

**A
F
U**

ISSN: 2594-3146



**Journal
of
Agriculture and Forestry
University**

Volume 2

2018

Agriculture and Forestry University
Rampur, Chitwan



Journal of Agriculture and Forestry University

Editor-in Chief

Prof. Naba Raj Devkota, PhD

Managing Editor

Prof. Bhuminand Devkota, PhD

Editorial Board

Prof. Shrawan Kumar Sah, PhD

Prof. Sunila Rai, PhD

Prof. Madhav Prasad Pandey, PhD

Prof. Balram Bhatta, PhD

Prof. Arjun Kumar Shrestha, PhD

Prof. Durga Devkota, PhD

Frequency of Publication	Annual
Editorial Policy	A medium of publishing original scientific papers
Official Language	English
ISSN	2594-3146
Subject of Interest	Plant Science, Animal Science, Veterinary Science, Forestry, and Social Science

Subscription	Category	Rate
	SAARC countries	US\$ 10.00 postage extra
	Other countries	US\$ 15.00 postage extra
	AFU faculty	NRs. 200.00
	AFU students	NRs. 100.00
	Other Nepalese citizen	NRs. 300.00
	Other organization in Nepal	NRs. 500.00

Mode of Payment By Bank Draft or Cheque on Bank of Kathmandu, Narayangarh, Chitwan, Nepal. It should be addressed to AFU-Directorate of Research and Extension (Exp), Rampur, Chitwan, Nepal

Correspondence JAFU Secretariat
Agriculture and Forestry University, Rampur, Chitwan, Nepal
E-mail: dor@afu.edu.np

Agriculture and Forestry University is not responsible for statements and opinion published in the Journal; they represent the views of authors, or person to whom they are credited, and are not necessarily those of the university or the Editors.

Correct citation: Authors detail with surname of first author, first name, followed by first name and surname of other authors in sequence (2018). Title of the article, Journal of AFU (Volume 2): pages, Agriculture and Forestry University, Chitwan, Nepal.

**Agriculture and Forestry University
Rampur, Chitwan, Nepal**

Journal of Agriculture and Forestry University (JAFU)

Volume 2 **2018**

Review Articles

1. Association of nutritional status to reproductive performance in buffaloes 1-7
B. Devkota
2. Can organic materials supply enough nutrients to achieve food security? 9-21
J. Timsina
3. Current diagnostic techniques of *Mycobacterium avium* sub sp. *paratuberculosis* in domestic ruminants 23-34
S. Singh, I. P. Dhakal, U. M. Singh, and B. Devkota

Research Articles

1. Effects of climate change on mountainous agricultural system in Makwanpur, Nepal 35-44
A. P. Subedi
2. Assessment of gender involvement and decisions in agriculture activities of rural Nepal 45-52
D. Devkota, I. P. Kadariya, A. Khatri-Chhetri, and N. R. Devkota
3. Gender roles in decision-making across the generation and ethnicity 53-62
D. Devkota and K. N. Pyakuryal
4. Out-migration and remittances in Nepal: Is this boon or bane? 63-72
R. R. Kattel and N. Upadhyay
5. Economic valuation of pollination service in Chitwan, Nepal 73-77
S. C. Dhakal
6. Behavioral practices of supply chain actors on quality maintenance of raw milk in Nepal 79-89
U. Tiwari and K. P. Paudel
7. Livelihood improvement through women empowerment for a broader transformation in the way of living: A case of Churia area 91-99
Y. Humagain and D. Devkota
8. Effect of organic and conventional nutrient management on leaf nutrient status of broad leaf mustard (*Brassica juncea* var. *rugosa*) 101-105
B. P. Bhattarai, K. P. Shing, S.M. Shakya, G. B. K.C., and Y. G. Khadka
9. Effect of planting dates of maize on the incidence of borer complex in Chitwan, Nepal 107-118
G. Bhandari, R. B. Thapa, Y. P. Giri, and H. K. Manandhar
10. Growth, yield and post-harvest quality of late season cauliflower grown at two ecological zones of Nepal 119-126
H. N. Giri, M. D. Sharma, R. B. Thapa, K. R. Pande, and B. B. Khatri
11. Efficacy of commercial insecticide for the management of tomato fruit borer, *Helicoverpa armigera* hubner, on tomato in Chitwan, Nepal 127-131
R. Regmi, S. Poudel, R. C. Regmi, and S. Poudel

12. Efficacy of novel insecticides against South American tomato leaf miner (*Tuta absoluta* Meyrick) under plastic house condition in Kathmandu, Nepal 133-140
R. Simkhada, R. B. Thapa, A. S. R. Bajracharya, and R. Regmi
13. Simulation of growth and yield of rice and wheat varieties under varied agronomic management and changing climatic scenario under subtropical condition of Nepal 141-156
S. Marahatta, R. Acharya, and P. P. Joshi
14. Wet season hybrid rice seed production in Nepal 157-163
S. N. Sah and Z. Xingjian
15. Nutritional parameters in relation to reproductive performance in anestrus chauri (Yak hybrid) cattle around Jiri, Dolakha 165-169
B. P. Gautam, B. Devkota, R. C. Sapkota, G. Gautam, and S. K. Sah
16. Changes in physiological and metabolic parameters of sheep (*Ovis aries*) during transhumance at western himlayan pastures 171-175
K. Bhatt, N. R. Devkota, I. C. P. Tiwari, and S. R. Barsila
17. Reproductive status and infertility in Chauries around Jiri, Dolakha 177-182
R. C. Sapkota, B. Devkota, B. P. Gautam, T. B. Rijal, G. R. Aryal, and S. K. Sah
18. Determining chemical constituents of the selected rangeland to help improve feed quality under the context of climate change in the districts of Gandaki river basin 183-189
S. Chaudhari and N. R. Devkota
19. Productivity and chemical composition of oat-legumes mixtures and legume monoculture in southern subtropical plains, Nepal 191-198
S. Dangi, N. R. Devkota, and S. R. Barsila
20. Effect of forced molting on post molt production performance of locally available commercial laying chicken 199-204
S. Sapkota, R. Shah, D. K. Chetri, and S. R. Barsila
21. Supply chain analysis of carp in Makwanpur, Chitwan and Nawalparasi districts of Nepal 205-210
K. Adhikari, S. Rai, D. K. Jha, and R. B. Mandal
22. Efficacy of tamoxifen on sex reversal of nile tilapia (*Oreochromis niloticus*) 211-216
N. P. Pandit, R. Ranjan, R. Wagle, A. K. Yadav, N. R. Jaishi, and I. Singh Mahato
23. Performance of pangas (*Pangasianodon hypophthalmus*) under different densities in cages suspended in earthen pond 217-224
S. N. Mehta, S. K. Wagle, M. K. Shrestha, and N. P. Pandit
24. An assessment on abundance of aquatic invasive plants and their management in Beeshazar lake, Chitwan 225-230
A. Sharma, S. Bhattarai, and B. Bhatta
25. In the search of end products of commercially important medicinal plants: A case study of yarsagumba (*Ophiocordyceps sinensis*) and bish (*Aconitum spicatum*) 231-239
G. Kafle, I. Bhattarai (Sharma), M. Siwakoti, and A. K. Shrestha
26. Carbon stocks in *Shorea robusta* and *Pinus roxburghii* forests in Makawanpur district of Nepal 241-248
P. Ghimire, G. Kafle, and B. Bhatta

Research Article**REPRODUCTIVE STATUS AND INFERTILITY IN CHAURIES
AROUND JIRI, DOLAKHA****R. C. Sapkota², B. Devkota^{1*}, B. P. Gautam², T. B. Rijal², G. R. Aryal³, and S. K. Sah¹**¹Agriculture and Forestry University, Rampur, Chitwan²Department of Livestock Services, Ministry of Livestock Development, Kathmandu³Himalayan College of Agriculture Sciences and Technology, Kathmandu**ABSTRACT**

The Yak/Chauries are raised in highlands of Nepal. They serve as mainstay of economy and life for the people in those areas. Infertility associated with several reproductive problems is the major constraints of Chauri production. This study investigated the prevalence of reproductive disorders and major causes of infertility with its treatment attempt in Chauries of Jiri area in Dolakha district. Questionnaire survey was carried out in 14 Chauri herds. Blood samples were collected (n=20) to examine brucellosis and fecal samples (n=69) for gastro-intestinal parasites egg count. Animals showing infertility problems were supplemented with vitamin+mineral mixture for 2 months (n=40) to see the response with estrus and mating followed by GnRH treatment in non-responding animals. Survey findings showed 33.45% animals with reproductive disorders, out of which retention of fetal membrane was the most common problem followed by anestrus, abortion and repeat breeding. Fecal examinations revealed 16% animals positive for intestinal helminths. The non pregnant animals had lower helminth prevalence and low egg count that suggested internal parasites cannot be attributed as the cause of infertility in the study area. Brucellosis was not detected in Chauries. The expression of estrus and mating after vitamin + mineral supplementation was higher (p<0.05) in Chauries with infertility problem than those in control group without supplementation (70 % vs 35%). The overall response of supplementation and GnRH treatment was 75%. The results suggested nutritional deficiency as a major cause of infertility in Chauries that might have attributed to other reproductive disorders as well.

Key words: Chauri, infertility, reproductive disorders, vitamin-mineral, GnRH.**INTRODUCTION**

Urang Chauries found in Nepal are predominantly the F1 hybrid of Yak with hill cow. Dimjo Chauries (♀) are off-springs of female Yak (Nak) and Kirkho bull (hill bull) and are found at higher altitude than Urang Chauries. Chauries are the mainstay of highlanders and tribal populations inhabiting the most inhospitable terrains of the Himalayan region. Yaks in Nepal are found in elevation of 3000-5000 masl but not below 2000 masl. Purebred mating among the Yak/nak is not common in lower altitude of Himalayas due to its lower productivity in comparison to their hybrids viz urang and dimjo Chauries. Infertility problem in crossbred and exotic cattle has been reported to be the most prioritized problem in dairy pocket areas in the country (Jha, 2000) however infertility status in Chauri is not yet studied in Nepal. Infertility in animals is associated with microbial pathogens, anatomical abnormalities, hormonal imbalance, nutritional deficiency, hereditary defects and extreme climatic conditions. The Yak/Chauries are seasonal breeders and the factors responsible for its seasonality include poor nutrition, harsh climate and high altitude. The main breeding season for Chauries is in summer (June - July). Parturition takes place after 9 months which is generally in February-March. The contributing factors for the fertility in animal are found to be nutritional management and breed characteristics mainly (Joshi & Shreshta, 2011). Regular breeding depends upon the normal function of the reproductive system. In order to breed regularly, the cow has to have functional ovaries, display oestrous behaviour, mate, conceive, sustain the embryo through gestation, calve and resume oestrous cycles and restore uterine function after calving. Management, disease and the genetic makeup of the animal can affect each of these aspects of reproductive function.

Abortion, retention of fetal membrane (RFM), repeat breeding, dystocia and prolapse are common reproductive problems prevailing in Chauries in Dolakha (DLSO, 2015). Around 20-25 percent Chauries are found to be open/dry in a herd owing to various causes. Diseases, mineral deficiency, blood nutrient

* Corresponding author: bdevkota@afu.edu.np

level and body condition score (BCS) and its relation in infertility in Chauris is yet not studied in Nepal. Parasitic infection and brucellosis is reported problem in Chauries in Nepal. In Nepal, the studies related to fertility status of Chauries are scarce. So far, the annual breeding pattern of the animals, factors affecting their breeding efficiency during different seasons and actual status and causes of infertility are unknown in Nepalese Chauries. These information are highly important to develop the strategies that can help to enhance their reproductive ability. Herd profitability can be increased by better cow fertility. Three management areas to reduce infertility cases are herd health (external/internal parasites, vaccination calendar), age at puberty and nutrition. The main objective of this research was to understand the common reproductive disorders and infertility in Chauries around Jiri, Dolakha. The other objective included to determine the prevalence of reproductive disorders, internal parasites and brucellosis in Chauries also considering the effect of vitamin mineral supplementation and GnRH.

MATERIALS AND METHODS

A longitudinal study was conducted adopting purposive sampling method in Chauri pocket of Jiri Municipality of Dolakha district from July, 2016 to December, 2016. The prevalence of reproductive disorder and infertility status among Chauri in the study area was performed using retrospective data. Mobile animal health camp was organized to assess the production and reproduction status among Chauries in Dolakha. Questionnaire/reproductive survey was carried out in 14 Chauri herds and blood samples were collected ($n=20$) to examine brucellosis and fecal samples ($n=69$) for gastro-intestinal parasites and egg count. The reproductive status of all the animals was recorded for the past one year. Reproductive parameters like age at puberty, age at first calving, gestation period, inter calving interval were recorded. These data were later validated after focal group discussion and discussion with technicians and officers working at District Livestock Services Office, Dolakha. Only the animals reported to have reproductive disorders like anestrus, repeat breeding, and abortion were selected for identifying causes of infertility and its treatment where possible. These animal were then randomly assorted into two groups. Mineral mixture (Chelated Agrimin forte® Virbac) that Vitamin A (7,00,000 I.U), Vitamin D3 (70,000 IU), Vitamin E (250mg), Cobalt (150mg), Copper (1200mg), Iodine (325 mg), Iron (1500mg), Magnesium(6000mg), Potassium (100mg), sodium (5.9mg), Maganese (1500mg), Sulphur (0.72%), Zinc (9600mg) DL-methionine (1000mg), Calcium(25.5%) and Phosphorus (12.75%) per kilogram was supplemented to 40 animals with infertility regardless of the history of reproductive disorder. They were also supplied with liver tonic for a week. Twenty animals were kept in control group. Animal in both the groups were dewormed (Albagon liq 120ml ®, Qmed) before the inception of the research. Observation for expression of estrous was made for a period of 60 days. Moreover, a total of 12 animals were treated for infertility with GnRH after a course of 60 days supplementation with mineral mixture (Agrimin forte®). GnRH (Ovacyst®, gonadorelin diacetate tetrahydrate, Bayer USA) was used for treatment. Each cow was injected with 2ml (100 mcg) of ovacyst and the expression of estrus behaviour was observed for a period of one month. Manifestaion of estrus was noticed by observation of a hill bull following and mounting the Chauries.

Among those Chauries, blood samples were collected from 20 animals from the jugular vein using 18 gauge, 1.5 inch needles to screen them for Brucellosis. During each blood sample collection about 5 ml of blood is collected in blank sterile tube. Fecal samples were collected from 69 Chauries. Samples were transported in cool box with ice crystal. Fecal sample were examined qualitatively and quantitatively as per Soulsby (1978) by using sedimentation and floatation methods. Test for Brucellosis was done as per the protocol provided by the manufacturer of the kit (Id vet France). Both the Rose Bengal Test and ELISA test were carried out for detection of brucellosis. Fecal samples were tested at laboratory of HICAST and serum samples were test at CVL, Kathmandu. Obtained data from survey and tested samples was entered in Microsoft Excel 2010 and analysis of data obtained from survey was done using MS Excel. Z test was used to test the significance of double proportion.

RESULTS

Reproduction status of Chauries in the study area

Table (1) shows the reproductive parameters of Chauri in Jiri area of Dolakha district. The average age at puberty was reported to be 3.25 ± 0.48 years. This information was obtained from farmers record and data recorded during questionnaire survey. Age at first calving was 4.04 ± 0.46 . Gestation length was found

to be 280.77 ± 5.90 days. Lactation length is about 227.77 ± 22.79 days (6-8 months). Dry period was found to be 132 ± 22.23 days. Calving to conception days varies depending on the season of calving. The animal that calved during beginning of warm seasons comes in estrous within 2-4 months of calving.

Table 1. Reproductive parameters of Urang Chauri in Jiri area of Dolakha district

Parameters	Mean \pm SE	Remarks
Age at puberty(yrs)	3.25 \pm 0.48	
Age at first calving (yrs)	4.04 \pm 0.46	
Gestation length (days)	280.77 \pm 5.90	
Lactation length (days)	227.77 \pm 22.79	
Dry period (days)	132.77 \pm 22.23	
Calving to conception (days)	Varies	depends on season of calving

Prevalence of reproductive disorders

Reproductive survey includes the reproductive history for the past one year observed by the farmers. Figure 1 shows the prevalence of major reproductive disorders of Chauries in the study area. Retention of fetal membranes (RFM) and abortion followed by repeat breeding are the major reproductive problems faced by the farmers besides anestrus and dystocia. Prolapse is reported to be rarely seen in urang Chauri in the study area. Retention of fetal membranes was the most common reproductive disorders in the Chauri pocket (13.75%) which results in anestrus too. Retention of fetal membrane, abortion, repeat breeding and anestrus prevalence accounts 13.75%; 6.32%, 5.20% and 9.67% respectively.

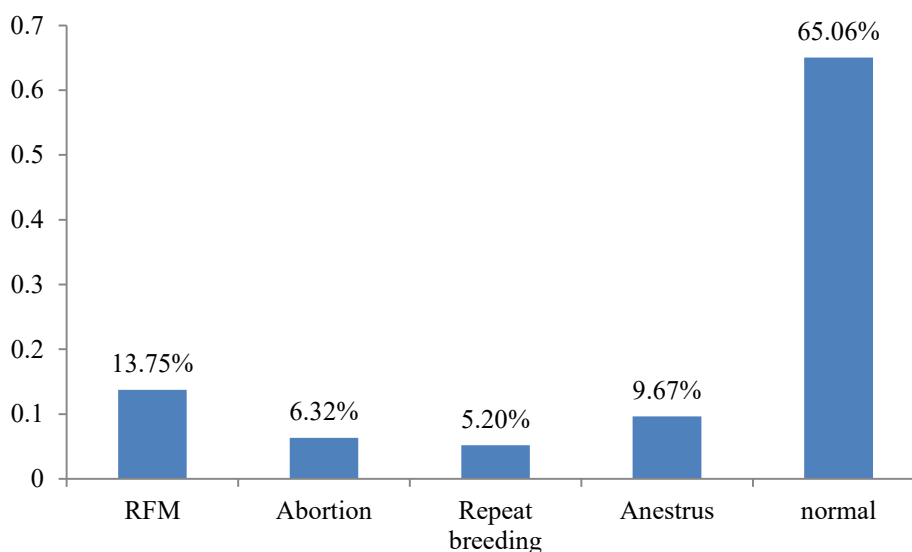


Figure 1: Reproductive status of Chauries around Jiri area of Dolakha district

Fecal Parasites and Brucellosis

Fecal examinations revealed that only 11 samples (16%) had intestinal helminths. One of the sample showed mixed infection whereas rest of the sample had single type parasite infection. Out of 11 positive samples, 7 samples were from pregnant and 4 samples were from non pregnant Chauries. Egg per gram (EPG) of the positive sample was below 400. Helminths prevalence between pregnant and non -pregnant was not significantly different ($p=0.34722$).

All the 20 animal samples tested for Brucellosis revealed negative result suggesting the absence of brucellosis in the population.

Effect of mineral supplementation

This study attempted the comparative efficacy of vitamin-mineral mixture treatment in anestrus animal irrespective of the history and cause.

Table 2. Response of Chauries with estrus and mating during vitamin + mineral supplementation

Groups	Number of animals treated	Number of animals responded	Proportion of animals responded	Proportion of animals not responded	P value
Test	40	28	28/40	12/40	<0.01
Control	20	7	7/20	13/20	

As shown in Table (2), the expression of estrus and mating rate in mineral mixture supplemented group is significantly greater (28/40 vs 7/20) than that in control group ($p < 0.01$).

Effect of GnRH treatment

As shown in Table (3), only 16.66% Chauri responded to GnRH treatment by showing the sign of estrus and mating. The overall response of vitamin mineral supplement followed by GnRH treatment was significantly higher in treatment group ($p < 0.01$) than in control group (30/40 vs 7/20).

Table 3. Overall response of treatment to anestrus Chauries

Groups	Number of animal	Number of animal responded	Number of animal not responded	Proportion of animal responded	Proportion of animal not responded	P-value
Test	40	30	10	30/40	10/40	$p < 0.01$
Control	20	7	13	7 / 20	13 / 20	

DISCUSSION

Different forms of reproductive disorders causing infertility were the major reproductive problems of Chauries in Jiri area of Dolakha district. Retention of fetal membranes was found in 13.75% of animals, abortion in 6.32% of animals and repeat breeding in 5.2% of animals. A total of 9.67 % of animals with or without reproductive disorders showed anestrus problem. It was interesting that RFM was the most common reproductive disorder that resulted in anestrus and infertility in every herd in the study area. RFM was also noticed to be over 50% in one of the herd which suggested that it was one of the major causes for infertility in Chauries. RFM is generally associated with dystocia, abortion, infection (*Brucella*, *Leptospira*), twin birth, mineral deficiency (Selenium, Iodine, Magnesium), deficiency of vitamins (Vit A, Vit E) and metabolic diseases (Hafez & Hafez 2006). Absence of Brucellosis and response of animal with vitamin-mineral supplementation suggested mineral deficiency as one of the major cause for RFM in the study area.

Incidence of abortion in this study was lower than that observed by Deori et al. (2010) in a study over a period of 6 years of 209 pregnancies (14.3%). Repeat breeding in Yak hybrids in this study (5.2%) was similar to that observed by Aryal and Poudel (2007) in Yaks in Mustang (6.6%) and Solukhumbu (6.5%). RFM is however significantly higher in our study compared to the finding of Aryal and Poudel (2007) in Yaks of Solukhumbu (2.09%) and was not significantly different to the findings in Mustang (7.26%). Abortion and other causes of premature termination of pregnancy are between 5-10% when Yak are bred pure, but higher in inter-species hybridisation, when calves born are much heavier (Li & Weiner, 1995). Joshi and Shrestha (2011) reported 15.4% cases of *L.hardjo* infection in aborted buffaloes.

The average age at puberty and age at first calving was found to be 3.25 ± 0.48 years and 4.04 ± 0.46 years respectively. Gestation length, lactation length, and dry period were found to be 280.77 ± 5.90 days; 227.77 ± 22.79 days (6-8 months) and 132 ± 22.23 days respectively. Age at first calving was found to similar to Shrestha et al. (1996) in Mustang and Dong et al. (2009) in Rasuwa (cited by Kharel et al., 2010). Calving to conception days varies depending on the season of calving.

The prevalence of gastrointestinal parasites revealed that only 16% samples showed positive to intestinal helminths. Its prevalence in non pregnant animal was found to be 21.05% and that in pregnant was found to be 14 %. However, the difference in prevalence between pregnant and non pregnant was statistically insignificant. Egg per gram (EPG) of the positive sample was below 400 which showed that the helminths load was low. This finding was inconsistent with findings made by Byanju et al. (2012) in Yak in Makalu Conservation Area (80.82%), with Shrestha and Bindari (2013) in Chauries in Gumdel VDC Ramechhap

(90.38%) and Acharya et al. (2016) in Yaks (85.42%). The lower prevalence may be attributed to periodic deworming and pasture rotation. Despite the lower loads and prevalence of helminths, the problem of infertility was found to be higher which might be associated with some other factors like mineral deficiency or other infections.

Infections causing reproductive disorders are less studied sector in Chauries in Nepal. Our attempt to find the prevalence of Brucellosis in Chaurie herd in Jiri showed the herds to be free from Brucellosis. This finding was similar to observation made by Aryal and Poudel (2007) in Yak in Mustang and Solukhumbu which showed all the 67 serum samples negative to the *Brucella abortus* antibody on ELISA test suggesting that the Yak population was free from brucellosis in these districts. Directorate of Animal Health (2015) reported none of the 12 samples tested from goats of Dolakha to were seropositive for Brucella by ELISA test.

One of the key findings of the current study was that the response of supplementing mineral mixture in Chauries with infertility problem was significantly higher than the animal in control group in terms of response based on signs of estrus expression. Bach, Pinto and Blanch (2015) found that cows supplied with chelated trace minerals (Zn, Cu & Mn) had greater odds of becoming pregnant at first service and also at second service than cows supplied with only inorganic trace minerals. Oestrus in the crossbred female is seasonal, as in Yak and is affected by climate and nutrition. Sexual maturity in the F1 however, occurs at least a year earlier than is typical for Yak (Li & Wiener, 1995). Sah et al. (2012) found repeat breeding buffaloes responded quickly and excellently to hormone GnRH with mineral-vitamin mixtures (75%) supplementation. Devkota et al. (2013) suggested Vit-M supplementation was effective for the treatment of anestrus in buffaloes, but needs a longer period to show its effectiveness in comparison with PGF2 α injection. Sah and Nakao (2013) found GnRH-treated buffaloes (with DF size 10-12mm) showing significantly higher pregnancy rate within one month after treatment than the Vit-M-treated animals.

The response of GnRH in this research was found to be intermediate. Only 16.66 % (2/12) animal responded to single shot of GnRH. Those animal which did not respond to supplementation of livertonic, deworming and mineral mixture in treatment group were injected with 2ml of Ovacyst® intra muscularly. Zi (2003) also agreed that a pregnancy rate of Yak cows of breeding age can be increased by 10-20% if treated with LRH in the breeding season (Zi, 2003). However the animal in our research group were administered with GnRH at the end of breeding season which might have influenced the estrus expression. Sah and Nakao (2012) found conception rate of 53.34% in buffaloes administered with GnRH only which is higher than our observations. The research also reported 66.67% and 75% conception in buffaloes treated with mineral vitamin supplementation and GnRH after mineral-vitamin supplementation respectively.

CONCLUSION

Retention of Fetal Membranes was the most common reproductive disorders in the study area in Chauries followed by anestrus, abortion and repeat breeding. Internal parasites did not attribute as the major cause of infertility in the study area. The Chauri herd was free from brucellosis. Supplementation of vitamin mineral mixture for more than a month could enhanced reproductive performance in Chauries suggesting nutrition management as a major cause of infertility.

ACKNOWLEDGEMENTS

We would like to acknowledge the University Grant Commission, Nepal for financial support to conduct this research and Cherdung Chauri Farmers Group, Jiri for their support and hospitality.

REFERENCES

- Acharya, K.P., Nirmal, B.K., Kaphle, K., Mahato, M.K., Yadav, G.P. & Rana, H.B. (2016). Prevalence of gastrointestinal and liver parasites in Yaks in the cold desert area of lower Mustang Nepal. *Asian Pacific Journal of Tropical Disease*, 6(2):147-150.
- Aryal, S. & Poudel, K.P. (2007). Reproductive Disorders and Seroprevalence of Brucellosis in Yak, *Nepal Agriculture. Res. J.* Vol.8, pp130.
- Bach, A., Pinto, A., & Blanch, M. (2015), Association between chelated trace mineral supplementation and milk yield, reproductive performance and lameness in dairy cattle, *Livestock Science* 182, pp.69-75.
- Byanju, R., Shrestha, S.P. & Khanal, D.R. (2012). Prevalence of gastrointestinal parasites in Yaks of Lehe VDC, Manaslu Conservation Area. *Nepal Journal of Science and Technology*, 12:366-369.

- Devkota, B.N., Nakao, T., Kobayashi, K., Sato, H., Sah, S.K., Singh, D.K., Dhakal, I.P. & Yamagishi, N. (2013). Effects of Treatment for Anestrus in Water Buffaloes with PGF 2α and GnRH in Comparison with Vitamin-Mineral Supplement and Some Factors Influencing Treatment Effects. *Journal of Veterinary Medicine Science*. vol 75(12).
- Directorate of Animal Health. (2015). *Annual Technical Report*, Central Veterinary Laboratory, Tripureshwor, Kathmandu, pp.24-25.
- DLSO, Dolakha. (2015). *Annul Bulletin*. District Livestock Services Office. Charikot, Dolakha.
- Hafez, E.S.E. & Hafez, B. (2006). *Reproduction in Farm Animals*, 7th edn. Blackwell Publishing Limited, pp.405.
- Jha, V.C. (2000). Study on infectious causes of infertility and its management in crossbred and exotic cattle in Nepal, *Nepalese Veterinary Journal*, vol. 28.
- Joshi, B.R., & Shrestha, B.S. (2011). Studies on Normal Fertility Indices and Factors Associated with Bovine Infertility in the Hills of Nepal. *Nepalese Veterinary Journal*. 30, 86-102.
- Kharel, M., Shrestha, B.S. & Shrestha, R. (2010). *The Nepali Yak*, Himalayan College of Agricultural Sciences and Technology (HICAST), Bhaktapur.
- Li, C. & Wiener, G. (1995). *The Yak*. Regional Office for Asia and Pacific of the Food and Agriculture Organization of United Nations, Bangkok, Thailand, pp.111.
- Sah, A.K., Sah, S.K., Yadav, J.L. & Kafle, K. (2012). Conception rate in repeat breeding buffaloes using hormone GnRH and Mineral-Vitamin mixtures under farmers managed condition in Chitwan, Nepal. *Proceedings on 10th National Veterinary Conference of Nepal Veterinary Association (Vetcon'12)*. Nepal Veterinary Association. pp.51-56.
- Shrestha, S. & Bidari, Y.R. (2013). Prevalence of gastrointestinal parasites in Chauries of Gumdel VDC of Ramechhap District, Nepal. *Journal of Agricultural Science*. 1(3):73-74.
- Soulsby, E.J.L. (ed.), (1978). *Helminths, arthropods and protozoa of domesticated animals*. 6th edn, The English Language Book Society and Bailliere, Tindall and Cassell Ltd. pp 207-218.
- Zi, X.D. (2003). Reproduction in female Yaks (*Bos grunniens*) and opportunities for improvement. *Theriogeneology*, vol, 59, 1303-1312.