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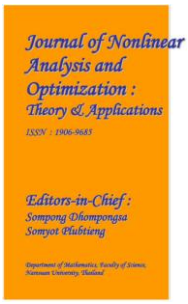

DETERMINANTS OF ARTIFICIAL INSEMINATION USE IN CATTLE - A LOGIT ANALYSIS

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Abstract
Dairy farming has a rich heritage in India. Since most Indians still reside in rural areas, farming and animal husbandry go hand in hand. Livestock provide farmers with manure, draught power, milk, and shelter, while crops provide food and shelter for animals. From a simple agricultural activity to a sophisticated industrial company, milk production has come a long way. The small Himalayan kingdom of Sikkim is also a prime example of this. Regardless of the challenging terrain, most people depend on dairy farming. The quality of food households eat and their disposable income are both improved. This research looks specifically at artificial insemination on mountain dairy farms, and it finds that the usage of AI in dairy production is on the rise in the region. The results have been assessed in the mountain region using a Logit analysis, 120 samples were collected from chosen villages in Sikkim using a random sampling procedure. It was observed that the dairy farmers in the study area, whether they worked full-time or part-time, seldom raised bulls for breeding. Among the two groups of dairy farmers, AI in cattle was the clear winner. Among households headed by full-time dairy farmers, the likelihood of using artificial insemination was 22.3% higher. Positivity and statistical significance are also shown by educational qualification. Among farmers, those with a bachelor's degree or above are 2.4% more likely to use AI. Finally, dairy farms in the highlands need to embrace new practices and greener methods if they want to be elevated. Use of qualitative and quantitative primary data has been made. There are supplementary tables and figures that back up the results. In order to get a better grasp of the subject, relevant papers were reviewed.

Keywords: Adoption, Artificial Insemination, Dairy-farming, Farmers.

Introduction

In 1941, Dr. Millar from Naini Agricultural University began investigating Artificial Insemination. Then, following this lead, the Indian Veterinary Research Institute began investigating this field as well, with an eye on creating AI methods of insemination. Artificial insemination's capacity to increase milk production, decrease the danger of STDs, and increase the quality of progeny has led to its increasing use in dairy farming. The study region of Sikkim has seen an impressive success rate with AI. However, there are continuous efforts to improve AI processes for the benefit of dairy producers. According to Rathod and Chander (2014), artificial insemination was a game-changer for the Indian dairy industry and had far-reaching social and economic effects. Artificial insemination is defined by Robert Lewis et al. (2016) as the practice of directly injecting bull sperm into a cow's rectum through the mid-cervix using syringes.

One could argue that the most difficult part of the dairy industry is the process of fertilizing cattle, which has long been the most difficult part of animal husbandry. There was a low conception rate and an elevated risk of sexually transmitted diseases during sexual mating in nature. Furthermore, the chances of getting pregnant were slim. Llya Lvanovich Lvanov, a Russian scientist, developed the technique of artificial insemination in 1922 as a result (Ombelet & Robays., 2015). In artificial

insemination, a syringe is used to artificially fertilize a cow's ovaries. The process involves fertilizing the cow's egg with the sperm of a bull. This method stops cattle from mating sexually, which means fewer cases of STDs, says Patel et al. (2017). Furthermore, the process involves injecting the semen straight into the cervix of the cow's ractovagina, enhances the conception rate and yields genetically superior progeny.

Due to the low prevalence of artificial insemination, the potential for animal development has not been realized in underdeveloped nations. Researchers Verma et al. (2012) found that when farmers had access to more organizational and technological resources, the success rate of artificial insemination increased. According to Wilmut et al. (1979), artificial insemination (AI) was among the earliest and most refined ways to create new animal breeds without mating. One of the most common ways to introduce new animal species is through artificial insemination. In keeping with the theoretical background, we sought to ascertain the study's objectives, which are to ascertain the current state of artificial insemination acceptance and to identify the factors influencing this adoption in mountain economies' cow populations.

Material and Methods

This study employs a variety of approaches in order to accomplish its goal. For the purpose of this article, quantitative and qualitative survey data are utilized to explore the factors that influence the acceptance of artificial insemination in cattle in the Himalayan state of Sikkim. In the year 2023, a total of 120 dairy farmers from selected villages in Sikkim were chosen at random, interviewed, and given a standard questionnaire. The findings of the interviews and questionnaires were analysed using the logit method. The subject matter is connected to dairy science, however social science has been utilized in order to centre attention on it.

Result and Discussion

According to Gujarati and Porter (2003), a binary logistic model is utilized in situations when the dependant variable is known to be discrete and binary. As a consequence of this, we have utilized a logit model in order to elucidate the relationship that exists between a binary variable that indicates whether or not dairy farmers have access to artificial insemination and a collection of explanatory variables that describe the socio-economic circumstances of dairy farmers.

Table 1: Sample overview and summary statistics

Sl. no.	**Explanatory variables**	**Mean**	**Standard Deviation**
1	Age	50.78	13.162
	Family Size	5.57	2.180
	Land	3.96	6.280
	Cattle	3.95	1.887
	Adult Education	9.12	3.679
2	**Structure of cattle shed**	**Frequency**	**Percentage**
	Near Home	85	70.83
	Other	35	29.17
3	**Full/Part timer dairy farmers**	**Frequency**	**Percentage**
	Full	89	74.17
	Part	31	25.83
4	**Establishment**	**Frequency**	**Percentage**
	Self	55	45.83
	Others	65	54.17

	Vaccinated	**Frequency**	**Percentage**
5	Yes (No Risk)	103	85.83
	No (High Risk)	17	14.17

Source: Field Survey, 2023

Table 1 above shows the number and an overview of the dairy farmer families that were chosen for the study. The factors that explain various parameters, like age, are shown in Sl. no. 1. The average age is 50.78 years old, and the range (SD) is 13.162 years old. The SD is very far from the mean, which means that dairy farmers can be as young as a teenager upto very old age. The mean for family size is 5.57, and the standard deviation is 2.180. The mean for land is 3.96, and the standard deviation is 6.280. The mean for cattle is 3.95, and the standard deviation is 1.887, which is close to the mean. The mean for adult education is 9.12, and the standard deviation is 3.679. The layout of the cattle shed, the full-time and part-time dairy farmers, and the business are shown in rows 2, 3, and 4. This study area has a lot of dairy farms; in fact, almost 71% of the homes have a cow shed nearby. They used money they already had to start their farms 46% of the time. The word for this is "self-establishment." Because they vaccinated or covered their cows, almost 86% of dairy farmers don't fall in a high-risk area. This is shown in the table above in column sl.no.5.

Table 2: Artificial Insemination Adoption Categories

Categories	Adoption						Non-Adoption		Total	
	Full		Partial		Discontinue					
	F	%	F	%	F	%	F	%	F	%
No. of HHs	66	55.00	36	30.00	6	5.00	12	10.00	120	100

Source: Field Survey, 2023

Note: F= Frequency

Figure: 1a
AI Adoption status of dairy farmers (%).

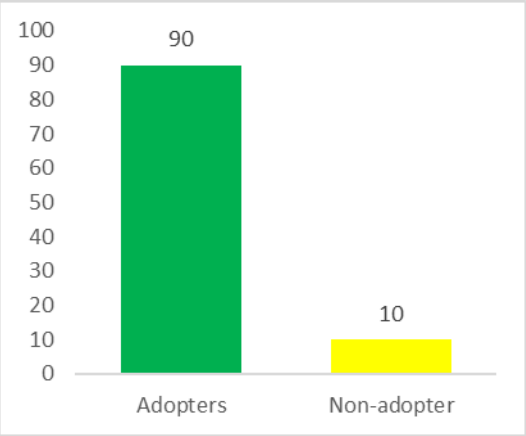
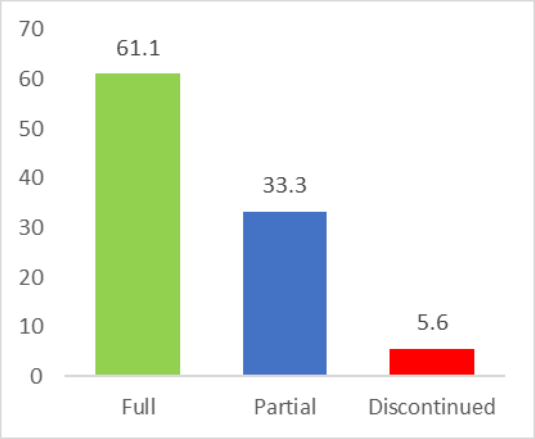


Figure: 1b
Categories of AI Adopters (%)



Farmers in South Sikkim who raise cows use artificial fertilization, which is shown in Table 2. 55% of the families polled, say that they always use artificial insemination. This is known as "full adoption." The last group of 30% dairy farmers only adopt artificial insemination sometimes, and the last group of 5% no longer use it. Finally, there are 10% of dairy farmers who are against artificial insemination for varied reasons. These farmers are in the "not in support of artificial insemination" group.

Table 3: Adoption Status of Artificial Insemination

Categories	0-3 years		3-6 years		6-9 years		9+ years		Total	
	F	%	F	%	F	%	F	%	F	%
No. of HHs	5	4.16	58	48.33	49	40.83	8	6.67	120	100

Source: Field Survey, 2023

Note: F= Frequency

Figure 2: Adoption Status of Artificial Insemination (Years)

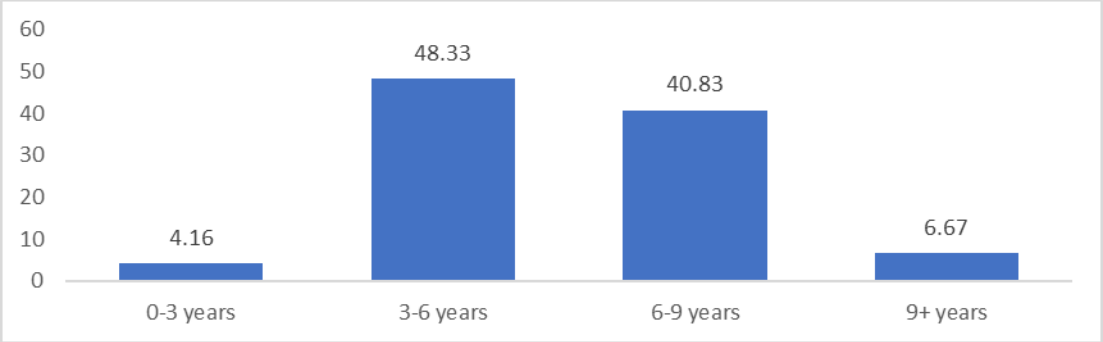


Table 3 shows the number of dairy farmers in South Sikkim using artificial insemination. About 4% of dairy farmers use artificial insemination on cows between the ages of 0 and 3 years. The rate is about 48% when the cow is between the ages of 3 and 6. About 41% of dairy farmers use AI on cows that are between 6 and 9 years old, and another 7% use it on cows that are older than 9 years old. The dairy farmers in the study area said that between the ages of 3 and 9 is the best time for cattle to be inseminated artificially. The table above shows this.

Table 4: Results of the binary logistic regression analysis

Variables	Co-efficient	S.E.	Wald-χ^2	Odds ratio	Marginal Effects
Age	.017	.017	.928	1.017	0.004
Households size	.100	.100	.998	1.105	0.022
Land	.117	.142	.679	1.125	0.025
Cattle	-.029	.119	.061	.971	-0.006
Farmer type (Full=1, Part=0)	1.035**	.491	4.442	.355	0.223
Adult education	.115*	.061	3.573	1.122	0.025
Agriculture is primary occupation	-.221	.454	.237	1.247	-0.048
Constant	-2.355*	1.273	3.421	.095	-
-2 Log-likelihood= 148.368 Pseudo R square=0.175 Prob>chi square:0.01					

*P<0.1, **P<0.05, ***P<0.01

Source: Field Survey, 2023

A logistic regression model was employed to ascertain the dairy producers who utilized Artificial Insemination (AI) and those who did not. The variables hypothesized to influence the adoption of AI were examined. Among all the variables examined, only two were determined to have a significant impact: the classification of farmers as either full-time or part-time (with a statistical significance of less than 5%) and the educational attainment of adult dairy farmers (with a statistical significance of less than 10%). Age, household size, and land exhibit positive effects, but their statistical significance is not significant.

The analysis demonstrated a favourable and statistically significant correlation between the classification of farmers as either full-time or part-time dairy farmers and their likelihood of using Artificial Insemination. This can be attributed to the observation that dairy producers, whether full-time or part-time, in the research area seldom raised breeding bulls. Both kinds of dairy farmers favoured Artificial Insemination due to its ability to increase milk production per cattle and reduce the expenses associated with maintaining breeding bulls. In fact, the current situation is such that the

indigenous breed is at risk of extinction. To address this, the government has established centres in specific areas where indigenous breeding bulls are made available. However, this initiative has not been successful in persuading farmers to choose indigenous breeding bulls over artificial insemination. Households that have full-time dairy producers are 22.3% more inclined to embrace Artificial Insemination due to their dual objective of commercial production and increasing their revenue. The level of education has a favourable and statistically significant impact. An individual with a greater level of knowledge in farming is 2.4% more inclined to embrace AI technology. This could be attributed to the fact that educated farmers possess a higher level of awareness, receptiveness, and understanding regarding the advantages of adopting new technologies to improve their production and productivity. No other variables were found to have a substantial impact. The log-likelihood value of 148.368 indicates that the model is a good fit for the data.

Conclusion:

The dairy producers in the study area, whether they worked full-or part-time, did not frequently rear breeding bulls. Both groups of dairy farmers favoured artificial insemination because it raised milk production per cow while lowering the cost of breeding bull maintenance. According to the research, artificial insemination (AI) in cattle was the pioneering biotech tool for improving the genetics and offspring of dairy cow. Artificial insemination methods necessitate relevant background knowledge and experience. If you want to know how successful AI is, go no farther than the quality of the semen used. Perhaps because these farmers produce for both personal and business profit, the use of artificial insemination is 22.3% more common in households where the dairy farmer is a full-time dairy producer. The degree of education is both encouraging and statistically significant. With each additional year of education, a farmer's chances of adopting AI technology rise by 2.4%. Thus, it is imperative that all parties concerned, including academic institutions and research centres, come up with new ways to use AI to train technicians better and give farmers more time to learn how to spot the signs of heat stress. Animal genetics will be enhanced by this.

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