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Economic Analysis of Mastitis Control Measures in Cuddalore District of Tamil Nadu

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***Abstract*—** This study was planned to economically evaluate the clinical mastitis control strategies on the data collected from the herds having 2 to 8 animals in the randomly selected Cuddalore District of Tamil Nadu. Multistage random sampling technique was used to select the dairy farmers and dairy animals. In total, 900 farmers having dairy herd size of 2 to 8 were chosen again randomly from the selected blocks. Among 900 dairy farmers, 187 dairy farmers experienced mastitis incidence during the study period (Year 2014-15 and 2015-16). Three sets of different mastitis control measures and their combinations were evaluated with partial budget analysis. First set comprised of practicing a set of control measures such as practising washing of udders before and after milking, teat dipping, cleaning of stalls twice every day, keeping cows standing after milking for at least 30 minutes, fore stripping and lastly milking the clinically affected cows. Second and third control measures adopted are being dry cow therapy and culling of chronic cases, respectively. Partial budget analysis revealed that practicing first set of control measures (Measure I) along with dry cow therapy resulted in a highest net returns of Rs, 2181.11, practicing first set of control measures (Measure I) resulted in next higher net return of Rs.2122.59 and implementation of dry cow therapy ensued a lesser positive return of Rs. 1132.41. Though culling was considered as an effective mastitis control measure, the analysis found it as economically infeasible. Further, partial budget analysis revealed that implementation all other combinations of control measures (Measure III, II & III and I,II & III) resulted in only negative returns.

Keywords— Clinical Mastitis, Mastitis Control, Economic Analysis, Partial Budget

I. INTRODUCTION

Dairy cow rearing plays a vital role in the Indian rural economy. The importance of dairying in India hardly need s emphasizing as this sector is the major source of income for an estimated 27.6 million people. Livestock sector provides employment to many people and nearly 70 per cent of them are women [1]. Dairy farming in India contributes significantly to the income of the poor and middle class rural farming community. Diseases and parasites are serious constraints affecting dairy cattle production in various ways such as reduced growth rate, milk production, fertility and value of hides and mortality causing considerable economic losses to livestock keepers [2]. Mastitis is one of the most economically important diseases affecting dairy cows. This study was planned to economically evaluate the clinical mastitis control strategies on the data collected from the herds having 2 to 8 animals.

Rest of the paper is organized as follows, Section I contains the introduction of importance of mastitis control , Section II contain the related work of economics of mastitis control, Section III explain the methodology of the study, Section IV contain results of the study with discussions and Section concludes research work with future directions.

II. RELATED WORK

In dairy practice, disorders of the udder are among the most frequent clinical conditions encountered [3}. Mastitis is an inflammation of the mammary glands of dairy cows accompanied by physical, chemical, pathological and bacteriological changes in milk and glandular tissue [4]. It is considered as one of the costliest disease affecting dairy cows. Economic losses due to mastitis are recognized worldwide as a major problem on dairy farms. Reviews of past calculations of the economic losses of clinical mastitis ([5]&[6]) clearly show that mastitis has a great economic impact.

The difficulties encountered in attempts to control mastitis successfully under field conditions reflect both the complex disease etiology and a need to improve the control programs [7]. The assessment of the economic worthiness of a control programme for mastitis has to be supported by a reliable

evaluation of the economic losses caused by the disease and the knowledge of the costs of the implementation of that programme [8]. Many studies conducted previously to estimate the economic losses due to mastitis in India and abroad were based on the data collected from organized dairy farms having hundreds of animals whereas India has about three times as many 'dairy' animals as the USA, the vast majority (over 80 percent) being kept in herds of 2 to 8 animals [9]. Hence, the objective is to study the clinical mastitis control strategies on the data collected from the herds having 2 to 8 animals in the selected area.

III. METHODOLOGY

Cuddlore District of Tamil Nadu was randomly selected for the present study. Multistage random sampling technique was used to select the dairy farmers and dairy animals. The Cuddalore district comprised 13 blocks of which, three blocks, viz.,Kammapuram, Kuringipadi and Panruti were randomly selected. In the next stage, two villages from each selected block were chosen randomly. In total, 900 farmers having dairy herd size of 2 to 8 were chosen again randomly from the selected blocks, 300 from each block for survey. Among 900 dairy farmers, 187 dairy farmers experienced mastitis incidence during the study period. Relevant data were collected from the chosen respondents through personal interview using a pre-tested interview schedule. The data were pertaining to the years 2014-15 and 2015-16. Cross checks were made to minimize the errors due to recall bias and also to ensure reliability of the information provided by the respondents. Percentage analysis was employed to analyse the incidence of mastitis. Three sets of different mastitis control measures and their combinations are evaluated with partial budget analysis [10]. First set comprised of practicing a set of control measures such as practising washing of udders before and after milking, teat dipping, cleaning of stalls twice every day, keeping cows standing after milking for at least 30 minutes, fore stripping and lastly milking the clinically affected cows. Second and third control measures adopted are being dry cow therapy and culling of chronic cases, respectively. Cost and return data collected from the study area are used to construct partial budget model in Microsoft Excel 2007.

IV. RESULTS AND DISCUSSION

Practising measures in the study area (table I) such as washing udder before and after milking, teat dipping, cleaning of stalls twice every day, keeping cows standing after milking for at least 30 minutes, fore stripping and milking clinical cases last, treating clinical cases, culling chronic cases and dry cow therapy were found to be the different mastitis control measures practised in the study area (Table 1) and many researchers found these measures were highly useful in the control of mastitis.

Table 1. Mastitis control measures practiced in the study area

S. No	Control measures
1	Washing udders before and after milking
2	Teat dipping
3	Stalls are cleaned twice every day
4	Keep cows standing after milking for at least 30 minutes
5	Fore stripping
6	Milking clinical cases last
7	Treating clinical cases
8	Culling chronic cases
9	Dry Cow Therapy

Table 2 Relationship between mastitis control measures practiced and the incidence of mastitis

control measures practiced	Number of animals	Number of affected animals	Per cent affected
Measure I*	512	14	2.73
Dry cow therapy (Measure II)	15	3	20.00
Culling of chronic cases (Measure III)	0	-	-
Both Measure I and II combined	170	0	0
Both Measure II and III combined	10	0	0
Measure I, II and III combined	12	0	0
None	181	170	93.92
Total	900	187	20.77

* Measure I Practising washing of udder before and after milking, teat dipping, cleaning of stalls d twice every day, keeping cows standing after milking for at least 30 minutes, fore stripping and milking clinical cases last

Table 3 Partial budget model for mastitis control measures (in rupees)

Control Measures/ Cost	Measure I*	Dry cow therapy (Measure II)	Culling of chronic cases (Measure III)	Both Measure I and II combined	Both Measure II and III combined
Additio	1472.12	1415.78	0	2118.13	0

nal returns (A)					
Reduced costs (B)	874.56	399.81	882.03	982.23	0
Total positive effects (C) (C=A+B)	2346.68	1815.59	882.03	3100.36	0
Returns foregon e (D)	0	0	0	0	0
Extra costs (E)	224.09	683.18	5315.0 0	919.25	5908.17
Total negative effects (F) (F= D+E)	224.09	683.18	5315.0 0	919.25	5908.17
Net effect	2122. 59	1132. 41	- 4432.9 7	2181.1 1	- 5908 .17

* Practising measures such as washing udders before and after milking, teat dipping, stalls are cleaned twice every day, keeping cows standing after milking for at least 30 minutes, fore stripping and milking clinical cases last

The effect of mastitis control measures practiced on the incidence is presented in Table 2. The incidence of mastitis was very high (93.92 per cent) among the animals where none of the control measures were adopted. Implementation of practising first set of control measures that include washing of udder before and after milking, teat dipping, cleaning of stalls twice every day, keeping cows standing after milking for at least 30 minutes, fore stripping and milking clinical cases last resulted in the mastitis incidence of mere 2.73 per cent. Practising of dry cow therapy (Measure II) alone resulted in the mastitis incidence of 20.00 per cent. In the study area, none of the farmers implemented culling of chronically affected animals (Measure III) as a sole mastitis control strategy. The combination of control measures I and II were found to be highly effective with zero mastitis incidence. Adoption of all the three measures (Combining measures I, II and III) also resulted in zero mastitis incidence. Implementation of dry cow therapy along with culling of chronic clinical cases (Combining measures II and III) also found to be highly effective with zero mastitis incidence.

For example, Mdegela *et al.* (2009) advocated the use of udder disinfectants and improved milking hygiene as intervention strategies to control mastitis on the smallholder dairy farms in Tanzania [11]. Deb *et al.* (2013) added that improvement of milking hygiene, implementation of post-milking teat disinfection and regular control of the milking equipments were among the important general measures to prevent new cases of mastitis[12]. Robert *et al.* (2008) and Runciman *et al.* (2010) encouraged the use of selective dry cow antibiotic therapy towards the prevention of new intra mammary infections([13] & [14].

Cost effectiveness of three different sets of mastitis control measures practised in the study area were estimated based on an economics module which rely on the principles of partial budgeting in which the economic consequences of a specific change were quantified. First set of control measures comprised a combination of practising washing of udders before and after milking, teat dipping, stalls are cleaned twice every day, keeping cows standing after milking for at least 30 minutes, fore stripping and milking clinical cases last. Second control measure evaluated was being dry cow therapy) which include the intra mammary infusion of antibiotics immediately after the final milking of the lactation period and intramuscular injection of enrofloxacin (Baytril, 10% inj. sol. ©, Bayer) at a dose of 2.5 mg/kg to all cows. Third control measure evaluated was culling of chronic cases. Different combinations of above mentioned control measures as practised in the study area are also evaluated.

Partial budget analysis revealed that practicing first set of control measures (Measure I) along with dry cow therapy resulted in a highest net returns of Rs, 2181.11, practicing first set of control measures (Measure I) resulted in next higher net return of Rs.2122.59 and implementation of dry cow therapy ensued a lesser positive return of Rs. 1132.41 which was largely due to higher drug cost, veterinarian's fees when compared to first set of control measures. Further, implementation of culling of chronic mastitic animals would led to a net negative return of Rs, 4432.97. Though culling was considered as an effective mastitis control measure, the analysis found it as economically infeasible. Further, partial budget analysis revealed that implementation all other combinations of control measures (Measure III, II & III and I,II & III) resulted in only negative returns.

Neave *et al.* (1969) stated that the complete prevention of the transfer of pathogens causing mastitis from cow to cow had not been found possible, even with a comprehensive hygiene system [15]. Nevertheless, hygiene systems designed to prevent the transfer of pathogens and more particularly to eliminate residual contamination at the completion of milking had been shown to reduce the number of new infections by about half. The combination of such hygiene systems with effective antibiotic therapy, which reduced the duration of infection, generally resulted in a decrease of more than 50 per cent in the incidence of infection within a year.

Beck *et al.* (1992) stated that the farms that have followed the recommended control procedures have reduced the average annual number of cases of clinical mastitis from 135 to 40 cases/100 cows each year, while the quarters remaining uninfected for a whole year has increased from 65 to 80 per cent of the total quarters [16]. The costs of the main control procedures (Eg. £8–60/cow for dry-cow therapy and teat dipping or spraying) are broadly covered by the reduction in clinical mastitis, leaving the benefits of reduced subclinical infection (e.g. £3810 for a 100 cow herd unconstrained by quota and achieving the average reduction in infection) as a substantial bonus. McDougall *et al*. (2009) reported that mastitis was a multifactorial disease, hence control required an understanding of the risk factors before effective interventions can be defined and potential control strategies included improved environmental and animal hygiene, application of internal and external teat sealants, prepartum application of teat antiseptics, prepartum milking and control of horn fly in environments where it acts as vector [17].

Firat (1993) and Thirunavukkarasu (1996) stated that the control of mastitis might be possible through controlling environmental factors predisposing mastitis and thereby masking the animal factors influencing udder infection ([18] & [19]). Sandhol *et al*.(1990) showed that mere antibiotic usage had not resulted in complete control of mastitis [20]. The U.S. National Mastitis Council and most Canadian Dairy Extension Programmes recommended a mastitis control programme consisting of hygienic washing and drying of udders before milking,teat dipping after milking, antibiotic therapy at drying off, culling cows with chronic mastitis and milking the infected cows lastly [19]. As none of the selected animal owners had or needed milking machine, there is no point in insisting on regular milking machine maintenance in rural small farmers.

V. Conclusion and Future Scope

The results of the study clearly showed that measures such as practising washing of udders before and after milking, teat dipping, stalls are cleaned twice every day, keeping cows standing after milking for at least 30 minutes, fore stripping, milking clinical cases lastly and dry cow therapy appears to be most appropriate methods of controlling mastitis in rural areas, which is still characterised by large number of small dairy units managed with family labour. The focus of mastitis control efforts should be on sanitising the general environment and preventing the contamination of teat pore during the period in which the streak canal remains open after milking [19] & [21]. Hence, well-knit extension programme about disease awareness, giving adequate emphasis to management and control measures is to be developed for education at farmers' level as udder health, hygiene and nutrition play an important role in the control of mastitis. The best and cost effective practices for reducing the incidence of mastitis like teat dip after milking, not allowing the cows to sit for 30 minutes after milking, emphasizing clean housing and milking hygiene should be propagated widely among the dairy farming community through appropriate channel [10]

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