Annual Report

2075/76 (2018/2019)

Government of Nepal
Nepal Agricultural Research Council

National Cattle Research Program

Rampur, Chitwan

2019

National Cattle Research Program
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Office building of National Cattle Research Program, Rampur, Chitwan

FOREWORD

In continuation of presenting series of annual reports, this annual technical report 2075/76 presents overall glance of National Cattle Research Program (NCRP) and a concise information and database on developed technology regarding cattle rearing, management and health practices for economy, effectiveness and efficiency in the Nepalese farming system.

The program has achieved some outputs that can be extended in the field to promote the dairy industry in Nepal. For example, management of mastitis and infertility,use of ultrasonography in bovine reproduction, development of package of practices for Yak/Chauri, dairy product diversification and its economic feasibility,heat stress management, establishment of terai cattle herd for the evaluation of productive and reproductive performance and conservation as well and maintenance of Lulu cattle for further research. Adoption of the genetic materials (sexed semen) in the farm of NCRP received from National Livestock Breeding Office (NLBO) for the further multipweuylication was helpful to produce the high- quality female calves for the replacement in the NCRP farm.

In this fiscal year 2075/076, we were success to construct biogas plant with the capacity of 200 cubic meters.Which was built in technical collaboration and fincial subsidy of Alternative Energy Promotion Centre (AEPC), Khumaltar. Likewise, use of sexed semen is giving promising outcomes to minimize the major constraint of cattle farming which is effective for the management of male calves. We have signed MoU with NLBO to incorporate embryo transfer (ET) technology as a routine activity in collaboration of NLBO, Pokhara under DLS which ultimately, will insure breed improvement of cattle with quality semen.

Our total efforts are towards the fulfilment of milk and milk products demend in the country. Present data shows that in total AGDP livestock sector contributes 28 % and dairy sector contributes 63% among livestock contibution. Within dairy, cattle contribute 34.28 %. Total annual milk production is 2000500 M.T (MoALD, 2075) and now only 586500 M.T milk is deficit anually.

In near future we have envisaged the establishment of satellite research station in mid hill and high hill as well, production of sexed semen within the country and developing NCRP farm as a model resource farm for initial phase and later on resource farm will be developed in farmers herd.

Finally, this report is the outcome of the untiring efforts of NCRP team. I would like to thank all our staff from NCRP. I am sincerely thankful to management team of NARC for their support in implementing and monitoring the program smoothly. I am very much indebted to Dr. Tek Bahadur Gurung, Acting Executive Director of NARC, Nepal for his close and continuous support in all aspects like research, technical guidance and logistic as well. Likewise support from the NASRI and all the divisions under NASRI. Other institutions within and outside NARC are gratefully acknowledged for their collaboration and partnership with us during the year.

Dr. Madhav Prasad Acharya
Coordinator
National Cattle Research
Program Rampur, Chitwan
Date: 15th October, 2019

ABBREVIATIONS

&	: and
@	: At the rate of
A.I.	: Artificial Insemination
ADS	: Agriculture Development Strategies
AFU	: Agriculture & Forestry University
AGDP	: Agricultural Gross Domestic Product
APP	: Agriculture Perspective Plan
B.Ed.	: Bachelor of Education
B.S.	: Bikram Sambat
BQ	: Black Quarter
B.Sc.Ag	: Bachelor of Science in Agriculture
BT	: Body temperature
B.V.Sc.& A.H	: Bachelor of Veterinary Science and Animal Husbandry
cm	: Centimetre
CMT	: California MastitisTest
DCIP	: Dairy Cattle Improvement Program
DCP	: Di calcium phosphate
DLS	: Department of Livestock Service
DLSO	: District Livestock Service Office
DM	: Dry matter
DNA	: Deoxyribo Nucleic Acid
ELISA	: Enzyme Linked Immuno Sorbent Assay
FAO	: Food and Agriculture Organization
FMD	: Foot and Mouth Disease
FY	: FiscalYear
GDP	: Gross Domestic Product
g	: gram
ha	: Hectare
HF	: Holstein Friesian
HH	: Household
HS	: Haemorrhagic Septicaemia
J.T.	: Junior Technician
J.T.A.	: Junior Technical Assistant
Kg	: Kilogram
L/lit.	: Litre
LPPM	: Livestock Product Production and Management

M.V.M. : Master of Veterinary Medicine
m : Meter
µ : micro
Min. : Minute
ml : mililiter
mm : Millimetre
MoAD : Ministry of Agricultural Development
MOE : Ministry ofEducation
MoLD : Ministry of Livestock Development
M.Sc.An.Sc. : Master of Science in Animal Science
Mt. : Metric Ton
MVSc : Master of Veterinary Science
NARC : Nepal Agricultural Research Council
NASRI : National Animal Science Research Institute
NBRP : National Bovine Research Program
NCRP : National Cattle Research Program
NGO : Non-Governmental Organization
NLBC : National Livestock Breeding Centre
No. : Number
NPK : Nitrogen, Phosphorus andPotash
^{o}C : Degree Centigrade
OR : Out-reach
PBS : Phosphate Buffer Saline
PCR : Polymerase Chain Reaction
PCV : Pack cellvolume
PFAF : Pasture, Forage and Agro Forestry
RCBD : Randomized Complete Block Design
Rs. : Rupees
SCM : Sub clinicalmastitis
Sec : Second
SNF : Solid NotFat
Sps. : Species
SPSS : Statistical Package for Social Science
TDN : Total Digestible Nutrient
TU : Tribhuwan University
UMMB : Urea Molasses Mineral Block
USG : Ultrasonography

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नेपाल कृषि अनुसन्धान परिषद् अन्तर्गतका विभिन्न बालीवस्तु अनुसन्धान कार्यक्रमहरू मध्ये `राष्ट्रिय गाई अनुसन्धान कार्यक्रम` पनि एक हो | नेपालको सन्दर्भमा मुख्यतया दुध उत्पादन, बहर/गोरु जोत्न,गाडा तान्न, खेतबारीमा मलका साथै धार्मिक कारणले समेत विविधरुपले गाईपालन हुदै आएको छ | नेपाल सरकारका विभिन्न अल्प, मध्य, तथा दिर्घकालिन आयोजनाहरू जस्तै; APP (समाप्त भैसकेको), ADS (संचालित) तथा अन्य विभिन्न आयोजनाहरुमा पनि गाई प्रबर्धनका लागी आबश्यकपर्ने प्रबिधि विकासले प्राथमिकता पाएको छ | नेपाल सरकारको योजनाहरूमा दुग्ध उत्पादन, प्रसोधन तथा बजार ब्यबस्थापन जस्ता कार्यहरू प्राथमिकतामा परेका छन | नेपाल कृषि अनुसन्धान परिषद्ले आफ्नो स्थापना काल वि.सं. २०४८ साल देखि नै गाई पालन प्रबर्धनका लागी आवश्यक प्रबिधि विकास गर्न अल्प, मध्य, तथा दिर्घकालिन निति लिएर यसको अनुसन्धान मुलक विभिन्न कार्यक्रम संचालन गर्दै आएको छ |

लक्षित प्रतिफलका लागी आ.व. २०७५/७६ का विभिन्न उत्पादन र प्रचारप्रसारका कार्यहरुको योजना तयार पारि कार्यहरु सम्पन्न भए र जसको उपलब्धि यो बार्षिक प्रतिवेधनमा उल्लेख गरिएको छ | कार्यक्रममा खास गरी दुई प्रकार क) अनुसन्धान तथा ख) उत्पादन गतिबिधिहरू संचालनमा ल्याइएको थियो| क) अनुसन्धान कार्य जसमाः राष्ट्रिय गाई अनुसन्धान कार्यक्रमको फार्ममा रहेका स्थानीय गाईहरूमा उन्नत जातको विर्य प्रयोगगरी उत्पादन भएका बर्णशंकर गाईहरूको उत्पादन मुल्यांकन गर्ने, रामपुर-चितवनमा रहेका विभिन्न बहुबर्सिय घाँसहरूको मुल्यांकन गर्ने, तराईका विभिन्न जिल्लाहरूमा घाँस उत्पादन प्रबिधि विकास तथा उत्पादन क्षमता मुल्यांकन गर्ने, थुनेलो रोगबाट बचाउन रोकथामका उपायहरुको विकास गर्ने तथा उपयुक्त औसधिहरूको छनौट र किटाणुको पहिचान गर्ने, चितवन,नवलपरासी र रुपन्देही जिल्लामा रहेका उन्नत जातका गाईहरूमा प्रजनन क्षमता सुधार गर्न विभिन्न कार्यक्रम गर्ने, दुधालु गाईहरुको रगतमा पाइने प्रोटोजोवाहरूको अवस्था पहिचान गर्ने, गर्मिबाट हुने तनाब कम गर्ने, दुग्ध पदार्थ विविधिकरण तथा आर्थिक सम्भाब्यता अध्ययन गर्ने र याक-चौरी सम्बन्धी अध्ययन गर्ने| ख) उत्पादन गतिबिधि अन्तर्गत विभिन्न देश हरुमा उत्पादित विर्य तथा नेपाल मै उत्पादित जर्सी तथा होलस्टीनका विर्य प्रयोग गरी उन्नत नश्लका जर्सी तथा होलस्टीनका बर्णशंकर बहर तथा बाच्छी उत्पादन गरी बितरण गर्ने, परिषद् बाट सिफारिश भएका विभिन्न घाँसका बिउहरू प्रयोगगरी घाँस उत्पादनमा बृद्धि ल्याउने तथा बाह्यअनुसन्धान स्थलहरुमा विकास गरिएका प्रबिधिहरुको प्रमाणीकरण गर्ने जस्ता गतिबिधिहरू सम्पन्न गरिएका छन् |

उत्पादन कार्यक्रम अनुरुप यस बर्षमा ५५ वटा बाच्छाबाच्छी, ८५० मे.टन(१४२६१३.०५ लिटर) दुध, २२७.०५ के.जी. पनिर, ६५.७ के.जी. खुवा, ८ लिटर घीउ, १९४ लिटर दहि, २ वटा बहरहरू चितवन जिल्लाका किसानहरू लाई नस्लसुधारका लागी वितरण गरियो भने ६ वटा बहरहरू राष्ट्रिय पशु प्रजनन कार्यालय बाँकेलाई प्रदान गरियो, त्यस्तै; १३० के.जी. विभिन्न घाँसका बिउहरू वितरण गरियो | यस कार्यक्रम भित्रका जग्गाहरुमा विभिन्न बहुबर्सिय घाँसहरूः स्ट्याइलो, सेटारिया, सिग्नल, नेपियेर, सोर्घम, भेच, मुलाटो उत्पादन तथा क्षेत्र विकास गरिनुका साथै विभिन्न डालेघाँस हरुका बिरुवाहरू लगाउने कार्य गरियो |गाईको दुध र दुग्ध पदार्थ तथा मल बिक्रिबाट जम्मा रु. ७७३०७९०.९० राजश्व संकलन भयो भने घाँसको बिउबाट रु.५१९०० र प्रसासनिक कार्यक्रमबाट ५८२०० र अन्य स्रोत बाट ११३२५९.४० राजश्व संकलन भयो | यो आर्थिक वर्षको राजश्व संकलन रु. ७९५४१५०.३० रहेको छ|

फार्ममा उत्पादित दुधको प्रयोग गरि निर्धारित उच्च स्तरीय ढाँचामा विभिन्न दुग्ध पदार्थहरु पनीर खुवा, दहि र रसवरी उत्पादन गरिएको थियो | सो को लागि प्रयोग गरिएको दुधमा औसत घृताम्स ५.१५%, एस.एन. एफ. ८.८५%, प्रोटिन ३.२३% र ल्याक्टोज ४.८६% रहेको थियो | उत्पादित दुग्ध पदार्थहरुको सुरु देखि भण्डारण सम्मको उत्पादन लागतको आर्थिक सम्भाव्यता अध्ययन गरिएको थियो, जसमा दुधको मूल्य रु. ५६ प्रति लिटरका दरले हिसाब गरिएको थियो | यसरि हिसाब गर्दा रामपुर फार्ममा विभिन्न दुग्ध पदार्थहरु पनीर, खुवा, दहि र रसवरी को उत्पादन लागत मूल्य क्रमश रु. ४४५.४४ प्रति किलो, २४२ प्रति किलो, ७२.७८ प्रति लिटर र ८.०३ प्रति गोटा रहेको पाइयो भने बाह्य अनुसन्धान स्थल देवदह र माडीमा क्रमशः पनीर रु. ६०४.५०, ५७५.२२ प्रति किलो, खुवा रु. ३७२,३६६ प्रति किलो, दहि रु. ८६.७७ प्रति लिटर र रसवरी रु. ११.८०, ८.२६ प्रति गोटा रहेको थियो |

रामपुर-चितवनमा रहेका विभिन्न बहुबर्सिय घाँसहरूको मुल्यांकनको नतिजा हेर्दा बहु बर्षीय सरगम, मुलाटो, सिंग्नल, सेटारिया र ग्वाटेमालामा उस्तै उत्पादन पाईएकोले जुनसुकै घाँसबाट पनि पशुपालनको पर्यास बिकाश गर्न सकिन्छ |

दुधालु गाईहरुको रगतमा सङ्क्रमन गर्ने प्रोटोजोवाहरूको अवस्था पहिचान गर्ने अनुसन्धान गर्दा एनाप्लास्मोसिस ५%, बेबोसियोसिस ४%, थेलेरिओसिस ७% र ट्रीपनोसोमियासीस ११% पोजेटिभ रहेको पाइयो साथै पी.सी.आर. प्रबिधि बाट नमूना परिक्षण गर्दा एनाप्लास्मोसिस ९% पाइयो |

गाईमा हुने बाझोपन सम्बन्धी अध्ययनमा नतिजाहरू; समग्ररुपमा ब्रुसेलोसिस् २.३३%(४/१७) तथा चितवनमा ३.२७%(२/६१), कास्कीमा १०%(१/१०), नबलपरासिमा २%(१/५०) र रुपन्देहीमा

0%(0/५०) समग्ररुपमा निओस्पोरोसिस् ५%(९/१८०) तथा चितवनमा ६.५५%(४/६१), कास्कीमा 0%(०/१९), नबलपरासिमा ४%(२/५०) र रुपन्देहीमा ६%(३/५०) समग्ररुपमा बि.भि.डी. ३.८०%(१४/३६८) तथा चितवनमा २.७०%(५/१८५), कास्कीमा 0%(०/२३), नबलपरासिमा ४.९३%(४/८१) र रुपन्देहीमा ६.३२%(५/७९) समग्ररुपमा लेप्टोस्पाइरोसिस् ७.४०% (६/८१) तथा चितवनमा ६.५५%(४/६१) र कास्कीमा १०%(२/२०) समग्ररुपमा क्लामाइडियोसिस् ४.१२%(१४/३३९) तथा चितवनमा ०.७५%(१/१३२), नबलपरासिमा ०.०२%(१/९८), रुपन्देहीमा १३.०४%(९/६९) मकवानपुरमा ७.५% (१४/४०), समग्ररुपमा टोक्सोप्लाज्मोसिस ७.०९%(११/१५५) तथा चितवनमा ०% (०/३५), नबलपरासिमा ७.५%(३/४०), रुपन्देहीमा ७.५%(३/४०) र मकवानपुरमा १२.५% (५/४०) समग्ररुपमा आई.बि.आर १८.४७%(१७/९२) तथा चितवनमा ३६.६६%(११/३०), नबलपरासिमा ९.३७%(३/३२) र रुपन्देहीमा १०%(३/३०) रहेको पाइयो ।

थुनेलो रोग सम्बन्धी अनुसन्धानबाट स्टाफाईलोकोकस, ई.कोली जीवाणुले मुख्य गरी थुनेलो गर्ने पाइयो| औषधि एम्पिसिल्लिन र एमोक्सीक्ल्याव कम प्रभाबकारी देखियो भने टेट्रासाईक्लिन, सिप्रोफ्लोकस्, क्लोरम्फेनिकोल हरू थुनेलो उपचारमा राम्रो काम गर्ने पाइयो । यो रोग रोकथामको लागी दुध दुध दुने कार्यपछी थुनलाई पोभीडीन र ग्लिसिरिन (९:१) को झोलमा डुबाउने प्रबिधि प्रभावकारी देखियो ।

बाच्छा बाच्छीहरुलाई मिल्क रिप्लेसर खुवाउने परिक्षण गर्दा बाच्छा बाच्छीको औसत साप्ताहिक तौल वृद्धि टि-० मा २.२० किलोग्राम, टि-१ मा २.०८ किलोग्राम र टि-२ मा १.९० किलोग्राम रहेको छ । त्यसैगरि दैनिक तौल बृद्धि टि-० मा ३१४.२० ग्राम, टि-१ मा २९७.१० ग्राम र टि-२ मा २७१.०० ग्राम रहेको छ । एउटा टि-० समुहको बाच्छा बाच्छीले औसतमा दुध खान छुट्टाउन्जेल सम्म १५३.०० लिटर दुध उपयोग गरेको पाईयो भने टि-१ र टि-२ समुहका बाच्छा बाच्छीले १२.५० किलोग्राम र १८.६० किलोग्राम मिल्क रेप्लेसर पाउडर उपयोग गरेको पाईयो । टि-० समूहका बाच्छा-बाच्छीलाई खुवाउन औसतमा रु ८५५०.८० देखि रु. १२२१५.४० खर्च लाग्ने देखियो । त्यसैगरी टि-१ समुहका बाच्छा बाच्छीहरुलाई खुवाउन रु.६२५५.२० देखि ६९८८.८० र टि-२ समुहका लागि रु. ६७२२.०० देखि रु. ७५२५.४० लाग्ने देखियो । खुवाउनका लागि मिल्क रेप्लेसर सस्तो देखिएपनी तौल वृद्धिमा चाहिँ राम्रो देखिएन ।

याक/चौरी परियोजना लागु भएका ५ जिल्लाका २५ वटा घरधुरिमा सर्वेक्षण गर्दा याक/चौरीको संख्या ७२७ पाईयो । याक/चौरीको औसत संख्या प्रति घरधुरी २९.०८ रहेको छ । ३८% किसानले

याक/चौरीमा आन्तरिक परजीबी बिरुद्ध औषधी प्रयोग गर्ने गरेको र १४% किसानले खोरेत बिरुद्ध खोप लगाउने गरेको पाईयो । याक/चौरी खर्कमा पाईने मुख्य घाँसहरुमा बुकि, सेतो क्लोभर, राई घाँस, अलपीपी, खर, निगालो, पांग, ओक, माछी, बेखर, गडर, पासी, टिउरे, हकटो, कमल्या, गोजेंग, राम्बो आदि रहेका छन । बयश्क याक/नाकको मूल्य रु ८५,००० देखि १ लाख सम्म पर्ने र चौरीको मूल्य रु ३०,००० देखि ६५,००० सम्म पर्ने गरेको पाईयो ।

नाकको प्रति दिन औसत दुध उत्पादन १.६७ लिटर र चौरीको ३.४५ लिटर हुने पाईयो । नाकको औसत दुध दुहुना अबधि १८५ दिन र चौरीको २१२ दिन हुने रहेछ । नाकको पहिलो पटक ब्याउदाको औसत उमेर ३८ महिना र चौरीको ४३ महिना रहेको छ । याक/चौरीको गोबर परीक्षण गर्दा मुख्य परजीबीहरुमा टोक्सोकारा, पाराएम्फीस्टोमम, एसकारिस र संक्रमण दर १५.२९% देखियो । नदेखिने खालको थुनेलोको संक्रमण दर १०.७१% पाईयो ।

५ वटा सामान्य ऋतुकालमा आउने गाईहरु र ५ वटा बाझो गाईहरुको ईस्ट्रोजन, प्रोजेस्टेरोन, एलएच र एफएसएच हर्मोनहरुको मात्रा एलिसा टेस्ट बाट ५ वटा सामान्य ऋतुकालमा आउने गाईहरु र ५ वटा बाझो गाईहरुको ईस्ट्रोजन, प्रोजेस्टेरोन, एलएच र एफएसएच हर्मोनहरुको मात्रा एलिसा टेस्ट बाट निकालियो।

फार्ममा उत्पादित दुधको प्रयोग गरि निर्धारित उच्च स्तरीय ढाँचामा विभिन्न दुग्ध पदार्थहरु पनीर खुवा, दहि र रसवरी उत्पादन गरिएको थियो। सो को लागि प्रयोग गरियोको दुधमा औसत घृताम्स ५.१५%, एस.एन. एफ. ८.८५%, प्रोटिन ३.२३% र ल्याक्टोज ४.८६% रहेको थियो । उत्पादित दुग्ध पदार्थहरुको सुरु देखि भण्डारण सम्मको उत्पादन लागतको आर्थिक सम्भाव्यता अध्ययन गरिएको थियो, जसमा दुधको मूल्य रु. ५६ प्रति लिटरका दरले हिसाब गरिएको थियो । यसरि हिसाब गर्दा रामपुर फार्ममा विभिन्न दुग्ध पदार्थहरु पनीर, खुवा, दहि र रसवरी को उत्पादन लागत मूल्य क्रमश रु. ४४५.४४ प्रति किलो, २४२प्रति किलो, ७२.७८ प्रति लिटर र ८.०३ प्रति गोटा रहेको पाइयो भने बाह्य अनुसन्धान स्थल देवदह र माडीमा क्रमशः पनीर रु. ६०४.५०, ५७५.२२ प्रति किलो, खुवा रु. ३७२, ३६६ प्रति किलो, दहि रु . ८६, ७७ प्रति लिटर र रसवरी रु. ११.८०, ८.२६ प्रति गोटारहेको थियो ।

त्यसैगरी यस आर्थिक बर्षमा ३०२२ भन्दा बढी किसान, विद्यार्थी, तथा सम्बन्धित सरोकार वाला हरू लाई फार्म भ्रमण/ अबलोकन तथा गाई पालन सम्बन्धी जानकारी प्रदान गरियो साथै यसै वर्षमा

देबदह रुपन्देहीमा घुम्ती पशु-स्वास्थ्य तथा बझोपन निवारण शिबिर संचालन गरियो जसमा विभिन्न जातका गाईहरू उपचार गर्नुका साथै परामर्स सेवा प्रदान गरिएको थियो ।

राष्ट्रिय गाई अनुसन्धान कार्यक्रम पूर्वाधार तथा भवनहरू अझै पनि निर्माणाधीन अवस्थामा रहेका छन्। हालसम्म तीन वटा गाईगोठ, बाच्छा बच्छिकको गोठ, दुध तथा दुग्ध पदार्थ बिक्रि कक्ष, मेटाबोलिक क्रेट, काल्भिङ पेन, हे बार्न निर्माण भैसकेका छन् भने प्रयोगशाला संरचनाहरू र २०० घ.मि.क्षमताको बायो ग्यास निर्माण भै संचालनको अन्तिम चरणमा रहेको छ, जसले कम्तिमा ६० परिवारलाई खाना पकाउने ग्यास आपूर्ति हुनेछ । यस बायो ग्यासको निर्माणमा बैकल्पिक उर्जा प्रबर्धन केन्द्र, खुमलटारको आर्थिक तथा प्राबिधिक सहयोग रहेको छ ।

EXECUTIVE SUMMARY

National Cattle Research Program (NCRP) is one among the various commodity programs under the Nepal Agricultural Research Council (NARC). Cattle are the major source of milk and draught in Nepal. The commodity was prioritized by the Agricultural Prospective Plan (APP 1995) earlier, and now by Agriculture Development Strategies (ADS 2012) and other National Periodic Plans. Further these government plans have spell out the need of input generation to promote the milk and its products, processing and marketing. NARC has prepared short, medium and long term research strategies to generate the improved technology to promote the commodity since its establishment in 2048 B.S.

To implement approved plan of NCRP during FY 2075/76 it has conducted the different research activities and extension programs which has been mentioned in this report. During the FY 2075/76 program conducted two program activities: research and production program.

In the research work different projects were conducted like: Evaluation of the local dairy cows through crossbreeding with exotic breed semen at NCRP Farm, Rampur, Chitwan.Evaluation of different perennial fodders at Rampur, Chitwan. Performance evaluation and development of forage production technologies in teraidistricts**.** Identification of drug resistant bacterial pathogen and development of effective control strategy to combat against mastitis.Holistic approach to improve fertility in crossbred dairy cattle of Chitwan, Nawalparasi and Rupandehi districts.Screening of antibiotic residues in raw milk in dairy pocket area of Nepal.Status of haemoprotozoans in dairy cattle of Nepal. Study on existing situation of heat stress management of crossbred cattle in the dairy pocket area of the Terai region during the summer months.Dairy product diversification and its economic feasibility. The effects of feeding milk replacer on body growth and its economic feasibility in dairy calves. Verification of proven livestock technologies through outreach sites. Farm management project. Cattle herd management and production project. Similarly, in production and extension program projects were: use of high quality semen produced in the country and other countries to produce improve cross breed of Jersey and Holstein cattle and breeding bulls, forage seed production and cultivation of fodder for round the year feeding to the cattle maintained at NCRP farm, development of recording system and up-scaling and verification of livestock technologies by conducting research in out-reachsites.

In production program 55 calves were produced during this year. Similarly, 850 Mt. green fodders, 142613.05 liters milk, 227.05 kg paneer, 65.7kg khoa, 8lt ghee, 194lt Dahi were produced. Among the produced calves, two male calves were distributed to

farmers of Chitwan which were used in upgrading of local cattle in the area. Farmers demand the NCRP bull because of their past experience in production of high quality semen from the bull of this farm. Similarly, 130 kg of different fodder seeds were distributed to the farmers of Chitwan & Rupandehi. Perennial grasses like Stylo, Setaria, Signal, Napier, Sorghum, Vetch, Mulato, Para grass were established and produced for cattle feeding in the area of the program. Among the revenue collected this year Rs. 7730790.90 was from the sale of milk, milk products, calves and manure. Sales of forage seeds produced Rs.51900.00 revenue, Rs. 58200.00 were collected from administrative program and Rs.113259.40 from other sources. Total revenue of this fiscal year was Rs. 7954150.30.

Different dairy products like paneer, khuwa, dahi & ghee were prepared by following its standard protocol. For the production of dairy product we used whole milk produced from NCRP Rampur farm. The whole milk composition of average Fat, SNF, Protein and Lactose were found 5.15, 8.85, 3.23 and 4.86 percent respectively. The average dairy products percentage form milk is 15.04% paneer, 30.32% khowa, 15.71% chhena for rasbary and 87.18% dahi were found respectively. For economic feasibility study of producing different dairy products costing of each item were taken from its starting to till packaging and storage time. The economic analyses were done by using milk price rate of National Cattle Research Programme, Rampur. The cost of production of different dairy product like paneer, khuwa, dahi and rasbary were found Rs. 445.44/kg, 242/kg, 72.78/L. and 8.03/piece respectively. The highest margin can be taken form khowa and rasbary than other dairy products.

In the heat stress management trial during the experimental period, the result of T3 group (sprinkle at 12 Noon and 3 PM and Fan cooling at 12 Noon to 4 PM) has performed better result compare to other groups.

Research on Evalution of different perennial fodders at Rampur, Chitwan revealed that the yield of the experimented five fodders: Sorghum, Mulato hybrid ll, Sumba Setaria, Guatemala grass and Signal grass had similar yield for the Chitwan condition. Any of the fodder may be used for the substantial improvement of the livestock production.

At the end of fiscal year 2075/76 research on“Status of haemoprotozoans in dairy Cattle of Nepal” found that; 5%, 4%, 7% and 11% were positive for anaplamosis, babesiosis, theileriosis and trypanosomiasis respectively. In PCR 9% samples were positive for anaplamosis.

Screening of infectious agents in the infertile cows was done. The overall prevalence of brucellosis was 2.33%(4/171) and in Chitwan 3.27%(2/61), Kaski 10%(1/10), Nawalparasi 2%(1/50) and Rupandehi 0%(0/50), the overall prevalence of neosporosis

5%(9/180) and in Chitwan 6.55%(4/61), Kaski 0%(0/19), Nawalparasi 4%(2/50) and Rupandehi 6%(3/50), the overall prevalence of BVD was 3.80%(14/368) and in Chitwan 2.70%(5/185),Kaski 0%(0/23), Nawalparasi 4.93%(4/81) and Rupandehi 6.32%(5/79), the overall prevalence of leptospirosiswas 7.40%(6/81) and in Chitwan 6.55%(4/61) and Kaski10%(2/20), the overall prevanlence of chlamydiosis was 4.12%(14/339) and in Chitwan 0.75%(1/132), Nawalparasi1.02%(1/98), Rupandehi 13.04%(9/69) and Makawanpur 7.5%(14/40), the overall prevalence of toxoplasmosis was 7.09%(11/155) and in Chitwan 0%(0/35), Nawalparasi 7.5%(3/40),Rupandehi 7.5%(3/40) and Makawanpur 12.5%(5/40) and the overall prevalence of IBR was 18.47%(17/92) and in Chitwan 36.66%(11/30), Nawalparasi 9.37%(3/32) and Rupandehi 10% (3/30).

40 sera from healthy & infertile cattle were tested for Iron, copper, cobalt, Zinc and selenium micronutrient analysis of serum. This result might be the National reference value.

Milk replacer feeding trial was conducted in 27 calves and average weekly weight gain in T0 (whole milk), T1 (normal milk replacer) and T2 (medicated milk replacer) group was found to be 2.20 kg, 2.08 kg and 1.90 kg respectively. Similarly daily weight gain was 314.20 gm, 297.10 gm and 271.00 gm respectively for T0, T1 and T2 group. This was statistically significant ($P<0.05$). Average consumption of whole milk by a calf till weaning in control group (T0) was 153.00 liter, whereas average milk replacer powder consumption in T1 group was 19.50 kg and 30.50 liter of whole milk and in T2 it was 20.80 kg milk replacer powder and 33.00 liter of whole milk. Average cost for feeding a calf in T0 was NRS 8550.80 (NCRP rate @ Rs 56/Lit) and NRS 12215.40 (DDC rate@ Rs 80/Lit), for T1 average cost was NRS 6255.20 (@ Rs 56/Lit) and NRS 6988.80 (@ Rs 80/Lit) and T2 was NRS 6722.00 (@ Rs 56/Lit) and 7525.40 (@ Rs 80/Lit).Although cost was less in milk replacer feeding than controlgroup but growth rate was lower in milk replacer fed calves than whole milk fed calves.

According to survey conducted in 25 households of 5 different project districts, total number of yak/chauries was 727 (yak/nak- 490 & chauri-237). Average number of yak/chauries per household was 29.08. According to survey, 38% of farmers use antihelimintic for their yak/chauries and 14% farmers vaccinate their yak/chauries with foot and mouth disease vaccine. Transhumance type of migration is common in yak/chauri farming in every district. Commonly found forage and fodder for yak/chauries are buki, benakshi, alpipi, white clover, rye grass , bachi, oak , singkshe, rambo, chendi, machhi, pang, bhena, bekhar, nigalo, gadar, pasi, tiure, hakato, kamlya, gojeng, dhade buki, khar. Price of adult yak/nak ranges from NRS 85,000to NRS 1,00,000 and chauri ranges from NRS 30,000 to NRS 65,000. Average milk

production of nak per day is 1.67 liter and that of chauri 3.45 liter.Average lactation length of nak is 185 days and that of chauri is 212 days. Age of first calving of nak is 38 months and that of chauri is 43 months. Time to return estrus after calving for nak is 6 months and that of chauri is 5 months. In fecal examination major parasites found were *Toxocara* sps, *Paramphistomum* sps, *Ascaris* sps and prevalence rate was 15.29%. Quarterwise prevalence of subclinical mastitis was found to be 10.71%.

Regarding assessement of values of reproductive hormones of crossbred dairy cattle, values of hormones like estrogen, progesterone, LH and FSH of 5cyclic and 5 non cyclic cows were determined by using ELISA test.

From the research in mastitis disease, *Staphylococcus & Escherichia coli* were identified as major mastitis causing pathogen. Antibiogram profile indicated that pathogen mostly resistance to Ampicillin & Amoxyclav. Tetracycline, Gentamicin, Ciprofloxacin, Chloramphenicol & Enrofloxacin are effective antibiotics for treatment of mastitis. For the control of mastitis, post milking teat dipping in povidine iodine: glycerine (9:1) solution is found to be effective.

In this FY more than 3022 farmers, students and other stake holders were involved in observation and visiting the farm of NCRP and consultancy services were provided to them about the cattle. One animal health and infertility correction mobilecamp was organized in Devdaha, Rupandehi. National Cattle Research Program is still in constructive phase in Rampur, Chitwan. Till date, there are three cattle sheds, one calves shed, metabolic crate, calving pen, hay barn constructed and other structures like laboratory building, biogas plant having capacity of 200 cubic meters constructed and is ready to supply the gas for 60 families in their kitchens. Alternative energy promotion centre, Khumaltarhas provided the funds and technical help for the construction of this biogas plant.

1. WORKING CONTEXT

National Cattle Research Program (NCRP) is a commodity program among the various commodity programs of Nepal Agricultural Research Council (NARC) comprising cattle. Cattle are the main source of milk production, animal traction and manure in Nepal. In terms of animal mass units, it is the largest livestock in Nepal. This commodity is prioritized by the government long term plan such as Agriculture Prospective Plan (APP) and Agriculture Development Strategies (ADS). According to Agri-Business Promotion and Statistics Division (ABPSD) 2016, livestock contributes 28 % in AGDP and 12% in GDP. Cattle stand second after buffalo which contributes 34.28% in milk production of Nepal. Contribution of dairy sector is 8% in national GDP and it shares 63% of total livestock contribution (ADS, 2013). In Nepal, the total annual milk production is 1911239 Mt and the demanded amount is 2737500 Mt. thus, deficit is 826261 Mt. As concept developed by WHO and FAO availability of milk should be 250 ml /head/day. In present situation actual availability is 174.5/head/day. There is gap between recommended and actual available amount i.e. 75.5ml/head/day. So overall 826261 Mt milk is still deficient for 30 millions of Nepalese people.

The growth trend of cattle population in the country is described in the tablebelow.

Table 1. Growth trend of cattle (10 years period) in Nepal

Year	Total Population	Milking Cattle	Milk yield Cattle (Mt.)	Total Milk Yield (Mt.)
2007/08	7090714	915411	400950	1388730
2008/09	7175198	932876	413919	1445419
2009/10	7199260	954680	429030	1495897
2010/11	7226050	974122	447185	1556510
2011/12	7244944	998963	468913	1622751
2012/13	7274022	1025591	492379	1680812
2013/14	7243916	1024513	532300	1700073
2014/15	7241743	1025947	587719	1755725
2015/16	7302808	1026135	643806	1854247
2016/17	7347487	1029529	665285	1911239
2017/18	7376306	1039538	856675	2141697

Source: Statistical Information on Nepalese Agriculture (2016/17) & Livestock Diary (2076)

National Cattle Research Program is located in Rampur, Chitwan of Central development region of Nepal which has sub-tropical climate. Land occupancy of the program in Rampur is chiefly rain-fed while a portion of the total occupancy being irrigated through deep tube wells. This district in particular is marked as one of the leading area in dairy sector. The volume of the milk being collected and its contribution in terms of the supply of the fluid milk to the national milk grid is outstanding.

However, there are some challenges in terms of the diseases outbreak and productivity constraints. Infertility in cattle regardless the breed is perhaps the most limiting factors towards the dairy sector improvement. Likewise, the frequent occurrence of the mastitis contributes to low quality & quantity of milk production. Regarding its command area, it is a National program so; research should focus on overall management of cattle in all agro-ecological zones of thecountry.

2 INTRODUCTION

2.1 Background

National Cattle Research Program (NCRP) is one among the various commodity programs under the Nepal Agricultural Research Council (NARC), administered directly by the director for Livestock and Fisheries research. It has evolved from the Livestock Development Farm of the Department of Livestock Development and Animal Health after the establishment of Nepal Agricultre Research Council in 2048 B.S. (1991AD) and named as National Bovine Research Program (NBRP) at Khumaltar, Lalitpur. In 2069 B.S. (2013 AD) cattle commodity was separated from National Bovine Research Program (NBRP) and NCRP was formed. NCRP was shifted from Khumaltar to Rampur, Chitwan in 2071 B.S. (2014 A.D.). It is situated in the central region of Nepal (27^0 65′ N latitude; 84^0 35′ E longitude and 187 masl.) at Rampur, Chitwan. It has humid and subtropical climate with cool winter (2-3 ^oC) and hot summer (43 ^0C). The annual rainfall is over 1500 mm with a distinct monsoon period (>75% of annual rainfall) from mid-June to mid-September. This is 10 km west from the Bharatpur (districts headquarter of Chitwan). NCRP complex extends in an area of 25 hectare of land.

As a component of NARC, it aims to contribute towards increasing the production and productivity of livestock sectors in general and research and development of cattle in particular. Therefore, generation of appropriate technologies for various agro-ecological zones of the country, client oriented, problem based, participatory, holistic and systematic research on cattle is the approach undertaken by this program to maintain the dynamism in livestock production system and uplift the living standard of Nepalese people.

2.2 Goal

Livelihood of farming communities improved through increased livestock productivity.

2.3 Vision

National Cattle Research Program aims to enhance the production and productivity of livestock sector in general and cattle in particular with the integrated effort on client oriented, problem based, participatory & systematic research and maintain the dynamism in livestock production system.

2.4 Objectives

- To generate, verify and recommend suitable adaptable technologies in feeding, breeding, production / management (husbandry) & health of cattle for various agro-ecological zones of the country.
- To document, maintain and update information on cattle research in Nepal.

- To determine, formulate and prioritize issues and strategies in short, medium and long term in national cattle research in the country.
- To establish, maintain and strengthen linkage with other national and international organization for collaborative and participatory research.
- Evaluation, characterization, exploration, utilization and conservation of cattle germplasm.
- To assist in cattle breed registration and release.
- To assist in formulating and implementing the government policies regarding cattle.

2.5 Achievements

- Fifty percent gene level of crossbred Jersey or Holstein-Friesian (HF) is suitable for the on-farm condition of mid hills. Age at calving, calving interval and milk yield of 50 % Jersey and HF was recorded (32.4 & 27.9 months), (13.8 & 17.7 months) and (1471 & 1836 liters/ lactation) respectively.
- Early weaned crossbred cattle calves at 4 months of age performed better than the calves weaned at 2 and 6 months of age. The age and body weight at puberty of the cross-bred calves weaned at 4 months of age was 12.33 months and 195.3 kg. Whereas the calves weaned at 2 and 6 months of age had puberty at 12.7 & 14.4 months of age and body weight at puberty were 169.5 and 148.02 kg respectively.
- Increased milk production in cows and better growth rate of forthcoming calves can be expected by steaming up diet during last two months of gestation.
- Calves can be raised successfully by replacing whole milk feeding with unconventional milk replacer after the age of 21 days. Feeding milk replacer based on buttermilk and whole milk saved Rs.2284 and Rs.2141 per calf respectively during four months rearing period.
- Induced lactation is possible in dry and infertile animal with the use of sex steroids. Estrogen (Estradiol 17 ß and) progesterone (4-pregnene-3, 20 di-one) in the ratio of 1:2.5. It was more effective in terms of induction and average milk yield as compared to the hormone ratio of 1:1.
- Milk yield is affected significantly by the increased feeding frequency of lactating animals. Dividing the daily concentrate requirement of high yielding cattle (> 10 liters/day) into three parts and feeding them three times a day (7 a.m., 12 noon & 4 p.m.) produced an additional 495 liters of milk per lactation as compared with two times feeding (7 a.m. & 4 p.m.) 2268 liter/ lactation.
- Urea-mineral-molasses block (UMMB) feeding was economical for increased milk production in crossbred dairy cattle. Dairy cows supplemented with UMMB produced 1282.6 liters of milk as compared to the cows without supplementation (855.9 liters) in 140 days of study period.

- Early pregnancy diagnosis in bovine (30 days onward) from milk and blood serum has been established by ELISA technique.
- The quality forage based production system reduced the cost of milk production by reducing concentrate feed by 35% to 45%. Animals fed in certain feed regime (2 kg feed for maintenance extra for milk production) and rest dry matter supplied by combination of 50% non legume forage + 30 % legume forage + 20 % dry roughage per liter milk production cost as Rs. 19.46 in farm condition.

2.6 Strategies

The strategy of NCRP is to generate the technology on cattle promotion suitable for different agro ecological zone of the country. The strategies are short term, medium term and long term research. The research strategies are based on the cattle breeding, feeds and feeding, health, product processing and socioeconomic of the farming.

2.7 Current thrust area for research

National Cattle Research Program (NCRP) is focused to generate the dairy cattle related technology as per the national demand.

The current thrusts are

i. Genetic improvement of cattle using the genetic material (semen) generatedby DCIP and otherprograms
ii. Evaluation of the local dairy cows through crossbreeding with exotic breed semen at NCRP Farm, Rampur, Chitwan
iii. Adaptation of Lulu cattle in Tropicalregion.
iv. Identify the effective drugs againstmastitis,
v. Improve the fertility status of cattle by focusing on the problems relatedto infertility and itsmanagement
vi. Dairy product diversification and its economic feasibility
vii. Development of package of practices for Yak/Chauri
viii. The effects of feeding milk replacer on body growth and its economic feasibility in dairy calves
ix. Status of haemoprotozoans in dairy cattle of Nepal
x. Evaluation of different perennial fodders at rampur, Chitwan
xi. Performance evaluation and development of forage production technologies in teraidistricts

2.8 Infrastructure andfacilities

The program has been undergone administrative and technical changes significantly as decision made earlier by the NARC so as to give full fledge structure that can perform

nationwide research and development in cattle. The program is located in Bharatpur Metropolitan City of Chitwan district at Rampur. It is 11 km far from the main city of Chitwan district in south west region and 157 km far from the headquarter of the country Kathmandu.

Currently, the program has access to 25 ha land out of which about 5 ha is allocated for the farm structures, laboratory buildings, office buildings, residential quarters and rest for other use such as for pasture and fodder production as a feed stuffs required fordailyconsumption throughout the year, research/trial plot, pastureland, fodder trees cultivations as demonstrated in the table 2.

Table 2. Land utilization patterns at NCRP, Rampur, Chitwan

S.N.	Utilization	Area, ha	%
1	Forage cultivation	12	48.00
2	Infrastructure (farm structure, roads, office building, laboratory, residential buildings and others)	5	20.00
3	Research/trial plot	2	8.00
4	Fodder tree cultivated area	1	4.00
5	Pasture land	5	20.00
	Total	**25**	**100.00**

The program has maintained around 166 cattle heads of Jersey, Terai, Lulu and Holstein Friesian crosses in its farm with average daily milk production of around 390 liters. Milk is either sold as whole milk or as products like paneer, khoa, dahi, ghee, ice cream etc. Fodder trees saplings were cultivated recently in around one ha of land and other seasonal fodders are produced as necessary in thefarm.

Most of the constructions are yet to be planned and proposed while some are under constructions. Till now there is one already constructed office building, four cattle sheds and yards, one calf shed with yard, tractor garage, four manure pits, silage pit, chain link fence, isolation shed, metabolic crate. Likewise; laboratory building and other similar small structures are still under construction. To make the daily work efficient in the farm there are eight staffs quarter buildings with the capacity of 14 familyadjustments.

Biogas plant having capacity of 200cubic meters is under construction. After completion of this plant we are able to supply gas for 60households by pipeline system.

Similarly, there is a dairy processing unit with the facility of fluid milk storage and product processing like yoghurt, ghee, paneer, ice cream and khoa. Likewise, mini

laboratory to support the study of animal health parameters having the facilities of autoclave, incubator, laminar flow, hot-air oven, water bath, mastitis detector, microscopes, ELISA reader, semi-automatic biochemical analyzer, haematology analyzer etc and there is facility of artificial insemination under artificial insemination unit where frozen semen straw can be stored, and inseminated with appropriate handling and processing. At the moment there is the facility of Ultrasound (USG) for pregnancy diagnosis and estrus detector for heat detection.

For the farm operation there are facilities of milking machines to milk the animal, weighing balances to record the daily milk production and to measure the birth weight of the new born calves, lacto scan machine for routine milk analysis and chaff cutter for processing the forages and straw in desired size. Animal Nutrition Laboratorywas established in this fiscal year 2073/74 with the facility of estimation of crude protein, crude fiber, ether extract, ash and dry matter. The instruments available in Nutrition laboratory were Sox-holet apparatus, Muffle furnace, K-jeldhal apparatus, Fiber digester, Hot air oven etc. However, the program lacks many other types of equipment needed in different units and still there are lots of equipments required to sophisticate the laboratories. To cultivate different forages there is the facility of irrigation also. But, it has to be improved to produce the substantial amount of the forages and pastures. Also there is one four-wheeler Jeep, two motorbikes, one electric auto rickshaw & nine bicycle. But the condition of vehicle is very poor and insufficient motorbike in the office plays a significant role for delay of the research activities in theprogram.

2.9 Organizational Structure and humanresources

The organizational structure of National Cattle Research Program, Rampur, Chitwan

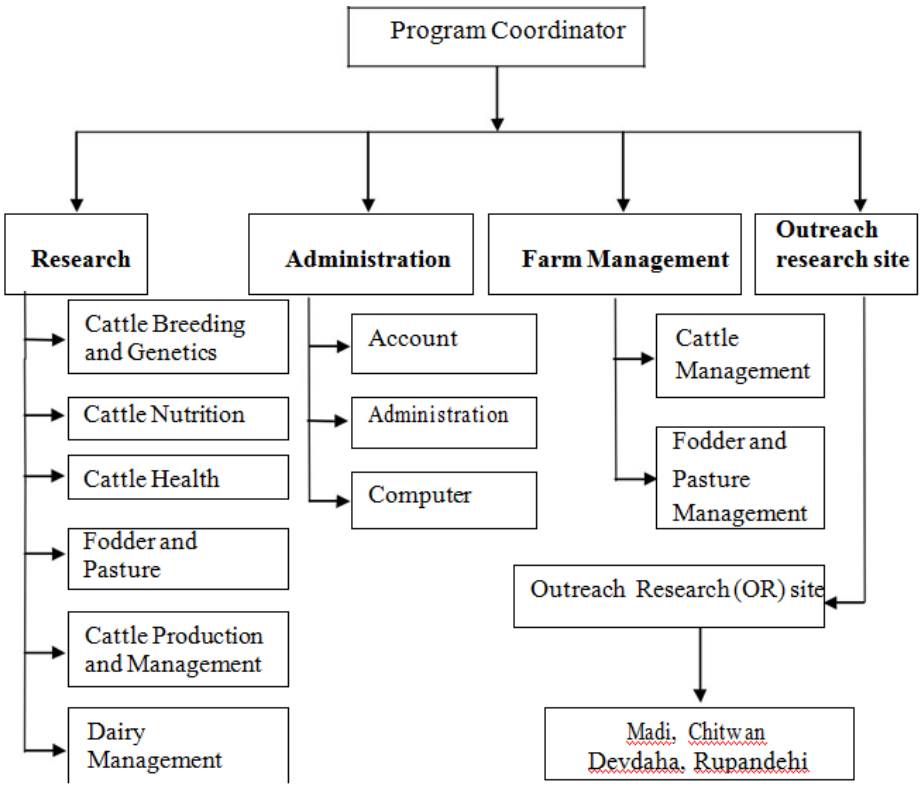

Figure 1: Organizational structures of NCRP, Rampur, Chitwan

The program is basically coordinated by Principal Scientist (S5) but in this FY it was coordinated by the Senior Scientist (S3) and supported by other scientists, technical officers, technicians and admin staffs as shown in Annex 2.3.

3. RESEARCH HIGHLIGHTS

3.1 Cattle

As a cattle commodity program all the researchers were involved in the carrying out the cattle related projects. The highlights of the research projects carried out by the scientists and technical officers of the NCRP in this FY are mentioned as below. The number of project implemented in FY 2075/76 is given in annex 3.1.

3.1.1 Evaluation of the local dairy cows through crossbreeding with exotic breed semen at NCRP Farm, Rampur, Chitwan

Phenotypically twenty local terai cows identified from the Rautahat district and introduced at NCRP, farm in the first trimester of 2074/075. For breeding purpose, we introduced two bulls of same breed identified in Tribeni area Nawalparasi. Routine work was carried out like daily feeding, deworming, and vaccination against HS, BQ and FMD etc. This is a core project where production and reproduction performances will be evaluated at certain defined interval by applying appropriate breeding technology. Besides, breed will be maintained as well.

Local Terai Cattle Introduced at NCRP Farm

3.1.2. Evaluation of different perennial fodders at Rampur, Chitwan

Abstract

The experiment was conducted from July 2017 to June 2018 to evaluate the introduced perennial fodder at National Cattle Research Program, Rampur, Chitwan. Coimbatore Fodder Sorghum (*Sorghum* spp. perennial hybrids), Mulato hybrid-II *Brachiariabrizantha x B. ruziziensis* artificial hybrids), Sumba setaria (*Setaria* hybrids), Guatemala grass (*Tripsacumanderso*) and Signal (*Brachiaria documbens*) were evaluated as five treatments laid out in randomized complete block design (RCBD) with three replications. An experimental unit was 5m×4m sized plot with the spacing of setts were Coimbatore Fodder Sorghum and Guatemala grass row to row 1m and plant to plant 0.5m and Signal grass, Mulatoll and Sumba Setaria maintained the spacing row to row to 0.50m and plant to plant 0.25m. The fertilizer was applied at the rate of 80:60:40 Kg ha^{-1}NPK.Observations on plant height, number of leaves $plant^{-1,}$leaf area and green biomass were recorded. A total five cutting were taken in year. The result showed that cumulative annual fresh biomass yield were obtained statistically similar (P>0.05) among Coimbatore Fodder Sorghum, Mulato hybrid ll, Sumba Setaria, Guatemala grass and Signal grass (113,116.3, 93.3,85 and 75.9 t ha^{-1} respectively). Accordingly, annual fodder dry matter yield of Coimbatore Fodder Sorghum, Mulato hybrid ll, Sumba Setaria, Guatemala grass and Signal grass were obtained (29.38, 22.09, 19.59, 20.55 and 20.49 t ha^{-1} respectively). The result of the experiment revealed that the yield of the experimented five fodders had similar yield for the Chitwan condition. Any of the fodder may be used for the substantial improvement of the livestock production.

Key words: DM yield, green biomass, perennial fodder

Introduction:

Animal farming is an important source of income for livestock farmers in the world (Rakotondramanana 1999; Raharimalala 2002).Feed shortage and particularly, high quantity as well as quality forage availability is one of the major limiting factors to meat and milk productivity improvement (Lecomte *et al.*, 2008). Low quality forage consisted of natural pasture and crop residues are found in the diet in large quantities.More feed deficit occurs in winter season and also deficit in summer. In other hand, concentrate feed is more expensive as a result it increases the cost of milk production.There is an overall feed deficit (Joshi, 1988), of is about 31% with seasonal variation (Raut *et al*., 2000); it is severest in the Hills (-56%), followed by the Terai (-42%). Major problems associated with feeds and feeding, include both their quality and quantity during winter and summer, be it in migratory, sedentary or stall fed systems.Shrinkage of pasture and community (public) grazing land, decreasing feed resources, unavailability of cereal and legume by-products for feeding animals etc. have led to the quantity related problems .Perennial forage are well adapted to the various agro-ecological zones and give high

biomass yields as well as nutrient to animal in year round (FIFAMANOR 2007). It conserve soil from erosion and reduce the cost of milk production by decreasing concentrate feed.There is an urgent need to evaluate the production potential, suitable methods of establishment, management practice, their nutritive value of some perennial fodder species for disseminating technology practices of forage cultivation under farmer field condition

Materials and Method

The experimental site was the National Cattle Research Program (NCRP) Farm, Rampur, Chitwan. The trial was conducted from August, 2017 to July, 2018. Different perennial fodder (Sumba setaria, Guatemala, Mullatoll and signal) sets were collected from pasture and forage division Khumaltar and Coimbatore fodder sorghum sets were collected from NCRP farm. The experiment was laid out in a Randomized complete block design (RCBD) with three replications & five treatments. There were fifteen experimental units having each area of 20 m^2 with a distance of 0.5 m from plot to plot. The spacing of setts wasCoimbatore Fodder Sorghum and Guatemala grass row to row 1m and plant to plant 0.5m and Signal grass, Mulato ll and Sumba Setaria maintained the spacing row to row to 0.50m and plant to plant 0.25m. The fertilizer dose was applied @ 80:60:40 kg NPK/ha and Farm yard manure was applied 100 t/ha. Observations on plant height, number of leaves $plant^{-1}$, leaf area and green biomass were recorded. The setts were transplanted July 31, 2017.1^{st} cut and data was recorded after two month of sapling sowing. 2^{nd}, 3^{rd}, 4^{th} and 5^{th} cut and data were recorded one month interval of each subsequent cut.1^{st} cut was done at September, 2^{nd}, 3^{rd}, 4^{th} and 5^{th} cut was taken April, may, June & July respectively.After each cut top dressing was applied.The maximum and minimum temperature (30.86^0c and 19.90^0c respectively) and relative humidity (91.14) were recorded. The soil type of the experimental plot was alluvial deposits, sandy loam texture, low in zinc, boron and moledebnum and soil Ph was 6.04 average.Data obtained from trial were recorded in MS –Excel and analysis of variance were carried out by using "R" program. ANOVA was used to test the treatment differences. Comparison between means was done by LSD at 0.05 level of significance.

Results and Discussions

Production performance

Green Matter production

Five subsequent cuttings were taken from perennial fodder species of study sites. Total green matter production of Mulato ll (116.3 mt/ha), Coimbatore Fodder Sorghum (113.0 mt/ha), Sumba Setaria (93.3 mt/ha), Guatemala (85 mt/ha) and Signal (75.9 mt/ha) were found.

Table 3. Green Biomass (GB) of different perennial fodder species at NCRP, Rampur, Chitwan

Perennial fodder	1st cut	2nd cut	3rd cut	4th cut	5th cut	Total
Signal	16.8±0.4abc	15.3±0.1abc	10.67±0.15ab	25.3±0.34abc	7.90±0.11a	75.9b
Mulatoll	11.50±1.1abc	22.3±0.4abc	23.3±0.38abc	37.5±0.65cd	21.7±0.61abc	116.3a
SumbaSetaria	33.6±0.2bcd	12.6±0.1ab	14.6±0.18abc	21.0±0.27abc	11.5±0.37ab	93.3ab
Coimbatore Fodder Sorghum	52.3±0.4d	17.3±0.6abc	13.0±0.62ab	18.1±0.47abc	12.3±0.58ab	113ab
Guatemala	15.2±0.5abc	14.4±0.3abc	17.7±0.4abc	20.3±1.1abc	17.4±0.7abc	85ab

The maximum GB (116.3mt/ha) was obtained from Mulatoll and lowest (75.9Mt/ha) from Signal grass and significant different (P<0.05). Whereas Sumba Setaria, Perennial sorghum and Gwatemala was found non-significant (P>0.05) but significant different in some cuts.

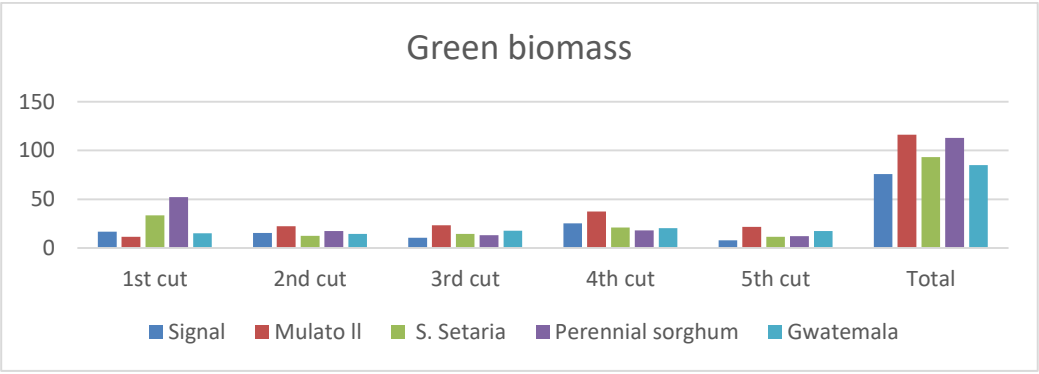

Fig 2: Green biomass production of different perennial fodder at Chitwan

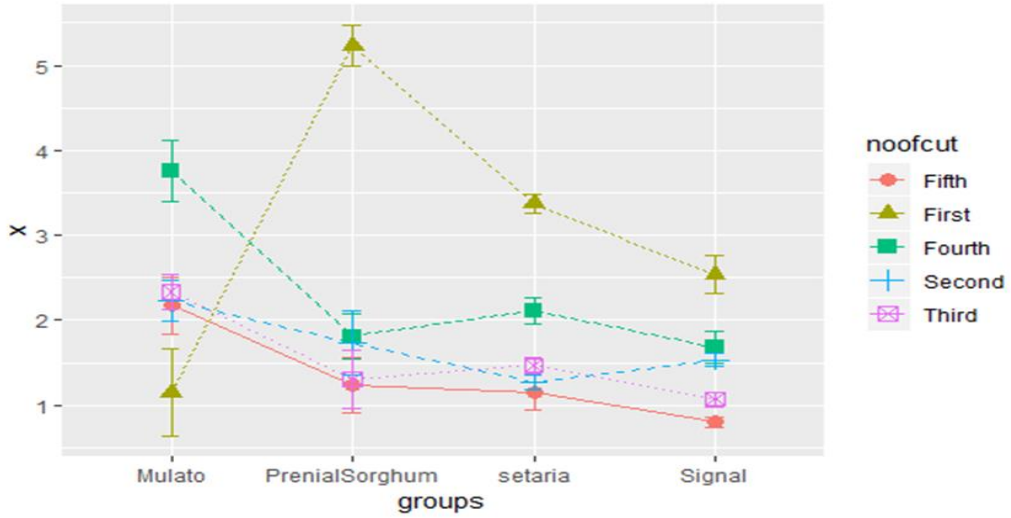

Fig 3: Green biomass production of different cut of different perennial fodder at Chitwan

Dry Matter Production

Dry matter production of fodder reveals the green matter production. Dry matter production of Coimbatore Fodder Sorghum, Mulatoll, Signal, Gwatemala and Setaria were 29.38, 22.09, 20.55, 20.49 and 19.59 mt /ha respectively (see table 2).

Table 4. Dry matter (DM) of different perennial fodder species at NCRP, Rampur, Chitwan

Perennial fodder	1st cut	2nd cut	3rd cut	4th cut	5th cut	Total
Signal	4.53	4.12	2.87	6.82	2.21	20.55b
Mulatoll	2.18	4.23	4.42	7.12	4.12	22.09ab
Sumba Setaria	7.05	2.69	3.06	4.40	2.42	19.59b
Coimbatore Fodder Sorghum	13.59	4.49	3.38	4.70	3.19	29.38a
Guatemala	3.67	3.48	4.27	4.90	4.15	20.49b

The yield is influenced by the height of plant and number of tiller. Pariyar (2007) reported that the taller plant the more dry matter.The highest DM (29.38 mt./ha) was found in Coimbatore Fodder Sorghum and the lowest DM (19.59 mt./ha) was found in Setaria and statistically significant ($P<0.05$). Coimbatore Fodder Sorghum dry matter was statistically significant ($P<0.05$) different with respect to Signal, Setaria and Gwetemala and all other fodder were statistically non-significant ($P>0.05$).

Morphological traits

Plant Height

The plant height and the number of tillers are the important attributes in contributing the biomass yield of the forage species. The measurement of plant height was taken at each cutting for fodder production. The highest plant height (161cm) was found in perennial sorghum and lowest (65.2 cm) was found in Mulato ll.There was statistically significant ($P<0.05$) within cut.

Table 5. Plant height (cm) of different perennial fodder species at NCRP, Rampur

Perennial fodder	1st cut	2nd cut	3rd cut	4th cut	5th cut	Average
Signal	82.8±6.3abcd	77.63±9.9abcd	57.66±2.7abc	52.26±2.2a	59.26±2.4abcd	66.80
Mulatoll	80.1±2.1abcd	55.40±3.5ab	59.93±4.2abcd	62.73±4.5abcd	70.53±1.1abcd	65.20
Sumba Setaria	158.2±4.6g	76.56±13.5abcd	98.60±10.2cdef	99.53±7.1def	95±4.5bcdef	105.57
Coimbatore Fodder Sorghum	260.86±1.8g	124.93±2.5efg	144.93±19.8g	146.26±7.7g	132.73±9.4fg	161.94
Guatemala	163.7±3.3g	145.1±9.2g	130±8.4efg	125.3±7.6efg	160.2±3.5g	144.86

Tillers per plant

The tillers numbers per plants were counted for each treatment at every subsequent cut. The highest average tiller number (116.91) was found in signal and lowest (5) was found in Gwatemala. There was statistically significant ($P<0.05$)within cut.

Table 6. Tiller no of different perennial fodder species at NCRP, Rampur, Chitwan

Perennial fodder	1st cut	2nd cut	3rd cut	4th cut	5th cut	Average
Signal	31.33±4.6abc	124.53±8.8ef	167.40±22.4f	172.46±16.8f	88.86±16.7cde	116.91
Mulatoll	17.10±2.1ab	76.86±2.1bcde	93.33±12.2de	171.33±24.6f	128.66±13.4ef	97.45
Sumba Setaria	14±2.4a	42.86±5.8abcd	49±6.3abcd	44.66±7.1abcd	56.80±12.6abcd	41.46
Coimbatore Fodder Sorghum	6.93±0.8a	28.60±2.1ab	19.53±.1ab	21.73±4.4ab	24.93±2.8ab	19.74
Guatemala	3±0.2a	5±0.4a	6±0.6a	5±0.15a	6±0.5a	5.0

Conclusion:

The result of the experiment revealed that the yield of the experimented five fodder had similar yield for Chitwan condition.Any of the fodder may be used for the substantial improvement of the livestock production.This study needs further verification of the

results covering in terai districts before the technology could be recommended for adoption by farmers.

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3.1.3. Holistic approach to improve fertility in crossbred dairy cattle of Chitwan, Nawalparasi and Rupandehi districts.

I. Screening of major infectious causes of infertility in dairy cattle of Nepal

Abstract

Infertility refers to the inability to produce viable young within a stipulated time for specific species. This is a major factor of economic losses for the dairy sector. It can be due to infectious or non-infectious factors. Among infectious factors, parasites, bacteria, viruses, and fungi can be involved. The present work is to investigate the sero-prevalence of the major infectious agents of infertility in dairy cattle of Nepal. The purposive sampling technique was applied to collect the serum samples from dairy cattle of different districts of Nepal during 2016 to 2019AD. The serumsamples were subjected to Indirect ELISA for Brucellosis, Neosporosis, Leptospirosis, Chlamydiosis, Toxoplasmosis & Infectious Bovine Rhinotraciteitis (IBR). Antibody Competition ELISA was used for Bovine Viral Diarrhoea (BVD) manufactured by ID.vet, France for respective diseases. The overall prevalence of brucellosis was 2.33 % (4/171) and in Chitwan 3.27%(2/61), Kaski 10% (1/10), Nawalparasi 2% (1/50) and Rupandehi 0%(0/50), the overall prevalence of neosporosis 5%(9/180) and in Chitwan 6.55% (4/61), Kaski 0%(0/19), Nawalparasi 4%(2/50) and Rupandehi 6%(3/50), the overall prevalence of BVD was 3.80%(14/368) and in Chitwan 2.70%(5/185), Kaski 0%(0/23), Nawalparasi 4.93%(4/81) and Rupandehi 6.32%(5/79), the overall prevalence of leptospirosiswas 7.40%(6/81) and in Chitwan 6.55% (4/61) and Kaski10%(2/20), the

overall prevanlence of chlamydiosis was 4.12%(14/339) and in Chitwan 0.75% (1/132), Nawalparasi1.02% (1/98), Rupandehi 13.04%(9/69) and Makawanpur 7.5% (14/40), the overall prevalence of toxoplasmosis was 7.09%(11/155) and in Chitwan 0% (0/35), Nawalparasi 7.5%(3/40), Rupandehi 7.5%(3/40) and Makawanpur 12.5% (5/40) and the overall prevalence of IBR was 18.47%(17/92) and in Chitwan 36.66% (11/30), Nawalparasi 9.37% (3/32) and Rupandehi 10%(3/30). The different rates of overall and district-wise sero-prevalance of infectious diseases reflects that the presence of antibodies against the diseases causing agent which may either due to previous vaccination or natural infections. In our context, among dairy cattle none of these vaccines are in practice. Thus, antibodies detected are due to infection. To overcome the problem of infertility and uplift of dairy sector, strategies in disease surveillance, monitoring and control should be developed.

Keywords: Dairy cattle, ELISA, infectious, infertility

Introduction

Livestock contributes 28 % in AGDP and 12% in GDP(ABPSD, 2016). Cattle stand second after buffalo which contributes 34.28% in milk production of Nepal. Contribution of dairy sector is 8% in national GDP and it shares 63% of total livestock contribution (ADS, 2013). Total annual milk production is 1911239 Mt. the demanded amount is 2737500 Mt. thus deficit is 826261 Mt. The concept developed by WHO and FAO there should be availability of milk is 250 ml /head/day. In present situation actual availability is 174.5/head/day. There is gap between recommended and actual available amount i.e. 75.5ml/head/day. So overall 826261 Mt milk is still deficient for 30millions of Nepalese people.

Infertility refers to the inability to produce viable young within a stipulated time for specific species (Hafez, 2013).Infertility is a major factor of economic losses in dairy sector.Economic loss can be analyzed in many ways for instances; the delay in revenue from the sale of dairy products due to disturbances in the reproductive performances of cattle, likewise, loss due to investments in the treatment to overcome from multi-factorial causes. In context of Nepal, there is the major problem of infertility in cattle herd. There are various etiological agents and factors leading to the infertility in cattle responsible for hindrance of timely expression of estrus, mating, and successful conception and parturition behaviors. All the Genetic factors, anatomical anomalies, pathological factor, nutritional factors, hormonal disorders and so on are the topic of concern with fertility in cattle. If there is infertility due to the pathological disorder then we can categorize them into the infectious or non-infectious factor. Parasites, Bacteria, Viruses, and Fungi are responsible for the infectious factors of infertility. These infections are suspected to be present in our country so, this paper is aimed to investigate the major infectious agents of infertility in dairy cattle of Nepal.

Toxoplasmosis, tirchomoniasis and neosporosis are the protozoal diseases that lead to infertility in cattle. Trichomoniasis is caused by the *Trichomonas fetus* which is responsible for the abortion in cow in first trimester, repeat breeding and pyometra and is transmitted via veneral route from infected to healthy animal. Neosporosis is transmitted by transplacental route and is responsible for abortion at 3-8 months of gestation. *Neospora caninum* is found worldwide and is the most common cause of abortion in dairy and beef cattle in many parts of the USA. Dogs and coyotes are definitive hosts for *N caninum* and can be the source of infection. Most infections result in an asymptomatic congenitally infected calf. Some infected calves are born with paralysis or proprioceptive deficits. Cows are not clinically ill, and placental retention is not common. Brucellosis, Vibriosis, Leptospirosis and Chlymadiosis are bacterial diseases of infertility in cattle. *Brucella abortus* is the etiological agent for brucellosis in cow, transmitted after ingestion of infective agent and is responsible for abortion in last trimester of gestation in cow. Abortion is the most obvious manifestation. Infections may also cause stillborn or weak calves, retained placentas, and reduced milk yield. Brucellae may enter the body through mucous membranes, conjunctivae, wounds, or intact skin in both people and animals. Usually, general health is not impaired in uncomplicated abortions. Vibrious is due to infection of *Campylobacter fetus* through the veneral route leading to abortion at 3-4 months of gestation period causing 5-10 % infertility. Leptospirosis in cattle is due to *Leptospira hardijo* which is transmitted through cutaneous route or via mucosal abrasions and is responsible for abortion in last trimester. Infectious bovine rhinotracheitis (IBR) is a major cause of viral abortion in the world, with abortion rates of 5%–60% in non-vaccinated herds. IBR is viral cause of abortion in second half of pregnancy. Bovine viral Diarrhoea (BVD) is another virus responsible for infertility in cattle (Lang et al. 1988, Radostis et al. 1994 and Arthur et al., 1996). In several surveys, BVD was the most commonly diagnosed virus in bovine abortion cases. The pathology of BVD in the developing fetus is complex. Infection before insemination or during the first 40 days of pregnancy results in infertility or embryonic death.

Methodology

The purposive sampling technique was applied to collect the serum samples from dairy cattle of different districts of Nepal during 2016 to 2019AD. Serum samples from female dairy cattle of more than two years of age having history of reproductive problems like abortion, retention of placenta, repeat breeding were taken into consideration. Districts: Chitwan, Kaski, Nawalparasi, Rupandehi and Makawanpur.

Table 7. Serum Samples collected from different districts of Nepal: Chitwan, Kaski, Nawalparasi, Rupandehi and Makawanpur.

Diseases/Districts	**Chitwan**	**Parasi**	**Rupandehi**	**Kaski**	**Makawanpur**	**Total**
Brucellosis	61	50	50	10	-	171
Leptospirosis	61	-	-	20	-	81
Toxoplasmosis	35	40	40	-	40	155
Chlamydiosis	132	98	69	-	40	339
Neosporosis	61	50	50	-	-	180
BVD	189	81	79	19	-	368
IBR	30	32	30	23	-	92

The serum samples were subjected to Indirect ELISA (Lot/Ch.-B: 690-007) for Brucellosis, Neosporosis (Lot/Ch.-B: 603-021), Leptospirosis, Chlamydiosis (Lot/Ch.-B: 623-015), Toxoplasmosis (Lot/Ch.-B: 628-011), Infectious Bovine Rhinotraciteitis (IBR (Lot/Ch.-B: 606-012)) and Antibody Competition ELISA was used for Bovine Viral Diarrhoea (BVD (Lot/Ch.-B: 693-008)). All this kits were manufactured by ID.vet, France. for respective diseases. The manual provided in the ELISA test kits were followed in the lab of National Cattle Research Program (NCRP), Rampur, chitwan.

RESULTS

Table 8. The overall prevalence of brucellosis, neosporosis, BVD, leptospirosis, chlamydiosis, toxoplasmosis and IBR.

Brucellosis	**Neosporosis**	**Leptospirosis**	**Chlamysiosis**	**Toxoplasmosis**	**I.B.R**	**B.V.D**
2.33 %	5%	7.40%	4.12%	7.09%	18.4%	3.80%
(4/171)	(9/180)	(6/81)	(14/339)	(11/155)	(17/92)	(14/368)

Table 9.The district-wise (Chitwan,Kaski, Nawalparasi and Rupandehi) sero-prevalence of Brucellosis, Neosporosis, Leptospirosis and BVD.

Diseases/Districts	Chitwan	Kaski	Nawalparasi	Rupandehi
Brucellosis	3.27% (2/61)	10% (1/10)	2% (1/50)	0% (0/50)
Neosporosis	6.55% (4/61)	0% (0/19)	4% (2/50)	6% (3/50)
Leptospirosis	6.55% (4/61)	10% (2/20)	-	-
B.V.D.	2.70% (5/185)	0% (0/23)	4.93% (4/81)	6.32% (5/79)

Table 10.The district-wise(Chitwan, Nawalparasi, Rupandehi and Makawanpur) sero-prevalence of Chlamydiosis, Toxoplasmosis and I.B.R.

Diseases/Districts	Chitwan	Nawalparasi	Rupandehi	Makawanpur
Chlamydiosis	0.75% (1/132)	0.02% (1/98)	13.04% (9/69)	7.50% (14/40)
Toxoplamosis	0% (0/35)	7.50% (3/40)	7.50% (3/40)	12.50% (5/40)
I.B.R	36.66% (11/30)	9.37% (3/32)	10% (3/30)	_

Discussion

The clinical signs of brucellosis are mainly manifested with abortion of cow in third trimester, retention of placenta, reduced milk production and infertility**.** In our study the overall prevalence of brucellosis was 2.33 % (4/171) which is greater than the study conducted by Jha 0.84% (1/118) in repeat breeder and aborted cow whereas less than the reported published in annual report of AHRD (2072/73) which was 18.52%(30/162) on RBPT in serum of aborted cattle of Nepal. This is because in aborted cow in 3rd trimester have more probability of having infection of brucellois. The prevalence rate of brucellosis in Chitwan was 3.27%(2/61) which is similar to 3.4%(3/91) by Pradhan whereas less than the report of Subedi (2016); 14.13%(13/92) and 10.86%(10/92) positive in RBPT and iELISA respectively. According to annual report AHRD 2073/74; the prevalence rate was 68.1% (15/22) and 50% (6/12) in aborted cattle of Ilam and Kavre respectively in Immuncomb. dotELISA which are also higher than our study of different districts; Chitwan 3.27% (2/61), Kaski 10% (1/10), Nawalparasi 2% (1/50) and Rupandehi 0%(0/50). These different rates of sero-positivity in cow of Nepal reflect the infection of brucellosis in animal during their life time leading to the infertility and production loss. To overcome the problem of brucellosis, calves should either be vaccinated with a vaccine of Strain RB51 (rough attenuated strain, and does not form antibodies, but detected in serological test) or with Strain 19 both have best result in USA (Merck Vet. Manual, 11 Ed).

Bovine Neosporosis is probably not a new disease, but rather a newly recognized one in context of our country. This means the increased rate of sero-positivity increases the risk of abortion in cows compared to sero-negative.The prevalence of *N. caninum* antibodies was 9.6% in India (Meenakshi, et al 2007), In England and Wales 12.5% and in China 13.3% (72/540) (Wang et.al. 2010)using ELISA which are greaterthan our study of overall prevalence 5% (9/180) of Neosporosis in cow of Nepal this is due to limited samples.

In this study, the overall prevalence of leptospirosis was 7.40 (6/81). In Chitwan and

Kaski was found to be 6.55% and 10% which is similar to the findings of Jha (2005) having sero-prevalence rate of 9.3% in 118 sample; this might be due to same geographical zone and same diagnostic tests. Similar according to the annual report of AHRD 2072/73 the prevalence rate was 5.26% (6/114). Whereas annual report of AHRD 2073/74 revealed that in Ilam the prevalence rate was 31.8% **(**7/22) this is much higher than our finding because they had taken the samples only from the aborted animals with mixed infection of *Brucella* and used immunocomb. DotELISA in sero-diagnosis.

In this study the overall sero-prevalence of chlamydiosis was 4.12% (14/339) which is similar to the report of Longbottom (2012) of Ireland 4.75% but higher than the study conducted by Jha (2005) for *C.pscttaci* 0% (0/118). Didugu (2016) has reported a seropositivity of 68.18% in cattle in India and Wang et al., (2001) in Taiwan reported approximately 71% of aborted showing Abs against *C. abortus* in cows which is much more high prevalence rate than our study.

T. gondii is an important zoonotic agent. In some areas of the world, as much as 60% of the human population has serum IgG titers to *T.gondii* and are likely to be persistently infected. Toxoplasmosis is also a concern for pregnant women because tachyzoites can migrate transplacentally and cause birth defects in human fetuses. The overall prevalence of toxoplasmosis 7.09%(11/155) which is lower than the study in Khartoum and Gazira state in Sudan (13.3%) by Elfahal *et al*., (2013), Southern Tunisia 12% by Lahmar *et.al*.(2015), Tharparkar and in part from Punjab in Pakistan 25% by Zaki (1995), Asam 26.66% by Khalita and Sarmah (2015), Grenada and Carriacau in West Indies 8.4% by Chikweto *etal.*,(2011). This prevalence is greater than the study in Southern China (5.7%) by Zhou *et.al*. (2012), North West in Iran (1.6%) by Raeghi *et.al*(2011), Majandaran provience in Iran (0%) by Sharif *et al.,* (2005) and Algeria (3.92) by Dechicha *et al.,* (2015).

In present study, overall prevalence of IBR was found to be 18.48% (Total samples=92) which is lower than previous finding by VC Jha (2002) i.e. 50.8% (Total samples=118) in Nepal. Dyson *et al.,* (2000) showed antibodies against IBR in animals showing reproductive disorders on testing in Nepal. This study is similar to the prevalence found in Karnataka 21% (Koppad *et al.,* 2007), Uttaranchal 10.75% (Jain *et al.,* 2006), Kerala 14.88% (Rajesh *et al.,* 2003) and West Bangal was 22% (Ganguly *et al*., 2008).

Overall prevalence of BVD in present study was found to be 3.80% (14/368), which is slightly higher than previous finding by Manandhar (2015) i.e. 2.2% (Total samples=350) in Nepal. In Tamilnadu the prevalence was 13.20% reported by Krishna (2017) which is higher than our findings. In contrast to this study, higher seroprevalence were found in different areas like in Europe, comprising more than around 50% of the

isolates in North American 90% of the isolates (Ridpath, 2005), 33.2% in cattle of Selangor, Malaysia (Daves et al., 2016), 15.29% in cattle of 16 states of India (Sudharshana et al., 1998) this may be due to provision of vaccination in foreign countries.

Conclusion

The different rates of overall and district-wise sero-prevalance of infectious diseases reflects that the presence of antibodies against the diseases causing agent which may either due to previous vaccination or natural infections. In our context, among dairy cattle none of these vaccines are in practice. Thus, antibodies detected are due to infection. Thus, to overcome the problem of infertility and uplift of dairy sector; strategies in disease surveillance, monitoring and control should be developed. Strict quarantine for during animal import-export should be adopted to minimize the transmission of trans-boundary animal disease from infected to susceptible animal. In most cases, cattle are found to be importing from India in illegal way. However, people are importing cattle by other measures and most of cattle were already infected with any of such diseases, which we had concluded during our sampling visit.

Recommondation

Government should think about the policies for diseased cattle having probability of transmission of zoonotic diseases, chronically infertile and unproductive. Surveillance of positive or negative reactors should be done in systematic manner. At least, government can collect and keep those cattle by making "Cattle Tending Center" in all seven provinces "Test and Segregate approach" Most of these diseases are zoonotic, therefore they should be considered in accordance with agreements and mandate of WTO and "ONE HEALTH" approach to assure the disease free animal and animal products for the safe guard of public health.

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II. Micronutrients analysis of crossbred dairy cattle of different districts

Introduction

Macro- and micronutrients are inorganic substances essential to maintain the normal function and living status in domestic animals (Sharma et al., 2010). These nutrients play a critical role in physiological processes related to health, growth and reproduction, and the adequate function of the immune and endocrine systems. Micronutrients (trace elements) such as iron, zinc, manganese, copper, cobalt, selenium, iodine and chromium play an important role in dry matter intake, energy metabolism, mastitis incidence, reproduction, immune functions, and hoof health. Micronutrient deficiency in dairy cows results in reduced animal performance, such as impaired reproduction, a high incidence of mastitis, reduced milk yield, impaired immunity, and an increased degree of lameness duetolaminitis(Miller,1975;Dvořáketal.,1980;Olsonetal.,1999;Stantonet2000; Ballantine et al., 2002; Spears, 2003; Dobrzański et al., 2005; Nocek et al., 2006). Limited information is available in the national published literature regarding serum levels of calcium (Ca), magnesium (Mg), inorganic phosphorus (P), iron (Fe), copper (Cu), zinc (Zn), manganese (Mn) and cobalt (Co) in dairy cows during the transition period and full lactation under increased metabolic demand for macro- and micronutrients.

Sampling

Blood samples from all experimental dairy cows (n=40) were taken from the jugular vein using a vacutainer system (Terumo® Venoject) and sterile needles. Upon sampling, blood underwent spontaneous coagulation at room temperature. The blood sera were centrifuged at 3000 rpm for 10 min. Then, they were stored at refrigerator untilanalysis.

Biochemical testing

Serum levels of Iron (Fe), Copper (Cu), Cobalt (Co), Zinc (Zn), Selenium (Se) of cattle of different districts were determined by 3111 C, APHA, 21ST EDITION test method by water engineering and training center Pvt. Ltd.132, Ratopul, Kathmandu,Nepal.

Result and discussion

Micronutrient analyses of serum of cattle are tabulated below:

Table 11. Serum micronutrients value of cattle of healthy cattle

Sample Type :- Blood Serum			Test of parameter				
S.N.	**Tag.No**	**Sample volume**	**Cobalt (Co) (**mg/L)	**Copper(cu) (**mg/L)	**Iron(Fe) (**mg/L)	**Zinc(Zn) (**mg/L)	**Selenium(Se) (**µg/L)
1	**17**	0.40	< 0.30	7.25	47.25	143.19	< 0.25
2	**122**	0.25	< 0.30	4.60	52.60	556.70	< 0.25
3	**259**	0.30	0.67	3.67	22.67	21.10	< 0.25
4	**318**	0.70	< 0.30	1.93	14.36	6.29	< 0.25
5	**366**	0.60	< 0.30	2.25	20.50	24.13	< 0.25
6	**105**	0.25	1	4.2	25.8	9.94	< 0.25
7	**108**	0.20	0.5	3.75	53.25	746.38	< 0.25
8	**9950**	0.20	2.50	13.75	52.25	53.63	< 0.25
9	**9905**	0.40	0.75	6.75	25.50	27.10	< 0.25
10	**22206**	0.25	1.2	10.60	44.80	42.60	< 0.25
11	**102**	0.20	1.00	3.25	41.25	54.15	< 0.25
12	**2648**	0.50	0.80	1.40	18.10	17.27	< 0.25
13	**9420**	0.45	0.56	5.33	41.33	103.78	< 0.25
14	**1815**	0.30	0.67	3.67	35.50	26.08	< 0.25
15	**12596**	0.20	2.00	14.75	91.00	87.28	< 0.25
16	**12530**	0.40	1.38	6.13	41.88	17.50	< 0.25
17	**12531**	0.40	1.25	8.50	45.50	38.48	< 0.25

Table 12. Serum micronutrients value of infertile cattle ofNCRP, Rampur, Chitwan

Sample Type :- Blood Serum			Test of parameter				
S.N.	**Tag.No**	**Sample volume**	**Cobalt (Co) (**mg/L)	**Copper(cu) (**mg/L)	**Iron(Fe) (**mg/L)	**Zinc(Zn) (**mg/L)	**Selenium(Se) (**µg/L)
1	**1805**	0.30	0.67	3.67	41.50	917.93	< 0.25
2	**1509**	0.40	1.50	2.75	31.88	384.56	< 0.25
3	**12514**	0.30	0.33	7.83	84.50	39.02	< 0.25
4	**12519**	0.30	2.50	10.50	50.33	15.47	< 0.25
5	**1763**	0.30	0.33	3.50	30.67	273.92	< 0.25
6	**1614**	0.20	2.25	16.00	85.75	233.65	< 0.25
7	**1639**	0.20	1.25	19.00	92.00	37.90	< 0.25
8	**1762**	0.20	3.25	17.50	94.50	45.95	< 0.25
9	**1647**	0.30	0.50	7.50	83.83	909.25	< 0.25

Table 13.Serum micronutrients value of infertile cattle of Chitwan

Sample Type :- Blood Serum			Test of parameter				
S.N.	**Tag.no**	**Sample volume**	**Cobalt (Co)** (mg/L)	**Copper(cu)** (mg/L)	**Iron(Fe)** (mg/L)	**Zinc(Zn)** (mg/L)	**Selenium(Se)** (µg/L)
1	**35**	0.40	1.00	4.75	54.25	44.60	< 0.25
2	**47**	0.20	< 0.30	12.00	87.25	343.95	< 0.25
3	**97**	0.20	< 0.30	19.75	114.25	1409.75	< 0.25
4	**98**	0.20	< 0.30	6.25	109.50	636.75	< 0.25
5	**308**	0.60	0.33	1.92	15.33	4.94	< 0.25
6	**375**	0.70	0.5	1.93	16.50	12.74	< 0.25
7	**386**	0.20	1.00	4.50	14.50	45.85	< 0.25
8	**444**	0.60	< 0.30	4.42	21.25	20.01	< 0.25
9	**239**	0.35	1.43	3.57	53.86	265.29	< 0.25

Table14. Serum micronutrients value of infertile cattle of Dolkha

Sample Type :- Blood Serum			Test of parameter				
S.N.	**Tag.no**	**Sample volume**	**Cobalt (Co)** (mg/L)	**Copper(cu)** (mg/L)	**Iron(Fe)** (mg/L)	**Zinc(Zn)** (mg/L)	**Selenium(Se)** (µg/L)
1	**2640**	0.30	< 0.30	3.33	27.67	30.25	< 0.25
2	**22205**	0.40	0.63	2.88	35.88	26.06	< 0.25
3	**9938**	0.40	< 0.30	2.63	20.63	17.36	< 0.25
4	**22275**	0.30	< 0.30	3.83	39.83	38.67	< 0.25
5	**22259**	0.45	< 0.30	2.22	29.22	21.70	< 0.25
6	**22011**	0.30	< 0.30	3.33	27.00	2.58	< 0.25

Table 15. Serum micronutrient value of infertile cattle of Rupandehi

Sample Type :- Blood Serum			Test of parameter				
S.N.	**Tag.no**	**Sample volume**	**Cobalt (Co)** (mg/L)	**Copper(cu)** (mg/L)	**Iron(Fe)** (mg/L)	**Zinc(Zn)** (mg/L)	**Selenium(Se)** (µg/L)
1	**R1**	0.40	0.38	4.63	32.13	63.15	< 0.25
2	**R2**	0.30	0.67	7.00	59.83	83.30	< 0.25
3	**R3**	0.30	0.67	3.83	48.00	207.52	< 0.25
4	**R4**	0.30	< 0.30	3.33	51.50	185.82	< 0.25
5	**R5**	0.40	0.63	3.13	78.25	363.38	< 0.25
6	**R6**	0.30	1.50	5.17	40.83	18.38	< 0.25
7	**R7**	0.40	0.50	2.88	34.38	149.43	< 0.25
8	**R8**	0.30	101.50	4.00	99.67	1001.92	< 0.25
9	**R9**	0.30	0.33	3.50	34.50	34.93	< 0.25

III. **Reproductive organs and hormonal assessment of infertile dairy cows**

Reproductive organs especially cervix, uterus and ovaries of infertile cows were assessed during health camps in OR sites, door to door farm visit and NCRP farm visit. Cases observed were found with cervicitis, persistent CL, follicular cyst, uterine tumor and inactive ovaries.

Reproductive hormones like estrogen, progesterone, LH and FSH were determined by using ELISA in NCRP laboratory.

Table 16. Reproductive hormonal value of infertile cows

Parameters	Estrogen (pg/ml)	Progesterone (ng/ml)	LH (pg/ml)	FSH (ng/L)
Cow 1	90.02	3.90	0.27	0.67
Cow 2	87.23	2.28	0.24	0.27
Cow 3	118.75	3.40	0.64	0.24
Cow 4	28.43	5.10	0.62	0.24
Cow 5	724.03	5.9	0.27	0.6
Mean± SD	209.69±129.41	4.116±0.64	0.408±0.09	0.404±0.09

LH value obtained by Mori *et al.*, 1974 (22720 ± 5680 pg/ml) is higher than our finding (0.408±0.09 pg/ml). FSH value (0.404±0.09 ng/L) obtained by Mondal *et al.*, 2004 (0.0017 ± 0.00031 ng/L) is lower than our finding. Similarly mean estrogen level is higher in our study but progesterone level is found to be lower than Ahemad *et al.*, 2018. Where estrogen and progesterone values are 107.30 ± 6.97pg/ml and 5.93 ± 0.42 ng/ml respectively in study of Ahemad*et al.*, 2018.

3.1.4 Identification of drug resistant bacterial pathogen and development of effective control strategy to combat againstmastitis

Introduction

Agriculture plays a vital role in Nepalese economy.Among the agricultural commodities, livestock sector plays significant role in the agricultural development and economic empowerment of the country. Livestock contributes 28 % in AGDP & 12% to the Gross Domestic Product (ABPSD 2016). Cattle stand second afterbuffalo which contributes 34.28% in milk production of Nepal. Contribution of dairy sector is 8% in national GDP and it shares 63% of total livestock contribution (ADS, 2013). Total annual milk production is 1911239 Mt. the demanded amountis 2737500 Mt. thus deficit is 826261 Mt.

Mastitis is a multi-etiological and complex disease, which is defined as inflammation of parenchyma of mammary glands and represents one of the most difficult veterinary diseases to control (Gomes, 2016). It is the most frequent and costly disease in dairy animals throughout the world (Gomes and Henriques, 2016).Mastitis occurs in sub clinical & clinical forms. Clinical mastitis characterized by change in quality and quantity of milk, swelling of the udder with systemic signs including elevated temperature, lethargy and anorexia. Subclinical cases show no visible changes in the appearance of the milk or the udder, but milk production decreases, composition is altered and bacteria are present in the secretion (Erskine, 2001).

Bovine mastitis is also classified as: contagious mastitis, generally caused by contagious bacteria presiding on the skin of the teat and inside the udder, transmitted from one cow to another during milking (e.g., *Staphylococcus aureus* or *Streptococcus agalactiae*) and environmental mastitis, caused by environmental pathogens normally found in shed surroundings such as bedding, manure, soil, and feed (e.g., *Escherichia coli*, *Streptococcus uberis*, *Klebsiella sp*.)The occurrence of disease is an outcome of interplay between three major factors: infectious agents, host resistance, and environmental factors

Sub clinical mastitis is more common and financially much more important than clinical mastitis (Francis and Summer, 1986). In Nepal, the largest proportion of loss results from the decrease milk production viz. Rs. 4282 or US $ 63/buffalo per lactation (Dhakal and Thapa, 2003). These economic losses are due to reduced milk production, treatment costs, increased labor, milk withheld following treatment, death, and premature culling. Reduced milk production is responsible for the majority of these losses- approximately 70%. (Sargeant *et al.*2001). Etiologies of mastitis were many but bacterial origin is the most common cause. 140 bacterial species has been isolated from infected animals (Radostits et al., 2006). The most frequent pathogen in small ruminant (Bergonier *et al.*, 2003) and cows (Fox *et al.*, 2001) is *Staphylococcus aureus* but mastitis is also caused by many other bacteria such us *Streptococcus* spp., *Escherichia coli*, *Pseudomonas* spp., and *Mycoplasma* spp.

Antimicrobial therapy is commonly implemented for mastitis prevention and control .Mastitis therapy is commonly started before the results of antimicrobial susceptibility test of pathogens (Hendriksen *et al.*, 2008) representing one of the most important reason for treatment failure. Moreover, this antibacterial strategy has many disadvantages including a low cure rate, increasing the presence of antibiotics residues and occurrence of antimicrobial resistance (Minst *et al.*, 2012). Resistance to antibiotics may be acquired by spontaneously occurring genetic mutations and more commonly by the horizontal transfer of mobile DNA elements from a donor cell to another bacterial

species (Chambers, 2001). Over the years, extensive use of antimicrobials has led to increasing resistant bacteria at alarming rate and has become a serious concern worldwide. In order to ensure suitable antibiotic therapy, the bacterial isolation and the evaluation of antibiotic susceptibility are essential.

Proper control of mastitis in dairy herd is considered an indispensable process to ensure both animal health and food (milk) safety. For this, numerous control programs have been developed over the last few decades (Fetrow *et al*., 1991), and despite the massive development in mastitis control techniques, mastitis still constitutes the main problem of dairy production (Bhutto *et al.*, 2012). Among these controlling regimes, teat dipping has acquired great importance as an essential mastitis preventive tool (Hassan *et al*., 2009). Teat dipping has been demonstrated to be highly effective at preventing new intramammary infections with different mastitis pathogens (Hogan *et al.*, 1987).

The dips are designed to effectively reduce infection caused by environmental bacteria as well as reducing the spread of infections caused by contagious bacteria. After milking the teat canal remains opened for at least an additional 15 minutes allowing pathogens to enter. Application of the teat dip immediately after milking kills the significant proportion of the pathogens on teats and reduces the possibility of the pathogens entering the teat canal.

Proper isolation and identification of the causative organism play significant role in prevention and control of the diseases. The objective of this study was to identify the common mastitis bacterial pathogen, to evaluate the effectiveness of different antibiotics against mastitis causing microorganisms &to evaluate the effect of post milking teat dipping solution for protection of dairy cow from subclinical mastitis.

Methodology

Sample collection

Milk samples collected from hundred cattle of Nawalparasi, eighty cattle of Lamjung & one hundred cattle of Chitwan for bacterial isolation & their antibiogram profile during the year 2075/76 B.S. Samples were transported cooled to the laboratory and kept at 4°C before examination (within 24 h).

Isolation and identification

The media and chemicals were obtained from Hi-media, Mumbai (India) and prepared in the laboratory as per the standard procedures. Milk samples were culturedon Nutrient agar & MacConkey agarsupporting the growth of various types of bacteria for their study and isolation. Plates were incubated 48 h at 37◦C and bacterial growth recorded at both 24 and 48 h of incubation. The typical colonies were sub-cultured in a

selective broth &media such as Mannitol agar & Eosin methylene blue agar, Brilliant green agar, Blood Agar, Sabouraud Dextrose Agar and subjected to various tests viz., Gram staining, Oxidase test, Indole, Methyl Red, Voges-Proskauer, citrate and Catalase. The bacteria were identified on the basis of their cultural, morphological characteristics & biochemical test result.

Antimicrobial susceptibility testing

The most prevalent isolated through microbiological procedures were tested for their drug susceptibility using disc diffusion method against the following antibiotics: amoxicillin-clavulanate 20/10 µg; ampicillin 10 µg; ceftriaxone 30 µg; chloramphenicol 30 µg; gentamicin 10 µg; enrofloxacin 5µg; erythromycin 15 µg; tetracycline 30 µg.

Postmilking dipping trial

Cattle without clinical mastitis were selected for the experiment. Cattle were divided into four groups, each group containing 6 cattle. First group treated with povidine iodine: glycerol (9:1) solution, second group treated with KMnO4, third group treated with Vaseline& fourth group is control. Milk sample collected from each animal on the day of teat dipping & thereafter 90 day respectively in a sterile sample collection bottle in a cool box & tested for mastitis using California Mastitis Test (CMT) as soon as possible

Result & Discussion

Bacterial examination shows that *Staphylococcus* was the predominant isolated followed by *E.coli.* In some cases *streptococcus, Klebsiella, Micrococcus, salmonella* also found.*E coli* was more sensitive to Ciprofloxacin, Norfloxacin and Tetracycline. Resistance to Cefotaxime and Amoxyclav might be due high use of beta-lactam antibiotics to treat mastitis in cattle. Research done by Chandrasekaran *et al.,* (2014) found 86.65% isolated *E.coli*were found to be resistant i.e resistance to 1 or 2 of antimicrobials and few *E. coli* isolates (13.45 %) were found to be multi-drug resistant i.e. resistance to 3 or more of antimicrobials which is similar to my findings. The reason might be due to unregulated use of antibiotic or prescription of drugs without AST that develop multiple antibiotic resistance strain.

The isolated *Staphylococus* mostly resistance to Ampicillin & Amoxyclav & sensitive to Tetracyclines followed by Chloramphenicol, Gentamicin, Ceftriaxone &Ciprofloxacin. Our finding is similar to Dhakal 2007 he found that mastitis pathogens have developed resistance to ampicillin and penicillin. This may be frequent used of penicillin group of antibiotics without AST.

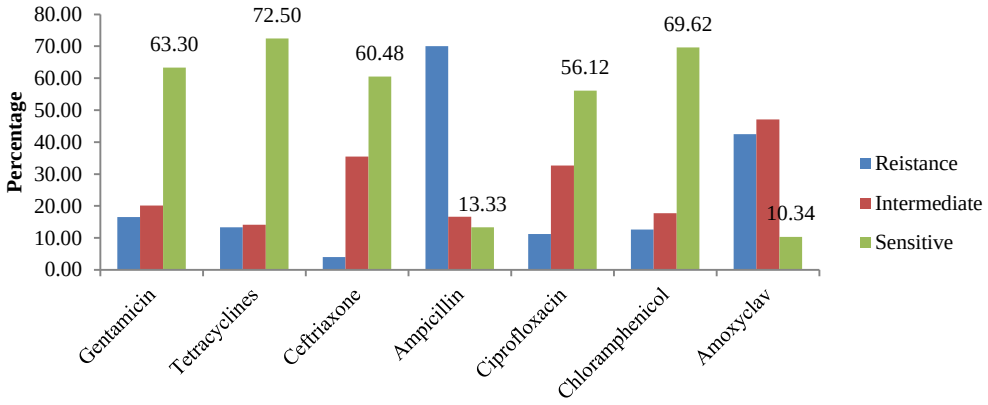


Figure 4: Bar graph showing AST results of isolates *Staphylococcus*

In the present study there was no effect of dipping on teat, the injury to teat, irritation of teat or redness over teats in cows. Results obtained from CMT were in the favor of post milking teat dipping as in comparison to the control group. From the 90 days experiment of teat dipping after milking in cattle the prevalence of mastitis reduction is more in group first as compared to others treatment group. The reduction percentage is 45 % in prevalence compared to before without dipping in first group. This reduction in prevalence is lower than that found by Joshi (2001) i,e., 70% and similar to Hu S. *et, al*. (1998).

To implement & maintain a good mastitis control program is the primary concern of dairy producers.Despite the widespread of such control programs among dairyherds (teat dipping, dry cow therapy and machine milking maintenance), mastitis cases still toconstitute a repetitive problem (Milne *et al.*, 2003). Teat dipping is among the highlyrecommended mastitis controlling programs (Oliver *et al.*, 2001), and it is widely used as asimple and cost-effective procedure.

3.1.5 Screening of antibiotic residues in raw milk in dairy pocket area of Nepal

Introduction

Antibiotics are Chemical substance derivable from microorganism that kills or inhibits microorganism and cures infection. Antibiotics are frequently used in veterinary practices to treat & prevent animal disease. They are also used at sub-therapeutic levels to increase feed efficiency, promote growth and prevent diseases (Mosalagae *et al*., 2011). In dairy animal commonly used antimicrobials are Sulphonamides, Aminoglycosides, Tetracyclines, Macrolids, Quinolones, β- lactams etc. Currently, approximately 80% of all food-producing animals receivemedication for part or most their lives (Lee *et al*., 2001).

Residues of drugs in milk is a potential health risks because of failure to observe the mandatory withdrawal time/periods, illegal or extra-label use of veterinary drugs and incorrect dosage levels application (Kurwijila *et al.,* 2006). Antibiotic residues above the MRL have different harmful effects on consumers like allergic reactions, disturbance of intestinal microflora (Dewdney *et al.,* 1991; Stoker *et al.,* 2007). Antibiotic contamination in milk can also cause significant economic losses for producers and manufacturers of milk and milk products. Although antimicrobial drugs are useful for treatment of human infections, their occurrence in milk causes adverse public health effects such as drug resistance and hypersensitivity that could be life threatening. Because of the public health significance, milk and milk products contaminated with antibiotics beyond a given residue levels, are considered unfit for human consumption (Plumb, 2005). The good quality of milk must be free from harmful or toxic residues, such as antimicrobial drugs. The extra-label use of these antimicrobial treatments, insufficient withdrawal period and lack of records are the most common causes of theses residue in milk, which lead to the increase of these residues in milk above the acceptable maximum residue limits (MRLs).

The (MRL) is defined as the maximum concentration of a residue, resulting from the registered use of an agricultural or veterinary chemical that is recommended to be legally permitted or recognized as acceptable in or on a food, agricultural commodity, or animal feed. The concentration is expressed in mg/kg of the commodity or mg/L in the case of a liquid commodity or ppm/ppb. To protect the public against possible health risks caused by drug residues hazards, regulations regarding veterinary use of drugs including withholding periods after antibiotics therapy and tolerance levels have been formulated (WHO/FAO-CAC, 2012) and are strictly adhered in developed countries (Lee *et al*., 2001; Donoghue, 2003).

In Nepal, most of the drugs are used without any restriction in such a huge amount and care of withdrawal period and assessment of antibiotic residue in meat and milk are not monitored properly by government and privet sectors (Sedai, 2007). Many standard methods have been developed worldwide for antibiotic residue analysis. But use of very high-tech method to evaluate the residue in milk may be impractical in our context. The present study was designed to assess the presence of commonly used antibiotic residue in raw milk marketed at different place of Chitwan, Nawalparasi & Pokhara.

Methodologies:

Sample Collection:

Cattle milk sample obtained from individual farms and milk collection center of Chitwan, Nawalparas & Kaski. Samples were collected at the early morning and random sampling method was followed. The milk samples were collected in sterile bottles

followed by coding and kept in refrigerator (4^0C) for further analysis.

Test kit & Sample Processing

Gentamicin (GEN) ELISA Kit manufactured by Cusabio Biotech Co., Ltd, USA. Catalog number CSB-E12088f, were used in the study for quantitative determination of Gentamicin residue in milk. The processing of the sample was done according to the protocol of the manufacturer. Kits were supplied with all necessary chemicals.

Reagent preparation

Extraction Solution1(for milk use only): Extraction solution was prepared by mixing 5.37g of Na2HPO4.12H2Oλ and 0.78g of NaH2PO4·2H2O to 100 ml of deionized water &shake well.

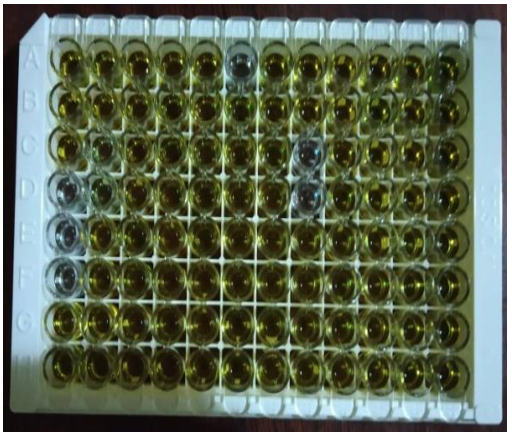
Wash Buffer (1x): If crystals have formed in the concentrate, warm up toλ room temperature and mix gently until the crystals have completely dissolved. Dilute 10 mL of Wash Buffer (10x) into 90 mL deionized or distilled water to prepare 100 mL of Wash Buffer (1x). Keep it at 4℃ for one month.

ELISA test procedure

The manufacturer's instructions were followed for ELISA**.** All reagents and samples were brought to room temperature (20~25℃) before use. The samples were centrifuged again after thawing before the assay. It was recommended that all samples and standards were assayed in duplicate.

All reagents and samples were prepared as directed in the previous sections. The numbers of wells to be used were determined. 50 µL of Standard or Sample was added per well. Then 50 µL of HRP-conjugate was added to each well and than 50 µL of Antibody to each well.The microtiter plate was covered with a new adhesive strip and mixed well, and then incubated for 30 min at 25°C. Each well Aspirated and washed, the process was repeated four times. Each well was washed by filling with 250 µL of Wash Buffer (1x) using a squirt bottle, multi-channel pipette, manifold dispenser, or autowasher, and allowed stand for 30 seconds, complete removal of liquid at each step is essential to good performance. 100 µL of TMB Substrate was added to each well, mixed well. Incubated for 15 minutes at 25°C & protected from light. 50 µL of Stop Solution was added to each well; gently the plate was tapped to ensure thorough mixing. The optical density of each well was determined within 5 min, using a microplate reader set to 450 nm (Recommended to read the OD value at the dual-wavelength: 450/630 nm within 5 min).

Research Photos



Results and Discussions

One hundred fifty milk samples from Chitwan, Nawalparasi & Kaski were tested & result shows that Gentamicin residue in milk is within acceptable level. We didn't find concentration of Gentamicin above MRL till now, this may be due to smaller sample size. This is ongoing project further more sample will be tested & final result will be updated.

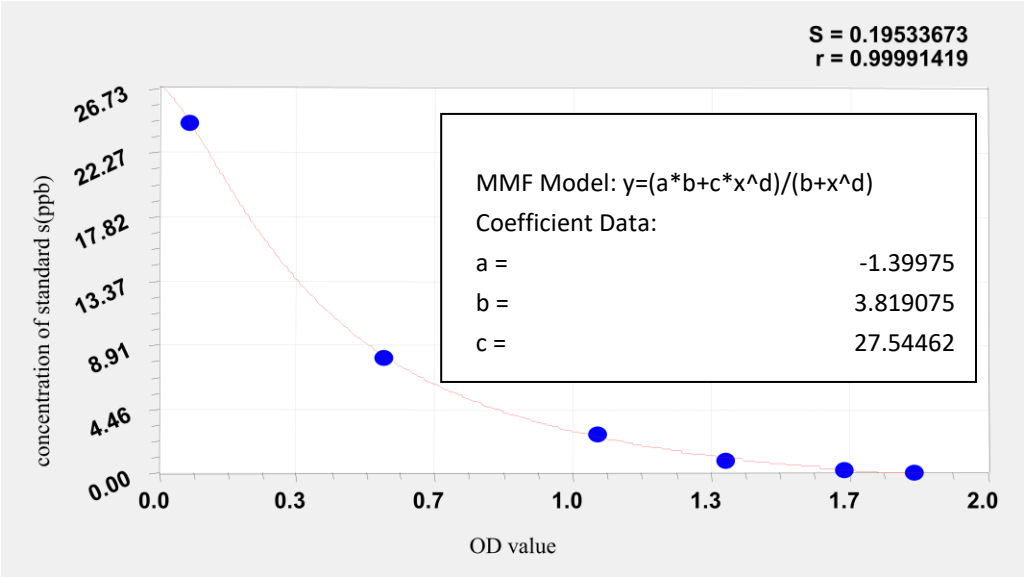


Fig 5: standard curve of gentamicin

In Nepal only a few studies have been done regarding quantitative analysis of antibiotic residue in raw milk. There is lack of such data and awareness among the dairy farmers and consumers. Only limited numbers of research reports are available for qualitative and semi-quantitative analyses. Lack of the government policies to prevent & reduce antibiotic residues in milk & milk product, antibiotics are used daily, without any rule & regulation.Special care is must to make the farmers aware about withdrawal period and hazards due to the consumption of residue bearing milk.

3.1.6 Status of haemoprotozoans in dairy cattle of Nepal

Introduction

Anaplasma sp., *Babesia* sp., *Theileria* sp. and *Trypanosome* sp. are major blood parasites of cattle leading to haemoprotozoan diseases in dairy cattle. These all have economic significance in dairy cattle industry. The existence of haemoprotozoan infections among farm animals causes serious losses because they are related to degradation of health status and ultimately production loss. There are many protozoa that affect the animal performance. Mostly, blood protozoa; *Anaplasma, Babesia, Theileria* and *Trypanosoma* are responsible for the anaplasmosis, babesiosis , theileriosis and Trpanosomiasis respectively in cattle and other farm animals (Uilenberg, 1995). Haemoprotozoan diseases are considered some of the major impediments in the health and productive performance of cattle (Rajput et al., 2005).Past effort for the study on prevalence of blood protozoa in dairy cattle are insufficient due to lack of adoption of new diagnostic techniques and expertise's.

The disease causing organisms are transmitted mainly by the bites of infected vectors; however, the possibilities of mechanical transmissions can't be neglected. These diseases are prevalent in the wide range of host viz. domesticated animal, wild animal and human as well and geographical regions; including tropics to sub-tropic area of world. Haemoprotozoan diseases cause deleterious impact on the health of animal and heavy losses to the livestock sector. As a result of lowered growth rate, production, reproduction and productivity of animal eventually become problem for development of dairy industry.

Bovine anaplasmosis is also known as gall sickness and the disease causing agents are *Anaplasma marginale, A. centrale, A.phagocytophilum, A. bovis, A.platy* out of which *A. marginale* is responsible for Clinical bovine anaplasmosis. Upto 17 tick species are found to be vector of these parasite including *Hyaloma, Dermacenter, Ixodes, Argas, Rhipicephalus*. In tick the infection may occur intra-stadial, trans-stadial or rarely via trans-ovarian. Sometime the bites of dipterous flies act as mechanical transmitters. Trans-placental infection occurs during the acute phase of infection in dam about second and third trimester. During diagnosis of *Anaplasma* sp. they appear as dense, homogeneously staining blue purple inclusions of 0.3-1 µm in diameter. Inclusion bodies contains 1-8 initial bodies (0.3-0.4 µm) known as individual Rickettiale.

Bovine babesiosis is mainly caused by *Babesia bovis and B. bigemina.* In one host tick trans-ovarian transmission occurs and due to larval (*B.bovis*) and nymph or adult (*B.bigemina*), the parasitic stages aretransmitted in final host. *B.bovis* is small, paired form at an obtuse angle to each other (1-1.5x 0.5-1µm). *B. bigemina* is large paired at and acute angle to each other. *B.bovis* is more virulent species leading to hypotensive shock syndrome, generalized non specific inflammation, coagulation disturbances, erythrocytic stasis in capillaries and *B. bigemina* responsible for direct destruction of erythrocytes. Clinically in first week signs are manifested by acute phase of fever (41^0C), anaemia, increased respiration, jaundice and haemoglobinemia, haemoglobinuria CNS involvement in late stages.

Theileriosis in bovine species is tick borne disease caused by *Theileria parva* (most pathogenic) and *T. annulata.* Infective stage (Sporozoite) of parasite found in saliva of tick which is injected during feeding to animal host; invade leukocytes and developed into schizont. Concurrent division of parasitized WBCs increases the number of Schizont in host. Some schizont give rise to merozoites and invade the RBCs. Infected RBCs are up taken by vector tick to complete the cycle. Clinically, the disease is manifested with high fever, swollen lymph nodes, dyspnea, lymphocytolysis, lymphoid depletion and leucopenia. *T. parva* causes the East Coast Fever (ECF) in cattle and *R. appendiculatus*

is a potential vector tick. In RBCs small and rod or oval shaped merozoites are visible under microscope.

Trypanosomiasis caused by various species of *Trypanosome*; out of which *T.evansi* is responsible for surra in cattle. Surra is also vector borne disease mostly to due Tsetse fly (*Glossina* spp.) and other biting flies (*Tabanus*). Metacyclic form of parasite is infective stage present in the vector.

Treatment trials in positive cases provide the effectiveness of drugs commonly used in context of our country. For instances, the positive cases of bovine anaplasmosis are treated with Tetracycline group of antibiotics and Imidocarb. Similarly, Diaminazene acetaurate and imidocarb are used in case of babesiosis, Buparvaquinones/ Butalax in theileriosis and Diaminazene acetaurate in trypanosomiasis.

The differential clinical signs during various haemoprotozoan infections and symptoms are useful in the diagnosis of disease. However, difficulties are aroused when there are presences of subclinical cases, low level of parasitemia; the microscopic detection is also impossible. The carrier state of previously infected animal may show false negative during microscopic evaluation. Based on such conventional technique there are also problems in differentiation of species parasite on the basis of morphology mainly during the mixed blood parasitic infections. Serology based diagnostic tests like; IFT, ELISA are also frequently employed in determining subclinical infection. However, due to intra-species cross-reactivity of antibodies and insufficient sensitivity are shortcomings of tests. For this reason, the use of specific and sensitive molecular alternative techniques has become necessary for confirmatory detection of determinants of haemoprotozoan diseases. In this research microscopic examination and PCR are performed.

Methodology

Blood samples are collected from peripheral blood vessels in total of 100 cattle of different dairy farms of Morang (40), Rupandehi (30), Surkhet (30) districts. Serum in serum vials and whole blood in EDTA vials maintaining cold chain in cool box. Blood smears were prepared at field level and fixed with 10% methanol. After staining with Giemsa-Stain the slides were microscopically observed under oil immersion (100X).

On the basis initial clinical sign and microscopic observations the treatments were recommended as: Buparvaquinone/Butalax for *Theileria*, Diminazine acetaurate/ Berenil for *Babesia* and OTC in case of *Anaplasma* positive animals.

DNA extraction was carried out by using protocol provided in QIAGEN tissue and blood test kits, in central biotechnology laboratory of Agriculture and Forestry University (AFU), Rampur.

- Cleaning and decontamination was done by spraying bench, pipette and equipment with freshly made 10% bleach solution, after 15-30 min. then wiped away any residual bleach and rinsed with clean water and finally sprayed with 70% ethanol.
- Gloves were worn at all times, all equipments were in place checked and Buffers were prepared (alcohol+AE). Heating equipment set at 56^0C.

Detail steps of DNA extraction from whole blood:

1. The ependurf tubes with sample ID were labeled.
2. The blood sample tubes were shaken 10 times to homogenize the blood.
3. The ProteinaseK was subjected to vortex (10sec.) and centrifuged quickly.
4. Pipette 20 µl of proteinaseK in each micropipette tube.
5. Pipette 200 µl of blood into each tube (slowly).
6. Put 200 µl of Buffer AL to each sample
7. The tubes were closed and vortex(15sec.)
8. The microtubes were transferred in heating block (56^0C) for 10 mins. for incubation
9. The samples removed and briefly centrifuge.
10. 200 µl of chilled absolute added ethanol to each of sample.
11. Vortex (15sec) and centrifuged gently.
12. Mini-spin column were prepared for each sample and the spin column labeled with corresponding to Sample ID.
13. The sample (whole mixture) transferred from tube to spin column and closed.
14. Centrifuged @ 8000rpm for 1 min.
15. The spin column (having DNA) placed into new collection tube and the tube containing lysate (old) were discarded.
16. 500µl of AW1 buffer added and closed & Centrifuged @ 8000rpm for 1 min.
17. The collection tube were discarded and transferred the spin into new collection tube
18. 500µl of AW2 buffer added and the cap was closed & Centrifuged @ 8000rpm for 3 min.
19. The collection tube was discarded; spin was transferred into new collection tube.
20. Centrifuged @ 14000rpm for 1 min. to remove residual of ethanol and others.
21. 1.5 µl Ependurf tubes were labeled corresponding to sample of spin column
22. the spin columns were transferred to corresponding tube
23. 200 µl of AE buffer added to Eluate the DNA
24. Incubation was performed at RT for 1min.
25. Centrifuged @ 8000rpm for 1 min.
26. Re-eluated with AE buffer with 200 µl and steps (24 and 25) were repeated.

The quality and quantity of DNA was detected in nano-spectrophotometer. About 1 µl of extracted sample was allowed to nano-spectrophotometer.
The extracted DNA sample having the value 1.8 (260nm /280nm ratio) are subjected to Polymerase Chain Reaction (PCR) in *BIORAD T100* Thermal cycler.

Dilution of primer

During this process all the works were performed in ice. The primers (Oligos) were manufactured by Sigma-Aldrich in dry forms. For dilution we had used TE buffer as calculated amount given in the Technical Data Sheet. Babesia F with 466 µl, Babesia R with 463 µl, Anaplasma F with 468 µl, Anaplasma R with 491 µl, Trypanosoma F with 526 µl, Trypanosoma R with 465 µl , Theileria F and Theileria R with 435 µl of TE buffer.

To prepare aliquots from diluted primer which was used in PCR mixture; we had prepared total of 40 µl of solution containing 32 µl of TE buffer while 8 µl of diluted primer so that the ratio of diluted primer: TE buffer at 1: 5.

Mixture for PCR

- Nuclease Free Water (NFW) = 7 µl, Master Mix (MM) = 10 µl
- Forward primer (F) =1 µl, Reverse primer (R) =1 µl
- Extracted DNA (60ng/ µl) = 1 µl.

Fwd: 5`AGAGTTTGATCCTGGCTCAG 3` Rev:5`GTTAAGCCCTGGTATTTCAC 3` primer is used for *Anaplasma* sp.Initial denaturation at 95^0C for 5 min. Denaturation (40cycles) at 94^0C for 30 sec. Annealing at 55^0C for 30sec, Elongation at72^0C for 90sec. Final extension at 72^0C for 5 min.
Fwd: 5`CAGGATTGCTTTCGCAACAAG 3` Rev:
5`CCTTGACATAACCGGCGAGG 3` and
Fwd:5`GCGCGGATTCTTTGCAGACGA3`Rev:5`TGCAGACACTGGAATGTTACT3`primers are used for *Babesia* sp. and *Trypanosome* sp.respectively with initial denaturation at 95^0C for 5 mi., Denaturation (30cycles) at 94^0C for 30 sec. annealing at 57^0C for 60sec, elongation at72^0C for 90sec. and final extension at 72^0C for 10 min.
Fwd:5'CCTGAGAAACGGCTACCACATCT3' Rev:
5'GGACTACGACGGTATCTGATCG3' primer is used for *Theileria* sp. with initial denaturation at 94^0C for 5 min., denaturation (25cycles) at 94^0C for 30 sec. annealing at 51^0C for 30sec, elongation at72^0C for 30sec. and final extension at 72^0C for 5 min.
Gel-electrophoresis was performed using 1.5% agarose 1X TBE in gel electrophoresis tank (CLEAVER Scientific Ltd.).
- 1.5% agarose gel was prepared by dissolving 1.05 gm (Calculation; 1.5 x 70/100) of agarose powder in 70 ml of 1X TBE (same concentration was also used in tank).

- Ingredients for Gel-E-Run: for each well, the well mixed solution of Loading Dye = 1 µl (6X) and PCR sample = 5 µl was dropped genteelly in the well of gel where as ladder of (100bp) = 6 µl was dropped into single well (generally into first and last well).
- The setting of current in gel-electrophoresis was 400 Amp, 80Volt for1.5 hr.

And then subjected to L.E.D. ORBIT SHAKER in the solution of $EtBr_2$ (15min.) and distilled water (DW) (5min.) and the gel was observed under the clear view UV-Transilluminator.

Results

At the end of first year of this research, total of 100 blood samples were collected and in the blood smear analysis under oil immersion; 5%, 4%, 7% and 11% were found to be positive for anaplamosis, babesiosis, theileriosis and trypanosomiasis respectively. In PCR 9% samples were positive (band of 577 bp.for anaplasmosis).

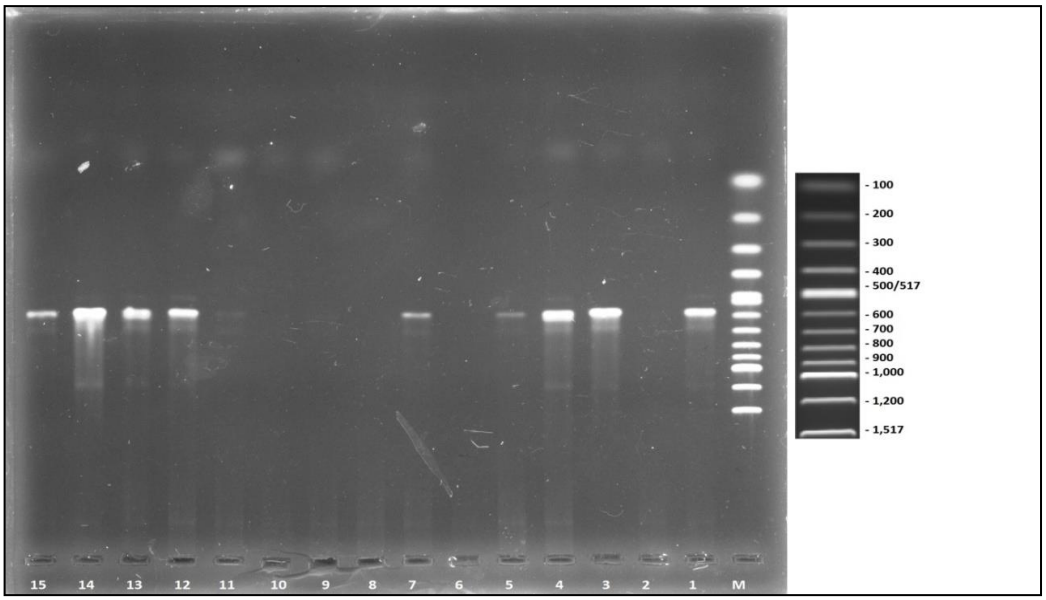


Fig 6: Identification of *Anaplasma* sp. from blood sample of cattle by Polymerase Chain Reaction (PCR). Lane, M: DNA Marker 100bp. Lane, 1,3,4,5,7,12,13,14,15 Positive samples with base pair 577.

3.1.7 Study on existing situation of heat stress management of crossbred cattle in the dairy pocket area of the Terai region during the summer months.

Introduction

Cattle are an important livestock commodity in Nepal. It is crystal clear that cattle have tremendous importance in the national economy, sustainable agriculture development as

well as in achieving the target of poverty reduction. The cattle are most important in the context of increasing and maintaining soil fertility, nutritional impact, adapted in local harsh environmental condition and in economic importance. Many people get employment opportunity in dairy sector.

Hot environments affect the performance of dairy cattle both directly and indirectly. To attain the fullest genetic performance, environmental conditions and diets should be modified. Thermal factors consist of air temperature, humidity, air movement, and radiation rate. In lactating Holstein cows, the comfortable temperature is within the range 4- 24^{o}C (Hahn 1985). The effects of heat stress on the cows begin to be observed above 24^{o}C, and milk yield decreases markedly above 27^{o}C (Johnson 1965). A decline in milk yield, fertility, and growth rate in hot environments is closely related to an increase in body temperature (BT). BT results from the balance between heat production (HP) and heat loss (HL). Since humidity affects the HL from an animal under high temperature conditions, dairy cattle performance falls markedly in hot, humid summers. Moreover, HP is associated with feed intake level, which in turn affects the production level. In high-producing cows, the HP is higher, and the effect of a hot environment is more pronounced. Preventing an increase in body temperature in hot environments can be approached in three ways (Shibata 1996):

- Lowering the environmental temperature by modifying the structure of the shed where the cattle are kept, or by introducing cooling facilities.
- Increasing heat loss from animals by sprinkling them with water, using fans and so on.
- Increasing the efficiency of feed energy utilization, and reducing the heat increment of animals from feeding.

In the lack of scientific information there are no specific guidelines to combat the problem of the heat stress management in cross bred cattle. Although, it is in practice that provide shed of tree, use of thatch roof etc. are important in heat stress management and enhance the productivity of cross bred cattle but still not documented well.

In inner terai and terai region due to the climate change temperature is increasing at the rate of 0.04^{0}C annually. There are many animals reared in poor management condition, without any heat stress management but under poor plane of nutrition. The palatability also decreases of feeds and fodders and animals are heavily dependent on straw during the season. There are many other problems like higher cost of production, infertility, inbreeding, low productivity, inadequate resources center, low reproductive efficiency, poor housing management. Management of heat stress for improving productivity of dairy animals during the summer months is of prime importance.

Selection of animal and preparation of research protocol and materials

The lactating dairy crossbred cattle were selected of similar parity, calving months, production level, stage of lactation for the heat stress management trial in the National Cattle Research Program, Rampur. The research protocol and material (fan, sprinkle materials and place)were prepared before the trial setting.

Heat stress management trial conduct

The selected twenty crossbred lactating animals were arranged in following ways for the trial conduct.

Replication: 4 (one animal was kept in one replication)
Treatment: 5 (4 animals were kept in one treatment)
Design: Randomized Complete Block Design (RCBD)
T_1: Kept in cattle shed under Gypsum board during the experiment period.
T_2: Sprinkle at 12 Noon and 3 PM
T_3: Sprinkle at 12 Noon and 3 PM and Fan cooling at 12 Noon to 4 PM
T_4: Fan cooling from 11AM to 4 PM
T_5: Control
Experiment period: 2075/01/25 to 2075/05/25

Blood parameter analysis

In blood the cortisol level was analyzed which is shown below:

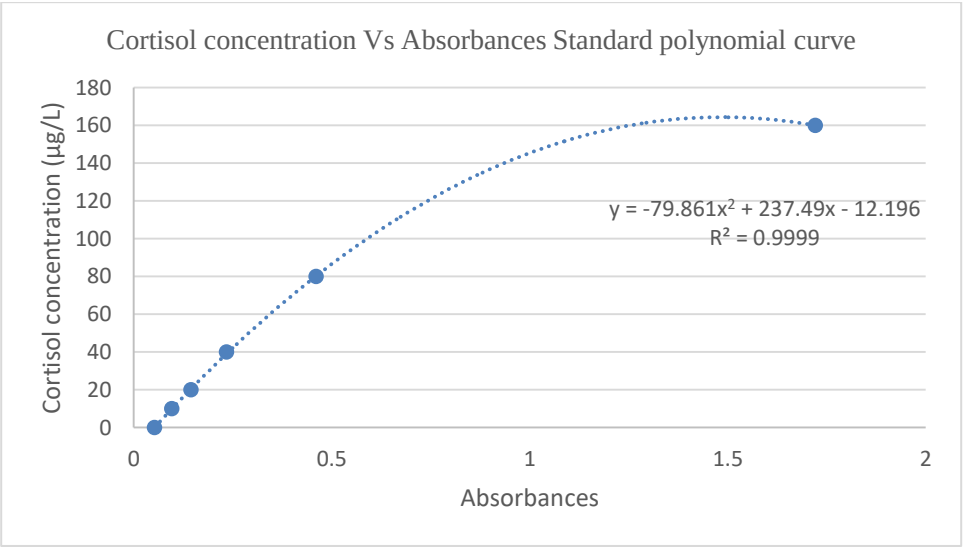


Fig 7: graph showing standard curve of cortisol in serum of cattle.

The temperature condition inside the cattle shed

The maximum and minimum temperature inside different shed were recorded during the

experimental period (four months)which are shown in following table. The average maximum temperature was slightly higher in shed No. 1 than shed No. 2 and 3

Table 17. Temperature condition inside the different cattle shed

Parameter	Shed No 1 (North - south direction)		Shed No 2 (East-west direction)		Shed No 6 (East-west direction and gypsum board under roof)	
	Minimum Temp. (^{0}C)	Maximum Temp.(^{0}C)	Minimum Temp. (^{0}C)	Maximum Temp.(^{0}C)	Minimum Temp. (^{0}C)	Maximum Temp.(^{0}C)
Mean	25.35	35.21	26.06	34.73	26.48	34.26
S.E.	0.13	0.24	0.12	0.21	0.11	0.21
Median	26.00	36.00	26.00	35.00	27.00	34.00
Mode	26.00	36.00	26.00	36.00	27.00	34.00
S.D.	1.46	2.66	1.40	2.37	1.28	2.33
Range	7.00	19.00	7.00	19.00	7.00	19.00
Minimum	21.00	25.00	21.00	27.00	22.00	27.00
Maximum	28.00	44.00	28.00	46.00	29.00	46.00
Count	127	127	127	127.00	127.00	127.00

Pulse rate

The pulse may be defined as “the rhythmic, periodic force felt over an artery in time with the heartbeat”. The important factors to note in taking the pulse are: (1) frequency, (2) rhythm, and (3) quality. Frequency is determined by counting the number of heartbeats occurring in one minute. Rhythm typifies a normal pulse seen in a series of rhythmic beats that follow each other at regular intervals. Quality is best described as the tension on the arterial wall; it is an indication of the volume of blood flow.

The data of pulse rate were found slightly different between treatment groups but not statistically significant ($p>0.05$)

Table 18. Average pulse rate during the trial period

Group	9.00 AM	12:00 PM	3:00 PM
T1	66	68	72
T2	69	71	75
T3	66	65	70
T4	68	72	77
T5	63	68	76

Respiration Rate

The respiration rates of different treatment group in different period were recorded. We found that there is no significant different at 9 am. At 12 lowest rate of respiration was found in T2 and highest in T5 group. Similarly at 3pm lowest respiratory rate in T3 & highest in T5 respectively.

Table 19. The average respiration rate per minute during experimental period

Group	9:00 AM	12:00 PM	3:00 PM
T1	58.8	69.35	62.4
T2	78.5	56.8	45.8
T3	78.4	44.4	45.0
T4	74.0	76.4	76.2
T5	68.2	81.1	79.1

Rectal Temperature

The rectal temperature of T3 group has lower temperature at 12PM and 3 PM than other groups.

Table 20. Average Rectal Temperature^{0}F

Group	9:00 AM	12:00 PM	3:00 PM
T1	101.7	102.2	102.3
T2	102.3	102.1	101.2
T3	102.2	101.2	100.5
T4	102.7	102.4	102.1
T5	102.2	102.6	102.8

Milk production Record

Daily milk production was recorded during the whole experimental period. During the four months period the T3 group has less decreased milk yield compare to other group in succeeding months.

Table 21. Average Monthly Milk production record (Liter)

Group	1st Month	2nd Month	3rd Month	4th Month
T1	357.66	286.60	295.95	184.80
T2	305.23	230.20	214.85	202.55
T3	353.28	327.95	306.85	280.15
T4	347.26	290.65	260.70	209.55
T5	306.40	266.55	220.93	197.18

Milk composition

There were not significant different found in milk composition among the different treatment group.

Table 22. Average milk composition

Group	Fat %	SNF %	Protein %	Lactose %
T1	4.66	8.49	3.01	4.65
T2	4.72	8.72	3.18	4.79
T3	5.13	8.54	3.11	4.69
T4	4.69	8.98	3.27	4.93
T5	4.68	8.53	3.11	4.69

3.1.8 Cattle Herd Management and productionProgram

To promote the bovine species in Nepal there is demands of suitable breeds for different agro ecological zone of the country. The review of past work reviled that 62.5 % blood level of Jersey, Holstein Friesian (HF) are better in existing feeding and management system.Therefore, cattle raisers are suggested to maintain their cattle herd into 62.5 % blood level of above mentioned breeds. However, there are not any recognised and officially recommended improved cattle breeds in the country. There is no any dairy farm where the elite herd of such breed is available for research and distribution. The livestock farm under National Cattle Research program, Rampur has been functioning as a centre for elite cattle herd in the country. This project has been designed, as ongoing management project and implemented for cattle breed development, their improvement and distribution to the farmers and research support.

Cattle herd comprising various blood levels of Holstein and Jersey together with local hill cattle were maintained for improvement & distribution to the farmers and research support. Concentrate feed, seasonal green grasses, straw, silage and fodder were made available to them as per their feeding requirement. Animals were vaccinated against HS, BQ and FMD as per the recommended schedule. Regular drenching against flukes and worms was made together with treatment of diseased animals as and when required. Maize, Teosinte, Bajra, Sorgum, Signal, Setaria, Mulato, Joint-Vetch, Stylo, Fleminzia, Napier, Perennial Sorgum etc. were grown for summer forage and Oat, Common Vetch, Berseem etc. for winter forage and fed to the animals. Milk produced from the lactating animals was either sold as whole milk or utilized for preparing dairy product like chhenna, paneer, ghee, khoa, churpi, dahi, ice cream, etc. Farm yard manure produced at the farm was used for manuring the forage blocks and surplus amount was sold as well. Seeds of seasonal forage were produced for next year planting and distribution if required.

Clean milk production (udder cleaning, Utensil, teat dipping)

Milk is a sterile product when secreted in the udder of a healthy cow. It is loaded with nutrients, which makes it a fertile ground for microbial growth. Due to its susceptibility

to microbial spoilage, there is a need to adopt clean milk production principles to reduce chances of contamination. We had taken consideration into internal factors (General health of the cow esp. mastitis) and External factors which includes Cow/animal's body, Milker-hygiene and habit, Milking and storage utensils, Method of milking, Feed and Water, Milking Environment. In our farm to control the mastitis by regular teat dipping with the dipping solution (Povidine Iodine: Glycerine = 9:1) instantly after completion of milking. Regular grooming and bathing with clean and fresh water were done to remove external dirt and dung from hind quarter. Milking and storage utensils are sterilized by washing with detergents. Generally, hand milking and machine milking technique are in practices; in addition to maintain cleanliness and prevent the transmission of infections, milking machines are disinfected after completion of individual milking and in case of hand milking personal hygiene is strictly followed. Daily cleaning and disinfection of farm is maintained to make clean milking environment.

Health and Infertility status monitoring

General health examinations of animal were done on regular basis at NCRP farm. Different types of internal parasites were detected by faecal examination in NCRP lab and mostly the faecal samples were found negative for any infestation which might be due to our regular deworming activities on farm at an interval of six months. Tick infestations were found to be higher in the early periods of summer seasons and they are controlled by external application of ectoparasiticidal solution, however, ivermectin injections in subcutaneous route were applied in some cases. So, routine drenching & spraying was done against internal & external parasite. Mastitis was a major problem in our farm, based on clinical signs, California Mastitis Test (CMT), microbiological culture and Antibiotic Sensitivity Test (AST) results; the line of treatment with antibiotics and supportive therapy adopted and in parallel regular sanitation, teat dipping and hygiene were followed. Thus, routine milk examination was done to identify and treat mastitis in cattle. Different types of infertility cases; including infectious and non infectious were also common in our farm. Milk fever was the common metabolic diseases in our farm.Animal were vaccinated against major economically important infectious viral and bacterial diseases Foot and Mouth Disease (FMD), Haemorrahagic Septicemia (HS) and Black Quarter (BQ) at regular interval.

Out of 12 cows at infertile status at NCRP farm, 5 were treated with hormones. Two were treated with single dose prostaglandin hormone (LUTALYSEInjection: *Dinoprost Tromethamine* @ 25mg) having problem of persistent corpus luteum and 3 were treated with GnRH analogue (GYNARICH Injection: Buserelin Acetate @ 20mcg), 1 having problem of follicular cyst and other 2 with inactive ovary. Out of 5 treated cows, 3 cows displayed estrus and AI was performed in them.

Ultrasonography was used for scanning ovary during diagnosis of reproductive problem.

Fig 8: Scanning of ovary and uterus of infertile cow by USG **&** Hormones (GnRH & PG)

Heat stress management for farm animal during summer months

During the summer months the environmental temperature of Chitwan goes to above 35^0C, which leads to heat stress condition in cattle. So, we need to provide different heat stress reducing management tools like daily two time bathing & use of fan as necessary. Bathing helps to reduce the heat stress, also help to maintain cleanliness of milking animal and clean milk production. During summer month two times bathing and use of fan were done regularly.

Feeding of animals with appropriate roughage and concentrate

The Livestock farm animals of different age group were provided with appropriate ratio of roughage and concentrate according to their need for the improvement of good health as well as high production of farm animal. Different types of legume and non-legume forages were cultivated and managed to feed cattle. Feeding to animals was done on the basis of body weight and milk production. Two kilogram of concentrate feed was provided to animal for maintenance ration and one kilogram of concentrate was provided at the rate of three kilogram of milk production above the maintenance requirement. For last two months of pregnant cattle 4.5 kg of concentrate ration was provided above the maintenance requirement.

Study on different agent to add value to silage (Molasses)

Teosinte, Sorghum, Bajra & Napier were used for preparation of silage. Grass treated with spraying 10% solution of molasses in each 10 inch layer. About 20 ton of silage was prepared in this fiscal year 2075/76 and feeding to animals 4-5 kg per day. Milk production was recorded daily and milk composition was recorded monthly. After adding of molasses agent palatability and digestibility of silage was slightly increased.

Growth record of calves

In this fiscal year, total 48 calves were born out of which 14 were crosses of Holstein Friesian and 30 were crosses of Jersey breed, 3 were Lulu, 1 was terai. Similarly, 22 calves were female and 26 calves were male. Holstein calves were found heavier than Jersey calves. Average birth weight of Jersey calves were 20.69 kg whereas average birth weight of Holstein Friesian calves were 22.82 kg. During this fiscal year 4 calves were died due to physical injury and diarrhea. The birth weight of male and female calves as found in NCRP farm are presented in tablebelow:

Table 23. Average birth weight of male and female calves in NCRP farm during FY 2075/76

S.N.	Date of Birth	Tag no.	Sex	Birth Wt.(Kg)	Breed (Cross)	Remarks
1	4/1/2075	12406	Male	20	HF	
2	4/10/2075	12592	Male	26	Terai	
3	4/25/2075	No tag	Male	19	HF	Death
4	4/26/2075	12407	Male	27	HF	
5	5/01/2075	12408	Male	24	HF	
6	5/03/2075	12409	Male	25	HF	
7	5/03/2075	12410	Male	26	HF	
8	5/11/2075	12412	Male	25	HF	
9	5/12/2075	12411	Male	26	Jersey	
10	5/14/2075	12413	Male	20.5	Jersey	
11	5/16/2075	12414	Male	20	Jersey	
12	5/25/2075	12415	Male	23.5	Jersey	
13	5/26/2075	12416	Male	23	Jersey	Death
14	6/03/2075	12417	Female	16.7	Jersey	
15	6/06/2075	12429	Male	18.8	Jersey	
16	6/07/2075	12418	Female	17	Jersey	
17	6/11/2075	12419	Female	13	Jersey	
18	6/11/2075	12420	Female	27	Jersey	
19	6/13/2075	12421	Female	15	Jersey	
20	6/21/2075	12422	Female	23	HF	
21	6/21/2075	12430	Male	12	Jersey	
22	6/22/2075	12421	Male	22	Jersey	
23	7/02/2075	12423	Female	14	HF	
24	7/07/2075	12432	Male	10.7	Jersey	
25	7/16/2075	12424	Female	27.6	Jersey	

S.N.	Date of Birth	Tag no.	Sex	Birth Wt.(Kg)	Breed (Cross)	Remarks
26	7/22/2075	12433	Female	24	HF	
27	7/23/2075	12425	Female	18.5	Jersey	
28	7/24/2075	12434	Male	22	Jersey	
29	7/28/2075	12426	Female	20	Jersey	
30	8/09/2075	12427	Female	15	HF	
31	8/16/2075	12428	Female	23.5	Jersey	
32	8/19/2075	No Tag	Male	20	Jersey	Death
33	8/20/2075	12435	Female	22.6	HF	
34	8/26/2075	12437	Male	28	HF	
35	9/25/2075	12436	Female	25	Jersey	
36	10/21/2075	12438	Female	7.2	Lulu	
37	12/05/2075	12439	Male	18.5	Jersey	
38	12/09/2075	12440	Male	23	Jersey	
39	12/15/2075	12441	Male	25	Jersey	
40	12/30/2075	12446	Female	8.7	Lulu	
41	1/28/2076	12442	Male	26	Jersey	
42	1/31/2076	12443	Male	14.5	Jersey	Death
43	2/03/2076	12444	Female	27.9	Jersey	
44	2/05/2076	12445	Female	23	Jersey	
45	2/20/2076	12447	Female	27	HF	
46	3/01/2076	12448	Female	23	Jersey	
47	3/02/2076	12449	Female	18	Jersey	
48	3/08/2076	12450	Male	10	Lulu	

Routine milk analysis

Milk samples from all milch animals were collected in regular basis and monitored for its composition. On an average the milk composition of cattle of NCRP farm were as mentioned in table 26 below:

Table 24. Milk composition of NCRP farm cattle in the fiscal year 2075/76

Fat	Density	Lactose	SNF	Protein	Total Solid
5.15	29.09	4.86	8.85	3.22	14

Processing & distribution of clean milk

Product diversification

Milk products paneer 227.05 kg, khoa 65.7 kg, ghee 8 kg and dahi 194 kgwere produced and sold during this year.

Introduction and evaluation of different forage for permanent pasture

Different forages like setaria, signal, perennial sorghum, mulato, were evaluated in National Cattle Research Farm. Production in terms of green biomass was found better in all perennial forage grass. Now, we developed permanent pasture at NCRP farm in the area of 4 ha land by cultivating above mentioned forage grass.

Production of green forage

Nearly 13 ha land was used for cultivation of green forage at NCRP. Stylo, Setaria, Signal, Napier, Sorghum, Vetch, Mulato, Para grassare the perennial forage cultivated at NCRP. We cultivate Sorghum, Bajra, Maize, Teosinate in summer. Common vetch & oat are cultivated in winter. The productivity of Stylo in first cutting was 31.07 ton/ha.

Seed production of major forage crops

Major forage crop for winter is oat. Oat seeds were cultivated in 10 ropani land for seed production. 500 Kg seed were produced in the fiscal year 2075/76. Similarly, teosinte, sorghum, bajra and maize are the major summer forage crops. 350 Kg teosinte seed was produced in the fiscal year 2075/76.

For heat detection a new tool Dramniski Estrous Detector made in Poland has been in use. This has made convenience in heat detection. It is based on the principle of electrical resistance detection as there are significant chemical changes in the mucus from the vaginal mucus membrane at the estrous.

Major source of revenue was sells of milk and milk products. However, sell of bulls, manure and other administration work contributed considerably in the revenue generation. Total revenue of was Rs. 47, 10,480.29 in the FY 2075/76.

Study on hydroponic fodder production and its use in dairy Animal

Hydroponics fodder production is the method of producing 7-8 days fodder seedlings without soil. In this system only moisture and nutrients are provided to the growing plants. In this Fiscal year a small hyroponic fodder production system was installed at NCRP having capacity of holding 140 metalic trays(tray size 45 cm x 102 cm). Hydoponic fodder maize was produced and fed to the dairy cows during the preliminary production test.

Table 25. Production performance of hydroponic fodder maize

Maize Variety	Seed rate/tray, (kg)	Harvesting time	Green Fodder Yield/tray, (kg)	Dry Matter %
Rampur Composite	1.4	On8th dayof sowing	5.11	22.58

3.1.9 Up-scaling and Verification of some proven Livestock Technologies in Outreachsites

Several promising technology have been generated for improvement of livestock productivity by Nepal Agricultural Research Council during the period of its establishment to date but the technology has not adopted by the farmers may be due to lack of proper extension work. By following the extension process "seeing is believing" for adaptation it is felt need to conduct some research activities for verification and dissemination of generated technology through outreach sites at Chitwan & Rupandehi districts. Farmers will be aware from generated proven livestock technology and village will be developed as a resource centre of livestock species and forage source.

Livestock technologies developed and verified in the previous year at the research command area have not been fully adopted by the targeted farmers. The reason behind it might be either due to the weakness in technology verification or in transfer of verified technologies in the past. In such circumstances, the same technology being popular among the farmers of one village of particular ecological domain has not been practiced in another village of the similar eco-domain. The universally accepted principle behind it is due to lack of technological packaging and demonstrating mechanisms in close collaboration of the ultimate end-users. Enhancing the risk bearing capacity and confidence among the farmers is the basic requisite for the adoption of any innovative technologies and knowledge systems.

There are two OR sites of NCRP selected with the help of DLSO staff in Chitwan and Rupandehi District. Madi, Chitwan is a place where the farmersare raising local cattle in their farm and some are raising crossbred cattle as well. Most of the farmers are interested to raise improved cattle. In Madi local government policy also give emphasis on cattle farming & milk production. They are providing subsidy on the basis of milk production Rs 3 per liter of milk production. Farmers of theses area are more interested on commercial cattle farming by adopting latest technology.

In Devdaha of Rupandehi, it is a semi urban area and most of the farmers are

commercial farmers. We can easily demonstrate and let them to adopt our promising technologies in this area. Farmers of Devdaha are involved in cattle farming through their cooperatives by making group. Hence these are places where we introduce proven technology to uplift the farmers' economic condition.

The activities tested in farmer's field conditions are as described below:

Evaluation of teat dipping in farmers management conditions

Demonstration of post milking teat dipping carried out in Devdaha& Madi OR site. Farmers were advised to use the post milking teat dip solution immediately after milking and it check the entry of pathogen into the teat and prevent mastitis. Dipping solution was prepared by mixing povid in eiodine & glycerol (9:1). Inputs like post milking teat dip container & solution were distributed to selected dairy farmers. Milk samples were collected from animals on days of teat dipping (day 0) and thereafter on 60 day respectively in a sterile sample collection bottle in a cool box & tested for mastitis using California Mastitis Test (CMT) as soon as possible. Post milking teat dipping practice helps to reduce mastitis. Teat dipping did not have any impact on the teats like injury to teat, irritation of teat or redness over teats.

Health campaign

We had organized mobile animal health &infertility management camp at Devdah, Rupandehi. A formal program was organized at the beginning and remarks were given by Senior scientist Mr.Devi Prashad Adhikari regarding activities of NARC, about objective of program and need of different approach for maximum farmers participation in the program and the president of milk co-operatives put forward about need of local farmers for maximization of animal production and other management. General health examinations of animals presented at moblile camp was done and respective medicines were distributed to farmers for their animals. Animals with problem of infertility, repeat breeding and anestrus were in majority and they were treated accordingly. Pregnancy diagnosis of cattle was done using USG. Service was provided to commercial farmers having cattle more than 5.



Health camp at Devdaha Rupandehi, OR site

Vaccination and drenching program

Vaccination & drenching program were held in Madi, Chitwan & Devdaha Rupandehi where more than 100 cattle were vaccinated against FMD & more than 200 cattle were dewormed with antihelmintics.

Demonstration of silage making

Silage making is promising and economic option for providing nutrients through fodder during the dry season, especially, if prepared at community-level, where surplus fodder harvested in the wet season is processed and stored. In line of awareness campaigns run for improved Cattle husbandry practices for rearing cattle, farmers at village of Madi of Chitwan and Devdaha of Rupandehi, were given demonstration on silage- making at their door under on-going outreach programme of National Cattle Research Program. Freshly harvested, chopped forage (Teosinte, Napier, Maize& Sorgum) was used, compacted in a filled pit ($2m^2$), available at farmer'sdoor to demonstrate making silage. Silage pit was then covered with plastic and left to ferment for around 45 days. More than 20 participants were participated for silage making demonstration in both side of Madi of Chitwan& Devdaha of Rupandehi. Farmers participated actively and learnt process of making good silage.

Fortification of UMMB using sustained release urea (SRU) and probiotic cultures

In the outreach sites of Madi farmers mostly fed straw and poor grade concentrate in the winter dry season, which was not satisfactory for dairy cattle nutrition. To overcome nutrient deficiency use of urea molasses mineral block (UMMB) lick has been recommended by our office. UMMB are the lick block containing urea, molasses, vitamins and minerals. A composition of UMMB consist of Urea (10%), Molasses (30-32%), Rice bran (35%), Minerals (6%), Salt (5%), Cemented (6%), Di calcium phosphate (5%) etc. The required ingredients were collected and thoroughly mixed. By the help o fUMMB pressed block machine, block were made and distributed to the farmers. The incorporation of probiotic culture at the rate of 2% in UMMB has also been done to enhance the quality.Eighty five farmers actively participated while making UMMB in both outreach sites. Due to UMMB feeding healthy growth and milk productivity of dairy animals has been improved.

Distribution of forage seed

130 kg of different improved fodder seeds like Teosinte, Sorghum, Bajara&Oats. were distributed to farmers, different offices as well as Agriculture and Forestry University for further multiplication of these fodders to different places. Farmers of different district along with Chitwan and Rupandehi were directly benefited by these fodder seeds.

Demonstration & making of milk Product:

Different milk product such as paneer, dahi, rasbari were made in each outreach site by active participation of farmers. In farmer groups, it will help to shoot the problem of milk holidays & they are able to produce diversified milk product.

Summary of OR Activities:

All the above mentioned technologies were tested and demonstrated in farmer's field to aware farmers about latest technologies. All these activities were found important to uplift the animal production. Dipping and drenching is one of the important activities for improving livestock health and production. Cattle rearing farmers were facing clinical mastitis problem in about 45% milch cattle. Dipping teats after milking with combination of 9:1:: povidine iodine: glycerine were found effective to prevent the mastitis problem. Silage is also the feed for cattle in dry season (Magh to Chaitra) which increases up to 25 % milk production in cattle. Use of UMMB also increases the milk production and maintains good health.

3.1.10 Dairy product diversification and its economic feasibility

Abstract

Dairy product diversification has become an important aspect of business strategy. With reasons for this increased focus being increased profitability, reduction in risk, increasing competition, higher growth and more efficient resource allocation. Milk producing farmers are suffering from the problem of milk holidays during flush season and the self-life of raw and pasteurized milk is very low as compared to different dairy products. The study was conducted to follow the standard procedure of dairy product making between December, 2018 to January, 2019 from cattle milk at National Cattle Research Program, Rampur, Chitwan and its Out Reach (OR) research site. The whole milk composition of average Fat, SNF, Protein and Lactose were found 5.15, 8.85, 3.23 and 4.86 percent respectively. The average output of dairy products paneer, khowa, chhena for rasbary and dahi were found to be 15.04%, 30.32%, 15.71% and 87.18% respectively. The cost of production of paneer, khowa, dahi and rasbary were found to be Rs. 445.44/kg, Rs. 242/kg, Rs. 72.78/L. and Rs. 8.03/piece respectively at Rampur. Similarly, paneer Rs. 604.50, Rs. 575.22/kg, khowa Rs. 372.366/kg, dahi Rs. 86.77/L. and rasbary Rs. 11.80, Rs. 8.26/piece at Devadaha and Madi respectively were found. The crude protein and crude fat % of paneer (21.22& 11.28), khowa (14.28 & 7.53), dahi (5.54& 1.82) and rasbary (15.15 & 7.15) were found respectively. Hence, from this study we can conclude that the highest margin can be taken from khowa and rasbary than other dairy products.

Key words: Dairy product, diversification, economic

Introduction

Livestock sector is an integral part of Nepalese agriculture system as well as plays important role in national economy. Livestock provides nutritious food for human consumption, draft power for agricultural operations, transportation, manure for maintaining and increasing soil fertility. Livestock sector contributes about 26.08% to Agricultural GDP of the country (MoLD, 2072) and dairy sector contribution in GDP is 8% and shares 63% of total livestock contribution (ADS, 2013). The most important animals contributing about 78 % (highest) to Livestock GDP are cattle and buffalo. They contribute mainly in terms of milk (47%) and meat (31%).

Among the milk produced in the country more than 80% of the produced milk is sold as raw milk or as pasteurized milk (FAO, 2010). Preparation and selling of milk products are very less in the country. Milk producing farmers are suffering from the problem of milk holidays during flush season and the self-life of raw and pasteurized milk is very low as compared to different milk products. So, to overcome the problem of milk holiday it will be the great idea to diversify milk into different products which will ultimately increase the storage time leading to more benefits to farmers. Due to the change in feeding habits, people prefer milk products better than the whole milk. On the other hand, the cost of production and selling prize of raw milk is similar. So, farmers are not getting better return from milk selling. Product diversification may be one of the best practices to get more benefits to milk producers.

Materials and Method

Study area: The study was conducted at National Cattle Research Program (NCRP), Rampur, Chitwan, OR site Madi and Devadaha Rupandehi. At first, all the dairy products were prepared at NCRP and their economic data analyzed for economic feasibility. In second phase, the study was conducted at OR site Madi, Chitwan and Devadaha, Rupandehi.

Milk: All the dairy products were prepared from Cattle milk.

Required materials: During the preparation of dairy product the materials like LP gas, fire wood, electricity, sugar, citric acid, milk powder, muslin cloth, pasteurizer, packaging materials, dahi culture, paneer pressure etc. were used.

Procedure: The standard procedure of dairy product making followed.

Selling price calculation: The milk price of official rate of NCRP Rs. 56/liter and farmers purchasing rate at OR site Devadaha Rs 60/L. and Madi Rs. 50/L. and the price of other materials were determined according to local market price.

Experimental Period: December, 2018 to January, 2019

Results and Discussions

Cost of production of dairy product

Paneer

Paneer is a rich source of animal protein available at a comparatively lower cost and forms an important source of animal protein for vegetarians. Over and above its high protein content and digestibility, the biological value of protein in paneer is in the range of 80 to 86 (Shrivastava and Goyal 2007). In addition, paneer is a valuable source of fat, vitamins and minerals like calcium and phosphorus. It has a reasonably long shelf life under refrigeration.

The production cost of paneer was calculated under the National Cattle Research Programme, Rampur and its OR site Madi and Devadaha. At NCRP, 685.1 liter cattle milk was used for paneer production, the milk was coagulated at 75-80 ^{0}C by citric acid (@ of 2grm/lit. of milk), in this process all together 103.05 kg (15.04%) paneer were made. The milk composition had SNF, Fat, protein and lactose 5.15, 8.85, 3.23 and 4.86 % respectively. The production cost of paneer was found to be Rs. 445.44/kg. The detailed information of about economic analysis of paneer preparation is given in table 29.

Table 26. Economic analysis of Paneer at NCRP Rampur

Milk amount L.	Heating temperature^{0}C	Cream production (kg.)	Used citric acid (kg)	Production of paneer (kg)	Product %	Price of milk Rs.	Wages to labour Rs.	Fuel charge Rs.
685.1	75-80	6.62	1.370	103.05	15.04	38365.6	1370.2	4378.32
Price of citric acid Rs.	Other Rs.	Total cost Rs.	Per kg production cost Rs.	Price of cream Rs.	Total income Rs.	Net income Rs.	With 20% margin/kg Rs.	
418.5	1370.2	45902.8	445.44	3972	55497	9594.18	534.53	

The paneer was prepared at OR Site Devadaha and Madi with farmer participation. The prices of all the materials were calculated; according to the farmers and local market. The paneer was prepared from 10/10 liter of milk at Devadaha and Madi, only 12.24 and 11.3 % product were made respectively. The production cost of paneer at Devadaha and Madi were found to be Rs. 604.50 and Rs. 575.22 per kilogram respectively. The detailed economic analysis is described in table 30.

Table 27. Economic analysis of paneer at OR Site

OR Site	Milk Lit.	Price of Milk Rs.	Paneer production Kg.	Citric Acid Rs.	Fuel Rs.	Wages to labour Rs.	Others Rs.	Total cost Rs.	Per kg production cost Rs.
Devadaha	10	600	1.224	10	50	50	30	740	604.50
Madi	10	500	1.13	10	50	50	40	650	575.22

There is variation in the market price of paneer according to the place and quality from Rs. 550 to 700 per kilogram. The consumer price of Dairy Development Corporation (DDC) has Rs. 600 per kg and NCRP has Rs. 500 per kg, which is nearest to our result of cost of production.

According to Chandan (2007a), the yield of paneer was dependent on the fat and SNF content of the milk used, fat and protein recovered in paneer and its moisture content. A yield of around 17-18% for paneer can be obtained from cow milk but our result 15.04% paneer obtained at NCRP which was slight poor than this result.

Khuwa

Khowa is a dairy product which is used in sweet dish in many festivals. The making procedure of khowa is very time taking and laborious process. The cost of production of khowa studied at NCRP Rampur, where 215.5 liter of whole milk and 2.15 kg sugar were used and 66 kg khowa (30.32%) produced. The cost of production of khowa Rs. 241.98 per kilogram was found. The detailed information about economic analysis of khowa is given in table 31.

Table 28. Economic analysis of Khuwa

Milk L.	Sugar kg.	Khowa production kg.	Production %	Price of milk Rs.	Wages to labour Rs.	Fuel charge (Ele.+gas) Rs.
215.5	2.15	66.00	30.32	12068	1360	1820
Price of sugar Rs.	Other Rs.	Total cost Rs.	Per kg production cost Rs.	Total income @ Rs. 600 Rs.	Net income Rs.	With 20% margin/kg Rs.
172	431	15844.89	241.98	39600	23755.11	290.37

The khowa were prepared at OR Site Devadaha and Madi with farmers group through their full involvement. The economic analysis was done considering local price rate. The cost of production of khowa was found Rs. 372 and 366 per kilogram at Devadaha and Madi respectively. The detailed economic analysis of khuwa is given in table 32.

Table 29. Economic analysis of khuwa at OR Site

OR Site	Milk Li.	Price of Milk Rs.	Khuwa production Kg.	Sugar Rs.	Fuel Rs.	Wages to labour Rs.	Others Rs.	Total cost Rs.	Per kg production cost Rs.
Devadaha	10	600	2.50	10	100	200	20	930	372
Madi	10	500	2.35	10	100	200	50	860	366

The market price of khuwa more variation than paneer that is from Rs. 600 to 900 per kilogram. In the market of Saptari district price is Rs. 700 per kg of buffalo milk khowa. The cow milk khowa is more expensive than buffalo milk. From this result the

production cost is very low according to the market price more margins can be obtained by selling khuwa in the market.(>100%).

Dahi

Dahi is a very traditional, popular and healthy food, produced by bacterial fermentation of milk. Dahi making procedure is very simple and easy. Dahi was made by using skim milk and mixed with sugar and skim milk powder and boiled properly. The properly mixed milk cool at 40 ^{0}C and inoculate dahi culture and left them for fermentation. The total 114.5 liter (87.18%) dahi were prepared from the mixture of Skim milk 126.28 litter, sugar 2.525kg and skim milk powder 2.53 kg. The cost of production of dahi Rs.72.78 per liter was found from this study. The detailed economic analysis was given in table 33.

Table 30. Economic analysis of Dahi

Skim Milk L.	Sugar kg.	Skim milk powder kg.	Dahi Production L.	Production %	Price of skim milk (@ Rs 45) Rs.	Wages to labour Rs.	Fuel charge Rs.
126.28	2.525	2.53	114.5	87.18	5682.6	300	792
Price of sugar Rs.	Price of skim milk powder (@Rs 300/kg) Rs.	Other Rs.	Total cost Rs.	Per L. production cost Rs.	Total Income (@ Rs. 80) Rs.	Net income Rs.	With 20% margin/L. Rs.
202	757.68	572.5	8306.78	72.78	9160	853.22	87.33

The cost of production of dahi at OR site Devadaha and Madi were calculated with farmers participation, from this study the cost of dahi were found to be Rs. 86 and 77 per liter respectively. The detailed calculation was given in table 34.

Table 31. Economic analysis of dahi at OR Site

OR Site	Milk	Price of Milk	Dahi production	Sugar and culture	Fuel	Wages to labour	Packaging materials & Others	Total cost Rs.	Per L. production cost
Devadaha	10	600	9.5	50	50	50	65	815	86
Madi	11	550	10	50	50	50	70	770	77

Now, the market price of dahi was found ranging between Rs. 80 to 150 per liter according to different places and its quality. The consumer price of Dairy Development Corporation (DDC) has Rs. 110 per liter in plastic packet and Rs. 120 per liter in plastic cup and NCRP has Rs. 80 per liter..

Rasbary

The cost of production of rasbary was calculated and produced at NCRPDairy lab. The

rasbary were produced from 29 liter whole milk and produced 387 pieces. The average weight of ready piece was found 19.61 gram/piece. The cost of production of rasbary was found Rs. 8.03 per piece. The detailed calculation of cost of production is given in table 35.

Table 32. Economic analysis of Rasbary

Milk L	Chhena kg.	Chhena %	Sugar kg.	Labour Rs.	Fuel Rs.	Price of sugar (@ Rs.80) Rs.	Sukmel Rs.
29	4.555	15.71	8	600	100	640	45
Other Rs.	Price of milk Rs.	Total cost Rs.	Rasbary pieces dry No.	Average Wt. of dry/ piece grm.	Average Wt. of Ready piece grm.	Cost of per piece Rs.	With 20% margin/pcs. Rs.
100	1624	3109	387	12.24	19.61	8.03	9.64

After find out the cost of production at Office lab and then comparative studied at OR site, at that time the cost of production at Devadaha and Madi were found to be Rs. 11.80 and 8.26 per piece respectively.The detailed economic analysis was given in table 36.

Table 33. Economic analysis of Rasbay at OR Site

OR Site	Milk	Price of Milk	Pieces of rasbary	Sugar	Fuel	Wages to labour	Others	Total cost Rs.	Per piece production cost
Devadaha	10	600	80	150	50	100	45	945	11.80
Madi	10	500	104	160	50	100	50	860	8.26

The market price of rasbary was found ranging between Rs. 20 to 35 per piece according to different places and its quality. The consumer price of DDC has Rs. 20 per piece, DDC has about 100% higher price than our result.

Chemical composition of cattle milk product

Chemical composition of cattle milk products was analyzed in Food Research Division, Khumaltar. According to the lab analysis the crude protein percent is highest in paneer and followed by rasbary, khowa and dahi 21.22, 15.15, 14.28 and 5.54% respectively. The lowest moisture content was found in Khowa and followed by paneer, rasbary and dahi 35.94, 41.72, 53.09 and 83.78% respectively. According to the moisture content we can say that the longest self-life had khowa and followed by paneer, rasbary and dahi respectively. Other detailed chemical composition was given in table 37.

Table 34. Chemical Analysis of cattle milk product

S. N.	Sample	Moisture (%)	Total Ash (%)	Crude Protein (%)	Crude Fat (%)	Iron (mg/100)	Calcium (mg/100g)	Phosphorus (mg/100g)
1.	Khuwa	35.94	2.59	14.28	7.53	6.03	373.54	382.70
2.	Paneer	41.72	1.71	21.22	11.28	1.15	547.43	243.41
3.	Dahi	83.78	0.75	5.54	1.82	0.37	38.61	93.29
4.	Rasbery	53.09	0.60	15.15	7.15	1.15	218.19	99.30

In our result the calcium content was found 0.55% in cow milk paneer, but Arya and Bhaik(1992) reported that the good quality cow milk paneer, calcium chloride at the rate of 0.08-0.15% was used to get better quality paneer.Dahi is reported to be very nutritious, and possess various therapeutic properties. In one study where authors produced dahi from cowmilks on a lab scale, protein, fat and ash content was reported to be 3.8%, 4.0% and 0.8% respectively for cowmilk dahi. The protein of dahi is reported to be higher than that of milk (Wijesinha-Bettoni and Burlingame, 2013).

Conclusion

From this study we can conclude that the highest margin can be taken form khuwa and rasbary than other dairy products. The different dairy product has better self-life than raw milk and easy to handle and transport. According to the lab analysis the crude protein percent is highest in paneer and followed by rasbary, khowa and dahi 21.22 %, 15.15 %, 14.28 % and 5.54% respectively.

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3.1.11 Development of package of practices for Yak/Chauri

Introduction

Yak is strong, hardy animal thriving in very cold (-50^{0}C) climate and also resistant to hypoxia (Paudel, 1994). These are only domesticated bovine of altitude more than 3000 meter above sea level. Crossbred of Yak and hill cow (kirko) is called Urang chauri whereas crossbred of nak (female yak) and hill bull/ tibetian bull (lyang) is called Dimjo Chauri. Male chauries are called Jhopkyos and are sterile. Nak (female yak) and female chauries are used for milk production, whereas Yak and Jhopkyos are used as pack animal. Small body size (180-390kg), poorly developed sweat glands, thick layer of subcutaneous fat and two types of hair (coarse and fine) which acts as effective insulator against the low temperature (Paudel, 1995). Yak/chauries are multipurpose and semi domesticated animal in himalayas. Yak/chauries are source of milk, meat, hide, hair energy and trasnportation. They play a key role in agro-biodiversity conservation and maintaining the high rangeland ecosystem, also in cultural traditions, livelihood strategies, and all aspects of socioeconomic development in the high mountain areas.

The major distribution of yak lies in the Qinghai-Tibetan Plateau in China, with relatively small populations present in the Hindu Kush Himalayas (HKH) countries (ICIMOD, 2016). In Nepal, yak and its hybrids (chauri) are distributed in 28 northern districts. Population of yak and its hybrids were reported to be 56488 in 1999 (DLSO Kathmandu, 1999), 95447 in 2002 (CBS, 2004), 68097 in 2010 (DLS, 2010), 65661 in 2013 (MoAD, 2013) and 48865 in 2017 (MoLD, 2017). Yak development farm Syangboche, Solukhambu is only one government farm of Nepal as resource farm and recently a yak farm in Dolpa has been under process by government of Karnali province.

Methodology

Household survey and sample collection was conducted in Taplejung (Kali khola area), Rasuwa (Gatlang), Dolpa (Sey- Phoksundo), Manang (Lamjung Base camp & Thum Kharka) and Mustang (Boksi khola) district purposively. Survey was conducted in 25 households of all project districts. Ninty nine serum samples, 243 fecal samples and 34 milk samples of yak/chauri were collected. Serum sample was collected to know the prevalence of brucellosis, tuberculosis and foot and mouth disease. Similarly milk sample was collected to know the prevalence of subclinical mastitis and fecal sample for endoparasite prevalence. This work was conducted from September 2018 to June 2019. Data entry and data analysis was done by using MS Excel 2007.

Fig: Research photo

Results and Discussions

Total number of yak/chauries was 727 (yak/nak- 490 & chauri-237) in 25 surveyed households of different district. Average number of yak/chauries per household was 29.08. Average number of yak/nak per household was 19.60 and chauri was 9.48. Considering the preference of farming, Manang and Mustang district have more preference of yak/nak farming. Unlike Rasuwa and Taplejung district have more preference towards chauri farming. Dolpa have more or less equal preference of yak and chauri farming. In surveyed area of Dolpa and Rasuwa, population of yak/chauri is increasing since last 3 years. Increasing pattern may be due to increased demand of chhurpi and cheese and establishment of DDC cheese factory in area (Gatlang, Rasuwa). In Manang, Mustang and Taplejung district, population of yak/chauri is in decreasing trend. This is due to less interest of youths into farming and outmigration of people of that area. According to survey, 38% of farmers use antihelimintic for their yak/chauries and 14% farmers vaccinate their yak/chauries against Foot and Mouth Disease (FMD). Farmers of Mustang, Rasuwa and Manang vaccinate their animal against FMD but Taplejung and Dolpa are devoid of vaccination. Antihelmintic use was made partially in all of our study districts. Transhumance type of migration is common in yak/chauri farming in every district. Before winter (October/November) they come to lower altitude of 2000-2200m and in summer (May/June) they move upwards to height of 5000m and above. They graze and live freely in grazing area but temporary shed are made for young calves and lactating nak/chauries.

In Taplejung, Rasuwa, Dolpa and Mustang chauries and nak are milked and cheese,

chhurpi, ghee is made from milk. But in Manang milking is rarely done. In Manang yak/nak are reared for meat purpose than milk. Regarding breeding practice, use of single yak/bull in certain herd for long time is practiced and there is no facility of artificial insemination. Problem of inbreeding seems to be increasing. According to farmer; attack of wild animals like snow leopard, bear, fox, tiger; scarcity of drinking water, heavy snow fall, poor veterinary service, poor interest of youth towards farming, shifting to other business (tourism, hotel, trekking) and deficit of grazing land are problems in yak/chauri farming.

Commonly found forage and fodder for yak/chauries are buki, benakshi, alpipi, white clover (*Trifolium repens)*, rye grass (*Lolium* perenne), bachi, oak (*Quercus leucotrichophora*), singkshe, rambo, chendi, machhi, pang, bhena, bekhar, nigalo, gadar, pasi, tiure, hakato, kamlya, gojeng, dhade buki, khar (*Imperata cylindrical)*. In districts like Manang and Mustang, yak/chauries are free to graze all the time. While in districts like Rasuwa, Dolpa and Taplejung they graze for 8-10 hours in a day and are taken to shed for rest and extra feeding. Generally milking is done once a day in morning. Milking animals are fed extra approximately 1-2 kg of feed (oil cakes and maize flour with common salt) at least for first month of lactation. Feeding of common salt (keep in large/flat stone) as mineral supplement to all yak/chauries weekly or biweekly is common practice.

The Price of nak and chauri milk ranges from Rs 88- Rs120 per liter. The Price of ghee ranges from Rs 500- Rs1250 per kg. The Price of hair of yak/chauri ranges from Rs 500- Rs 800 per kg. The Price of tail ranges from Rs 4000- Rs10000 per piece. The Price of double hair colored tail (Ganga Jamuna) is higher than single hair colored tail. The Price of chhurpi ranges from Rs 600- Rs 1000 per kg. The Price of yak/nak meat ranges from Rs 500- Rs 1000 per kg. The Price of adult yak/nak ranges from Rs 85,000- Rs 1, 00,000 and chauri ranges from Rs 30,000- Rs 65,000. Regarding health problem of yak/chauries, endoparasitic prevalence, ectoparsite prevalence, mineral deficiency, FMD and locally called AUL (Occurs when they come to lower altitude and sudden death) are common. Farmers have poor market access but in Rasuwa because of cheese factory of DDC, marketing is easy.

Only a very few research works has been carried out on yaks/chauries in Nepal and different studies have produced different results. According to this study average milk production of nak per day is 1.67 liter and that of chauri 3.45 liter. Average lactation length of nak is 185 days and that of chauri is 212 days. Age of first calving of nak is 38 months and that of chauri is 43 months. Time to return estrus after calving for nak is 6 months and that of chauri is 5 months. Milk production of nak in Syangboche farm was 0.65 liter per day (Paudel & Parajuli, 2016) to 0.86 lit per day (Shrestha et al, 1996) in

Mustang. Similarly milk production of chauri per day is 2.77 liter (Shrestha, 1994). Findings of other research have less milk production of both nak and chauri than our study. According to Shrestha *et.al* (1996), average age of first calving for nak is 56 months and chauri is 47 months. This is higher than our study. Joshi (1982) reported that the lactation length for nak was 40 days, while Kharel (2000) reported 167 to 180 days and Shrestha *et, al* (1996) reported 159 days. At the Yak Development Farm, Sangboche it was 63 days (Paudel & Parajuli, 2016). Similarly, reports of the lactation length for chauri range from 96 days (Neopane et al. 2001), to 120–180 days (Sherchand and Karki 1996), 150–180 days (DLSO Jumla, 2013) and 180 days (Shrestha, 1994). Our study is similar with study of Kharel (2000) regarding lactation length of nak but higher than other studies. Lactation length of chauri is high in our study than other studies.

In fecal examination major parasite were *Toxocara* sps., *Paramphistomum*sps. ,*Ascaris* sps. , andthe prevalence rate of these endoparasites was 15.29%. Quarterwise prevalence of subclinical mastitis was found to be 10.71%. This year serum was not tested for prevalence of diseases mentioned in methodology portion. Serum is stored in deep freeze (-40°C) to test sample in coming year.

Conclusion and Recommendation

Still yak/chauri husbandry is traditional type in Nepal and population of yak/chauri is decreasing in recent years. Scarcity of drinking water, poor veterinary service, less interest of youth towards farming, less awareness of famer, predation from wild animal and heavy snow fall are major problems in yak/chauri farming in Nepal. From very early times, yak herding, breeding and management have became an important part of traditional cultures, religions and social life in the himalayan region, with several ethnic communities and tribes highly dependent on yak for their day-to-day activities, livelihood options and tourism. Yak/chauri production can continue to be one of the major means of supporting pastoralists in the high-altitude areas of the himalayan region. Thus, there is a need to improve yak/chauri production, conserve yak genetic diversity and traditional breed selection systems and improve the livelihoods of yak herders.

In context of Nepal improving the awareness level of farmer is essential for improving yak/chauri husbandry. Availability of veterinary service, establishment of pasture bank and regular water supply is vital. Use of regular deworming, vaccination and mineral supplement to yak/chauries is needed for improving production and productivity. For breed improvement, introducing superior breed from other places (China/Tibet) along with start of artificial insemination program with semen of superior genetic value will be helpful. Establishment of yak research center and yak resource centers in the country has become crucial. Animal insurance policy should be implemented to minimize possible risk due to loss from predators, snow fall and diseases. For improving marketing facility, establishing more factory related to yak/chauri products in high altitudes recommended.

3.1.12 The effects of feeding milk replacer on body growth and its economic feasibility in dairy calves

In this fiscal year, 27 newborn (Jersey crossbred, Holstein Friesian crossbred and pure Lulu) calves were allocated for trial. They were divided randomly in three different feeding groups like T0 group (whole milk), T1 group (normal milk replacer), T2 group (medicated milk replacer). Eleven calves were allocated in T0 group, 6 calves were allocated in T1 group and 10 calves were allocated in T2 group.

Birth weight of each calf was taken and calves were fed milk till 2 weeks of age as 10% of body weight. After that, feeding trial was conducted for 12 weeks regularly. Body weight, chest girth, body length and body height of each calve was recorded weekly in regular basis. Feeding was done in such a way that each calf gets $1/10^{th}$ part of its body weight in first month, $1/20^{th}$ parts of its body weight in second month and $1/30^{th}$ parts of its body weight in third month. For determining amount of feeding, weekly body weight of each calf was considered. Feeding was done twice a daily, in morning (6-7am) and evening time (4-5pm).

Milk replacer solution was made by mixing 125 gm of milk replacer powder in 1 liter of lukewarm water. Calves in trial were supplemented with few amounts of soft green grasses, straw and feed.

Table 35.Normal milk replacer (T1)

Ingredients	Parts (%)
Wheat	35.00
Soyabean meal	30.00
Skim milk	13.50
Coconut oil	8.40
Molasses	8.00
Citric acid	1.50
Butyric acid	0.30
Mineral mixture	3.00
Multivitamin	0.30
Total	100.00

Table 36.Medicated milk replacer (T2)

Ingredients	Parts (%)
Wheat	35.00
Soyabean meal	30.00
Skim milk	13.50
Coconut oil	8.40
Molasses	7.985
Citric acid	1.50
Butyric acid	0.30
Mineral mixture	3.00
Antibiotic mixture	0.30
Multivitamin	0.015
Total	100.00

One way repeated measures ANOVA was used to compare the weekly weight gain rate in different groups. Average weekly weight gain in T0, T1 and T2 group was 2.20 kg, 2.08 kg and 1.90 kg respectively. Similarly daily weight gain was 314.20 gm, 297.10 gm and 271.00 gm respectively for T0, T1 and T2 group. This was statistically significant ($P< 0.05$).

Average consumption of whole milk by a calf till weaning in control group (T0) was 153 liter, whereas average milk replacer consumption in T1 group was 19.50 kg and 30.50 liter of milk and in T2 it was 20.80 kg and 33.00 liter milk. Milk consumption in T1 and T2 group was upto 2 weeks of age and then only they were subjected to milk replacer feeding. Average cost for feeding for a calf in T0 was NRS 8550.80 (NCRP rate @ Rs 56/Lit) and NRS 12215.40 (DDC rate@ Rs 80/Lit), for T1 average cost was NRS 6255.20 (@ Rs 56/Lit) /6988.80 (@ Rs 80/Lit) and T2 was NRS 6722 (@ Rs 56/Lit) /7525.40 (@ Rs 80/Lit).


Fig: Milk replacer powder prepared by mixing different ingredients & Feeding of calves in control group (milk)


Fig: Feeding of calves in treatment group (T1) & Calves after trial completion

3.1.13 Assessment of major reproductive hormones in cyclic and non- cyclic crossbred dairy cows

Introduction

Most of the cattle dairy farms are facing problem of infertility despite of their good managemental practices, which ultimately retards the farm economy. Currently practice of using hormones as treatment for infertility is becoming popular. Veterinarians and

technicians are making use of exogenous reproductive hormones to overcome infertility in cows, but without assessing the hormonal profile. In this context, success results are not observed as expected and widespread misuse of hormone prevails in this sector.

Hormones basically progesterone, estrogen, luteinizing and $PGF_{2\alpha}$ imbalance is major cause of functional infertility in dairy cows (Abraham, 2017). Hormonal response to infertility happens only if the animal hormonal profile is in disorder as per normal cyclicity.

Hormonal assessment will help to know whether non-cyclic animals under good managemental practices are due to deficit of required hormonal concentration. Eventually, this will also lead to wise use of hormones in farms. This will also help to analyze the deviation of reproductive hormonal physiology in infertile cows with respect to normal cyclic cows.

Methods and Methodology

Five cyclic and five non-cyclic cows were selected in NCRP Farm, Rampur. Non-cyclic cows were in anestrous condition for at least six months and below fourth parity. Cyclic cows were at least in 2 months post calving stage and showing proper estrus signs in regular cycle.

In cyclic cows, blood sample collection was made 16 times each (0 hr of estrus detection, 12 hr, 24 hr, 36 hr, 48 hr, 4^{th} d, 6^{th} d, 8^{th} d, 10^{th} d, 12^{th} d, 14^{th} d, 16^{th} d, 18^{th} d, 20^{th} d, 22^{th} d and 24^{th} d) or same way upto next regular heat detection with vaccuitainer tube. In case of non cyclic cows, blood sample collection was done 13 times each (0 day, 2^{nd} day, 4^{th} d, 6^{th} d, 8^{th} d, 10^{th} d, 12^{th} d, 14^{th} d, 16^{th} d, 18^{th} d, 20^{th}, 22^{th} d and 24^{th} d). Serum was separated by centrifuging @ 2000 rpm for 10 minutes and kept in deep freeze (-20^{0} C) till test. Hormone assessment was done by using ELISA test kit. For determination of estrogen and progesterone ELISA kit manufactured by CUSABIO, USA was used and for determination of LH and FSH, ELISA kit manufactured by Life Technologies, India was used.

Table 37. Hormonal values in cyclic and non cyclic cows

Parameters	Cyclic (mean±SE)	Non-cyclic (mean±SE)	Level of significance
Estrogen (pg/ml)	385.83±156.29	950.52±472.25	Ns
Progesterone (ng/ml)	7.27±1.959	5.61±0.86	Ns
LH (pg/ml)	0.52±0.03	0.52±0.00	Ns
FSH (ng/L)	0.32±0.02	1.78±0.86	Ns

Mean±SE values of estrogen and FSH are less in cyclic cows than non cyclic cows but

mean±SE values of progesterone and LH are higher in cyclic cows than non cyclic cows. These values do not show statistically significant difference between cyclic and non cyclic cows.($p>0.05$)

LH value obtained by Mori *et al.*, 1974 (22720 ± 5680 pg/ml) is higher than our finding (0.52±0.03 pg/ml). FSH value obtained by Mondal *et al.*, 2004 (0.0017 ± 0.00031 ng/L) is lower than our finding (1.78±0.86 ng/L). Similarly estrogen and progesterone values obtained in our study are higher than Ahammed *et al.*, 2018. Where estrogen and progesterone values were 107.30 ± 6.97 pg/ml and 5.93 ± 0.42 ng/ml respectively.

Test of estrogen in cyclic cows

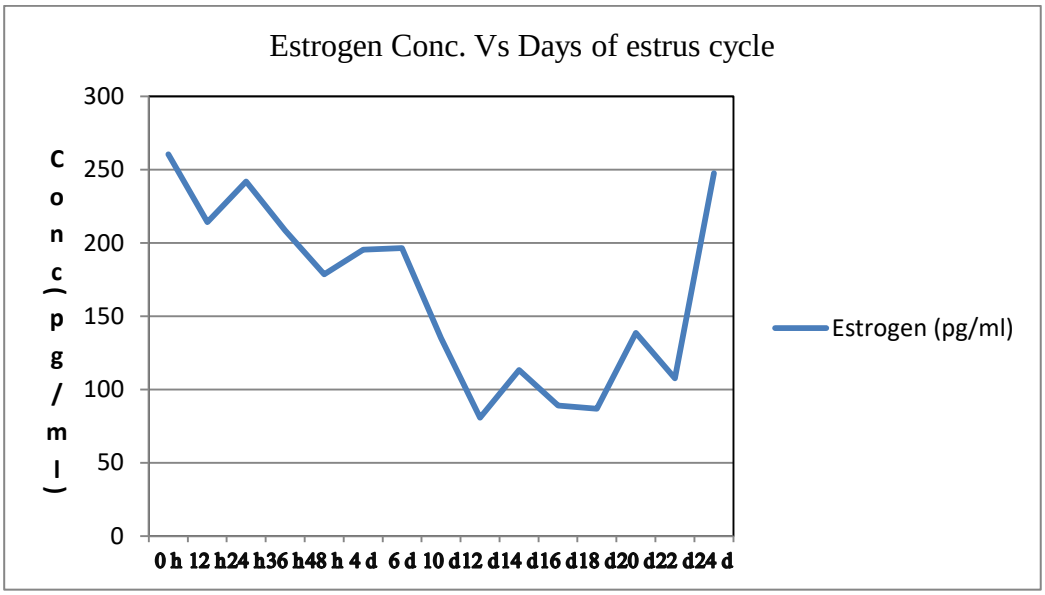

Fig: Graph showing estrogen concentration in estrus cycle of cyclic cow

The estrogen values mentioned in our research finding are higher than studies made by Naik *et. al.*, 2013 and Ahameed *et. al*., 2018.

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3.2 Collaborative/Support Researchhighlights

Such research projects are jointly conducted in collaboration with other divisions and regional stations or as multi-location project or in support to the students from bachelor ormasterdegree.HerearesomeoftheprojectsworkscarriedoutintheFY2075/76.

3.2.1 Seroprevalence of *Chlamydia abortus* in Anestrous Cattle of Nawalpur and Chitwan District, Nepal

ABSTRACT

Chlamydia abortus aregram negative coccoid, obligate intracellular zoonotic bacteria responsible for abortion and other reproductive problems in dairy cattle. This leads to sub-fertility and infertility in cattle thereby causing significant economic losses to dairy farmers.However, the status of *Chlamydia abortus*in Nawalpur and Chitwan dsitricts, which are the dairy pockets of Nepal, are poorly understood. The objective of this study was to determine the seroprevalence of antibodies to *Chlamydia abortus* in anestrous dairy cattle of Nawalpur and Chitwan districts in winter season.In total, 92 cattle serum (Nawalpur (n= 27) and Chitwan (n= 65))samples were collected from April 2018 to May 2019 and tested using *Chlamydia abortus* specific indirect ELISA kit to evaluate the seropositivity status of cattle. Results showed that only 2 (2.17%) cattle were seropositive for *Chlamydia abortus.* Both the positive cattle were Jerseys from Nawalpur area with a history of abortion. The ages of the seropositive cattle were 3 and 4 years. In conclusion, there was a low seroprevalence of *C. abortus* in dairy cattle of Nawalpur and

Chitwan districts but indicates it as one of the causes of unidentified abortion in dairy cattle. We suggest screening dairy animals for *C. abortus*infection to minimize the *C. abortus*associated abortion.

Keywords: Abortion; cattle; Chlamydia abortus; iELISA test;seroprevalence

3.2.2 Seroprevalence and Risk Factors of Bovine Viral Diarrhoea in Improved Cow of Chitwan, Nawalpur and Rupandehi districts of Nepal

ABSTRACT

Objective: The general objective of this study was to know the prevalence of Bovine Viral Dairrhoea (BVD) in improved dairy cattle of Chitwan, Nawalpur and Rupandehi Districts of Nepal. The specific objective was to find the association of Bovine Viral Diarrhoea with age, breed, district and reproductive problems in improved dairy cattle of Chitwan, Nawalpur and Rupandehi district.

Study design: A cross sectional study was done with purposive sampling Chitwan, Nawalpur and Rupandehi district within the study period of Mangsir to Magh. A total of 92 blood samples were collected from jugular vein of cattle aseptically, transferred to clot activator tube and transported to National Cattle Research Program, Rampur, Chitwan. Serum separation was done by centrifugation @3500 for 5 minutes. The serum was stored at -20°C till ELISA test was done. Serological analysis was done according to the protocol ofID.vet BVDAb ELISA kit. Statistical analysis was done by using Ms excel and spss version 20.0.

Results: The seroprevalence of Bovine Viral Dairhoea Virus was found to be 7.76%. Provided that no history of vaccination against BVD in cattle was done in the study area, seropositive was due to natural infection. Geographic location as well as sampling method might have contributed to this result.

Conclusion and Recommendation: The result showed lower prevalence along with no statistical significance to breed and age risk factors undertaken during the research.But there was significant association between abortion history and seropositivity.Thus, further study is needed in the Chitwan, Nawalpur and Rupandehidistrict to identify the disease burden and it's significance in economic loss.

Keywords: Bovine viral diarrhoea, dairy cattle, ELISA, seroprevalence.

3.2.3 Seroprevalence of Bovine Viral Diarrhoea in Crossbred Dairy Cattle in Commercial Farm of Chitwan, Nepal

ABSTRACT

Bovine viral diarrhoea is caused by Bovine viral diarrhoea virus (BVDV), a single stranded RNA virus, which belongs to family Flaviviridae and genus Pestivirus. The aim of this study was to investigate the seroprevalence of BVD in representive farms of Chitwan district. A total of 92 blood samples were collected from three different farms of Chitwan district. Serum was extracted from blood samples to detect the antibody level of BVD using P-80 competitive ELISA kit. Serum samples were identified on the basis of breed, parity and various history of individual animal. Among 92 blood samples, 28 were from Jersey cross and remaining 64 were from Holstein Friesian cross. 50 animals were $\leq 4^{th}$ parity and 42 animals were $> 4^{th}$ parity. Likewise among 92 cows, 83 cows had the history of repeat breeding and 2 cows had history of abortion. In conclusion, no animals were tested positive which is good for commercial dairy farms. Further detailed investigation including a large number of farms from various places of Chitwan is recommended to ensure this condition in Chitwan district.

Keywords: Bovine viral diarrhoea (BVD), Cattle, Chitwan, Seroprevalence

3.2.4 Seroprevalence and Risk Factors of Infectious Bovine Rhinotracheitis (IBR) in Improved Dairy Cow of Chitwan, Nawalpur and Rupandehi districts of Nepal

ABSTRACT

Objective: To determine the seroprevalence and risk factors of Infectious Bovine Rhinotracheitis (IBR) in improved dairy cow of Chitwan, Nawalpur and Rupandehi districts of Nepal

Study design: Cross-sectional study from July to September 2018

Methods and methodology: Questionnaire interview was done to collect individual as well as herd level data from all 92 serum samples of 55 herds which were collected purposively from Chitwan, Nawalpur and Rupandehi. All serum samples were screened by Indirect-ELISA from ID.vet France. Association between categorical variables and the outcome variable (seropositive) were assessed by using Pearson chi-square test by SPSS version 16.0. For all analyses, a p-value of ≤ 0.05 at 95% CI was considered statistically significant. Graphical representation and tabulation were done by MS Excel 2013.

Results: Out of 92 samples, 17 were found positive (18.48%) Significantly higher percentage positive (PP)were found in Chitwan (36.37%) than Nawalpur (9.38%) and Rupandehi (10.00%). PP of IBR was significantly higher in Jersey crosses (30.00%) as

compared to Holstein Friesian crosses (12.90%). Herds with >10 cattle (33.33%) have significantly higher PP than herds ≤10 cattle (10.71%). Cattle ≥5 years old (24.53%) were found more sero-positive than cattle of 2-5 years (10.26%) but no significant difference. There was no association between PP and history of reproductive problems like abortion, ROP and repeat breeding with PP of 19.23%, 8.33% and 17.74% respectively.

Conclusion: Overall PP was found to be 18.38% that results from natural infection of virus (since no vaccination) and there was positive association of PP, breed and herd size.Previous studies and this study as well urged to further planned research on IBR in national level to protect our dairy industries from possible economic losses due to infectious diseases.

Keywords: Control, IBR, Risk factors, Seroprevalence

3.2.5 Seroprevalence and Associated Risk Factors of *chlamydia abortus* in Improved Dairy Cattle of Chitwan, Nawalpur and Rupandehi Districts of Nepal

ABSTRACT

Objectives: To determine the seroprevalence of Chlamydia abortus in improved dairy cattle of Chitwan, Nawalpur and Rupandehi districts of Nepal in the winter season.

Study Design: Cross-sectional study from November to December 2018.

Methods and Methodology: Questionnaire interview was performed to collect individual as well as herd level data from all 92 samples of 51 herds. The samples were collected purposively from Chitwan, Nawalpur and Rupandehi. All serum samples were screened by Indirect ELISA from ID vet. Association between categorical variables and the outcome variable (seropositive) were assessed using Pearson Chi-square test SPSS version 20.0. For all analyses, p-value of ≤ 0.05 at 95% CI was considered statistically significant. Graphical representation and tabulation were done by MS Excel 2013.

Results: Outof 92 samples, 3 were found to be positive (3.27%). All positive samples were from Rupandehi. There was significant difference between the locations. PP of Chlamydia abortus was higher in Jersey crosses (4.22%) as compared to Holstein Friesian crosses (0%). Cattles of age >3 years were found to be more seropositive (6.97%) as compared to cattle of age ≤3 years (0%).

Conclusion: Overall PP was found 3.27% that results from natural infection of causative agent (no vaccination in practice) and there was no positive association of PP, breed and age group. Previous studies and this study as well urged to further planned research on Chlamydia abortus.

Keywords: Chlamydia abortus, Commercial dairy farm, Nepal, Seroprevalence.

3.3 Multilocation Research Highlights

3.3.1 Establishment of Farm Animal and Forage Genetic Resource Center at Khumaltar (Rampur)

3.3.1.1 Genetic evaluation of Lulu cattle (Adaptation research on Lulu cattle in low altitude)

Two males and eight females of Lulu cattle were brought from Animal Breeding Division, Khumaltar in 2074/11/08, before starting warm season through collaborative research to National Cattle Research Programme, Rampur and maintained in optimum management condition at NCRP farm. During the warm season from Chaitra 2074 to Shrawan 2075 the morphological characterization were found very good. Out of 8 lulu cattle 3 calved in fiscal year 2075/76.Average birth weight of calf is 8.63kg. Weight of calf at two month is 13.2kg.Average milk production of Lulu cattle at NCRP is 2.16 ltr per day. Milk of Lulu cattle contains Fat 5.87%, SNF 9.93%, Proetin 3.32% & Lactose 5.01%.

Fig: Lulu cattle at NCRP farm

4. PRODUCTION

4.1 Cattle ProductionProgram

The Program had maintained a herd of approximately 166 heads of cattle in its farm. It includes different stages of animals of Jersey crosses, Terai Local, Lulu and Holstein Friesian crosses. The initial and closing herd composition of fiscal year 2075/76 is given in Table 41 below.

Table 38. Herd compositions of cattle in the beginning and by the end of fiscal year 2075/76

Breed	Opening Balance						Total	Closing Balance						Total
	Adult		YB	H	Calves			Adult		YB	H	Calves		
	M	F			M	F		M	F			M	F	
Jersey Cross	0	44	0	9	7	11	71	0	51	5	11	13	14	94
HF Pure	0	1	0	0	0	0	1	0	1	0	0	0	0	1
HF Cross	0	21	0	2	1	2	26	0	20	0	2	6	7	35
Terai Local	0	0	2	20	0	0	22	1	1	1	19	1	0	23
Lulu	2	8	0	0	0	0	10	0	8	2	0	1	2	13
Total	**4**	**75**	**0**	**30**	**8**	**13**	**130**	**1**	**81**	**8**	**32**	**21**	**23**	**166**

M = Male, F = Female, YB = Young Bull, H = Heifer

In this year total of 21 calves (male 8, female 13) were produced in the farm of NCRP.

4.2 Forage seeds and saplingproduction

Table 39. Production of green grasses for livestock units maintained in the farm of NCRP during FY 2075/76

S.N.	Name of Grass	Area cultivated (ha)	GM Production (Mt)	Seed Production (kg)
1.	Teosinte	8	480	350
2.	Bajra	1	50	
3.	Sorghum	1.5	60	
4	Perennial Sorghum	0.5	50	
5	Oat	8	200	500
6	Napier	0.2	24	
7	Signal	0.3	0.5	
8	Setaria	0.3	0.5	
9	Maize	1	35	
	Total		**900**	**850**

Silage prepared from maize, Napier, teosinte, sorghum and bajra Production = 30 Mt

These grasses were produced all the year round and supplemented to the cattle. Along with green grass sometimes silage and rice straw were also provided. Grasses were chopped by chaff cutter and supplemented to the cattle. Concentrate feed was provided all the year round. For maintenance level 2 kg concentrate given to individual cattle and for lactating animals "addition of 1kg concentrate for each 2 liter of milk production was given. Seven kg of concentrate feed was supplied to the pregnant animals during last two months ofpregnancy.

4.3 Milk and milk productsproduction

Table 40. Monthly Milk and milk products Production in the FY 2075/076

Month	Total Milk (ltr.)	Paneer (kg)	Khuwa (kg)	Ghee(kg)	Dahi(kg)
Shrawn2075	5050.9	-	-		-
Bhadra2075	7070.5	14.35	-		-
Aswin2075	8621.8	50.4	18.2		66
Kartik 2075	10917.6	35.68	29.5		-
Margh 2075	13017.4	13.05	18	5	
Poush 2075	13490.0	4.9	-		
Magh 2075	14707.4	20.1	-		
Falgun 2075	14069.0	51.9	-		29
Chaitra2075	14066.5	24.5	-		
Baisakh2076	14271.0	-	-		
Jestha2076	13422	5.45	3	3	99
Ashad 2076	13909	6.75	-		
Total	142613.05	227.05	65.70	8.00	194.00

Table 41. Calf Production and distribution in the FY 2075/076

Calf Production	Sex	Unit	Total
Jersey cross	M	No.	13
	F	No.	20
Holstein Friesian	M	No.	10
	F	No.	8
Lulu	M	No.	1
	F	No.	2
Terai	M	No.	1
	F	No.	0
Total		**No.**	**55**
Calf distribution	M	No.	8
	F	No.	0

WORKING GROUP MEETING ON CATTLE RESEARCH

Effective project proposal will be generated only when it is able to address the issues raised in different forum, meetings and discussions. Over the year, several issues regarding need of cattle research have been raised but not adequately transformed into researchable issues in the NCRP. Thus, National Cattle Research Program had a working group meeting on cattle research.

During the fiscal year 2075/76; dated on November 23rd, 2018 the first Working Group Meeting (WGM) on cattle research was organized in NCRP. For the purpose, Nepal Agricultural Research Council has been mandated to conduct research to enhance the production and productivity of livestock sector with the integrated effort on client oriented, problem based, participatory & systematic research and maintain the dynamism in livestock production system. In this first Working Group Meeting in Cattle Research, results of various research studies conducted on different discipline of cattle have been discussed. Working group meeting was focused different aspects of Cattle health, Production Management, Nutrition, Breeding, fodder and Pasture. Different messages from director, program coordinator, information of undergoing research in NCRP, past research in cattle, Research in Animal Nutrition Research Division, animal health division, animal breeding division, pasture and fodder division and future probable research topics on cattle were presented.

Activities

Started with Inauguration Session and formality was provided with Chairperson: Mr. Yamuna Kumar Shrestha (Director, NASRI),Chief Guest: Dr. Baidya Nath Mahato (ED, NARC) Special Guest: Dr. Tek Bahadur Gurung (Director, Livestock & Fisheries Research), Special Guest: Dr. Sita Ram Aryal (Director, Administration), Guest: Dr. Megh Raj Tiwari (Chief, Animal Nutrition Research Division), Guest: Dr. Shoyam Prakash Shrestha (Chief, Animal Health Research Division), Guest: Dr. Neena Gorkhali Amatya (Chief, Animal Breeding Research Division), Guest: Dr. Madhav Prashad Acharya (Coordinator, National Cattle Research Program), Guest: Mr. Purna Bhadra Chapagain (Chief, Pasture and Fodder Research Center).

1. Welcome Address & Objective of the meeting - Dr. Madhav Prasad Acharya
2. Technical Session

- Ongoing projects and next year planning of National Cattle Research Program -Mr. Buddhi Ram Acharya
- Past Research and present issues in cattle in Nepal -Dr. Yagya Raj Pandeya
- Presentation from Animal Breeding Division -Dr. Neena Gorkhali Amatya

-	Presentation from Animal Nutrition Division	-Dr. Megh Raj Tiwari
-	Presentation from Animal Health Research Division	-Dr. Shoyam Prakash Shrestha
-	Presentation from Pasture and Fodder Division	_
3.	Discussion	..
4.	Draft on Vision and Research Strategy in Cattle	-Dr. Madhav Prasad Acharya

5. TECHNOLOGY TRANSFER ANDSERVICES

Technology generated by the research has no meaning unless it has been extended to the farmers. Over the year, several outputs has been obtained by research but not adequately extended to the farmers. Therefore National Cattle Research program had a project to do the extension of technology generated by the program.

5.1 Training/workshops

In the fiscal year 2075/76 one village level workshop on cattle production and management was organized in Devdaha, Rupandehi. Total 25 people were participated in this program including farmers; ward President, Member of dairy cooperatives, government livestock officers &technicians. During the workshop major discussion was done on following topic: cattle nutrition, fodder pasture production, dairy product production & diversification, causes of infertility and its correction.Problem were prioritize in this workshop which help for the development research project in next year.

5.2 Service

Technical briefing to the farmers, students, extension officials, co-operatives, farmers group, NGOs were done on cattle husbandry practices. At least 3022 people were benefitted through our counseling and farm observation. Beside this, program distributes the high quality bulls as a seed animal to the farmers for the further multiplication of the superior quality progeny. Moreover, program also generously supply the clean and fresh whole milk continuously to at least 200 household for daily consumption and also some of the milk products like Khoa, Paneer, and Ghee to some of the households dwelling nearby its vicinity.

One Animal Health and Infertility Correction Camp was organized at Devdaha Rupandehi. General health examinations of animals presented at mobile camp was done and respective medicines were distributed to farmers for their animals. Animals with problem of infertility, repeat breeding and anestrus were in majority and they were treated accordingly. Pregnancy diagnosis of cattle was done using USG. Service was provided to commercial farmers having cattle more than 5.

5.3 Publication

Hundred copies of Annual Report 2074/75 were published.

6. OTHERACHIEVEMENTS

The details of staffs' involvement in different trainings were presented in the annex 6.1.

7. BUDGET ANDEXPENDITURE

The total annual budget and expenditure of the program for this fiscal year are provided in details in annex 7.1. However, the Program has been relocated recently in the new area there is the need of huge budget in the infrastructure development of the farm. Some of the infrastructure construction started in the previous year was completed this year and still there is the need of huge amount of resources required for the completion of different other infrastructures and laboratory set up. Along with details of the budget and expenditure of this fiscal year in the Annex 7.1. Detail of special project budget and expenditure, revenue status and beruju status of the program were mentioned in Annexes 7.2, 7.3 and 7.4respectively.

8. KEYPROBLEMS

The major problems of the programs are;

1. Inadequate scientific manpower and competent technicians as per the approved posts.
2. Lack of Experimental trial sheds for qualityresearch.
3. Insufficient staff quarters, Laboratory, working rooms and other physical facilities.
4. Tendency of encroachment of its land holdings for otherpurposes.
5. Poor mechanism for the dissemination of generatedtechnologies.
6. Lack of carrier development opportunities and encouragement for thestaff.

9. WAYFORWARD

1. Conduct various research programmes either in sole authority or in collaboration with other institution on production & management, nutrition, feeding, breeding and health care of bovine to enhance their production & productivity.
2. Identify the existing production & management system of livestock indifferent agro-ecological zones of Nepal for proper technological intervention.
3. Conduct farmer's field trial or on-farm research to demonstrate and disseminate the technologies for their wider adoption and adaptation Upgrade the native *zebu* cattle by strengthening AI facilities and distribution of upgraded breeding bulls to thefarmers.
4. Conduct research to mitigate the methane level to make dairy farmingmore environmental friendly.
5. Study on the cost of milk production to make dairy farming moreeconomic.
6. Maintenance and production of improved grasses for animal feeding, silage production and forage seed distribution to thefarmers.
7. Conduct research on Vaccine failure for different disease like Foot and Mouth disease, Hemorrhagic septicemiaetc.

Annexes

Annex1.1. MapofCommandArea

Annex 2.1. Map of the Office/Program

Annex 2.2. Lists of Laboratory Facilities

SN	Name of laboratory	Major instruments	Manpower in Laboratory	Testing facilities
1	Dairy Laboratory	Lacto-scanner, Khoa maker machine, Paneer vat, Sealing and filling Machine, Milk Pasteurizer (Batch Pasteurizer), Milk Analyser, Ice Cream Vat, Deep Freeze, Refrigerator, Cream Separator, Chilling Vat	Senior Technical Officer, J.T.A.	Milk Quality, Milk products production
2	AI Laboratory	AI Gun, Refree with liquid nitrogen, Estrus detector, USG, Liquid Nitrogen Mother Tank,	Senior Technical Officer, Technical Officer, J.T.A.	Pregnancy test
3	Health Laboratory	Microscopes, Incubator, Laminar flow, Autoclave, Water bath, Hot-air oven, Mastitis detector, Centrifuge, ELISA reader, Semi-Automatic biochemical analyzer, Hematocrit centrifuge, Deep Freeze	Scientist (S1), Technical Officer, J.T.	AST, Bacterial culture, Fecal examination, Biochemical Tests for mastitis, Different infectious diseases test, Serum analysis, PCV test
4	Nutrition Laboratory	Sox-holet apparatus, Muffle furnace, K-jeldhal apparatus, Fiber digester, Hot air Oven, Titration Unit	Scientist (S1), Technical Officer, J.T.	Estimation of crude protein, crude fiber, Ether extract, Ash, Dry matter

Annex 2.3. Human Resources in 2075/76 (2018/19)

S.N.	Name	Designation	Qualification	Specialization/Workingarea
1.	Dr Madhav Prasad Acharya	Coordinator/ Sen. Scientist (S3)	M.V.M. (Microbiology)	Veterinary Science
2.	Mr. Devi Prasad Adhikari	Senior Scientist (S3)	M.Sc.An.Sc.(LPPM)	LPPM
3.	Dr. Bodh Raj Baral	Scientist (S1)	M.Sc. An. Sc.(Nutrition and Fodder)	Pasture Forage and Agro-forestry
4.	Dr AnjayKumar Sah	Scientist (S1)	M.V.Sc.(Theiriogenology)	Animal Breeding andGenetics
5.	Mr. Shankar Raj Pant	Scientist (S1)	M.Sc. An. Sc.(Nutrition and Fodder)	Pasture Forage and Agro-forestry
6.	Dr Gita Pandey	Scientist (S1)	M.V.Sc.(Pharmacology)	Veterinary Science
7.	Mr. BuddhiRam Acharya	Senior TechnicalOfficer	M.Sc., An. Sc.(LPM)	LPPM
8.	Dr Yagya RajPandeya	Technical Officer	M.V.Sc.(Theiriogenology)	LPPM
9.	Dr. Chet RajPathak	Technical Officer	M.V.Sc.(Parasitology)	Veterinary Science
10.	Mr. HemSharma	Administrative	B.A	Administration
11.	Mrs. NandaKala Sapkota	Administrative	B.A	Administration
12.	Binod ChandraAdhikari	Account Officer	BCom, MA	Account
13.	Dr. Lila RamPathak	J.T. (T5)	B.V.Sc.&A.H	
14.	Dr. PratikHamal	J.T. (T5)	B.V.Sc.&A.H	
15.	Mr. SanjitNiraula	J.T. (T5)	B.Sc. Ag.	
16.	Mr. Kapur Bhusal	J.T. (T5)	B.Sc. Ag.	

S.N.	Name	Designation	Qualification	Specialization/Workingarea
17.	Mr. Prabin Sapkota	J.T. (T5)	I.Sc. Ag	
18.	Mrs. Tara Shahi	J.T.A. (T4)	J.T.A.	
19.	Mr. Chakra BahadurGhalan	J.T.A. (T4)	J.T.A., B.Ed.	
20.	Mr.Khadka Bahadur Khadaka	J.T.A. (T4)	J.T.A., 10+2	
21.	Dipendra Kathayat	J.T.A. (T4)	B. Sc. Ag.	
22.	Mrs. Lahani Tharuni	Lower Technician (LT1)		
23.	Mrs. Mitra Maya Gurung	Lower Technician	I.A	
24.	Mrs. Aasha Gurung	Lower Technician	IX	
25.	Mrs. Ambika Kafle	Lower Technician	VII	
26.	Mrs. Sushma Praja	Lower Technician	S.L.C	
27.	Mr. Dipendra Oja	Lower Technician (LT1)	IX	
28.	Mrs. Manju Rai	Lower Technician	10+2	

Annex 3.1. Summary progress of NARC Research Projects and Activities in 2075/76 (2018/19)

S.N.	Project/Activities	Project Leader	Annual Budget in Rs. '000'	Cummulative progress upto reporting month	Remarks
1	**696-Farm management project**	**Dr. M.P. Acharya**	**1453**		
1.1	Farm security (3)		410	Farm security well maintained	
1.2	Farm Maintenance (3)		530	well maintained	
1.3	Research support (Admin. Lab services etc) (3)		355	Completed	
1.4	Annual report publications and audio-visual documentary production (1)		50	Annual report published	
1.5	Livestock working group meeting (2)		108	Completed	
2	**384-Cattle herd managemant and production project.**	**Dr. M.P. Acharya**	**13963**		
2.1	Feeding of animals with appropriate roughage and concentrate. (3)		10255	Completed	
2.2	Health and infertility status of animal monitored bi-weekly(3)		685	Completed	
2.3	Vaccination and antihelmintics of animal in prescribed time frames. (3)		530	Completed	
2.4	Clean milk production (udder cleaning, utensils, teat Dipping etc. (3)		240	Completed	
2.5	Processing and distribution of clean milk(3)		140	Completed	
2.6	Product diversification (Paneer, Khoa, yoghurt and Ice cream) and its study on different consumer's acceptance(3)		210	227kg paneer, 194 litter dahi, 8 lit. Ghee and 65 kg khuwa were produced	

S.N.	Project/Activities	Project Leader	Annual Budget in Rs. '000'	Cummulative progress upto reporting month	Remarks
2.7	Heat stress management for farm animal during summer months(3)		210	Twice daily bathing of animals during summer months.	
2.8	Routine milk analysis. (3)		100	Fat 5.15%, SNF 8.85%, protein 3.23% and Lactose 4.86% were found	
2.9	Comparison of milking methods (Machine and hand milking (3)		257	Continued	
2.10	Introduction and evaluation of different forage for permanent pasture(3)		178	Stylo, setaria, signal, vetch, super napier, guatemala etc	
2.11	Seed production of major forage crops(3)		183	850 kg of oat and teosinte seed produced	
2.12	Production of green forage(3)		170	adequate green forage produced	
2.13	Study on hydroponic fodder production and use in dairy Animal(3)		170	hydroponic forage production and feeding continued	
2.14	Study on different agent to add value to silage (urea + molasses, probiotic culture, yeast etc. (1)		170	15 ton silage produced	
2.15	Routine recording of feeding and milk production (3)		110	Completed	
2.16	Maintenance of pedigree record and updating of data management(3)		90	Completed	
2.17	Effects of feeding milk replacer on body growth and its economic feasibility in dairy calves(3)		155	Trial completion 27 calves.	
2.18	Growth records of calves(3)		110	Completed	

S.N.	Project/Activities	Project Leader	Annual Budget in Rs. '000'	Cummulative progress upto reporting month	Remarks
3	**976-Status of haemoprotozoans in dairy cattle of Nepal**	**Dr. C.R. Pathak**	**752**		
3.1	Blood collection preparation of slide and storage -preparation of lymph node smears in clinically suspected cattle especially for Theileriosis -Wet blood examination for clinically suspected trypanosomiasis (3)		139	total of 100 blood samples were collected and respective blood smears were prepared and examined	
3.2	Rapid blood test in test kit (3)		134	Not feasible due to on availability of test kits	
3.3	Blood profile test (3)		108	Completed	
3.4	Molecular detection of different protozoa (3)		247	DNA extraction and PCR	
3.5	Treatment trail in positive animals: Buparvaquinone/Butalax for *Theileria*, Diminazine acetaurate/ Berenil for *Babesia* and OTC in case of *Trypanosoma* positive cases. (3)		124	treated based on symptoms	
4	**697-Study on existing situation of heat stress management of crossbred cattle in the dairy pocket area of the Terai region during the summer months.**	**Mr. B.R.Acharya**	**293**		
4.1	Selection of animal and preparation of research protocol and materials 3		30	20 Animal were selected	
4.2	Heat stress management trial conduct -3		119	20 animal in 4 group set in trial	
4.3	Blood parameter analysis -3		100	20 blood samples were collected and analysed	
4.4	Economic analysis of cost of production-2		44	Completed	

S.N.	Project/Activities	Project Leader	Annual Budget in Rs. '000'	Cummulative progress upto reporting month	Remarks
5	**850-Dairy product diversification and its economic feasibility study.**	**Mr. B.R.Acharya**	**230**		
5.1	Lab analysis of the products (3)		102	The crude protein and crude fat % of paneer (21.22& 11.28), khowa (14.28 & 7.53), dahi (5.54& 1.82) and rasbary (15.15 & 7.15) were found respectively	
5.2	Economic feasibility study of different products (3)		35	The cost of production of paneer, khowa, dahi and rasbary were found Rs. 445.44/kg, 242/kg, 72.78/L. and 8.03/piece respectively.	
5.3	Verification of different dairy products in farmers field/OR sites(2)		52	varified at Devadaha Rupendehi	
5.5	Adaptation of product diversification by farmers (3)		41	Completed	
6	**377-Identification of drug resistant bacterial pathogen and Development of effective control strategy to combat against mastitis**	**Dr. Gita Pandey**	**295**		
6.1	Site selection & Milk samples collection (3)		114	500 milk sample were collected	
6.2	General and specific media used to isolate bacterial species (3)		23	Different media were prepared	
6.3	Primary and secondary biochemical tests for further idenfication (3)		20	Different bio-chemical test were done	

S.N.	Project/Activities	Project Leader	Annual Budget in Rs. '000'	Cummulative progress upto reporting month	Remarks
6.4	Identified pathogens are inoculated and incubated into muller hinton agar (3)		19	Different pathogen inoculated and incubated intoMHA	
6.5	Antibiotic sensitivity test and zone of inhibition were used to identify antibiotic resistance according to CLSI guidelines (3)		14	Commonly used antibiotic disc were used for AST	
6.6	Post teat dipping in first group (3)		19	Post teat dipping trial was done in NCRP farm	
6.7	KMNO4 solution in second group (3)		20	Post teat dipping trial was done in NCRP farm	
6.8	Vaseline used in third group to seal the teat canal after milking (3)		21	Post teat dipping trial was done in NCRP farm	
6.9	Herbal treatment of mastitis (3)		45	turmeric ointment was used for treatment of mastitis	
7	**848-Evaluation of the local dairy cows by crossbreeding with exotic semen at NCRP, Rampur**	**Dr. M.P. Acharya**	**1104**		
7.1	Survey on Terai cattle production management (1)		35	Done at Rupendehi, Nawalparasi and Kapilbastu	
7.2	FGD upon need of Terai cattle or its crossbred (3)		70	Completed	
7.3	Breed Maintenance of Terai cattle and its crossbreds (3)		85	AI done in 10 cows and NI done in 10 cows	
7.4	Production management of Terai cattle and its crossbreds (3)		914	Completed	
8	**977-Assessment of major reproductive hormones in**	**Dr. YR Pandeya**	**1085**		

S.N.	Project/Activities	Project Leader	Annual Budget in Rs. '000'	Cummulative progress upto reporting month	Remarks
	cyclic and non- cyclic crossbred dairy cows				
8.1	Identification of cyclic and non-cyclic cows (1)		31	5 cyclic and 5 non-cyclic animal idenfied	
8.2	Assessment of major reproductive hormones (3)		996	progesterone, estrogen, FSH and LH hormone assesed	
8.3	Hormonal treatments in identified cyclic and non-cyclic cows (3)		55	Continued	
8.4	Fertility evaluation/examination (3)		3	Continued	
9	**849-Performance evaluation and development of forage production technologies in terai districts.**	**Mr. B.R. Acharya**	**299**		
9.1	Performance evaluation of nearly new perennial forage (3)		133	Completed	
9.2	Analysis of nutrient content of grasses (3)		138	Completed	
9.3	Economic analysis of forage production (3)		28	Completed	
10	**978-Screening of antibiotic residue in raw milk in dairy pocket area of Nepal**	**Dr. G. Pandey**	**498**		
10.1	Sample Collection(3)		95	200 milk samples were collected	
10.2	Survey of Antibiotics used for treatment of Livestock(3)		52	100 HH survey was done	
10.3	Detection of drug residue through bacterial growth inhibition methods(3)		74	Detection of drug residue through bacterial growth inhibition was done in collected samples	

S.N.	Project/Activities	Project Leader	Annual Budget in Rs. '000'	Cummulative progress upto reporting month	Remarks
10.4	Quantification of antibiotic residue in milk(3)		277	ELISA was done for quentification of antibiotic residue in collected milk samples	
11	**379-Verification of proven livestock technologies in OR sites**	**Dr.M.P. Acharya**	**1361**		
11.1	Evaluation of teat dipping in farmers management conditions (1)		146	Done at Devdaha and Madi	
11.2	Effectiveness of vaccination for major economic diseases and drenching against major internal and dipping/spraying for external parasites. (3)		105	Completed	
11.3	Health campaign (2)		265	Health campaign done at Devadaha	
11.5	Fortification of UMMB using sustained release urea (SRU) and probiotic cultures (3)		150	Done at Devdaha, Rupendehi	
11.6	Demonstration of silage making (3)		127	Done at Devdaha, Rupendehi	
11.7	Community forage and forage seed production(3)		165	50 Kg Amritdhara oat, 16 kg Bajra 18kgTeosinte and 20 kg sorghum seeds were distributed at Madi and Devdaha for seed production	
11.8	Travelling Seminar (3)		193	Travelling seminar were done at estern part of nepal	
11.9	Demonstration and making of milk product (3)		57	At Madi and Devadaha	

S.N.	Project/Activities	Project Leader	Annual Budget in Rs. '000'	Cummulative progress upto reporting month	Remarks
11.1	Village Level Workshop (1)		50	18 people (Farmer, Ward president and other) were participated and collected problem facing by farmer	
11.12	Use of improved/latest technologies in breeding practices (3)		103	At Madi and Devadaha	
12	**974-Development of Package of Practise for Yak/Chauries**	**Dr. Y.R. Pandeya**	**529**		
12.1	Household Survey (3)		71	Survey was done at Taplejung, Mustang, Rasuwa, Dolpa and Manang district in 21 household	
12.2	Fecal collection and examination (3)		76	243 fecal sample collected and examined	
12.3	Blood collection and serum analysis(3)		101	99 blood sample collected	
12.4	Milk collection and test of mastitis(3)		81	36 milk sample collected	
12.5	Test of brucellosis(3)		64	99 sample collected & preserved	
12.6	Test of FMD(3)		73	99 sample tested	
12.7	Test of TB(3)		63	99 sample collected & preserved	
13	**630-Holistic approach to improve fertility in crossbred dairy cattle of Chitwan, Nawalparasi and Rupandehi districts.**	**Dr. M.P. Acharya**	**810**		

S.N.	Project/Activities	Project Leader	Annual Budget in Rs. '000'	Cummulative progress upto reporting month	Remarks
13.1	Survey and Lab based Evaluation of the breeding practices - recording system, quality semen, access to skilled AI technicians, Timing of AI and pregnancy diagnosis practices(3)		103	Survey was also conducted in different 81 households of Chitwan, Nawalparasi and Rupandehi	
13.2	Evaluation of the incidence of the reproductive problems in relation to the housing and bio-security/sanitation management(3)		84	115 serum samples of infertile cattle from Chitwan, Nawalparasi and Rupandehi were tested for BVD and found to be 7.6% (7/92) positive and 184 serum samples of infertile cattle were tested for Chlamydiasis and found 2.71% (5/184) positive.	
13.3	Reproductive organs and hormonal assessment of the infertile dairy cows(3)		428	42 sera samples analyzed for 5 micro nutrients (Cu, Co ,Fe, Zn, Se)	
13.4	Assessment of the adoption of reproductive tools (use of USG, estrous detector and AI) in relation to improve fertility (3)		74	Completed	
13.5	Problem based correction and remedies intervened in holistic approach for infertility management (3)		103	Completed at three districts	
13.7	Publication(3)		18	Publishing in procceding	
14	**979-Multilocation trial at NCRP, Rampur,Chitwan**		**1283**		
14.1	Genetic evaluation of Lulu, Siri and Achhami cattle (3)		67	Completed	

S.N.	Project/Activities	Project Leader	Annual Budget in Rs. '000'	Cummulative progress upto reporting month	Remarks
14.2	Maintenance of Lulu cattle at NCRP farm(3)		742	Completed	
14.3	Feeding trial (3)		180	Completed	
14.4	Data collection (3)		46	Completed	
14.5	Data analysis and report writing(3)		46	Completed	
14.6	IET of winter and perennial forage crops (3)		75	Completed	
14.7	CVT of winter forage crops(3)		66	Different variety of Oat, Vetch and Berseem were sowed	
14.8	CVT of perennial forage crops(3)		61	Completed	

Annex 3.2. Summary Progresses of Special Research Projects and Activities in 2075/76 (2018/19)

Name of project/ activity	Project/Activity leader	Begin Year	End year	Budget allocated for this year	Major progress/ Achievements
Not any					

Annex 4.1. Production of (commodity/product) in FY 2075/76

SN	Commodity /Product	Variety/Breed	Type (Breeder/Foundation/ Blood level)	Unit	Target Quantity	Produced Quantity
1	Calves	Jersey Cross, Holstein cross	-	No.	-	55
2	Grasses	Green grasses	Annual and Perennial	Mt.	-	850
3	Milk	Whole milk		Lit.	-	**142613.05**
4	Paneer		-	Kg	-	227.05 kg
5	Khoa	-	-	Kg	-	65.7kg
6	Ghee	-	-	Kg	-	8lt
7	Dahi	-	-	Kg	-	194lt
8	Ice cream					-
7	Silage	-	-	Mt.	-	35
8	Manure	-	-	Kg	-	

Annex 4.2. Distribution of (commodity/product) in FY 2075/76

S.N.	Commodity/Product	Type	Quantity	Major stakeholders	Distributed district
1	Male Calf	Jersey cross, Holstein cross	8	Farmers, office	Chitwan & Rupandehi
2	Seeds	Teosinte	350 kg	Farmers, Offices	Chitwan & Rupandehi
		Oat	500 kg		

Annex 5.1. Training/Workshop/Seminar Organized in FY 2075/76 (2018/19)

S. N.	Name of Training/ Workshop/ Seminar	Duration	Target group	Location	No. of Participants
1.	Working Group Meeting	1 day	Scientists and Technical officer	NCRP, Rampur	15
2.	Village level workshop on Cattle production and management	1 day	Farmers and Government Technician	Devdaha, Rupandehi	25

Annex 5.2. Services Provided in FY 2075/76 (2018/19)

SN	Laboratory/field test/ counseling services Provided	Numbers	Major clients
1.	Farm Observation and technical briefing to Farmers	3022	Farmers, students, Entrepreneurs, Extension officials, NGOs

Annex 5.3. Publications in FY 2075/76 (2018/19)

SN	Name of publications	Type	Language	Authors	No. of copies
1	Annual Report 2074/075	Book (Revised)	English	NCRP	100

Annex 5.4. Information Disseminated Through Media in FY 2075/76 (2018/19)

SN	Information disseminated/Media Coverage	Type	Name/ Type of Media	Date
	गाईको सट्टामा भ्रुण ल्याउन उपयुक्त हुने विज्ञको सुझाव	National News	Halo Khabar. Com	2075-12-3
1	चितवनमा पहिलो पटक गाईमा भ्रुण प्रत्यारोपण	National News	Halo Khabar. Com	2075-12-29
2	६० परिवारलाई गोबर ग्यास	National News	Kantipur	2076-2-19
3	गाईको सट्टामा भ्रुण ल्याउन उपयुक्त हुने विज्ञको सुझाव	National News	Halo Khabar. Com	2075-12-3
4	कृषि कार्यक्रम	National Television	NTV +2	

Annex5.5. Visits of the Office/Station by Farmers, Extension Officials/Technicians, Entrepreneurs, Cooperatives, Farmer Groups, NGO/CBO Officials etc.

SN	Category	Number	Districts	Area of major Interest
1	Farmers	721	Various District of all over the country	Cattle raising and farm visit
3	Extension officials	97	Kathmandu, Lalitpur, Pachthar, Rukum	Cattle husbandry Practices
4	NGOs officials	44	Pyuthan, Rasuwa, Gorkha, Gulmi, Janakpur	Cattle husbandry Practices
5	Student And Instructor	2160	Nepal Poly-technique Institute and other Technical Schools	Farm visit, Cattle husbandry practices
	Total	3022		

Annex 6. Training/Workshop/Seminar Attended by Staff in FY 2075/76 (2018/2019)

SN	Name of staff	Position	NameofTraining/ seminar/workshop	Duration	Place/ Country	Organizer
1.	Dr. Madhav Prasad Acharya	S3	Summer School	076/02/27-31	Khumaltar	NASRI,
2.	Mr. Devi Prasad Adhikari	S3	Summer School	076/02/27-31	Khumaltar	NASRI
3.	Dr. Gita Pandey	S1	Statistical Analysis Training for Scientist & Technical Officers	2075/12/27-30	Khumaltar	NASRI
4.	Dr. Gita Pandey	S1	Proposal Writing Trianing	2075/09/11-12	NWRP, Bhairahawa	NARC
6.	Mr. Buddhi Ram Acharya	T7	Statistical Analysis Training for Scientist & Technical Officers	2075/12/27-30		NASRI
7.	Mr. Buddhi Ram Acharya	T7	Applied training on data recording & management of Cattle & Goats for Scientist & Officers	2076/01/27-30	RARS, Lumle	NASRI
8.	Dr. Chet Raj Pathak	T6	Proposal Writing Trianing	2075/09/11-12	NWRP, Bhairahawa	NARC
9.	Dr. Chet Raj Pathak	T6	Applied training on data recording & management of Cattle & Goats for Scientist & Officers	2076/01/27-30	RARS, Lumle	NASRI,
10.	Dr. Yagya Raj Pandeya	Technical Officer (T-6)	workshop on epidemiology, data analysis and health policy	27-31 August, 2018	Sauraha, Chitwan	Feed the Future, USA
11.	Dr. Yagya Raj Pandeya	Technical	Training course in research design	3-14 September 2018	Rampur, Chitwan	University of Florida

SN	Name of staff	Position	NameofTraining/ seminar/workshop	Duration	Place/ Country	Organizer
		Officer (T-6)	and biostatics in R			&Agriculture and Forestry University
12.	Dr. Yagya Raj Pandeya	Technical Officer (T-6)	Research proposal writing	13-15 February, 2019	Khumaltar, Lalitpur	NASRI, NARC
13.	Dr. Yagya Raj Pandeya	Technical Officer (T-6)	Applied training on data recording and management for scientists and officers; Component-Poultry Research	27-29 April, 2019	Khumaltar, Lalitpur	NASRI, NARC
14.	Dr. Yagya Raj Pandeya	Technical Officer (T-6)	Biostatics in R, Refresher training	11-15 July, 2019	Rampur, Chitwan	University of Florida & Agriculture and Forestry University
15.	Dr. Yagya Raj Pandeya	T6	Applied training on data recording & management for Scientist & Officers component- Poultry research Statistical Analysis Training for Scientist & Technical Officers	14-16/1/2076 27-		NASRI,
16.	All Scientist & Technical Officers (7 staff)	S3/S1/T7/T6	11th National Workshop on Livestock & Fisheries in Nepal.	2076/3/1-2.	NASRI, Khumaltar	NASRI,

SN	Name of staff	Position	NameofTraining/ seminar/workshop	Duration	Place/ Country	Organizer
17.	Mr. Prabin Sapkota	T5	Experirmental design & Data recording training to non officers	1-5th june, 2019	RARS, Tarahara	NASRI,
18.	Mr. Kapur Bhusal	T5	Experirmental design & Data recording training to non officers	1-5th june, 2019	RARS, Tarahara	NASRI,
19.	Mr. Khadka Bd Khadka	T4	Experirmental design & Data recording training to non officers	1-5th june, 2019	RARS, Tarahara	NASRI,
20.	Mr. Chakra Ghalan	T4	Experirmental design & Data recording training to non officers	1-5th june, 2019	RARS, Tarahara	NASRI,

Annex 7.1. Regular Annual Budget and Expenditure Record of FY 2075/76 (2018/19)

CURRENT EXPENSES				
Code no	**Budget Heads**	**Annual budget(NRs.)**	**Expenses(NRs.)**	**Balance(NRs.)**
21111	Staff Basic Salary	14323000.00	9451456.50	4871543.50
21113	Staff Dearness Allowance	594000.00	593032.00	968.00
21119	Other Allowance	75000.00	26250.00	48750.00
21121	Staff Uniform Expenses	278000.00	230000.00	48000.00
22111	Water and Electricity Cost	800000.00	788368.12	11631.88
22112	Communication Expenses	300000.00	270377.40	29622.60
22121	House Rent	360000.00	0.00	360000.00
22211	FuelandLubricant(Vehicle)	550000.00	545499.05	4500.95
22212	Repairs & Maintenance Cost	1440000.00	1321499.00	118501.00
22213	Insurance	210000.00	96970.30	113029.70
22311	Office Expenditure	1200000.00	850615.61	349384.39
22312	Livestock feed Expenditure	10001000.00	8230917.00	1770083.00
22313	BooksandMaterialsCost	100000.00	99998.00	2.00
22314	Fuel(forotheruse)	124000.00	120259.00	3741.00
22321	Public Property Repairs & Maintenance	400000.00	393390.00	6610.00
22412	Miscellaneous service Expenses	875000.00	874492.00	508.00
22512	Training/Workshop	200000.00	152535.00	47465.00
22521	Production Materials Cost	10329000.00	9981350.63	347649.37
22521	Labor cost	4950000.00	4912444.00	37556.00
22521	Lab Equipment	2924000.00	2671359.54	252640.46
22521	Farm Equipment	2455000.00	2397547.09	57452.91
22611	Monitoring and Evaluation	670000.00	517020.00	152980.00
22612	Travel Expenses	2205000.00	2201631.00	3369.00
22711	Miscellaneous Expenses	300000.00	299640.00	360.00
	TOTAL	45334000.00	37045300.61	8288699.39

CAPITAL EXPENSES				
Code No.	**Budget Heads**	**Annual budget(NRs.)**	**Expenses(NRs.)**	**Balance(NRs.)**
29221	Building and construction cost	5000000.00	4988781.25	11218.75
29231	Capital maintenance expenditure	1000000.00	949354.00	50646.00
29311	Furniture and Fixture cost	300000.00	295986.00	4014.00
29411	Vehicle	0.00	0.00	0.00
29511	Machinary Equipment	2300000.00	1850343.27	449656.73
29611	Public Construction Expenditure	7500000.00	7477463.00	22537.00
	Total	**16100000.00**	**15561927.52**	**538072.48**

Annex 7.2. Special Project Budget and Expenditure of FY 2075/76(2018/19)

(In '000 Nepalese Rupees)

Name of the project	Funded by	Project period	Annual budget	Expenses

Annex 7.3. Revenue Status of FY 2075/76(2018/19)

(In Nepalese Rupees)

S.N.	Sources of Revenue	Revenue Collected (NRs)
1	Milk, milk products, calves, Manure	7730790.90
2	Administrative Service	58200.00
3	Forage seeds	51900.00
4	Others	113259.40
	Total	**7954150.30**

Annex 7.4. Beruju Status of FY 2075/76(2018/19)

Beruju	Amount (NRs 000)	Remarks
Beruju till2061	1494.87	
Beruju from 2060/61 to till 070/71	10213.64	
Beruju from 2071/72	2186.257	
Beruju cleared this year	1146.334	
Beruju till 2073/74	12768.857	
Beruju cleared this year	24.9316	
Beruju till 2074/75	12,723.504	
Beruju cleared this year	212.307	
Remaining Beruju	12,511.196	

Annex 7.5. Human Resources Chart at NCRP

SN	Post	Group	Number of post	Post fulfilled	In	Out	Vacant Post
1	Principal Scientist	LPPM	1	0	0	1	0
2.	Senior Scientist	LPPM	1	0	2	1	0
3.	Scientist	LPPM & AB	3	0	2	2	1
4	SeniorTechnicalOfficer	LPPM	1	1	0	0	0
5	Technicalofficer	LPPM, Veterinary and PFAF	4	2	0	0	2
6	Accountofficer	Admin & Finance	1	1	0	0	0
7	Admin officer	Admin	2	2	0	0	0
8	J. Technician		5	3	0	0	2
9	Technical Asst		4	4	0	0	0
10	Technical Helper	-	12	7	0	4	1
11	Admin helper	Admin	1	0	0	0	1
12	Driver Heavy	Admin	1	0	0	1	0
13	Driver light	Admin	1	0	0	1	0
	Total		**37**	**20**	**4**	**10**	**7**

Note: Some Personnel were in on deputsation and in and out during the 2075/76.