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Constraints Identification and on Station Evaluation of Hormonal Assisted Artificial Insemination on Reproductive Performance of Horro Cattle in Western Oromia, Ethiopia

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Abstract: The study was conducted in Guto gida, Diga and Sibu sire districts of East Wollega, Bako tibe and Ilu galan district of West Shaw zones and on station in Bako agricultural research center with the objectives to assess constraints associated with hormonal assisting artificial insemination and to evaluate the response of Horro cattle (Bos indicus) cows after estrous synchronization. In this study, structured questioner was used and a total of 204 respondents (180 small holder dairy farmers, 8 animal health workers, 8 animal production professionals and 8 AI technicians were interviewed. Retrospective data from specified districts were also included to identify constraints associated with hormonal assisting artificial insemination in the study areas. The study indicated that most of the respondents (93.33%) were got information/ took training on the issue of mass estrous synchronization and AI services before the commencement of the program. However, most of the respondents (57.78%) had moderate knowledge on heat detection and only few (27.22%) of them can keep the record of their synchronized cows/heifers. The main restraints for the low success rate of on farm hormone assisted artificial insemination (estrus synchronization) were identified as failure of conception (42.22%), using poorly managed cows/heifers (15%), difficulty in heat detection by the farmers (13.89%), skill gap and unavailability of artificial insemination technicians (AITs) (12.78%) and poor hormonal responses (11.11%) and the assessment made on farm in comparison with observational test made on station indicated that there were minimum or very few problems with estrus synchronization since majority of cows hormonally treated were conceived as that of normally cycling animals. Therefore, to enhance the genetic potential of indigenous dairy cows through cross breeding scheme, revising of the existing hormone assisted estrus synchronization, artificial insemination delivery system, improving the ability of farmers and experts on the handling of frozen semen and management of dairy cows/heifers before and after hormonal synchronization should be due in place. Moreover, awareness creation should be done to change the attitude of farmers on hormone assisted estrus synchronization.

Keywords: Constraints, Artificial Insemination, Mass Estrus Synchronization, Horro Cattle

1. Introduction

Artificial insemination (AI) is a proven bio-technique, which is used globally to improve the genetic makeup of the cattle and thereby improve their production and reproduction traits [12]. However, the overall impact of AI can only be achieved when it is coupled with proper animal husbandry practices. Over the years, there have been efforts to improve the productivity of native breeds through the introduction of AI program with improved exotic dairy [2]. However, the success of such programs so far is far from satisfactory due to numerous factors, which includes substandard nutrition, poor management and infrastructure status. Thus, dairy producers have been complaining about poor reproductive performance in cattle, which were exposed to AI [10, 13].

Crossbreeding work in Ethiopia has been initiated in the

early 1950s when Ethiopia received the first batch of exotic (Friesian and Brown Swiss) dairy cattle from the United Nation Relief and Rehabilitation Administration [4]. However, formal breed improvement research started in early 1970's at Bako, Melka Werer, Adami Tulu and Holleta Agricultural Research Centers. Thus, crossbreeding program with three exotic breeds as sires (Friesian, Jersey and Simmental) and three local breeds as dams (Horro, Borana and Barka) have been carried out for about three decades along with several management studies. Crossbreeding program was planned for upgrading the local cattle with the infusion of *Bos Taurus* blood. AI program always demands to keep records of non-return rate, conception rate, service per conception and calving rate in order to properly evaluate the reproductive efficiency of cows, skill-ness of the inseminators, fertility and semen quality of bulls. Ideally, optimum economic fertility could be achieved with a pregnancy rate of 80% after the first insemination, a maximum of 1.3 services per conception and an average interval of 85 days between parturition and conception [7]. Conception rate determines directly to the total profitability of farm enterprises. There are many genetic and non-genetic factors, *viz*. genotypes of cow, genotype of bull, age and parity of cow, semen quality and season.

A successful AI program is dependent upon optimization of the number of healthy cycling females at the beginning of the breeding season, careful attention to sire selection, implementation of appropriate estrus synchronization, low stress cattle handling, purchase of high quality semen, proper semen handling and insemination technique, and good nutritional management before and after AI. Conception rate is directly associated with the production attribute and responsible for monitoring life time productivity of the individual animal [14, 5]. In Oromia, around the year a large number of animals remain barren or unproductive by hormonal assisting artificial insemination and become a burden for the farmers. Low conception rate were reported during ADPLAC from East Wollega zone hormonal assisting artificial insemination. Some farmers were reluctant to bring their cows for artificial insemination on onset time (72 hours) after hormonal treatments. There is also reported on the repeated breeding. However pregnancy rate were reported 60% in Amahara, Tigray and South regions [4, 15]. Different genotypes of cattle respond differently to oestrus synchronization [3, 11]. Study conducted at Adami Tulu indicated that crossbred animals came into heat 18.9 hrs earlier than Borana animals. Differences have been observed in the in endocrinology, estrus behavior and LH release pattern between Brahman and Hereford cows [11].

Livestock Maters Plan Road Maps for GTP II (2015/16-2020) crossbred dairy cattle will produce an average of 6 liters of milk per day vs 1.9 liters/day for local cattle milk (an increase of 216%), weigh 375 kg while the average live-weight of adult local animals is 280 kg, have a lactation length of 270 days on average vs 200 days for local breeds (an increase of 35%) and give average milk production per year of 1,053 vs milk production of 247 liters/year for local breeds (a 326% increase). This plan is targeted to be aligned with the long-term plan of the Livestock Master Plan (LMP, 2015 that targets to improve the dairy genetics through artificial insemination (AI) combined with estrus synchronizations. Therefore, before starting the second phase of GTP II it is very crucial to identify the problem associated with estrus synchronization in order to achieve the intended plan.

Reproductive performance of animals has a vital role in improving productivity. Reproductive performances are a milestone for dairy animals to produce maximum calf crops in the animal lifespan and make dairy keepers profitable. Estrus detection is a tough work and time taken activities with limited success to obtain maximum reproduction performance. To fill this gab estrus synchronization with prostaglandin hormone were developed. The success of this hormone was confirmed and the extension of this technology is distributed across the world. Among economically important reproductive traits identified and well recognized estrus synchronization (Hormone treatment) is the most important for the success of reproduction. Artificial insemination supported by synchronization of estrus could hasten selection and the introduction of improved genotypes. Estrus synchronization is a biotechnological device that helps to plan for better reproductive performance in dairy enterprise in order to get maximum pregnant cows at specified period of time. The response of Horro cattle breed on estrus synchronization is not studied in controlled environment. Horro cattle breed are commonly found and plays major socio-economic activities of the communities but theoretically perceived as low respondent to estrus synchronization about 7% have been achieved from previous efforts which is far below other regions such as Amahara and Tegray regions which are around 60%, so that maximum effort has to be made in case of Oromia Livestock Agency in general and Livestock research Process of BARC in particular. However this hormone was used on farm in our mandate area, through the Oromia Livestock Agency in collaboration with other Projects like LIVES of ILRI. Even though, the farmers are complaining this technology due to very poor conception rate and very low success. Therefore; the objective the study was to assess constraints associated with the hormonal assisting artificial insemination and to study the response of Horro (*Bos indicus*) cows after estrous synchronization.

2. Materials and Methods

2.1. Study Areas

Study was conducted in western Oromia where hormonal assisting artificial insemination was implemented namely in Guto Gida, Sibu Sire and Diga districts from East Wollega and Bako-Tibe and Illu-galan district from West shoa zones as well as at Bako Agricultural Research Center on station which is located in West Shoa Zone of Oromia Regional state at about 258 km west of Addis Ababa at an average altitude of 1650 m.a.s.l.

2.2. Survey

The major users of hormonal assisting AI service in the two zones were purposively selected to undertake the study. From each districts two Kebele's (Ganda) were selected depending on estrous synchronization using history. A total of 180 farmers from each district over all were interviewed with structured questionnaire. Moreover, 8 animal health workers, 8 AI technicians and 8 animal production experts, 2 from each district were contacted to generate additional information on the efficiency of mass estrous synchronization for better AI delivery system. The data on the status of hormonal assisting AI services and constraints associated/ related with other AI service were collected. Before the commencement of the actual interview process, the objective of the study and other related issues were briefly introduced to each respondent in the study areas. Secondary data were also collected from respective district livestock agency.

Observational Assessments

After commencement of survey work, observational assessments were made with districts livestock agencies. The Observation was undertake for season, time of insemination, body condition, parity, feed availability, type of breeds and semen motility, hormonal response, semen handling and recording keeping issues.

2.3. On station Evaluation

The study was undertaken at Bako Research Center. A total of 40 non-pregnant normally cycling cows were randomly divided into two groups (20 cows per group). Cows in one group were synchronized by injection with 2 ml of prostaglandin F2α analogue (estrumate) intramuscularly while cows in the other group did not synchronized with prostaglandin F2α and inseminated as usual by flowing normal heat sign.

Estrous detection was made by continuous visual observation by trained technicians. Cows that failed to respond to treatment were inseminated following their regular cycle. Pregnancy test (PD test) was conducted after 90 days of insemination by palpation through rectum. Cows in the control group were inseminated following their regular cycle.

Different parameters were also calculated for on station work using the following formulas

Abortion rate=Number of abortions/ Number of pregnancies *100

Calving rate=Number of calving /Number of pregnancies *100

Fertility rate=Number of live births /Number of inseminated cows *100 Live birth rate=Number of live births /Number of calving *100 Birth weaning mortality rate=Number of death calves /Number of live births *100

2.4. Data Analysis

Data analyses (frequencies, percentages) were computed using the descriptive statistics procedures of Statistical for social sciences (SPSS, version 20).

3. Results and Discussion

From the observation made the season, time of insemination, body condition scoring, party of the cow, hormonal responses, semen handling and record keeping have their own drawbacks. As the report of experts, the time when the hormone made available and the time when the group were made ready to accomplish the activity didn't match, which means when the hormone made available the animal were not ready to be injected and inseminated since the cows were not flushed (Given additional feed or concentrates) to make them ready. Parity of the cows were also not considered as criteria, farmers brought their own cows within 72 hrs of onset of estrus signs and the cooling facilities that the AI technicians used for AI service is also not enough.

Some of the problems associated with estrus synchronization were identified as synchronization of cows with poor management which leads to less response to hormone and inseminating cows with low quality semen without checking its viability and motility are few constraints raised by group.

The other drawbacks obtained from group discussion on issue of mass estrus synchronization were; poor heat detection by farmers, low participation of farmers, poor selection of participating animals, poor managements of hormone treated animals/cows, less attention or poor attitude of farmers for the work and other related issues.

3.1. Farmers' (Respondents) Speculation and Awareness on Mass Estrous Synchronization

Majority (42.22%) of the respondents were reported that low success of mass estrous synchronization and AI services were came from failure of conception followed by poor management of cow (15%) before and after estrous synchronization (Table 1). Similar to our finding, [6]. in Amahara region indicated less success of mass estrous synchronization due to poor conception, poor management of cows/heifers before and after synchronization and skill gab and unavailability of AIT (Artificial insemination technician), But none of them reported disease as cause for less success of mass estrous synchronization AI service as current finding.

Among the participant farmers about 11.11% were reported poor hormonal responses for synchronized animals and 12.78% of the respondents complaining about skill gab and unavailability of AITs. In addition to farmers speculation the professionals also listed out similar and additional thought for less success of mass estrous synchronization and AI services, such as? Poor hormonal response, skill gab in

heat detection and other related issues.

Therefore; for successful mass estrous synchronization for more AI services it is good to reduce or avoid all the speculation of the farmers through engagement of the farmers into the work and awareness creation for farmers and district professionals as well through training.

Table 1. *Respondent responses for low success rate of mass synchronization and AI service in the study areas.*

Variables	No of respondents in each district (%)					
	Diga	Guto Gida	Sibu sire	Bako Tibe	Ilu galan	Total no of respondents (%)
Poor hormonal responses	16.67	13.89	11.11	8.33	5.56	11.11
Failure of conception	50.00	41.67	38.89	38.89	41.67	42.22
Poor managements of cows/heifers	11.11	13.89	25.00	5.56	19.44	15.00
Skill gab and Unavailability of AITs	11.11	13.89	5.56	19.44	13.89	12.78
Difficulty in heat detection by farmers	8.33	11.11	13.89	25	11.11	13.89
Disease	2.78	5.56	5.56	2.78	8.33	5.00
Total	100	100	100	100	100	100

Although, most of the respondents (93.33%) were took training on the issue of mass estrous synchronization and AI services before the commencement of the program, still the knowledge for heat detection of the respondents (57.78%) were moderate and only 27.22% of the respondents can keep record keeping of their synchronized cows/heifers (Table 2). Few farmers also stated and perceived as estrus synchronization hormone make their cows/heifers sterile.

Table 2. *Respondent responses about mass synchronization and AI service in the study areas.*

Variables	Categories	No of respondents in each district (%)					
		Diga	Gutogida	Sibu sire	Bakotibe	Ilu galan	Total no of respondents (%)
Keeping of records (N)	Yes	5	12	6	16	10	27.22
	No	31	24	30	20	26	72.78
Perception of respondents (%)	Very good	12	14	10	13	14	35.00
	Moderate	18	18	19	20	21	53.33
	Poor	6	4	7	3	1	11.67
Knowledge on heat detection (%)	I know very well	10	11	10	15	13	32.78
	I know moderately	24	22	19	18	21	57.78
	I don't know	2	4	7	3	2	10.00
Participation of respondents on the program (N)	Yes	32	26	24	30	26	76.67
	No	4	10	12	6	10	23.33
Is training given for the respondents before (N)	Yes	34	30	34	35	35	93.33
	No	2	6	2	1	1	6.67
Availability of privet AI services (N)	Yes	2	8	1	0	0	6.11
	No	34	28	35	36	36	93.89

N= number of respondents.

Table 3. *Dairy cattle feed availability and Supplementation.*

Variables	Categories	No of respondents in each district (%)					
		Diga	Gutogida	Sibu sire	Bako tibe	Ilu galan	Total no of respondents (%)
Is there enough feed for your animal throughout the year	Yes (9 months)	20	24	26	23	22	23 (63.89)
	No (3 months)	16	12	10	13	14	13 (36.11)
What are common feed to your animals	Grazing	18	16	14	16	17	16.2 (45.00)
	Crop residue and hay	10	11	12	12	11	11.2 (31.11)
	Atela and other food left over	8	9	10	8	8	8.6 (23.89)
What types of animals do you supplement	Milking Dairy cows	12	14	8	13	12	12 (33.33)
	Synchronized cows/heifers	10	10	10	12	10	10.2 (28.33)
	Oxen	8	9	12	8	11	9.6 (26.67)
	Calves	6	3	6	3	3	4.2 (11.67)
Supplementation of estrous synchronized cow	With concentrate or mixture made at home from	12	14	8	13	12	11.8 (32.78)
	With crop residue or hay	18	18	22	20	21	19.8 (55.00)
	No supplementation	6	4	6	3	3	4.4 (12.22)

3.2. Dairy Cattle Feeding

Majority of the respondents 63.89% reported that sufficient feed availability throughout the year, while 36.11% faced feed shortage particularly for three months of the year in April, May and June. Grazing with 45% is the most important feeding systems for animal in the study area followed by crop residue and hay with average 31.11% availability (Table 3). Among the respondents who had participated in the hormonal estrus synchronization program, only 32.78% of the respondents were supplemented hormone treated cows/heifers with concentrates or mixture made at

home, this is similar with the report of [9] in Amahara region. However, majority (33.33%) of the respondents need concentrate feeds for supplementation of milking cows at the time of milking (Table 3).

In general, milking cow supplementation practiced more in the study area rather than synchronized cows/heifers. Farmers 'feeding trend is among the major obstacles which can negatively affect success rate of estrus synchronization [8]. This dictates awareness creation as well as development and distribution of synchronized cow feed supplementation strategies [1].

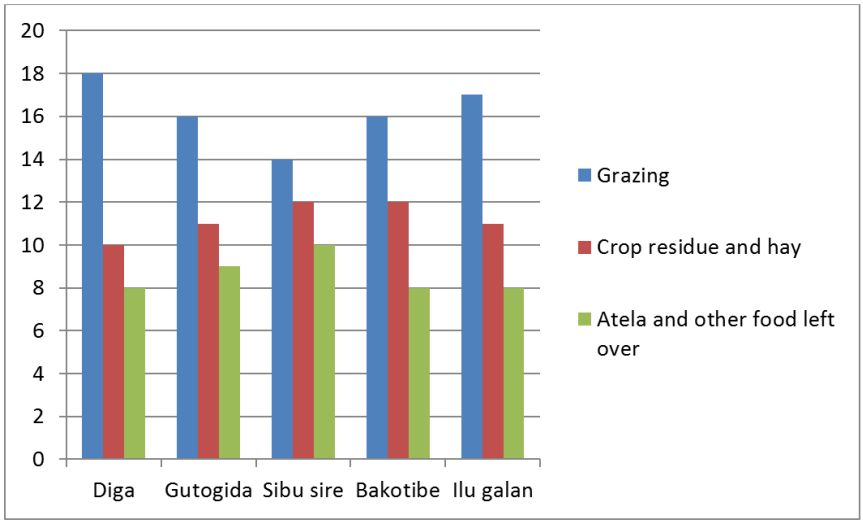

Figure 1. *Common feeds that the respondents farmers feed their cows in the study area.*

Table 4. *Status of hormonal synchronization estrus response and fertility rate of cattle at different districts and on station.*

Districts	Cow synchronized with PGF2α hormone	Cow responds to hormone inseminated (%)	PD checked +ve (%)	Calves born (%)	Abortion (%)
Diga	2680	78.25	30.04	6.25`	0.79
Gutogida	1904	80.25	11.85	8.44	0.00
SibuSire	2633	86.10	81.83	6.57	1.40
BakoTibe	2138	87.98	48.69	28.05	1.35
Ilu Gelan	1350	73.56	18.53	6.04	0.00
BARC	40	85	55	55	0.00

Source: secondary data from Livestock Agency and on station work result.

The total numbers of cattle are different in different districts; and it is difficult to compare the result obtained but for simple observation and comparison it is directed in the table above since the data were taken from different districts secondary data.

Table 5. *On station results for few reproductive parameters for synchronized cows.*

Parameters	Value (%)	Remarks
Abortion rate	0.00	No abortion
Calving rate	64.71	
Fertility rate	55.00	
Live birth rate	100.00	All born live
Birth weaning mortality	0.00	No mortality

Even though the sample population was few, it is possible enough to falsify the farmers believing that synchronization of cows/heifers withhormone make their animal sterile.

Generally the assessment made on farm in comparison with observational test made on station indicated that there were minimum or very few problems with estrus synchronization since majority of cows hormonally treated were conceived as that of normally cycling animals.

4. Conclusion

The low success rate of estrous synchronization cows has led farmers to lose their confidence on mass synchronized AI services. From this study, what are your conclusions for the less/low success rate of estrus synchronization among the parameters you have studied? Please add this information to your conclusion part.

From this, it is concluded that if we still want fast improvements of our cattle through cross breeding revising of the existed estrus synchronization operation is essential and the following sets of recommendations are forwarded to stockholders that implement interventions to improve the success of on-farm estrus synchronization in dairy cattle.

5. Recommendations

1) Engaging of farmers in estrus synchronizations and AI service before synchronizing of their cows to improve their knowledge/skill on estrus synchronization and associated cows' management issues.

2) Improving poor heat detection of farmers for proper time of AI insemination.
3) Awareness creation should be also done towards changing the attitude of farmers on estrus synchronization.
4) Appropriate animal selection should be done before implementing estrous synchronization and AI service.
5) Proper management should be given for estrous synchronization cows before and after mass estrous synchronization and AI services.
6) Poor technical ability and lack of experiences in AI service of AI technician who work in the district should be improved through practical training.

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