Effect of Soybean-based Semen Extender on Goat Artificial Insemination (AI) Conception and Factors Determining Conception Rate

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Introduction

- Artificial insemination (AI) has been used in many developed countries as an effective breeding tool for goats to rapidly improve their genetic makeup by using extended or frozen semen from superior bucks.
- AI on goat in the region and elsewhere in the country was relatively new and not yet widely adopted.
- Need for a delivery system so AI services can be done among goats in order to facilitate goat upgrading.
- The ISU and CVARRD with funding from PCAARRD, spearheaded AI delivery in Region 2. One project that was implemented was entitled "Enhancement of Artificial Insemination and Meat Processing Technologies Towards Production of Quality Slaughter Goats in Cagayan Valley"

Introduction

- The project was completed in 2011.
- One of the project's component developed a cheaper extender named as SemEx, a soybean lecithin-based semen extender as a possible alternative to egg yolk-based extender and identified a delivery system for artificial insemination (AI).
- The project involved the Isabela State University (ISU) in partnership with the Department of Agriculture, Provincial Veterinary Office and the Local Government Units in Region 2.

The SemEx

- ***SemEx* -** an improved semen extender to replace the egg yolk-based extender for longer semen viability and post-thaw motility of frozen spermatozoa.
- The formulation of semen extender was conducted at the existing semen laboratory of ISU.
- From 2009 to 2011, about 200 does were synchronized in project sites (Echague, Jones, Alicia, and Santiago in Isabela, and Bayombong in Nueva Vizcaya) to test the successful conception rate of AI using the formulated extenders.
- Results showed 70% (70/100) does were verified pregnant using the traditional egg yolk-based extender, and 75% for does inseminated with soybean lecithin-based extended semen (Balbin et.al, 2012).

Objectives / Focus

- Effect of using soybean-based extender SemEx on goats' conception
- Factors that determine AI conception rate

Data (2018)

- Personal interview of goat raisers
- 184 goat raisers
- 81 did not adopt AI
- 103 adopted AI
- 42 continually availing AI services

Methods

- Examination of Adoption Characteristics
- Analysis of factors to explain conception rate

$$\textit{Conception rate of AI} = \frac{number\ of\ does\ which\ conceived}{number\ of\ does\ inseminated}\ x\ 100\ \%$$

Methods

- *Analysis of factors to explain conception rate*

X_1 - number of years of adoption of the AI technology

X_2 - type of extender

X_3 - farmer's knowledge on estrus

X_4 - farmer's adoption of estrus synchronization

X_5 - attendance to seminars on AI

X_6 - farmer's adoption of housing in goat raising

Criteria:

Significance of the model
Coefficient of determination
RMSE

A Priori Assumption:

each explanatory variable relationship to conception rate is positive.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + e$$

Adoption Characteristics

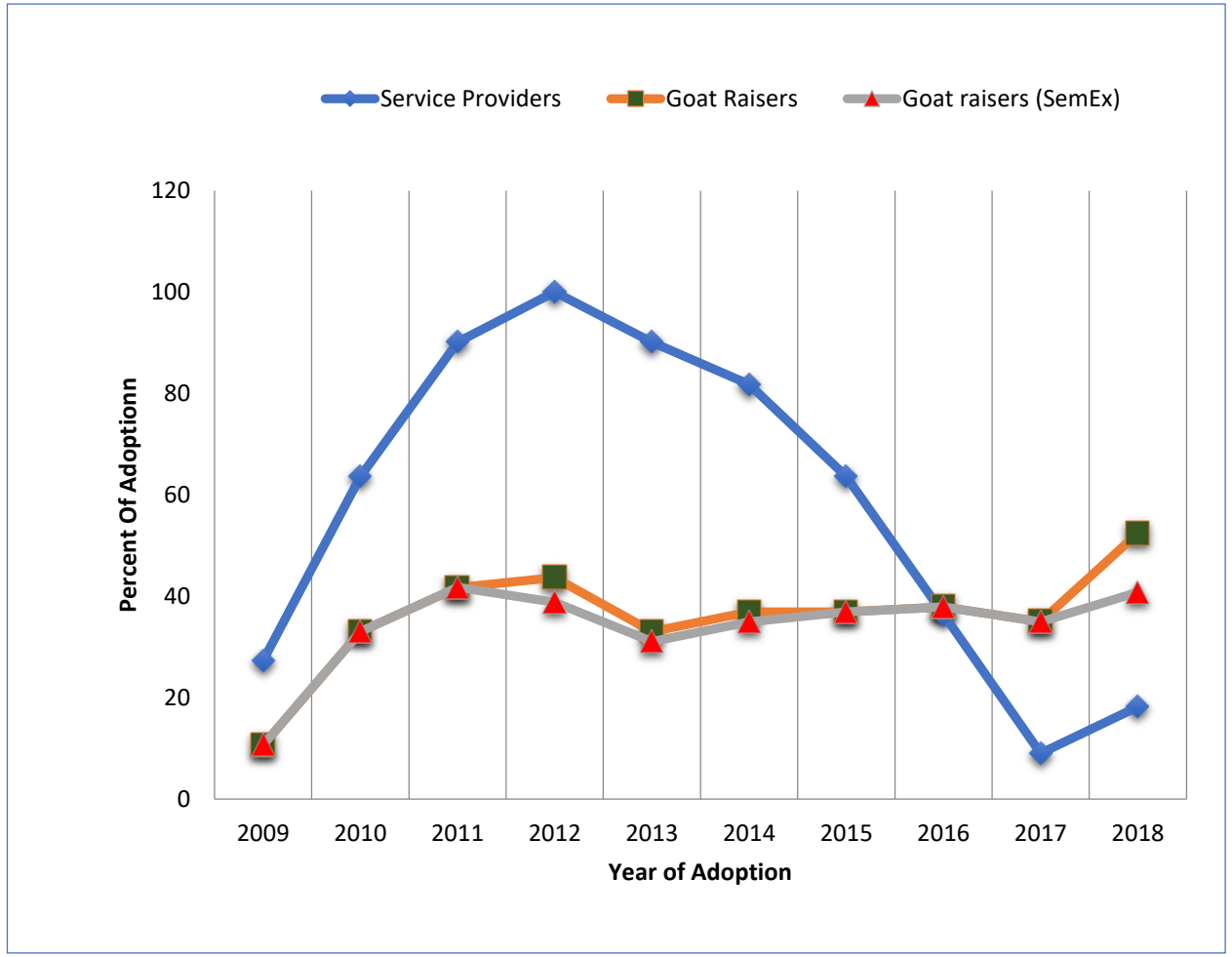


Figure 1. % adoption per year by service providers and goat raisers (SemEx and non-SemEx users)

Table 1. Distribution and Descriptive Statistics on Characteristics of the AI Adopter Respondents

Characteristic	*Frequency (n=103)*	Percent	Descriptive Statistics
Age			
<= 30	5	4.85	Mean = 50.1
31-40	20	19.42	SD = 12.04
41-50	25	24.27	Range: 23 – 75
51-60	29	28.16	
> 60	24	23.30	
Years in Goat Farming			
< = 5	29	28.16	Mean = 11.7
6-10	38	36.89	SD = 9.24
11-15	14	13.59	Range: 1 – 56
16-20	10	9.71	
21-25	6	5.83	
>25	6	5.83	
Years Adopted AI			
1-2	62	60.19	Mean = 2.9
3-4	22	21.36	SD = 2.50
5-6	5	4.85	Range: 1 – 10
7-8	6	5.83	
9-10	8	7.77	
Attended Seminars on AI			
No	48	46.60	
Yes	55	53.40	
Type of Semen Extender adopted			
SemEx	70	67.96	
EggYolk based	33	32.04	

Goat's Conception Rates

Table 2. Number of AI Adopters and Mean % Conception Rate by Adopter Characteristic

Characteristics of Adopters of AI		Number of Adopters		Conception Rate (%)		Point Biserial Correlation			
						All Adopters (n=103)		SemEx Adopters only (n=70)	
		Freq.	Percent	Mean	SD	r_b	p-value	r_b	p-value
Adopted semen extender	SemEx	70	68.0	52.58	45.65	0.037	0.712		
	Egg yolk based	33	32.0	48.99	46.43				
knowledge of estrus	YES	77	74.8	56.68	45.06	0.198*	0.044	0.335**	0.005
	NO	26	25.2	35.90	44.89				
Adopts estrus synchro	YES	49	47.6	57.14	45.80	0.120	0.229	0.106	0.383
	NO	54	52.4	46.25	45.42				
Adopts housing on goat raising	YES	57	55.3	56.68	45.05	0.128	0.196	0.259*	0.030
	NO	46	44.7	44.93	46.16				
Attended seminar	YES	55	53.4	54.27	45.07	0.067	0.502	0.185	0.126
	NO	48	46.6	48.18	46.68				

* - significant at 0.05 ** - significant at 0.01

Table 3. Relationship between Conception Rate and Number of Years of Adoption of AI Technology

Characteristic	All Adopters (n=103)		SemEx Adopters only (n=70)	
	r	p-value	r	p-value
Number of years of Adoption of AI	0.187	0.058	0.344**	0.004

Factors Affecting Conception Rate

IBM SPSS Statistics 25

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
4	Regression	20967.991	3	6989.330	3.602	.016[e]
	Residual	192108.976	99	1940.495		
	Total	213076.968	102			
5	Regression	15865.074	2	7932.537	4.022	.021[f]
	Residual	197211.894	100	1972.119		
	Total	213076.968	102			

Model Summary[f]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.329[a]	.108	.053	44.48949	
2	.326[b]	.106	.060	44.30304	
3	.324[c]	.105	.069	44.11199	
4	.314[d]	.098	.071	44.05105	
5	.273[e]	.074	.056	44.40855	1.928

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
4	(Constant)	9.424	14.275		.660	.511
	Number of Years Adopted	3.670	1.751	.201	2.095	.039
	Type of extender	18.614	11.478	.155	1.622	.108
	knowledge estrus	21.302	9.997	.203	2.131	.036
5	(Constant)	25.891	10.114		2.560	.012
	Number of Years Adopted	3.424	1.759	.187	1.947	.054
	knowledge estrus	20.781	10.073	.198	2.063	.042

a. Dependent Variable: Conception Rate

Factors Affecting Conception Rate

Table 4. Regression results on factors influencing conception rate

Source of Variation	Sum of Squares	DF	Fc	P-value
Regression	20967.991	3	3.602	0.016
Error	192108.976	99		
Total	213076.968	102		
Variables	**Coefficients**	**Std. Error**	**t-values**	**p-value**
Constant	9.424	14.275	0.660	0.511
X_1 Years of adoption of AI tech	3.670	1.751	2.095*	0.039
X_2 Type of extender	18.614	11.478	1.622	0.108
X_3 Knowledge of estrus	21.302	9.997	2.131*	0.036
R^2 = 0.098				
Adj R^2 = 0.098				
RMSE = 44.05				

*Significant at 0.05 level

C.Rate = 9.424 + 3.670 Number of years adopt + 18.614 Type of extender + 21.302 Knowledge of estrus

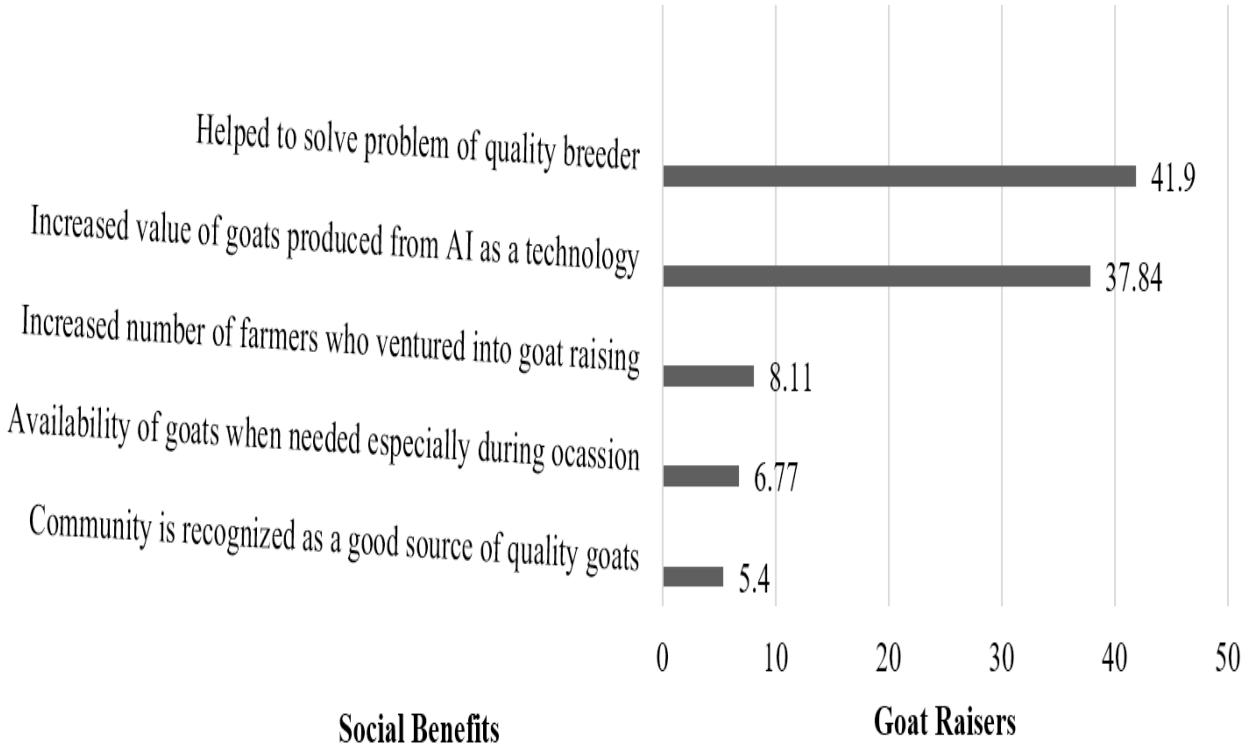
Increased income from adoption

Table 5. Comparison of income of farmer using soybean lecithin and egg-yolk based semen extender for goat (based on average conception rate from 2012-2018)

	Income of Goat Raiser	
	with **soybean lecithin** based semen extender	with **egg-yolk** based semen extender
Average no. of goats inseminated/raiser[1]	5	5
Does Conceived[2]	2.63	2.45
Total kids born (hd)[3]	3.94	3.67
Mortality (20%)	0.79	0.73
Total kids reared (hd)	3.15	2.94
Selling price[1]	4,305.56	4,305.56
Income of farmer	**13,583.18**	**12,655.76**
	Additional Benefit/Loss per Raiser = Php 927.42	

[1] Based on the survey results
[2] Average no. of goats inseminated/raiser multiplied to the conception rate of each animal (soybean lecithin (52.58%) and egg-yolk based (48.99%))
[3] No. of does conceived multiplied by kid size

Perceived Social Benefits



Summary and Conclusion

The number of client goat raisers had not increased significantly over time.

Among those whose goats were inseminated, numerically higher conception rate of 52.58% for SemEx and 48.99% for egg yolk, was derived. The performance of goats under AI is comparable regardless of extender used.

What explained the difference in conception at the farm level are the farmers' knowledge of estrus and the years AI had been adopted as a breeding technique.

Nonetheless, the change in conception rate resulted in an added benefit of Php1,250.33 (computed in 2009-2011 during the project) and Php927.42 (2012-2018 after the project) per farmer.

Soybean lecithin can be a potential replacement to egg yolk in the formulation.

True enough, the project was able to produce a technology that is cheaper whose performance is comparable to the prevailing one.

Recommendations

An incentive in doing AI service is recommended so private inseminators can make AI service as a source of income. The cost of AI service should be compensated by the renumeration of service.

- To ensure higher success among goats under estrus synchorinization, capability enhancement among inseminators and goat raisers could be an intervention.
- Continue to capacitate LGU technicians who are and will be directly involved in AI services.
- Continued implementation of AI program at the regional, provincial and local levels especially in areas with difficult access to quality breeders.
- For ISU to continue to produce SemEx and promote the same to DA as potential alternative to egg yolk-based extender.

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Salamat

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