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Status of Artificial Insemination Delivering in and Around Assosa Town

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Abstract: This study was conducted to assess the status of Artificial Insemination (AI) delivering service in and around Assosa town of Benishangul-gumuz Region. The study was conducted with cross sectional survey and 42 households were purposively selected from 12 Peasant Associations for data collection. Collected data was analyzed by SPPS software and independent t-test, chi-square and ranking index was employed for numerical, string and ranking data respectively. The average total number of cattle per household is 4.83 in urban and 5.91 in rural smallholder dairy types. The primary purpose of keeping cattle both in urban and rural was milk production. The majority of households in urban areas (66.6) were use intensive dairy production system and both semi-intensive and extensive dairy production systems (50%) were common in rural areas. Average age at first calving of local and exotic heifer in urban was (36.06 and 22.12 months) respectively, whereas (38.33 and 22.50 months) in rural dairy types. Average calving interval of local and exotic/hybrid cow were (13.00 and 12.00 months) respectively in urban smallholder dairy producers and (13.50 and 12.00 months) in rural type in the same order. Smallholder dairy farmers both in urban and rural areas use AI breeding service and average total cow used for AI is (3.66) in urban and (2.41) in rural. Data of seven years (2009 to 20015) shows that even if the number of cows inseminated per year increased year to year, the number of calves born via AI did show slight increase in the last seven years of service. Urban (83.3%) and rural (66.7%) communities smallholder dairy producers was strongly agree with the idea that AI is preferable than bull. Low conception rate was the top ranked problem in urban smallholder dairy type, whereas lack of awareness was the top in rural smallholder dairy type and trypanosomiasis was the most important disease in the study area.

Key words: Artificial Insemination · Smallholder · Dairy · Urban · Rural

INTRODUCTION

Ethiopia ranks first in Africa in livestock population; with an estimated livestock population of 56.71 million cattle, 29.33 million sheep, 29.11 million goats, 2.03 million horses, 7.43 million donkeys, 0.4 million mules, 56.87 million poultry and 5.89 beehives [1]. From the total cattle population 98.95% are local breeds and the remaining are hybrid and exotic breeds. 99.8% of the sheep and nearly all goat population of the country are local breeds [2]. The livestock sub-sector has a great contribution to Ethiopia's national economy and livelihoods of many Ethiopians and still promising to rally round the economic development of the country. Livestock plays vital roles in generating income to farmers, creating job opportunities, ensuring food security, providing services, contributing to asset, social, cultural and environmental values and sustain livelihoods. The sub-sector contributes about 16.5% of the national Gross Domestic Product (GDP) and 35.6% of the agricultural GDP [3]. It also contributes 15% of export earnings and 30% of agricultural employment. The livestock sub-sector currently support and sustain livelihoods for 80% of all rural population [4].

Despite the presence of large diverse animal genetic resources and existing favorable environmental conditions, the productivity (milk and meat) of livestock remains low in Ethiopia due to poor management program, poor genetic potential, in adequate animal health service and others [5]. In order to improve the low productivity of local cattle, selection of the most promising breeds and crossbreeding of this indigenous breed with highly productive exotic cattle has been considered a practical

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solution [6].Thus, the need for clear strategies for improvement and maintenance of indigenous cattle genetic resources is required along with clear breeding programs for sustainable genetic improvement.

Artificial insemination, the most commonly used and valuable biotechnology has been in operation in Ethiopia for over 30 years [7]. Artificial insemination (AI) is the technique of transferring semen collected from a male animal and manually (Artificially) placing the spermatozoa in the reproductive tract of a female animal (insemination) in order to get the female impregnated. Artificial insemination is widely used for livestock breeding around the world and a necessary tool in sustainable farm animal breeding [8].

Artificial insemination has become one of the most important techniques ever devised for the genetic improvement of farm animals. It has been widely used for breeding dairy cattle as the most valuable management practice available to the cattle producer and has made bulls of high genetic merit available to all [7, 9].

Milk production in Ethiopia is mainly from indigenous cattle breeds, which are kept for multiple purposes in the different agro-ecologies and production systems. In order to enhance the development of smallholder dairy production in Ethiopia, national dairy development programs and projects were implemented in selected highland areas, where mixed crop livestock production prevails. The introduction of exotic dairy breeds and crossbreeding technologies, along with some feeding and marketing packages were some of the constituents of the programs.

Although artificial insemination, the most commonly used and valuable biotechnology [7] has been in operation in Ethiopia for over 30 years, the efficiency and impact of the operation has not been well-documented [10]. However, cattle breeding are mostly uncontrolled in Ethiopia making genetic improvement difficult and an appropriate bull selection criteria have not yet been established, applied and controlled [11].

Reproductive problems related to crossbreed dairy cows under farmers' conditions are immense [12]. It is widely believed that the AI service in the country has not been successful to improve reproductive performance of dairy industry [13]. From the previous little studies, it has been found that AI service is weak and even declining due to inconsistent service in the smallholder livestock production systems of the Ethiopian highlands [14]. The problem is more aggravated by lack of recording scheme, wrong selection procedures and poor management of AI bulls associated with poor motivations and skills of inseminators [5]. It is also true that in our region AI delivering service accounts many years in service to bring genetic improvements in indigenous farmers' cattle.

Although delivering of AI service to rural and urban community has been made intensively throughout Benishangul-gumuz Regional State (BGRS) in general and Assosa town in particular, but the status it might exist has not been systematically studied in depth and reported. Therefore, the main purpose of this study will be to generate baseline information on status of AI delivering service in Assosa town; BGRS of North West Ethiopia. Eventually such scientific information will be used to suggest or recommend remedial actions to be taken (Sound and socio-economically feasible interventions to be done) to solve problems that may exist related AI delivering practice as well as to improve effectiveness of using AI service in the study area.

This study aimed to assess the contribution of AI to farmers, to assess farmers perceive towards AI service and to analyze factors that affect AI service.

MATERIALS AND METHOD

Study Area Description: The study was conducted in four peasant associations (PA's) in and eight PA's around Assosa town. Assosa town is located in Benishangul-gumuz Regional State, in Assosa zone. Assosa town located at a distance of 687 Km from Addis Ababa. Its astronomical location is 10° 00'and 10° 03' north latitude and 34° 35' and 34° 39' east longitude. It was founded in 1936. Now a days, it has municipality and four PA's. According to the National Population and Housing Census carried out in 2007, the population of the town was 24,214. Out of this 12,463 (51%) were males and 11,751 (49%) were females. Regarding age distribution 8,128 (33%) were within the age group of 0-15 years, 15,700 (65%) 16-60 years and 386 (2%) 60 years and above. The area of Assosa town is 980 ha and it is compact in shape. Its altitude is 1,580-1,730 m above sea level; Mean Annual Temperature 22°C; Mean Annual Rainfall is 1200 mm. The six largest ethnic groups reported in this town were the Oromo(41.19%), the Amhara (29.93%), the Berta (17.39%), the Tigray (5.43%), the Sebat Bet Gurage (1.35%) and the Silt'e (1.29%); all other ethnic groups made up 3.42% of the population. Oromiffa was spoken as a first language by 44.42%, 31.53% spoke Amharic, 15.98% Bertaand 4.43% Tigrinya; the remaining 3.64% spoke all other primary languages reported *(https://en.wikipedia.org/wiki/Asosa)*. Data from urban agriculture office (2016) showed that 241 Cow, 6 Ox, 49

Heifer, 31 Bull, 159 Calves, 749 Goats, 325 sheep, 3113 Poultry and 41 Donkey populations are available in the town.

Research Design: The research design used in this study was cross-sectional survey. In order to obtain the required information relevant to meet the objectives of the study; different data was collected at a time. Both qualitative and quantitative data collection instruments (Questionnaire) were well developed and employed. Non-probability/Purposive sampling techniques were employed to select respondents of sample household survey, participants of focus group discussion (FGD).

Sampling Procedure

Sampling Method and Sample Size: To select sample PA's and households, the study employed non-probability/purposive sampling techniques. All the households that use AI service in the study area were addressed for this study. Based on the availability of dairy cattle breeds as well as the system they used to breed them; purposive sampling technique was used, to select PA's and households. Assosa town AI delivering station was visited and sample of individuals that bring their cattle for AI service was invited for focus group discussion. Purposive sampling technique was employed to select individuals that participate on group discussion. A total of forty two (42) households: Thirty (30) sample households from in and twelve (12) sample households from around the study area (All AI user households from each PA's) were selected to assess survey and one artificial insemination technician, one District expert of animal science and eight households from sample PA's; a total of ten (10) individuals were invited for focus group discussion as a sample using non-probable sampling technique.

Type and Source of Data: Both qualitative and quantitative data types were collected. The main purpose of using qualitative data is to assess farmers' awareness and attitudes towards artificial insemination merits and demerits. Quantitative data was use to examine the effectiveness and contribution of AI to the farmers' in cattle production. The study was used both primary and secondary types of data. The primary data was the demographic, social, attitude of farmers' towards the AI service, merit and demerits of AI from the view of farmers and AI technicians and experts. The secondary data was from the AI technician's record books, Documents and reports of district agricultural and rural development office.

Methods of Data Collection: Primary data relating to demographic, social, attitude of farmers' towards the AI service, merit and demerits of AI from the view of farmers and AI technicians and experts was collected from respondent by open ended survey interview guide. Moreover, other data's like amount of cows inseminated by year, number of calves born in each year, conception rate in the study area and related information's were collected from secondary sources such as similar research works, books, district level assessments and performance reports, statistical bulletins and reports.

Data Collection Procedures: The conduct of such a study was not executed without the arrangement of fieldwork. In recognition of this the organization of fieldwork was interested to the researchers. Researchers were involved in the study execution especially in contacting relevant PA's administrators, extension workers, AI technicians, district level experts and households, sampling the respondents and data collection.

Methods of Data Analysis: Data collected were managed in such a way that qualitative as well as quantitative variables can be analyzed. Data were entered in to statistical program for social science computer software, version 20 (SPSS-20) and coded for analysis. Variables analyzed by using independent t-test for numerical data and chi-square for categorical data. Data of purpose of keeping cattle and constraints of AI in the study were analyzed by using ranking index analysis.

RESULTS AND DISCUSSION

Demographic Characteristics: Some lists of the study area households' characteristicsrelated with demography are presented in Table 1 and Fig. 1. Household heads with the age between 25-39 years are higher in the urban smallholder dairy with 46.7%, while both 25-39 and 40-50 year age category accounts equally 41.7% in rural smallholder dairy. It shows that there wasno significant difference in age being engaged in using AI service to breed their cattle between urban and rural smallholder dairy types. Concerningthe gender of the respondents, in rural smallholder dairy male was significantly higher ($P<0.05$) than smallholder urban dairy types which might show that in rural area males dominate over women to become household head, there is less chance to divorce, hence production system of the rural is mostly extensive system it is not suitable for females to participate in it.

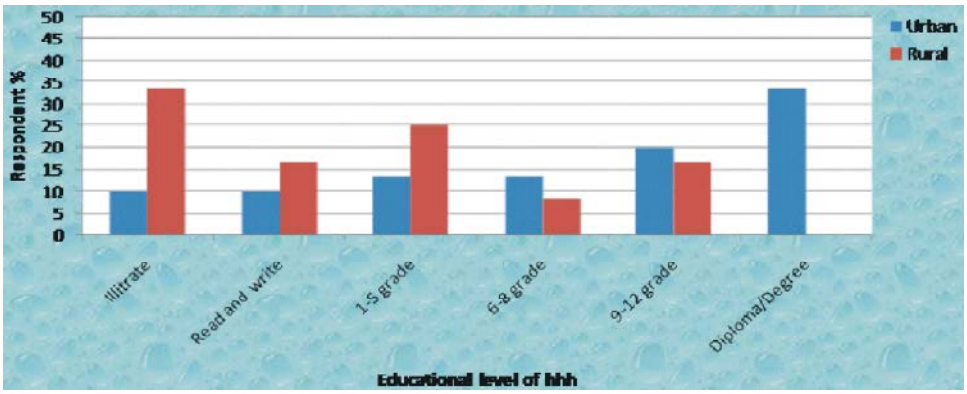

Fig. 1: Educational status of households in the study area

Table 1: Demographic characteristics of the households in the study area.

	Smallholder dairy					
	Urban		Rural			
Factors	N	%	N	%	X^2	P
Age						
25-39	14	46.7	5	41.7	0.373	ns
40-50	13	43.3	5	41.7		
Above 50	3	10	2	16.7		
Gender						
Male	14	46.7	12	100	10.338	**
Female	16	53.3	-	-		
Marital status						
Married	26	86.7	12	100	1.768	ns
Widowed	2	6.7	-	-		
Divorced	2	6.7	-	-		
Family size						
Only 1	-	-	-	-	3.303	ns
2-5	18	60	8	66.7		
6-10	11	36.7	2	16.7		
Above 10	1	3.3	2	16.7		
Religion						
Muslim	8	27.7	8	66.7	5.936	Ns
Orthodox	21	70	4	33.3		
Protestant	1	3.3	-	-		
Ethnicity						
Oromo	5	16.7	-	-	10.303	*
Berta	-	-	3	25		
Amhara	23	76.7	9	75		
Tigire	2	6.7	-	-		

ns=non-significant, *=P<0.05, **=P<0.01, ***=P<0.001

Orthodox Christians (70%) are dominant in urban smallholder dairy while Muslims (66.7%) aredominant in rural smallholder dairy. Amhara ethnic groups take lead in both urban and rural smallholder dairy with 76.7% and 75% respectively, followed by Oromo and Berta ethnic groups with 16.7% and 25% in urban and rural areas, respectively. The abundance of Amhara ethnic group in higher proportion in and around Assosa is associated with the settlement program in 1960s. Marital status of the households in the study area showedthat both in urban and rural smallholder dairy types married respondents are leading by 86.7% and 100%, respectively, while both widowed and divorced are second in urban areas(6.7%). This shows that, there is no significant difference between urban and rural smallholder dairy in case of marital status.

The main economic income source of households in the study area is significantly different between urban and rural smallholder dairy types. Livestock is the main income source (66.7%) in urban while crop-livestock mixed agricultureis the main income source of the rural smallholder dairy producers.

The educational background of the households is presented in Figure (1). A significant different was recorded in educational level between urban and rural smallholder dairy producers who are beneficial to AI technology. Majority of the urban producers (33.3%) were diploma/degree followed by grade 9-12 (20%), whereas majority of respondents in rural area were illiterate (33.3%) followed by grade 1-5 (25%). This might imply that in rural areas the chance of people to get education is minimal than urban areas, schools are far from the households' residence and educated rural peoples also may migrate from rural to urban areas forbetter life.

Herd Structure and Composition of Households in the Study Area: The herd composition and holding of the households in the study area is presented in Table (2). The average total number of cattle per household is 4.83 in urban and 5.91 in rural smallholder dairy types. The average number of local cattle (4.83) and donkey (0.66) owned by the community of rural smallholder dairy was significantly higher than urban community (1.03) and (0.16) respectively which showed that rural community rear local cattle for: draft power, because of their harsh

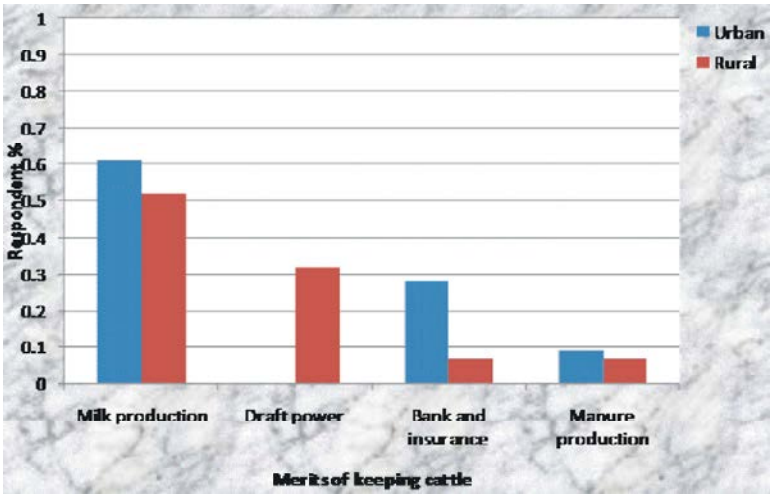

Fig. 2: Purpose of keeping cattle of the households

Table 2: Herd structure and composition per household

	Smallholder dairy			
	Urban N=30	Rural N=12		
Factors	Mean±SE	Mean±SE	t	p
Local cattle	1.03±0.28	4.83±0.36	-7.560	***
Exotic cattle	3.80±0.55	1.08±0.14	4.755	***
Total cattle	4.83±0.49	5.91±0.39	-1.303	ns
Sheep	0.16±0.13	0.50±0.50	-0.880	ns
Goat	0.60±0.33	2.83±1.31	-1.640	ns
Donkey	0.16±0.06	0.66±0.18	-2.280	**
Poultry	3.40±0.76	4.75±1.46	-0.886	ns
Exotic cow used for AI	2.90±0.44	1.08±0.25	3.522	**
Local cow used for AI	0.73±0.30	1.33±0.22	-1.181	ns
Total cow used for AI	3.66±0.45	2.41±0.28	2.338	*
Male calves born via AI	3.10±0.75	0.33±0.18	3.547	**
Female calves born via AI	2.30±0.53	1.00±0.12	2.353	*

ns=non-significant, *=P<0.05, **=P<0.01, ***=P<0.001

environment resistance, there might not the problem of grazing land to use extensive production system and other local feed resources and also rural community used donkeys as transportation means to transport their crop and livestock products, fetch water from long distant river, also get income by renting and giving transportation service to the others. In other way, there is no significance difference between urban and rural communities of smallholder dairy with the number of sheep, goat and poultry they hold that may be due to they can be managed regardless of sex and age in both communities and also the number of mule and horse across the smallholder dairy type was not significant (In both communities no number of mule and horse recorded during the study) it might be due to the unfavorable ecological condition of the study area to these livestock and high infestation of trypanosomes in the area. There was significant difference between urban and rural smallholder dairies with the: total number of cow used for AI, exotic number of cow used for AI, number of male calves born via AI and number of female calves born via AI which could show the urban communities are available to information about AI, they were aware on AI than rural communities, they also were close to AI service while rural communities were suffering the above problems. There was no significant difference between the two communities with the number of local cow used for AI this may be due to that the local farmers use cows for draft power hence number of oxen wee low due to trypanosomes infestation in the study area.

Purpose of Keeping Cattle: The purpose of keeping cattle of the household in the study area is presented in Figure 2. The primary purpose of keeping cattle in urban was milk production followed by bank and insurance as second and manure production as third purpose. In same manner, in the rural communities' milk production was a first purpose followed by draft power as second and both bank & insurance and manure production as third purpose. Keeping cattle for milk production as primary function in the study areas was in agreement with findings of Ayenew *et al*. [14] and Dekeba Dekeba *et al*. [15] who conducted studies in North western Ethiopian highlands and Shashamane-Dilla areas of southern Ethiopia, respectively. But, Sintayehu *et al*. [16] reported draught power as a primary function of cattle in north western Ethiopia. The more importance of draught power in rural areas than urban can be explained as the availability of more lands to cultivate in rural areas. Concerning manure, It is highly important as a fertilizer in

Table 3: Production system, feeding and watering practices of households in the study area

	Smallholder dairy type					
	Urban		Rural			
Factor	N	%	N	%	X^2	P
Production System						
Intensive	20	66.7	-	-	23.625	***
Semi-intensive	10	33.3	6	50		
Extensive	-	-	6	50		
Housing						
Proper house	23	76.7	3	25	9.702	**
Simple shade	7	23.3	9	75		
Source of feed supplement						
Seed cake	15	50	-	-	37.590	***
Atela	9	30	1	8.3		
Grain mill	6	20	-	-		
Hay and straw	-	-	4	33.3		
Feed supplement accessibility						
Accessible	13	43.3	3	25	21.288	***
Inaccessible	17	56.7	2	16.7		
Frequency of watering animals/day						
1 times	4	13.3	-	-	13.878	**
2 times	11	36.7	12	100		
3 times	15	50	-	-		
Source of water						
Pipeline	25	83.3	-	-	37.477	***
Ground water	4	13.3	-	-		
River water	1	3.3	12	100		

Ns=Non-significant, *=P<0.05, **=P<0.01, ***=P<0.001

rural small holder dairy might be related to incapability of smallholders in this category to timely purchase of artificial fertilizers. Previously, artificial fertilizers were given to smallholders on loan, but currently the local government stopped the loan due to low repayments. As a result, smallholders of rural dairy producers couldn't afford the price of artificial fertilization and relied on manure and compost prepared from it.

Production System, Feeding and Watering Practices of the Household in the Study Area: The production system, feeding and watering practice of the household in the study area is presented in Table (3). There is significant difference between urban and rural communities in dairy production system. The majority of households in urban areas (66.6%) use intensive dairy production system followed by semi-intensive system (33.7%). However, semi-intensive and extensive dairy production systems (Both 50%) were common in rural areas. that urban communities are aware of keeping dairy cattle in cut and carry system and rural communities have grazing land compared to urban communities.

There was also a significant difference in housing system between urban and rural smallholder dairy communities. About 76.7% of smallholders in urban areas use proper house followed by simple shade (23.3%); whereas majority of households in rural areas use simple shade (75%) followed by proper house (25%). The use of proper dairy house by higher proportion of smallholders in urban areas than rural areas could be associated with higher education level, better wealth and proximity of urban areas to modern extension services. Use of proper house has important implication in improving dairy cattle productivity, thus smallholders in rural areas has to be trained to use proper dairy cattle house.

All the respondents (100%) in urban give supplement feed to their dairy animals, but only 41.7% respondents of the rural smallholder dairy farmers provide supplement feed to their dairy animals. Seedcake is the main feed source (50%) followed by atela which is a byproduct of local brewery called tela (30%) and grain mill (20%) in urban smallholder dairy; whereas hay and straw takes alead (33.3%) as source of feed followed by atela (8.3%). This finding is in contrary with the findings of Asaminew

Table 4: AFC and CI of local and exotic cattle in the study area

	Smallholder dairy					
	Urban		Rural			
Factors	N	Mean±SE	N	Mean±SE	T	P
AFC of local heifer (month)	30	36.06±1.22	12	38.33±1.85	-0.997	Ns
AFC of exotic heifer(month)	30	22.13±0.67	12	22.50±1.01	-0.295	Ns
CI of local cow (month)	30	13.00±0.39	12	13.50±0.70	-0.656	Ns
CI of exotic cow (month)	30	12.00±0.00	12	12.00±0.00	-	-

ns=non-significant difference

and Eyassu [17], they reported that hay is the least important source of animal feed in permanent cultivation farming system in Assosa zone Benishangul-gumuz and this might be due to the increment of population, expansion of crop cultivation, decreasing of grazing land from time to time in rural areas of the study area. Concerning the accessibility of the supplement feed, 56.7% of the urban smallholder dairy farmers responded that it is inaccessible and the rest 43.3% responded that it is accessible. About25% sampled smallholder farmers from rural areas responded that supplement feeds are accessible and about16% responded that it is accessible. This could show that feed supplement for extensive and semi-intensive such as hay and different crop straw is accessible in rural areas due to farm land increment in rural community, but feed supplement like seed cake is not accessible in the study area due to unavailability or limited availability of food processing factories in the area; for instance only one oil processing center in Assosa town. Most farmers in urban smallholder dairy (50%) provide water for their dairy cows three times per day and 36.7% of them provide two times per day; whereas all smallholder dairy farmers used to provide water for their dairy animals two times per day. The main source of water for cattle in urban areas was pipeline (83%), whereas it is river (100%).

Cattle Breeding System in the Study Area: There was no significance difference between the two smallholder dairy types in type of improved livestock technology they use and breeding system they follow. Smallholder dairy farmers both in urban and rural areas use improved breeding system among the improved livestock technologies and AI breeding service among the improved breeding system.

The survey result indicated that there was no significant difference between urban and rural smallholder dairy types in age at first calving (AFC) and calving interval (CI) of heifers and cows of local breeds and exotic/hybrid cows. Average AFC of local and exotic heifer in urban is (36.06 and 22.13 months) respectively, whereas (38.33 and 22.50 months) in rural dairy type. Average CI of local and exotic/hybrid cow is (13.00 and 12.00 months) respectively in urban smallholder dairy producers and it also (13.50 and 12.00 months) in rural type in the same order (Table 4). The AFC of local cow (36.06 months in urban and 38.33 months in rural) are lower than report of Beyene Teklu *et al*. [18], 41 months of Boran cattle and 43 months of highland zebu [19].

Distance of households travel to get AI service center was significantly different between the two dairy types. Urban households dairy type producers travel on average (23.17 minutes) to get AI service centers and rural smallholder dairy farmers travel on average (116.67 minutes) to get the AI service center. Conception rate of dairy cows in the study area has no significant difference between both in urban and rural smallholder dairy types. Assessment done on thirty households from urban smallholder shows that 50% of them say the cow inseminated two times on average per pregnancy and 13.3% of them say that it need to inseminate the cow three times and above on average to get pregnancy. In similar, among twelve households interviewed from rural smallholder dairy community, 33.3% of them inseminate their cow to times per pregnancy and 25% of them say it is must to inseminate the cow three and above to get in pregnancy. This would be from various factors related to management, nutrition, reproductive diseases, semen quality and other factors, AI technicians' skill as reported by Aynalem Haile *et al.*[20].

Performance of Artificial Insemination in the Study Area: The performance of AI in the study area is presented in Figure (3). Data of seven years (2009-2015) from Assosa District agricultural and rural development office showed that even if the number of cows inseminated per year increased from year to year, the number of calves born via AI did show slight increase in the last seven years of service; this could be due to various factors related to management, nutrition

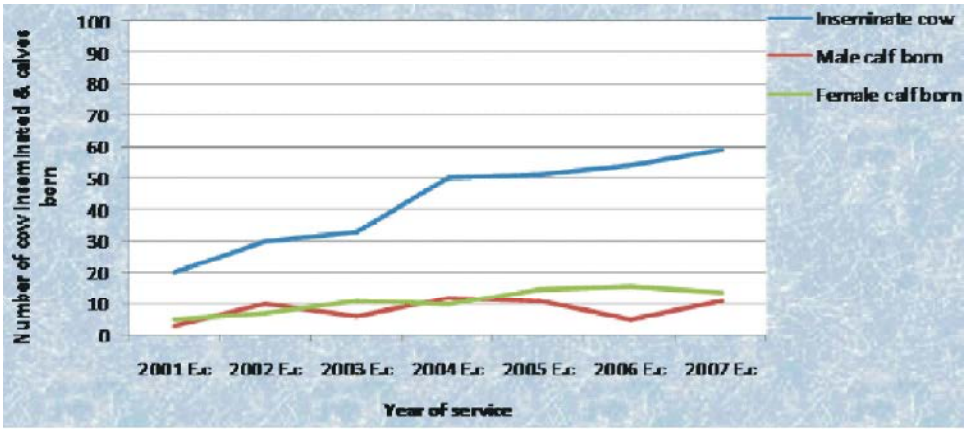

Fig. 3: Performance of AI service in the study area

reproductive diseases, semen quality and other factors, which agreed with the findings of Mekonnen *et al.*[21] that are inefficient management, lack of integration of AI service with livestock health and feed package, absence of appropriate collaboration among stakeholders, poor motivations and skills of inseminators, lack of readily available inputs such as liquid nitrogen, absence of proper recording systems; and some farmers have to move their cows for a long distance in search of AI service. This is happening in many areas due to inability of AI technicians to get transport facilities like motor bicycles, fuel, etc. AI is also known to be a time dependent activity, in which during this long journey/waiting time, heat period is over before the service have been given.

Perception of Sample Households Towards AI: All households covered by this survey both in urban and rural areas preferred AI than bull breeding system. In urban communities of smallholder dairy 83.3% of them strongly agreed that AI was preferable than using bulls while 16.7% of them agreed. In rural smallholder dairy type 66.7% of the respondents strongly agreed with the idea that AI is preferable to bull while 33.3% of them agreed. This might be because of using AI- reduces cost of feeding bull, improves breed of local cattle thereby improving milk productivity, price paid per insemination became cheap, it was home to home service, reduced AFC and CI other case why they preferred less particularly and increases households income in general. As far as estimated price of exotic/hybrid cattle and local cattle in the market was concerned, the interviewed respondents and group discussion participants of both small holder dairy types indicated that the price of exotic male calf and exotic bull was lower than local male calf and local bull; whereas the price of exotic female calf, exotic heifer and exotic cow was higher than the price of local female calf, local heifer and local cows. This showed that exotic male calf and exotic bull was not preferred to breed the local one because of their susceptible to disease they can't serve farmers for a long time as a draft power and feeding them also may be costly than the local bulls. But exotic female calf, exotic heifer and exotic cow were preferred than the local ones because of their short AFC, short CI and high milk yield. All households interviewed both in urban and rural smallholder dairy types had awareness about basic estrous signs. However, the time interval that smallholder farmers contact AI technicians and the response of AI technicians to the request vary among the farmers. There was significant difference between the two smallholder dairy types in the study area. Majority (93.3%) of the urban smallholder dairy households contact AI technician immediately as they could observe estrous signs and the rest 6.7% inform AI technician after a half-day of onset of estrous sign. whereas, 41.7% of the rural smallholder dairy farmers call AI technician immediately as they observe estrous sign, 33.3% of them after a day and the rest 25% of them after half a day.

Concerning AI technicians response to the farmers, 93.3% of the urban community of smallholder dairy responded as they get immediate response after they inform and the rest 6.7% of them reported that AI technicians respond after half a day; whereas 41.7% of the rural smallholder households responded as they get response of the AI technicians immediately after they inform and equal proportion of respondents reported that response of AI technicians delay a day. The delayed response of AI technicians to farmers request was related with the lack of transport facilities like motor bicycles, fuel, lack of commitment and lack of readily available inputs like liquid nitrogen.

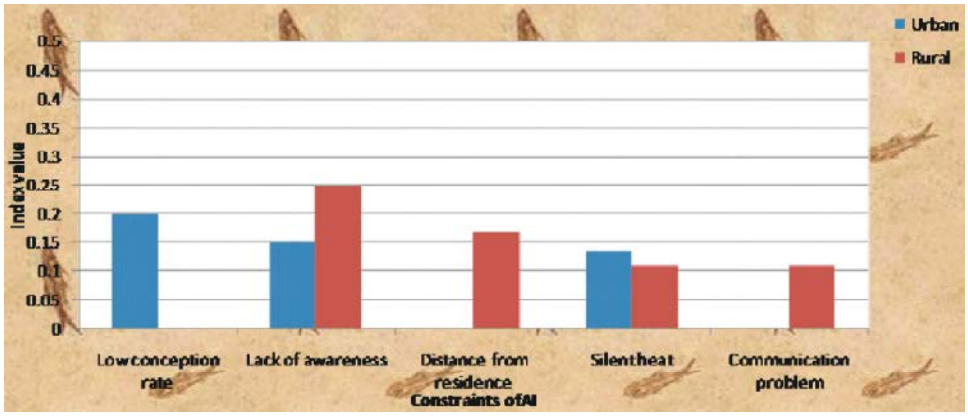

Fig. 4: Constraints of AI service in the study area

Constraints and Opportunities of AI in the Study Area

Constraints: The three most important constraints of AI service in study area ranked by respondents among the others are presented in Figure (4). Low conception rate was the top ranked problem in urban smallholder dairy type, whereas lack of awareness was the top in rural smallholder dairy type. The low conception rate was related to management, nutrition, reproductive diseases, semen quality and other factors as indicated by Kelay Belihu [20]. Shiferaw *et al*.[22]also reported that the efficiency of the service in the country had remained at a very low level due to infrastructure, managerial and financial constraints as well as poor heat detection, improper timing of insemination and embryonic death. Lack of awareness in the rural area could be due to higher illiteracy among the farmers and inadequacy or lack of information communication technologies than urban community.

The second top ranked constraint of rural smallholder dairy farmers (That was longer distance of AI service center from their home) was due to absence of AI service in rural areas so that farmers had to travel longer distances with their animals to get the service. This was happening due to AI technicians are unable to get transport facilities like motor bicycles, fuel, etc. In addition to the above constraints during the group discussion many problems were raised, among these: AI technicians problem, insufficiency of concerned bodies support, loss of structural linkage between AI center and service giving units, absence of collaboration and regular communication between AI technicians, dairy producers and concerned government bodies, inadequate resource in terms of inputs and facilities and absence of incentives and rewards to motivate AI technicians, lack of land for forage development and expansion, problem of finance (Amount and system) of getting credit. Disease was other constraints mentioned during group discussion and trypanosomiasis was and still the most important disease in the study area. Mastitis and pneumonia were also commonly occurring disease in the area. Besides, the need for medication with laboratory diagnosis was among the constraints of urban and rural households of the study area.

Opportunities: In both production systems (Urban and rural smallholder dairy) demand for milk production was the most top rated opportunity of keeping cattle. This indicated that milk demand both in urban and rural smallholder dairy type was high due to urban development and population growth of the study area was increased with high rate in recent years. According to respondents, the government strategy of delivering synchronization and AI technology service to dairy producers was also a good opportunity to run dairy production in the area. In rural smallholder dairy system the households used high yielding improved forage in their backyard which had multipurpose (Improve soil fertility, prevent erosion, could be used as fence and wind break). So there is opportunity to create awareness how to conserve feeds in rural dairy production system and scaling up of improved forage technologies in this area thereby improving the livelihoods of smallholder dairy in rural area.

CONCLUSION

In conclusion, there was no significance difference between urban and rural smallholder dairy types by average age and family size of households while educational level and gender of the household in the

study area showed significant difference between the two dairy types. There was no significance difference between urban and rural smallholder dairy in marital status of the smallholder dairy producers. Livestock was the main economic income source of urban while crop-livestock integration in rural smallholder dairy. Average number of cattle per household was (4.83) in urban and (5.91) in rural while average total cow used for AI was (3.66) in urban and (2.41) in rural. The primary purpose of keeping cattle both in urban and rural was for milk production. The production system practiced in rural was extensive while in urban it is intensive and semi-intensive. The most important constraints associated with AI service in the study site included conception failure, distance of AI service from residence, lack of awareness, AI technicians' problem, insufficiency of concerned bodies support, loss of structural linkage between AI center and service giving units, absence of collaboration and regular communication between AI technicians, dairy producers and concerned government bodies, inadequate resource in terms of inputs and facilities and absence of incentives and rewards to motivate AI technicians. Disease such as trypanosomiasis, mastitis and pneumonia were also other constraints of the study area.

Recommendations:

- Strong structural linkage between AI center and service giving unit should be created
- Semen and liquid nitrogen preparation plans should be implemented nearby area
- Training and sensitize AI technicians and farmers on various aspects of dairy management and AI services should be done
- Functional breeding policy and strategy should be given at most priority
- Improved forage production, conservation and utilization packages have to prepare to utilize locally available feed resources with along side other feed treatments technologies.
- It also needs great attention to prevent trypanosomiasis by controlling tsetse fly (Causative agent of trypanosomiasis) with collaboration of government non-government and other concerned bodies to increase (re)production of the households in the study area.

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