

Adoption and Effectiveness Value of RFID Based Digital Recording System for Commercial and Rural Beef Cattle Farming

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ABSTRACT

One of the main challenges in livestock sector especially cattle farming in Indonesia which is very crucial is recording system for livestock production that can be valid. A simple way can be a solution for this challenge is used of RFID based digital recording system. This system is utilizing microchips in the RFID tags that are attached to each cattle, in addition to avoiding human error both in counting and recording, also eliminating the possibility of double data, because every single RFID Tag has a Unique-ID as the individual identity for each cattle. RFID based digital recording system was tried by comparing commercial beef cattle farming (CF) and rural beef cattle farming (RF) at Lampung province of Indonesia. Cattle population that used for this research are 1.473 heads for CF and 992 heads for RF. The data that recorded is ear-tag number, breed, sex, body weight, and paddock with a remark when needed. The parameters compared of both farming are number of cattle that can be recorded per day and time required to record per head of cattle (second). Effectiveness value of this system on rural farming was learned through by comparing for each trial for first trial to fourteenth trials of time required to record per cattle. Data was analyzed by t-student test method. CF more adaptive and effective than RF for RFID based digital recording system. Number of cattle that can be recorded per day by CF was significantly higher ($199 \pm 100,70$) than RF ($63 \pm 33,51$). Time required to record per head of cattle by CF was significantly shorter ($29,85 \pm 12,37$) than RF ($68,95 \pm 30,76$). Time required to record per cattle was significantly reduce at Trial 1 (130.814), 2 (115.458), 3 (86.313), 8 (66.053), 9 (53.841), 11 (40.424), 14 (29.867). The last trial time required to record per cattle of RF was equal with CF. RFID based digital recording system for livestock was adaptable and effective for both of commercial beef cattle farming and rural beef cattle farming.

Keywords: RFID, digital recording system, commercial, rural, beef cattle farming.

1. INTRODUCTION

The main problem of the livestock industry in Indonesia which is very crucial is the absence of a standard livestock recording system that can be a valid reference to determine population development, productivity, reproductive status, distribution, level of livestock availability as well as mapping the potential and problems of national livestock. Common problems that

occur in manual data collection, include data input errors due to errors in reading and recording, as well as the occurrence of duplicate data due to the absence of Unique-ID which is the identity of each cattle. A simple way can be done to anticipate this, by utilizing a microchip in the form of an RFID Tag that is attached to each cattle, in addition to avoiding the occurrence of human errors both during counting and recording, also

eliminating the possibility of duplicate data, because each RFID Tag has a Unique-ID as identity of each cattle. The digital recording model using RFID can be implemented on national farms with various typological scenarios, both nationally and regionally, in livestock companies, livestock areas and smallholder farms. One of the centers of beef cattle farming in Indonesia is Lampung province. RFID based digital recording system was tried by comparing commercial beef cattle farming and rural beef cattle farming at Lampung province of Indonesia.

2. MATERIAL AND METHODS

2.1. Material

Cattle population that used for this research are 1.473 heads from three commercial beef cattle farming and 992 heads from rural beef cattle farming from smallholder farmer at Lampung Selatan. All livestock is given RFID Ear Tag which there is a RFID Micro chip that using TK4100/EM4205/EM4305 chip on frequency 134.2 kHz. RFID Reader and Digital Recording Software are using the product of PT. Buana Integrasi Solusi Infotama. RFID Reader is “Made in Indonesia” product that can

read RFID Tag on frequency 134.2 kHz using FDX-B/HDX protocol as described on ISO-11784/11785 standard and equipped with Micro-SD Card for storage media. The software is connected to digital animal scales for automatic weight recording, and connect to RFID Reader for automatic cattle identity recording, and use MariaDB for database server to save the data.

2.2. Method

2.2.1. General

The data that recorded is ear tag number, breed, sex, body weight, and paddock with a remark when needed. The parameters compared from both farming type are number of cattle that can be recorded per day and time required to record per head of cattle (second). Effectiveness value of this system on rural farming was learned through by comparing for each trial from first trial to fourteenth trials of time required to record per cattle.

2.2.2. Statistic

Table 1. Adoption value of RFID system

	CF	RF
Number of cattle that can be recorded per day	199 ₊ 100,70 ^b	63 ₊ 33,51 ^a
Time required to record per head of cattle (second)	29.85 ₊ 12.37 ^a	68.95 ₊ 30.76 ^b

CF: commercial beef cattle farming

RF: rural beef cattle farming

Different superscript in the same row means significantly different (P<0.05)

Table 2. Effectiveness value of RFID system

Trial Repetition Number	Mean	Duncan Grouping
Trial-1 (21-Feb-21)	130.81 ₊ 35.52	A
Trial-2 (22-Feb-21)	115.46 ₊ 42.77	B
Trial-3 (26-Feb-21)	86.31 ₊ 31.92	C
Trial-4 (01-Mar-21)	82.82 ₊ 25.23	C
Trial-5 (02-Mar-21)	81.09 ₊ 30.00	C
Trial-6 (03-Mar-21)	81.55 ₊ 41.46	C
Trial-7 (04-Mar-21)	80.82 ₊ 37.67	C
Trial-8 (05-Mar-21)	66.05 ₊ 31.08	D
Trial-9 (10-Apr-21)	53.84 ₊ 9.04	E
Trial-10 (17-Apr-21)	45.07 ₊ 29.13	EF
Trial-11 (18-Apr-21)	40.42 ₊ 14.39	FG
Trial-12 (22-Apr-21)	36.15 ₊ 16.37	FG
Trial-13 (28-Apr-21)	35.07 ₊ 11.13	FG
Trial-14 (01-May-21)	29.87 ₊ 12.19	G

Number of cattle that can be recorded per day and time required to record per head of cattle were analyzed using the t-student test method. The model used to analyze was:

$$t = \frac{(\bar{x}_a - \bar{x}_b) - (\bar{\mu}_a - \bar{\mu}_b)}{\sqrt{\frac{s_a^2}{n_a} + \frac{s_b^2}{n_b}}}$$

Where \bar{x}_a = a sample mean, \bar{x}_b = b sample mean, $\bar{\mu}_a$ = a population mean, $\bar{\mu}_b$ = b population mean, s_a = a standard deviation, s_b = b standard deviation, n_a = a sample amount, n_b = b sample amount. Significance was declared at $P < 0.05$.

Effectiveness value were analyzed by comparing for each trial for first trial to fourteenth trials of time required to record per cattle using Analysis of Variance with Completely Randomized Design. The model used to analyze was:

$$Y_{ij} = \mu + P_i + \varepsilon_{ij}$$

Where Y_{ij} = the value of the observation of the i treatment and the j repetition, μ = median, P_i = i treatment effect, ε_{ij} = experiment error effect. Significance was declared at $P < 0.05$.

3. RESULT AND DISCUSSION

Adoption value of RFID system are presented in Table 1. Effectiveness value of RFID system are presented in Table 2. Number of cattle that can be recorded per day by commercial beef cattle farming was significantly higher ($199 \pm 100,70$) than rural beef cattle farming ($63 \pm 33,51$). Time required to record per head of cattle by commercial beef cattle farming was significantly shorter ($29,85 \pm 12,37$) than rural beef cattle farming ($68,95 \pm 30,76$). Adoption value of RFID system are higher for commercial beef cattle farming than rural beef cattle farming. This condition may occur due to routine training carried out by commercial beef cattle farming in the operation of the RFID system or it could be due to repetition RFID system using in commercial beef cattle farming which is more frequent than rural beef cattle farming. The effectiveness value test shown that the more often rural beef cattle farming repeats the use of the RFID system, it takes less time to record per head of livestock until the 14th test shows the time required to record per head of cattle is equal with commercial beef cattle farming. Repetition of the RFID system using until the 14th repetition takes 69 days with the average of repetition time interval is 5 days.

AUTHORS' CONTRIBUTIONS

Adoption value of RFID system at commercial beef cattle farming was higher than at rural beef cattle farming. Repetition of the RFID system using will

increase the effectiveness value of RFID system implementation at rural beef cattle farming.

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