI) are becoming instrumental to solve the effects of these limiting factors as well as to make the possible application of more intensive systems of production and facilitate the genetic improvement of the productive characteristics of the herd^[2]. Further, the studies on male reproduction associated with season have shown a significant impact on the conception rate in cows. This had been observed during months with higher ambient temperature which lead to the production of poor quality semen^[3].

However, except the environmental, management and physiological elements, reproductive ability of the animal is a crucial issue which influences a lot in the profit of the country where the reproductive performance (high fertility) of the cows and heifers is the critical concern in livestock sector towards the successful range of sustainable milk production. In Sri Lanka, production performance of Dry Zone dairy still depends on the extensive system where the average milk production is around 2.1 litres/cow/day^[4]. And also, in general natural breeding of cattle and buffalo takes longer period in most of the part which comes under the Dry Zone and in some cases it shows the failure and thereby extends the calving interval. In tropical countries, low reproductive rate is a major problem, which is associated with semen quality of bull^[5] and causes the huge reduction in the estimated production performance of the animal.

Among the areas consisted into the Dry Zone, Batticaloa is one of the District 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) [1]. 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.

II. LITERATURE REVIEW

As mentioned in 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.

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. And also, the breeds which are chosen for the production criteria, is an essential issue for the best production performance in the country. Mainly, exotic breeds are adopted to incorporate in dairy herd composition in all the 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.

Sustainable milk production of a dairy enterprise can be achieved through the purchase of replacement heifers, something that is not feasible for most poor-resource smallholder farmers. An alternative is the strategy of good calf within herd management [6]. The latter is feasible because today, most of the smallholder dairy farmers own small dairy herds and with the introduction of AI this would provide farmers an opportunity to transform the herd structure by the introduction of proven dairy semen with a great potential to produce better heifers, thereby increasing milk production [6]. This strategy is in accordance with the government promotion of improved milk production by the smallholder sector [7].

Further, cattle breeding has been recognized as a critical issue for the dairy sector [8] with many programs and schemes were implemented during the last few decades. Both natural service and AI have been used for cross breeding programme [9] however the latter strategy was pursued vigorously over the former, particularly in the recent past. Although AI is widely used for cattle breeding in many Asian countries, the above factors together with other socio-economic considerations specific to smallholder production systems and inadequate infrastructure for the efficient delivery of AI services, have often led to poor success rates [5].

III. MATERIAL 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.

Location of the study

A baseline study was conducted with the farming families who rear livestock as their one of the main income 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.

Data Collection and Analysis

At the current study, primary and secondary data were collected from the selected Veterinary Ranges for the further concern. And also, direct interview was carried out with the Livestock Development Officers, and the AI Technicians (both private and public) for further evaluation. Secondary data was collected from the each veterinary ranges (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. Further, frequencies and descriptive statistics were carried out to summarize the main data for an overview and to conduct further analysis, as well.

IV. RESULTS AND DISCUSSIONS

Among the total of 15 VS Ranges, three VS Ranges named Chenkalady, Batticaloa and Karadiyanaru were randomly selected where the number of farms for cattle were 2,979 and 1,514 for Chenkalady/Karadiyanaru and Batticaloa, respectively. And also, the number of buffalo farm was 705 in Chenkalady/Karadiyanaru and no any buffalo farms were available in Batticaloa VS Ranges. Nearly 62,200 and 9,868 were the total number of cattle in a respective order and approximately, 19,400 of total buffalo were available in Chenkalady/Karadiyanaru VS Range. As shown in Table 1, common breeds and the management systems were slightly different in each of the VS Ranges. Moreover, the average milk production of the selected study location was 152,500 litres and 19,833.3 litres for Chenkalady/Karadiyanaru and Batticaloa, respectively.

Common Breeding program in the study location

According to the records available at the study location, January to July, 2016; a total of 1784 AIs were done successfully where 10.7% (n=190), 5.1% (n=90) and 16.2% (n=289) 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.

Approximately, 69.3% of the farmers utilised AI services where rearing system was mainly Intensive and Extensive with the respective value of 30.7% and 50%. 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.

Table I
breeds and management systems in selected vs range

VS Range	Common Breeds (%)			Management Systems (%)		
	Indian Cross	European Cross	Local Breeds	Intensive	Semi-Intensive	Extensive
Chenkalady/ Karadiyanaru	5	5	90	15	20	65
Batticaloa	48	30	22	44	46	10

(Source: Department of Animal Production and Health, 2016)

Number of AI, PD and Calving Performance in 2016-2017
According to the secondary data available at the each VS Range, around 281 Inseminations were carried out while 62 of PD were performed and Calving of 65 were recorded at the Chenkalady VS Range during the period of January to October, 2016. Further, the Karadiyanaru VS Range consisted with 130 inseminations with the diagnosis of 6 PD and the 8 Calving during the period of January to December, 2016. However, the number of farms and the cattle are higher in the Karadiyanaru VS Range where the adapted insemination is comparatively lower in terms of AI. And also, this situation was at the third place which was dominated by the Batticaloa and the Chenkalady VS Range. The number of European Cross is higher in Batticaloa VS Range where 419 insemination has been done while 310 PD and the 86 Calving were recognized as the success for the particular range. At this range, intensive farming was common while this area comes under the urban site of the Batticaloa District, Sri Lanka.

And also, the total Number of AI (2617), Number of PD (1525), Pregnant (1116), Non Pregnant (409) and Number of Calving (683) were ultimately fitted with 15 VS Ranges in Batticaloa District, Sri Lanka in 2016. 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, perception revealed the positive significant relationship with the adaptation of AI Techniques ($p < 0.01$, $r = 0.747$).

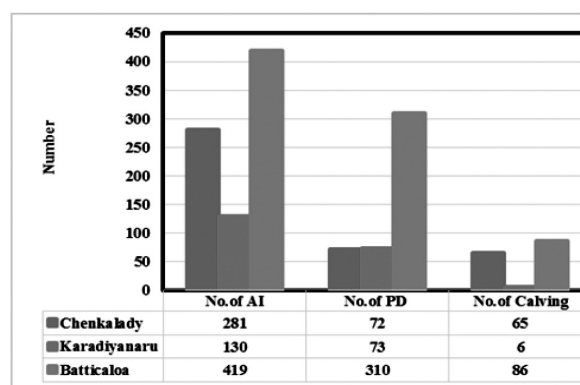


Figure 1: Number of AI, PD and Calving in VS Range

Breeds Information

Insemination by using the Friesian Semen was higher in Batticaloa VS Range and the success rate also higher due to the intensive rearing of the heifer/ cow at the study location. While the animals are in intensive rearing, management and the confinements are peak than the animals which are under the extensive rearing. Friesian cow is well adopted in the temperate region, which shows the reduction in its performance in the tropical nature especially in the dry zone of the country. 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. 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.

On the other hand, Sahiwal is well adapted in the dry zone and their performance in the dry zone is higher even the animal is under the intensive, semi intensive and extensive system of the study location. The insemination was succeeded in all the study location as the Sahiwal is well suited to the all the climatic conditions of the country. Insemination was higher in the month of October in Batticaloa VS Range and higher in September in Chenkalady VS Range which was differed due to the micro climatic deviation in each of the location of Sri Lanka. Australian Friesian Sahiwal (AFS) also contributed an equal role like Sahiwal Cattle and the adaptation was higher in June and July of the year, 2016 & 2017.

This was equally utilized in each of the VS Range of the Batticaloa District. And also, it is comparatively increased in all the rearing systems. Number of AI was significantly higher in the month of August and was ultimately lower in February. It was preferred by the farmers who reared cattle and buffalo was peak in concern. And also, the PD also significantly higher at the particular period. However, the calving performance was higher in February and March, as well.

V. CONCLUSION

At the study location, non-descriptive breeds are higher than the Indian and European Crosses. However, more than half of the farmers utilize the AI services where extensive rearing system was common. And also, success rate was higher with Sahiwal breed while European breeds show the negative significant relationship with the success rate in extensive rearing system. Moreover, there are high potentials while the

animals are reared under the confined environment for the successful AI (European) in Batticaloa District, Sri Lanka.

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