

Annual Report

2080/81 (2023/2024)



Government of Nepal

Nepal Agricultural Research Council



National Cattle Research Program

Rampur, Chitwan, Nepal

2024

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Citation:

NCRP, 2024. Annual Report 2080/81 (2023/24). National Cattle Research Program,
NARC, Rampur, Chitwan, Nepal.

Editor:

NCRP, Rampur

Cover Page Photo:

Office building of National Cattle Research Program, Rampur, Chitwan

FOREWORD

National Cattle Research Program (NCRP) has been mandated for research on cattle breeding, cattle health, cattle production & management, cattle nutrition and cattle pasture/fodder to improve the production and productivity of cattle reared in Nepal. This report presents an overall glimpse of National Cattle Research Program (NCRP) and concise information on developed technology by NCRP on different aspects of cattle farming to improve efficiency and make cattle farming a more profitable business. Present data shows that dairy sector contributes 33% and 8% of AGDP and GDP respectively (CASA Nepal, 2020). Within the dairy sector cattle contribute 42.8% and buffalo contributes 57.2% of total 2479899 metric tons of milk produced in the country (MoALD, 2079). According to FAO, annual milk demand per person is 92 liters per annum for Nepal whereas availability is just 72 liters per annum only (CASA Nepal, 2020), Which shows high supply gap.

In this FY 2080/81 some activities have been conducted which can be useful in the farmer's field. This year we conducted research work related to cattle breed development for tropical and sub-tropical region of Nepal. Similarly, Study of non-genetic factors influencing milk yield and its composition in Jersey and Holstein crossbreed cattle. Inception of selection index values and improved reproductive technologies for genetic improvement of dairy cattle for overall genetic merit. Assessment of probiotics strains on the health and productive parameters of dairy cattle in Chitwan conditions. Participatory approach for improving Yak and Chauries production and productivity in Nepal, four multilocation projects namely field experiment on Egyptian clover, evaluation of forage and fodder crops and evaluation of teosinte for genetic diversity and agronomic traits under different sowing dates, evaluation of maize varieties for fodder and silage production in Terai region of Nepal were carried out.

Our cattle herd is also associated with Dairy Cattle Improvement Program (DCIP) headed by NLBO, Pokhara. Adoption of the exotic semen in the NCRP farm received from NLBO for the further multiplication was helpful to produce the high-quality female calves for the replacement in the NCRP farm. Similarly, NCRP has special project SAPLING – by ILRI Nepal, also another project related to methane emission in cattle in collaboration with Heifer International Nepal and ILRI. Collaborative work with ADRA Nepal has been undertaken in TERA project.

In the near future we have envisioned the establishment of satellite research station in mid hill and high hill as well, center of excellence for dairy research, and developing NCRP farm as a model resource farm.

This report is the outcome of the untiring efforts of all NCRP team and supporting hands from outside. I would like to thank all the staffs of NCRP. I am thankful to Dr. Uddhav

Paneru for his efforts in editing this annual report. Similarly, I express my gratitude to Dr. Shiva Hari Ghimire, Mr. Bishnu Bahadur KC, Mr. Yagya Raj Pandeya, Mrs. Durga Rawat, Dr. Pratik Hamal and other supporting staff including admin/finance.

Finally, I am sincerely thankful to the management team of NARC for their support in implementing the program smoothly. I am very much indebted to ED of NARC Dr. Dhoj Raj Khanal for their continuous support, motivation & guidance. I am very much thankful to Dr. Neena Amatye Gorkhali (Director of NASRI) and other directors of NARC for their guidance and support. Likewise support from the NASRI, research centers under NASRI, other institutions within and outside NARC are gratefully acknowledged for their collaboration and partnership with us during the year. Especially NMRP Rampur, AFU Rampur, DoAR Lumle, VHLEC Chitwan are appreciated.



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Date: 20 January, 2025

ABBREVIATIONS

&	: and
@	: At the rate of
μ	: micro
A.I.	: Artificial Insemination
AD	: Anno Domini
ADS	: Agriculture Development Strategies
AFU	: Agriculture & Forestry University
AGDP	: Agricultural Gross Domestic Product
APP	: Agriculture Perspective Plan
AST	: Antibiotic Sensitivity Test
B. Sc. Ag.	: Bachelor of Science in Agriculture
B.Ed.	: Bachelor of Education
B.S.	: Bikram Sambat
B.V.Sc. & A.H.	: Bachelor of Veterinary Science and Animal Husbandry
BQ	: Black Quarter
BT	: Body Temperature
CBS	: Central Beuro of Statistics
CF	: Crude Fiber
cm	: Centimetre
CMT	: California MastitisTest
CP	: Crude Protein
DCIP	: Dairy Cattle Improvement Program
DCP	: Di calcium phosphate
DDC	: Dairy Development Corporation
DLS	: Department of Livestock Services
DLSO	: District Livestock Service Office
DM	: Dry Matter
ELISA	: Enzyme Linked Immuno Sorbent Assay
FAO	: Food and Agriculture Oraganization
FMD	: Foot and Mouth Disease
FY	: Fiscal Year

g	: gram
GM	: Green Matter
GDP	: Gross Domestic Product
GHP	: Good Husbandry Practise
ha	: Hectare
HF	: Holstein Friesian
HS	: Haemorrhagic Septicaemia
IAAS	: Institute of Agriculture and Animal Science
INGO	: International Non - Governmental Organization
J.T.	: Junior Technician
J.T.A.	: Junior Technical Assistant
Kg	: Kilogram
L/lit.	: Litre
LPPM	: Livestock Product Production and Management
m	: meter
M.Sc.An.Sc.	: Master of Science in Animal Science
MDR	: Multiple Drug Resistant
Min.	: Minute
ml	: mililiter
mm	: millimetre
MoAC	: Ministry of Agriculture and Cooperatives
MoALD	: Ministry of Agriculture and Livestock Development
MoF	: Ministry of Finance
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
NLBO	: National Livestock Breeding Office
NMRP	: National Maize Research Program

NPK	: Nitrogen, Phosphorus and Potash
oC	: Degree Centigrade
oF	: Degree Farenhright
OR	: Out-Reach
PCR	: Polymerase Chain Reaction
PCV	: Packed Cell Volume
RCBD	: Randomized Complete Block Design
Rs.	: Rupees
SCM	: Sub Clinical Mastitis
SNF	: Solid Not Fat
SPSS	: Statistical Package for Social Science
UMMB	: Urea Molasses Mineral Block
USG	: Ultrasonography
WHO	: World Health Organization

TABLE OF CONTENTS

FOREWORD	iii
ABBREVIATIONS	v
संक्षिप्त वार्षिक प्रतिवेदन	xiii
EXECUTIVE SUMMARY	xv
1. WORKING CONTEXT	1
2. INTRODUCTION	3
2.1 Background	3
2.2 Goal	3
2.3 Vision	3
2.4 Mission	4
2.5 Mandate	4
2.6 Objectives	4
2.7 Achievements	5
2.8 Strategies	6
2.9 Current thrust area for research	6
2.10 Infrastructure and facilities	7
2.11 Organizational structure and human resources	9
3. RESEARCH HIGHLIGHTS	10
3.1 Cattle Breeding	10
3.1.1 Cattle breed development for tropical and sub tropical region of Nepal	10
3.1.2 Maintenance of different blood level of terai crossbreds	11
3.1.3: Productive and reproductive performance of cattle evaluated on station	12
3.2 Inception of selection index values and improved reproductive technologies for genetic improvement of dairy cattle for overall genetic merit	12
3.2.1: Selection of farmers	13
3.2.2: Examination of the health status of animals	13
3.2.3: Selection and tagging of the animals	14
3.2.4: Data recording and collection of milk sample	14
3.2.5 Analysis of the milk sample	15
3.2.6: Data entry, modelling and analysis	15
3.2.7: Estimating EBVs of animals and support of high genetic merit semen to farmers to inseminate their outstanding animals	16

3.2.8 Application and evaluation of different estrus detection methods	16
3.2.9 Ovarian dynamics study of cows	16
3.2.10 Evaluation of different estrus synchronization protocols in cows	16
3.2.11 Application of embryo transfer technique	16
3.2.12 Results:	17
3.2.13 Application and selection different estrus detection methods	18
3.2.14 Evaluation of different estrus synchronization protocols in cows	18
3.2.15 Ovarian dynamics study in cows	19
3.3 Participatory approach for improving Yak and Chauries production and productivity in Nepal	19
3.4 Evaluation of silage feeding on health and reproductive and productive parameters of growing heifers' cattle in Chitwan conditions	22
3.4.1 Introduction	22
3.4.2 Performance evaluation of silage on growing heifers' cattle	24
3.5 Cattle production and management	26
3.5.1 Introduction	26
3.6 Effect of different probiotics strains in milk composition, milk yield and nutrient digestibility in dairy cattle at NCRP, Rampur, Chitwan	28
3.7 Outreach research project	30
3.7.1 Background	30
3.7.2 Adaptation of teat dipping in farmers management condition	31
3.7.3 Health campaign	32
3.7.4 Transfer of technology related to cattle breeding and reproduction	33
3.7.5 Vaccination, drenching and dipping	33
3.8 Farm management and production project	33
3.8.1 To implement the activities of good husbandry practices to produce clean milk (Breeding, health, nutrition)	34
3.8.2 Disease prevalence related to infertility on station and on farm	35
3.8.3 Outbreak investigation on station and on farm	36
3.8.4 Assessment of heat stress in different cattle breeds (Terai, exotic and Terai crossbreds) in sub-tropical	36
3.8.5 Fodder and forages seed production	37
3.8.6 Silage production for feeding cattle	37
3.8.8 Nutritional management with appropriate proportion of concentrate and roughage	37
3.8.9 Milk and milk product preparation and quality analysis	38
3.8.10 Maintenance and proper use of bio-gas plant	38
3.8.11 Routine milk analysis	38
3.8.12 Product diversification	38

3.8.13 Introduction and evaluation of different forage for permanent pasture	39
3.8.14 Field gene bank management	39
3.8.16 Coordination and collaboration	39
3.8.17 NARC Day, milk day celebration	39
3.8.18 Maintenance of herd book	41
3.8.19 Vaccination for major economic diseases, drenching against major internal and spraying for external parasites	41
3.8.20 Health campaign to monitor health and infertility of cattle	41
3.8.21 Collaborative/Support Research Highlights	42
4. PRODUCTION	43
4.1 Cattle Production Program	43
5. Technology Transfer and Services	45
5.1 Training/Workshops	45
5.2 Service	45
5.3 Publication	46
5.4 Research Publication	46
5.5 Papers in Submission/Review for publication	48
6. OTHER ACHIEVEMENTS	49
7. BUDGET AND EXPENDITURE	49
8. KEY PROBLEMS	49
9. WAY FORWARD	49
Annexes	50

LIST OF TABLES

S.N.	Name of Table	Page No.
1	Cattle population and milk production trend in Nepal	1
2	Land utilization patterns at NCRP, Rampur, Chitwan	7
3	Productive performances of cattle in NCRP, Chitwan, Nepal	12
4	Reproductive performances of cattle in NCRP, Chitwan, Nepal	12
5	Estimated breeding values of cattle for milk yield and ranking of cattle based on genetic potential for milk production	17
6	Average milk composition of 36 Naks from Mustang district	21
7	Average body weight (BW) and body weight reduction test (BWRT) percentage in heifer at NCRP, Rampur, Chitwan	25
8	Hierarchical regression analysis of non-genetic factor on milk yield	28
9	Average milk yield and milk composition of treatments groups	29
10	Environmental conditions in NCRP, Rampur	37
11	Average milk composition of NCRP cows in the fiscal year 2080/81	38
12	Herd composition of cattle at the beginning and the end of fiscal year 2080/81	43
13	Monthly milk and milk products production in the FY 2080/81	43
14	Calf production in the 2080/81	44

LIST OF FIGURES

S.N.	Name of Figure	Page No.
1	Organizational structure of NCRP, Rampur, Chitwan	9
2	Activites at Animal Health Camp Devdaha, Rupandehi	42
3	Participants of one day cattle and buffalo research workshop in Rampur	45

LIST OF ANNEXES

S.N.	Name of Annexes	Page No
1.1	Map Showing Site of NCRP Office	50
1.2	Map Showing Areas of NCRP in Rampur, Chitwan	50
2.1	List of Laboratory Facilities	51
2.2	Human Resources in 2079/80 (2022/23)	52
3.1	Summary of NARC Research Projects in FY 2079/80 (2022/23)	53
3.2	Summary Progress of Special Research Projects and Activities in 2079/80 (2022/23)	63
4.1	Production of Commodity/Product in FY 2079/80 (2022/23)	64
4.2	Distribution of Commodity/Product in FY 2079/80 (2022/23)	64
5.1	Training/Workshop/Seminar Organized in FY 2079/80 (2022/23)	65
5.2	Services Provided in FY2079/80 (2022/23)	65
5.3	Publications in FY 2079/80(2022/23)	65
5.4	Information Disseminated Through Media in FY 2079/80(2022/23)	66
5.5	Visits of the Office/Station by Farmers, Extension Officials/ Technicians, Entrepreneurs, Cooperatives, Farmer Groups, NGO/ CBO Officials etc.	66
6.0	Training/Workshop/Seminar Attended by Staffs in FY 2079/80 (2022/23)	67
7.1	Regular Annual Budget and Expenditure Record of FY 2079/80 (2022/23)	68
7.2	Special Project Budget and Expenditure of FY 2079/80 (2022/23)	69
7.3	Revenue Status of FY 2079/80 (2022/23)	71
7.4	Beruju Status of FY 2079/80 (2022/23)	71
7.5	Human Resources Chart at NCRP	72

सङ्क्षिप्त वार्षिक प्रतिवेदन

नेपाल कृषि अनुसन्धान परिषद् अन्तर्गतका विभिन्न बाली वस्तु अनुसन्धान कार्यक्रमहरूमध्ये राष्ट्रिय गाई अनुसन्धान कार्यक्रम पनि एक हो। राष्ट्रिय गाई अनुसन्धान कार्यक्रमले किसानको आवश्यकता अनुसार गाईको उत्पादन र उत्पादकत्वसम्बन्धी अनुसन्धानको नेतृत्व लिइरहेको छ। नेपालको सन्दर्भमा मुख्यतया दूध उत्पादन, बहर/गोरुलाई जोत्न र गाडा तान्न, खेतबारीमा मलका साथै धार्मिक एवम् सांस्कृतिक महत्त्वका दृष्टिकोणले गाईपालन हुँदै आएको छ। नेपाल सरकारका विभिन्न आयोजनाहरूमा पनि गाई प्रबर्द्धनका लागि आवश्यक पर्ने प्रविधि विकासले प्राथमिकता पाएको छ। नेपाल सरकारका योजनाहरूमा दुग्ध उत्पादन, प्रशोधन तथा बजार व्यवस्थापनजस्ता कार्यहरू प्राथमिकतामा परेका छन्। नेपाल कृषि अनुसन्धान परिषद्ले आफ्नो स्थापनाकाल वि.सं. २०४८ सालदेखि नै गाईपालन प्रबर्द्धनका लागि आवश्यक प्रविधि विकास गर्न अल्प, मध्य, तथा दीर्घकालीन नीति लिएर अनुसन्धानमूलक विभिन्न कार्यक्रम सञ्चालन गर्दै आएको छ।

लक्षित प्रतिफलका लागि आ.व. २०८०/८१ मा सञ्चालित विभिन्न अनुसन्धान परियोजनाहरूको प्रतिफल, उत्पादन र प्रचार/प्रसार कार्यहरूको उपलब्धि यो वार्षिक प्रतिवेदनमा उल्लेख गरिएको छ। कार्यक्रममा खास गरी अनुसन्धान र उत्पादन गतिविधिहरू सञ्चालनमा ल्याइएको थियो। अनुसन्धान कार्यहरू जसमा: स्थानीय तराई जात र उन्नत जातका गाईको वर्णशङ्करको विकास र अध्ययन। जसमा अहिलेसम्म पहिलो र दोस्रो पुस्ता जन्मिएको र उनीहरूको उत्पादकत्व र प्रजनन क्षमताको अध्ययन भैरहेको छ। तराई, तराई जर्सी क्रस, तराई होलिस्टेन क्रसको औसत दूध उत्पादन 0.6 ± 0.2 , 4.50 ± 2.12 , 4.70 ± 2.02 लि. पाइयो र गाईको दूध दुने अवधि 97 ± 60 , 264 ± 99.62 , 296 ± 13.43 दिन पाइयो। यो सँगै तराई, तराई जर्सी क्रस, तराई होलिस्टेन क्रसको प्रतिवेत दूध उत्पादन 97 ± 60 , 1344 ± 97.46 , 1645 ± 313.9 लि. पाइयो।

अर्को अनुसन्धान परियोजना अन्तर्गत जर्सी र होलिस्टेन वर्णशङ्कर गाईहरूमा दूध उत्पादन र दूधको संरचनामा असर गर्ने विभिन्न आनुवांशिक बाहेकका तत्त्वहरूको अध्ययन गरिएकोमा गाईको दूध दुने तरिका, दूध दूधाको अवस्था, बेत, मौसमी सिजनले दूध उत्पादन र दूधको संरचनामा महत्त्वपूर्ण प्रभाव पार्ने देखियो।

नेपालमा पाइने गाईहरूको आनुवांशिक सुधारका लागि चितवन र नवलपरासी जिल्लाका ५५० गाईहरूको उत्पादन र प्रजनन क्षमताको तथ्याङ्क लिई, विश्वभरिमा सर्वमान्य ब्लुप (BLUP), विधिबाट आनुवांशिक क्षमताको आधारमा ५५० गाईहरूको उत्पादन र प्रजनन क्षमता पत्ता लगाई उच्च नस्लका गाईहरू छानिएका छ।

चितवन क्षेत्रमा रहेका गाईहरूको स्वास्थ्य र उत्पादनमा प्रोबाओटिक्स खुवाउँदाको अध्ययन । रगतको नमुना सङ्कलनका साथै डाईजेसटिबिलिटी ट्रायल गरिएको र डाईजेसटिबिलिटी ट्राइलपछि गोबरको नमुना पनि सङ्कलन गरिएको । उक्त अध्ययनबाट गाईहरूलाई प्रोबाओटिक्स खुवाउँदा गाईको दूध उत्पादन बढेको पाइयो । याकको रगतको नमुना लिई परीक्षण गरिएकोमा याकमा विभिन्न परजीवीहरूको मात्रा ३३% पाइयो ।

- यस वर्ष यस अनुसन्धान कार्यक्रमको फार्ममा ५१ वटा बाच्छा-बाच्छी जन्मिए त्यसैगरी १३४२३३.५ लिटर दूध, ६०९.८ केजी पनिर, ९६ केजी खुवा, २१५ लिटर दही, २.४ केजी घ्यू उत्पादन भयो ।
- दूधको फ्याट, प्रोटीन, एसएनएफ, ल्याक्टोज क्रमसँग ५.१%, ३.२७%, ८.८५% र ४.८९% रहेको पाइयो ।
- बहुवर्षीय घाँसहरू जस्तै नेपियर, इस्टाईलो, सेटारिया, सिम्ल, मुलाटो, पारा घाँसहरू लगाइयो र पछि काटेर गाईहरूलाई खुवाइयो ।
- त्यसै गरी यस आर्थिक वर्षमा १६४२ भन्दा बढी किसान, विद्यार्थी तथा सम्बन्धित सरोकारवालाहरूलाई फार्म भ्रमण/अवलोकन तथा गाईपालनसम्बन्धी जानकारी प्रदान गरियो साथै यसै वर्षमा हरिहरपुर गढी गाउँपालिकाको करकरेमा पशु-स्वास्थ्य तथा बाँझोपन निवारण घर दैलो शिविर सञ्चालन गरियो, जसमा गाईहरूको साथै अन्य पशु वस्तुहरूको उपचार र परामर्श सेवा प्रदान गरिएको थियो ।
- गाई, बाछी र गोरुहरू गरी एकसाठी वटा पशुवस्तुहरू न्यूनतम मूल्यमा किसानलाई बिक्री वितरण गरियो ।
- यो आर्थिक वर्षको राजस्व सङ्कलन रु. ९०,०३५,९२९ रहेको छ । गाईको दूध र दुग्ध पदार्थ बिक्रीबाट जम्मा रु. ८,७४४,२६० राजस्व सङ्कलन भयो । प्रशासनिक कार्यक्रमबाट रु. २९१,६६८ राजस्व सङ्कलन भयो ।
- राष्ट्रिय गाई अनुसन्धान कार्यक्रममा अझै पनि पूर्वाधार तथा भवनहरू निर्माणाधीन अवस्थामा रहेका छन् । हालसम्म पाँच वटा गाईगोठ, १ वटा बाच्छा बाच्छीको गोठ, १ वटा दूध तथा दुग्ध पदार्थ बिक्री कक्ष, १ वटा मेटाबोलिक क्रेटसहितको गोठ, १ वटा बहर गोठ, १ वटा हे बार्न, १ वटा पराल राख्ने घर निर्माण भएका छन् । १ वटा प्रयोगशाला भवन निर्माण भए पनि पूर्णरूपमा सञ्चालन हुन बाँकी रहेको छ । त्यसै गरी २०० घन मिटर क्षमताको बायो ग्यास निर्माण भई सञ्चालनमा रहेको छ ।

EXECUTIVE SUMMARY

National Cattle Research Program (NCRP) is one of the leading commodity programs under the Nepal Agricultural Research Council (NARC), located at the central part of Nepal. Dairy cattle are highly valued in Nepal as a source of milk, manure and draught with high religious and cultural value. Dairy is prioritized by Agriculture Development Strategies (ADS) and other national periodic plans. Further, the government plans have spelled out the need of technology generation to promote the milk and milk 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 an approved plan of NCRP during FY 2080/81, it has conducted the different research activities and extension programs which are mentioned in this report. Broadly activities conducted in FY 2080/81 can be categorized as: research and production activities.

In the research works, different projects were conducted like **Cattle breeding**- “Cattle breed development for tropical and subtropical region of Nepal”. “Inception of selection index values and improved reproductive technologies for genetic improvement of dairy cattle for overall genetic merit”. **Cattle production and management**- “Study of non-genetic factors influencing milk yield and its composition in Jersey and Holstein crossbred cattle”. “Assessment of probiotics strains on the health and productive parameters of dairy cattle in Chitwan conditions”.

“Participatory approach for improving Yak and Chauries production and productivity in Nepal. **Nutrition**-“Evaluation of silage feeding on health, reproductive and productive parameters of growing heifers cattle in Chitwan condition”s. **Outreach**- “Participatory technology development and verification at outreach sites”. **Multilocation project**: “Field experiment on Egyptian clover, evaluation of forage and fodder crops, evaluation of teosinte for genetic diversity and agronomic traits under different sowing dates and evaluation of maize varieties for fodder and silage production in Terai region of Nepal” and **Others**- “Cattle herd management and production project”, and “Farm management project”.

In cattle breed development for tropical and sub-tropical region of Nepal. Average daily milk yield of Terai, Terai Jersey cross and Terai Holstein cross was observed to be 0.8 ± 0.2 , 5.50 ± 2.12 , 4.70 ± 2.02 Liters. Further, the Lactation length of pure Terai Jersey Terai cross and Terai Holstein cross was observed to be 73 ± 40 , 265 ± 99.62 , 296 ± 13.43 days respectively. Further, the lactation yield of pure Terai, Terai Jersey cross and Terai Holstein cross was observed to be 97 ± 60 , 1344 ± 787.46 and 1685 ± 313.9 L per lactation. In inception of selection index values and improved reproductive technologies for genetic improvement of dairy cattle for overall genetic merit, productive and reproductive performances of 550 cattle from Chitwan and Nawalparasi were collected, and dairy

animals were ranked based on high milk yield and future bull mother were selected.

In study of non-genetic factors influencing milk yield and its composition in Jersey and Holstein crossbreed cattle. It was observed that milking system, stage of lactation, parity and season of birth has significant impacts on milk yield and composition of Jersey and Holstein crossbreed.

In assessment of probiotics strains on the health and productive parameters of dairy cattle in Chitwan conditions. Blood parameters and digestibility of feed materials assessed. It was observed that feeding probiotics helps in increasing milk yield of cattle. In Yak project, prevalence of different parasites on Yak was observed to be 33.8%.

Similarly, in production and extension activities: Activities under cattle herd management and production project, and outreach project were carried out. Use of high-quality semen produced inside or outside the country to produce improved cross breeds of Jersey and Holstein Freisian cattle, cultivation of fodder/forage for round the year feeding to the cattle maintained at NCRP farm, fodder/forage seed production, milk and dairy products production & distribution were the major activities. In the production program 51 calves were produced during this year. Similarly, 134,233.5 liters milk, 609.8 kg paneer, 96 kg khuwa, 215 liters dahi, 2.4 kg ghee were produced.

The average composition of whole milk produced in NCRP farm was as 5.10%, 8.85%, 3.27% and **4.89%** respectively for fat, SNF, protein and lactose. Average electrical conductivity was 4.67. Twenty-five cows and thirty-one male calves were sold to farmers in minimal price. Five lulu cattle were distributed to government offices and Agriculture and Forestry University. Perennial grasses like stylo, setaria, signal grass, napier, sorghum, vetch, mulato, para grass was cultivated in fodder cultivating area of the program. Thus, cultivated grasses were harvested and fed to cattle of NCRP farm. Total revenue of this fiscal year was Rs.9,035,929 Revenue from the sale of milk and milk products was Rs. 8,744,260. Revenue from the administrative program was Rs. 291,668.

In this FY more than 1642 people (Male 981 and female 661) of various background including farmers, students, extension staffs, NGO/INGO staffs, local government authorities of different places and other stake holders visited the NCRP farm and consultancy services was provided to them on cattle farming. One day an animal health camp was organized at Kakare of Hariharpurgadhi. Sixty-one animals including cattle, heifers and bull were provided to farmers in subsidized rate of NCRP, Rampur.

National Cattle Research Program is in bharatpur metropolis-15 Rampur, Chitwan. To date, there are five cattle sheds, one calf shed, one bull shed, one shed with metabolic crates, two silo pits, one straw house and one hay barn constructed. Other structures like veterinary laboratory and dairy unit. Biogas plant of 200 cubic meters has been constructed and is regularly supplying biogas for 60 families in their kitchens.

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. This commodity is prioritized by the government in different long-term plans such as Agriculture Prospective Plan (APP) and Agriculture Development Strategies (ADS). Contribution of agriculture is 23.95% in GDP (CBS, 2022). Livestock contributes 23 % in AGDP and about 13% in GDP (DLS, 2021). Cattle stand second after buffalo which contributes 42.8% in milk production of Nepal (Agriculture and Livestock Diary, 2079). Contribution of dairy sub-sector is 9 % in national GDP and it shares 63% of total livestock contribution (CASA, 2020). In Nepal, the total annual milk production is 2479899 MT (Agriculture and Livestock Diary, 2079). As concept developed by WHO and FAO availability of milk per person should be 250 ml/head/day. Looking total milk availability from domestic production there is still deficit of milk availability.

The trend of cattle population in the country is described in the table below:

Table 1. Cattle population and milk production trend in Nepal

Year	Total population	Milking cattle	Milk yield from 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
2018/19	7385035	1560584	795530	2168434
2019/20	7458885	1166156	920400	3301000
2020/21	7466841	1209141	1060487	2479899
2021/22	7413197	1223061	1101812	2566614
2022/23	4750329	916579	1214046	2613843

Source: Statistical Information on Nepalese Agriculture, 2079/2080 (2022/2023) and Agriculture and Livestock Diary, 2081

National Cattle Research Program is located in Rampur Chitwan under Bagmati Province of Nepal with 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. Chitwan in particular is marked as one of the leading districts 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 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 the country.

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 Agricultural Research Council in 2048 B.S. (1991AD) and named as National Bovine Research Program (NBRP) at Khumaltar, Lalitpur to conduct research works on cattle and buffaloes. Realizing the importance of the commodity specific research in the country, NARC management decided to separate the cattle from NBRP. In 2069 B.S. (2013 AD) NBRP was re-structured to form National Cattle Research Program and National Buffalo Research Program as two separate commodity programs. National Buffalo Research Program was established in Tarahara, Sunsari and 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° 65' N latitude; 84° 35' E longitude and 187 masl.) at Rampur, Chitwan. It has humid and subtropical climate with cool winter (2-3 °C) and hot summer (43 °C). 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 (district headquarters 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, the 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

To enhance the production and productivity of cattle for nutritional security and livelihood improvement of Nepalese people and be a leading research institute in the country.

2.4 Mission

Improving cattle production and productivity by conducting problem based, farmer oriented, participatory & systematic research and recommend innovative & adaptable technologies to farmers.

2.5 Mandate

- Conducting research in areas of cattle feeding/nutrition, fodder/pasture, breeding, health, production & management and socio-economic aspects, suitable for various agro-ecological zones of country.
- Documentation, maintenance and update information on cattle research in Nepal.
- Verify and recommend adaptable technologies for dairy (cattle) sector transformation in the country.
- Develop and recommend suitable technologies related to milk production, collection, processing, milk product diversification and marketing.
- Publication of developed technologies on cattle and collaborations with extension agencies for their disseminations and easy adaptation by farmer.
- Collaboration with national and international research organizations, institutions and centers for research support and specialization development.
- Evaluation, characterization, exploration, utilization and conservation of cattle germplasm.
- Assist in cattle breed registration and release.
- Determine, formulate and prioritize issues and strategies in short, medium and long term in national cattle research in the country.
- Assist in formulating and implementing the government policies for cattle sector development.

2.6 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.

2.7 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 β 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 molasses mineral 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 and 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.

2.8 Strategies

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

2.9 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) generated by DCIP and other programs
- ii. Adaptation of Lulu cattle in Tropical region
- iii. Improve the fertility status of cattle by focusing on the problems related to infertility and its management
- iv. Year round fodder production and low-cost milk production

- v. Inception of selection index values and improved reproductive technologies for genetic improvement of dairy cattle for overall genetic merit.
- vi. Assessment of probiotics strains on the health and productive parameters of dairy cattle in Chitwan conditions.

2.10 Infrastructure and facilities

The program has been undergone administrative and technical changes significantly as decision made earlier by the NARC to give full fledge structure that can perform nationwide research and development in cattle. The program is in Bharatpur Metropolitan City-15 of Chitwan district at Rampur. It is 10 km far from the main city of Chitwan district in southwest 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 stuff required for daily consumption 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 181 cattle heads of Jersey and Holstein Friesian crosses, Terai, Lulu and Achhami cattle breed in its farm with average daily milk production of around 390 liters from average of 40 cows. Milk is either sold as whole milk or as products like paneer, khuwa, dahi, ghee etc.

Fodder trees are cultivated in around 1 hectare of land and other seasonal/perennial forages are produced as necessary in the farm within 10-12 hectare of land.

Till now there is one office building, five cattle sheds (3 with 40 heads adjustment and

2 with 20 heads adjustment), two yards, one calf shed, tractor garage, four manure pits, 4 silage pits, chain link fence around farm area, one bull shed with yard, one isolation shed, one shed with metabolic crates, one feed store and 2 paddy straw store. Likewise, one laboratory building. To make the daily work efficient in the farm there are eight staff quarter buildings with the capacity of 14 family adjustments.

Biogas plant having capacity of 200 cubic meters is constructed. This is providing regular gas supply for 60 households by pipeline system for staff quarter buildings and office/labs of NCRP and NMRP, Rampur.

Similarly, there is a dairy processing unit with the facility of fluid milk storage and product processing like dahi, ghee, paneer, ice cream and khuwa. Likewise, mini veterinary 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. Now there is the facility of Ultrasound machines (USG) for assessing ovarian dynamics of cows and early pregnancy diagnosis. Estrus detector is available for aid in appropriate timing for artificial insemination.

For the farm operation there are facilities of milking machines for milking the cows, weighing balances to record the daily milk production and to measure the birth weight of the newborn calves, lacto scan machine for routine milk analysis and chaff cutter for cutting the forages and straw in desired size. Animal nutrition laboratory was 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 are Sox-holet apparatus, Muffle furnace, K-jeldhal apparatus, Fiber digester, Hot air oven etc. Colony counter, somatic cell counter. 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. Facility of irrigation is quite good in the land. Also, there is one four-wheeler jeep, three motorbikes, one electric auto rickshaw & nine bicycles.

2.11 Organizational Structure and human resources

The organizational structure of National Cattle Research Program, Rampur, Chitwan is presented in figure 1.

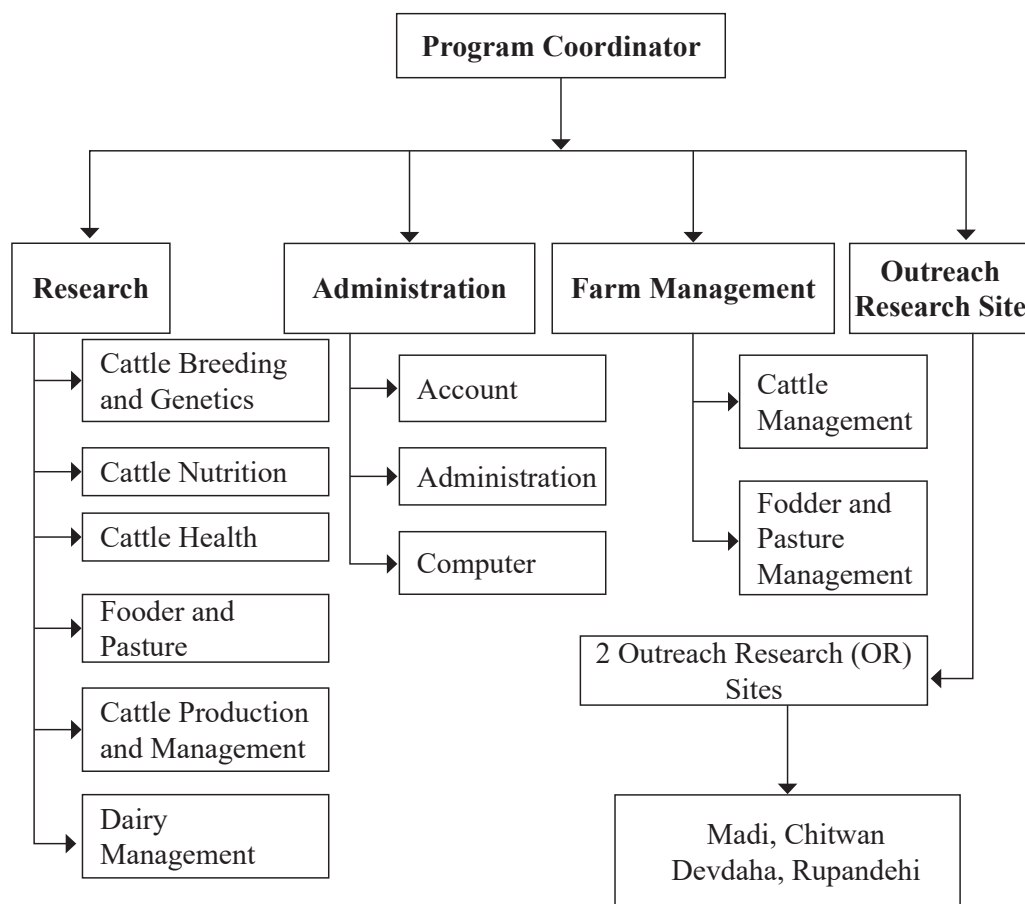


Fig. 1. Organizational structure of NCRP, Rampur, Chitwan

The program is basically coordinated by Principal Scientist (S5) but in this FY it was coordinated by the Senior Scientist (S4) and supported by other senior scientist, scientists, technical officers, technicians and admin/finance staffs as shown in annex 2.2.

3. RESEARCH HIGHLIGHTS

The highlights of the research projects carried out by the scientists and technical officers of the NCRP in this FY are mentioned as below. Numbers of projects implemented in FY 2079/80 are given in annex 3.1.

3.1 Cattle Breeding

Project 1: Cattle Breed Development for Tropical and Sub tropical Region of Nepal

Activity 3.1.1: Maintenance of terai cattle population

Currently we have maintained 12 pure terai cattle. Among them 5 are cows, 5 heifers, 1 bull and 1 is female calf. They were managed in optimum husbandry practice. Eleven pure terai cows causing very much difficulty in handling were culled in fiscal year 2080/81.



Fig: Herd of pure terai cows in NCRP farm (Front cows)

Activity 3.1.2: Maintenance of different blood level of terai crossbreds

We have maintained 13 terai exotic crossbreds. Seven (50% T & 50% J) crossbreds, 2 (25% T & 75% J) crossbreds and 4 (50% T & 50% HF) crossbreds are maintained in NCRP farm. Estrus synchronization with ovsynch protocol was applied in some cows for breeding and some are bred on their natural heat for producing crossbreds.



Fig: Terai and Jersey cross (f1)



Fig: Terai and HF cross (f1)

Activity 3.1.3: Productive and reproductive performance of cattle evaluated on station

Table 3. Productive performances of cattle in NCRP, Chitwan, Nepal

Parameter	Average daily milk yield (liter)	Average peak daily milk yield (liter)	Lactation length (days)	Lactation yield (liter)
Pure Terai	0.8 ±0.2	1.33±0.5	73±40	97±60
Terai Jersey cross	5.50±2.12	9.29±0.50	265±99.62	1344±787.46
Terai HF cross	4.70±2.02	7.71±2.00	296±13.43	1685±313.9
Jersey Cross				
HF Cross				

Table 4. Reproductive performances of cattle in NCRP, Chitwan, Nepal

Parameter	Average age at first estrus (months)	Average age at first calving (months)	Service period (days)	Calving interval (days)
Pure Terai	-	57	-	416
Terai Jersey cross	17.40±8.12	26.4±6.39	57.00±00	324.00±00
Terai HF cross	19.00±3.13	28.5±2.40	111.00±00	398±96.16
Jersey Cross				
HF Cross				

3.2 Inception of selection index values and improved reproductive technologies for genetic improvement of dairy cattle for overall genetic merit

Background:

Dairy farming is the most important sub-sector, contributing about 63% to the total Livestock Gross Domestic Products (LGDP) which is more than 5% of the total National Gross Domestic Product (GDP) (MoALD, 2021/22). However, the productivity of the cattle in the country is only 900 Kg per lactation and needs a lot of improvement) (MoALD, 2021/22). Genetic improvement of the animals is a universal practice to increase the productivity of the animals. There is no proper dairy cattle genetic evaluation system prevalent in Nepal that is running for a long time. Almost all previous work has focused on either animal selection based on performance data or crossbreeding of indigenous cattle with improved cattle. This warrants inception of a world-recognized genetic evaluation system to evaluate the performance of the animals.

Best Linear Unbiased Prediction (BLUP) of breeding value is one of the best methods used to evaluate the performance of the animals worldwide. Moreover, performance of the animals should be estimated for several traits using BLUP and that information should be combined to select animals based on dollar index, and which is more holistic approach than selection based on only EBVs.

Research Objective

■ General Objective

Genetic improvement of dairy cattle for overall genetic merit through multiple trait selection index values

■ Specific Objectives

1. Initiation of formal Pedigree and progeny recording system in dairy cattle.
2. Providing estimated breeding values (EBVs) of animals for most economic traits.
3. Inception of NCRP selection index in dairy cattle.
4. Examination of improved reproductive technologies for dairy cows in Nepalese perspective.

1. Activity-wise Methodology

Objective 1

Activity 3.2.1: Selection of farmers

For the smooth implementation of genetic improvement programs, performance of a large number of animals need to be collected. As dairy cattle in NCRP farm is insufficient, extra information on dairy collected from the dairy farmers nearby the command area of NCRP, Rampur. A total of 10 herds, who are keeping more than 10 dairy cattle were selected from Chitwan and Nawalparasi districts. and 550 animals were selected and productive and reproductive performance were recorded.

Activity 3.2.2: Examination of the health status of animals

Health status of the animals was checked before selecting animals. History of any diseases was carefully analyzed to select healthy animals. Further, health of animals was checked for leg abnormality, mastitis and for visual symptoms of any diseases. Only

health animals were selected for further data analysis. Total of 550 animals were tagged for further data collection. It is hard to get assistance from dairy cattle farmers without any direct or indirect support from the farmers. Therefore, animals were provided with anthelmintic medication, minerals and vitamins from this project fund. This will help to strengthen the bonding between NCRP, Rampur and farmers for the long run of the research project. A prescription will be made if there is a prevalent disease in the animals free of cost to the farmers.

Activity 3.2.3: Selection and tagging of the animals

A total of 550 dairy cattle were selected to implement this project. Once the animals are approved for data collection by veterinary doctor, tagging of the animals will be done to identify the animals used for Dairy Cattle Selection Index (DCSI). Pedigree of the animals recorded, and animals assigned into proper contemporary groups based on the management system used to raise these animals. Other important characters recorded are:

- Breed of the animals
- Udder score
- Leg score
- Conformation score
- Horn in the animals
- Temperament
- Body condition score

Note: These visual and temperament traits are not included till date, because of less animals in the analysis, but will be included in the later years for the calculation selection index. It is hard to get assistance from dairy cattle farmers without any support from the farmers. Therefore, high quality semen will be provided to farmers free of cost and seed of improved forage seeds will be provided to farmers to feed their livestock free of cost, which will help in creating ownership of the project by the farmers.

Activity 3.2.4: Data recording and collection of milk sample

Amount of milk produced by animals was measured at monthly intervals in the morning and evening, also called Test Day Milk Yield. Milk recording starts from five days after the onset of the milking to the end of the lactation. Daily milk yield of the animals recorded with the help of a uniform measuring cylinder provided to the farmers. Further, farmers were provided a record book for keeping the reproductive performance of the cattle.

About 50 ml of milk samples were collected and taken to NCRP, Rampur, to analyse the milk properties. Total of 4 recorders hired till date to take milk samples from 8 locations across Chitwan and Nawalparasi districts, and the recorder were provided enough training for the collection of milk samples. Staff from NCRP, Rampur, were assigned to bring milk samples from the collected locations to the office of NCRP, Rampur, for analysis of the milk sample.

Activity 3.2.5 Analysis of the milk sample

Milk samples were analysed with a milk analyzer to determine the important milk constituents including Solid Not fat (SNF), protein percentage, fat percentage, and milk conductivity. Recorder who got access to milk analyzer, analyzed their milk samples by themselves and sent us the report. Whereas, those recorders who don't have access to milk analyzer, technician of NCRP collected those milk samples and analyzed the milk samples in NCRP.

Objective 2

Activity 3.2.6: Data entry, modelling and analysis

Data were entered in MS excel regularly. Data preparation and visualization done through R. Systematic environmental effects that affect the performance of the animals investigated, and significant fixed effects included in the model. Systematic environmental effects tested but not limited to include flock, management group, birth type, rear type, parity and location. Random effects fit include Direct genetic effect of the animal, maternal genetic effect. Data were fitted in Animal Model and analysed through ASReml-R (Gilmour et al., 2015).

The mixed model used to estimate the fixed and random effects solutions were.

$$y = Xb + Z_1a + Z_2m + e \quad [1]$$

Where y is the vector of observations, b is the vector of fixed effects, a is the vector of estimated breeding values, m is the vector of maternal breeding values, e and is a vector of random residual. X is the incidence matrix relating b to y and Z_1 , Z_2 and are incidence matrices relating a , m and to y and e is the vector of random residuals. In the initial stage, it would be very difficult to create reliable pedigree. Therefore, fixed effect model was used and gradually upgraded towards sire and animal model once the program proceeds and reliable pedigree was created. Heritability and phenotypic and genetic correlation between traits were estimated.

Activity 3.2.7: Estimating EBVs of animals and support of high genetic merit semen to farmers to inseminate their outstanding animals

Estimated breeding value of animals for several traits were carried out. These include Lactation Milk Yield (LMY), Milk Fat (MF), Milk Protein (MP), Solid Not Fat (SNF), and Milk conductivity. High quality semen exported from abroad was planned to provide to farmers for artificial insemination of their elite cow to achieve top quality male calf to be used as future bull and top-quality female heifers to be used for replacement cow. However, due to the lack of budget, it is not completed.

Objective 4

3.2.8 Application and evaluation of different estrus detection methods

Different estrus detection methods like visual technique, heat mount detector/ tail paint, neck collar/pedometer, estrus detector and rectal palpation applied in cattle of NCRP farm. Comparison and usefulness of different methods in estrus detection evaluated. At least 50 cows/heifers of NCRP farm selected for this activity.

3.2.9 Ovarian dynamics study of cows

Ovarian dynamics of cyclic and non-cyclic cows will be studied by rectal palpation and use of ultrasonography. This will be done in NCRP Farm, Rampur. At least 30 cows of NCRP will be selected for this activity.

3.2.10 Evaluation of different estrus synchronization protocols in cows

Different hormonal protocols like Ovsynch, CIDR Synch, Single/double prostaglandin will be applied in cyclic and non-cyclic anestrous cows and output regarding ovulation and conception will be recorded. This study will be conducted in NCRP farm and in farms of outreach sites (At least 30 animals).

3.2.11 Application of embryo transfer technique

Good quality embryos transferred to at least 50 cows in NCRP and nearby Chitwan and Nawalparasi district in collaboration with ARDA, Nepal. Jersey embryos were provided by ARDA, Nepal, and some embryos were brought from NLBO Pokhara. For this, estrus synchronization protocol applied in 120 cows. This work was done in collaboration with ARDA, Nepal, NLBO, Pokhara and Agriculture and forestry university.

3.2.12 Results:

A total of ten cattle herds were selected, three herds each from Chitwan and Nawalparasi districts. The productive and reproductive parameters of 550 cattle were recorded on a regular basis. Milk samples were analysed by the recorder in the selected herd. Those farmers who does not milk analyser, milk samples were brought back to NCRP to measure the milk composition. Staff from NCRP are helping in bringing data from these farms. Estimated breeding values of 4% representative animals were presented in Table 3.1.

Major activities conducted for the last fiscal year

- Selection of 550 dairy cattle from Chitwan and Nawalparasi districts.
- Collection of milk samples at monthly interval from each cow in the morning and evening; also called test day milk yield.
- Collection of milk samples to NCRP, Rampur to identify different milk constituents including fat, protein, lactose, SNF, conductivity.
- Collection of information related to cow reproductive performance.
- Collection of information related to udder score, leg score and conformation of the cow.
- Finally, data entry, analysis and providing EBVs of the cows to farmers.

Table 5. Estimated breeding values of cattle for milk yield and ranking of cattle based on genetic potential for milk production

ID	ID_Herd	ID_sire	ID_dam	Lact.M	Lact.F	Lact.P	Lact.C	EBVs
272147	351608001	3094	12358	5626.65	4.16	3.08	4.76	1091.98
21523	352602124	12052	1507	4860.63	4.67	3.2	NA	1056.17
272817	351608001	9930	9473	5833.25	5.41	3.2	NA	835.73
12809	491608001	9930	9473	3793.75	4.15	3.5	NA	835.73
13261	490408002	NA	5814	4956.6	3.5	3.05	4.96	829.76
24780	351608001	575	11647	5115	3.33	3.17	NA	796.53
261125	351608001	3094	9489	4970.75	4.35	3.75	NA	786.03
272180	351608001	98390	2785	4990.25	4.27	3.28	5.23	780.86
17955	351608001	925	3195	4452.15	4.49	3.1	NA	772.74

24780	351608001	925	3195	4618.25	3.93	3.5	NA	772.74
24764	351608001	925	3195	4952.85	4.53	3.32	4.44	772.74
9437	352602124	541	9414	4345.05	4.14	3.21	NA	767.89
12348	351608005	NA	2790	5161.95	3.93	3.15	5.34	725.00
12212	351608005	NA	11417	4911.5	4.9	3	NA	723.43
12258	351608005	3094	11140	4612.5	4.5	3.13	NA	706.59
12342	351608005	10602	11620	4449.45	3.6	3.15	NA	689.56
272874	351608001	10602	11620	4388.25	3.6	3.15	NA	689.56



Fig. 1. Taking milk sample from cattle



Fig 2. Analysis of milk sample using milk analyzer

Reproductive technology of Inception of selection index project

3.2.13 Application and selection different estrus detection methods

Visual method (mounting behavior, mucus discharge, drop in milk yield, bellowing) Allflex software detection were being compared in NCRP farm. Visual method with good history worked well for detection. Allflex software also make supplementary support in heat detection, since we have limited number of neck collar at this time.

3.2.14 Evaluation of different estrus synchronization protocols in cows

This year we compared Ovsynch protocol, single PG and CIDR synch (0-day GnRH and CIDR insert, 9th day PG injection and 10th day CIDR removal) protocol in cows. CIDR synch protocol was found to have high estrus expression and ovulation compared to rest two protocols.

3.2.15 Ovarian dynamics study in cows

Ovarian dynamics study was done in both cyclic and non-cyclic cows and heifers. Persistent corpus luteum was found in more cows and some of cows have follicular cystic condition.

3.3 Participatory approach for improving Yak and Chauries production and productivity in Nepal

Yak and Chauries are Himalayan cattle of Nepal, Bhutan, China and India. They are the prime source of milk, meat and are the excellent pack animal for the expeditions to mountains. It is endangered species of the world. Present world population of Yak is estimated to be 12 million, out of this approximately 0.05 million Yak and its crosses are found in Nepal (MoLD, 2017). Yak is a male animal and female is called Nak in Nepali; are pure breed Himalayan cattle. Yak and Nak reared at higher altitude regions and seldom come below 3,000 masl. Yak is raised in 28 Himalayan districts of Nepal along the Tibetan borders. The crosses of Yak (*Bos grunniens*) and local hill cow (*Bos indicus*) and vice versa are called Chauri. Chauri are more productive than Yak and are more adaptive to lower altitudes and are reared at the intermediate zone between cattle and Yak. The Chauri are reared under migratory systems, grazing in alpine/sub-alpine pastures during summer and feeding fodder tree leaves during winter. The female Chauri are more productive than Nak.

Population of Yak/Chauries is in decreasing trend because of pasture scarcity, less productive stock, low economic return and subsequently less interest of youth in farming leading to urban migration. This situation has been worse because of other external factors such as attack by wild animals, heavy snowfall and emergence of new diseases.

Improvement in the production and productivity of Yak/Chauries, are critical to ensure health and nutritional security for farmers of mountain region. Research works in this area are very limited because of difficult terrain to collect data and scattered nature of herd in mountain region. Therefore, this project was designed to address breeding, feeding, management and health care of animals to improve the overall productivity of Yak and Chauries in the study locations.

In the previous study conducted by National Cattle Research Program, Rampur, Chitwan where household survey was done in Mustang district along with serum, fecal and milk samples of Yak/Chauri collection. Survey revealed that average number of Yak/Chauries per household was 29.08 and population of Yak/Chauries is in decreasing trend. This is due to less interest of youths into farming and outmigration. Before winter (October/November) they come to lower altitude of 2000-2200 masl and in summer (May/June) they move upwards to height of 5000 masl and above. They graze and live freely in grazing area, but temporary sheds are made for young calves and lactating

Nak/Chauries.

Similarly, the 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 farmers, attack of wild animals like snow leopard, bear, fox, tiger; scarcity of drinking water, heavy snowfall, 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/Chauries farming.

Likewise, 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*) are the common forage of Mustang district. Generally milking is done once a day in morning and Nak and Chauri produce 1.67 and 3.45-liter milk / day, respectively. Cheese, chhurpi and ghee are being generally made from the milk of Chauries and Nak. Milking animals are fed extra 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.

Price of Nak and Chauri milk ranges from Rs 88-120 per liter. Price of ghee ranges from Rs 500-1250 per kg. Price of hair of Yak/Chauri ranges from Rs 500-800 per kg. Price of tail ranges from Rs 4000-10000 per piece. Price of double hair colored tail (Ganga Jamuna) is higher than single hair colored tail. Price of chhurpi ranges from Rs 600-1000 per kg. Price of Yak/Nak meat ranges from Rs 500-1000 per kg. Price of adult Yak/Nak ranges from Rs 85000-100000 and Chauri ranges from Rs 30000-65000. Regarding health problem of Yak/Chauries, prevalence of endo and ecto-parasites, mineral deficiency, FMD and locally called AUL (Occurs when they come to lower altitude and sudden death) are common.

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. Prevalence of brucellosis was found to be 1.12% (1/89). ELISA test was performed for the diagnosis. In fecal examination major parasite were *Toxocara sps*, *Paramphistomum sps*, *Ascaris sps* and prevalence rate was 15.29%. Quarter wise prevalence of subclinical mastitis was found to be 10.71%.

The project was designed to study the animal production system, productive and reproductive performances of Yak/Chauries specifically in project sites and broader implication of this study in the country. Project was implemented in two mountain districts (Rasuwa and Mustang).

Different sites of Rasuwa and Mustang district were selected and vegetation were collected for further analysis. Baseline survey was done to know the husbandry practices followed by the farmers to raise yak and chauries in that area. Technical information about the breeding strategy and mating plan was discussed among the farmers group to get better production from yak/chauries. During the survey, we found that Yak from Solukhumbu district were distributed to the farmers of Mustang district by provincial government to check the inbreeding. Performance of Yak/Nak and chauries from Mustang and Rasuwa were recorded in the sheet.

Faecal samples from different farms of Rasuwa and Mustang district were collected in the zip lock bag and taken to the NCRP lab for further analysis. Altogether 68 faecal samples from Rasuwa (Dhunchu, Gatlang) and Mustang (Nupsang, Aalubaree, Lomanthang) district were analyzed. Among these samples 33.8% prevalence of different parasites were found. Similarly, blood samples of 70 animals were collected. Whole blood was taken for haematology analysis and serum was separated for serum biochemistry test to know the prevalence of diseases of economic importance. Milk samples of 36 Nak were collected from Mustang district. Somatic cell count (SCC) and composition analysis of milk was done. Milk composition was analyzed using lactoscan analyzer. Average values of different milk compositions of Naks were mentioned in the table below.

Table 6: Average milk composition of 36 Naks from Mustang district

Fat%	SNF%	TS%	Protein%	Lactose%	Density	Conductivity	FP
7.69	9.02	16.71	3.26	4.93	27.45	4.19	-0.604





Cattle Fodder/Pasture and Nutrition

3.4 Evaluation of silage feeding on health and reproductive and productive parameters of growing heifers' cattle in Chitwan conditions.

3.4.1 Introduction

Corn silage has become an important source of forage for dairy cattle rations because of its high energy content, ease of mechanization in a feeding system, and high yield per hectare. Use of corn silage has increased rapidly as forage for dairy cattle because of storage, and uniformly high feeding value. Intake of forage and total dry matter has varied with showing increased intake when hay was substituted for corn silage (Belyea *et; al* 1975, Holter *et;al* 1973, Thomas *et; al* 1970).

In general, corn silage is satisfactory as the sole source of roughage for performance of lactating cows. Coppock and Stone (1968) reviewed research work on corn silage diets for dairy cattle and their review indicated a need for more nutrition studies to determine effects of long-term corn silage consumption upon nutritional and physiological responses of dairy cattle. However, there are no recent reports of comparisons between corn silage and its combinations with other forages fed continuously to dairy cattle throughout the growing period as well as during lactation in the contest of Nepal. More data are needed to corroborate previous studies and to provide information to dairy

farmers about the feasibility of long corn silage feeding.

The authors Rupert and Katie (2003); LiSS *et al.* 2020; Beauchemin *et al.* 1997; Eun *et al.* 2003; Gownipuram *et al.* 2020 stated that silage and hay based prepared forage of gama grass, cowpea and alfalfa was observed with no significance difference on lactating cows dry matter intake, milk yield and composition of milk. On the other hand, the Authors Nelson and Satter (1992a); Broderick (1995) found that dry matter intake and milk yield of silage was higher than hay the reason probably silage diet digestibility was higher than hay. Feed efficiency of lactating cows was lower on hay fed cows than silage which means silage fed cows were efficiently convert feed to production but not significantly differed (Beauchemin *et al.* 1997; Gownipuram *et al.* 2020 ; Haselmann *et al.* 2020).

The cost of rearing dairy cattle is dependent on growth, early breeding and time to first calving, milk production. The price of cereal grains and traditionally fed protein concentrates (e.g. soybean meal) has risen steadily, increasing the cost of animal feeding. Consequently, finding adequate replacements for these feed ingredients have become a priority for livestock producers. Determining the proper level of forage inclusion in diets for optimal production will benefit the dairy industry greatly. Few research trials have been conducted on the effects of forage level on the performance of milk producing cattle.

Furthermore, data on forage based ration are still lacking in the literature. The farmers have raised their animals mostly feeding low quality concentrate and low grade roughage like straw, Stover and others. Green grasses are available seasonally and are poor quality. This has resulted into high production cost of livestock products as well as farmers have less return and low income. Livestock are generally underfed by about one third and this is directly associated with the low productivity of the animals. Our country have different high yielding exotic cattle but they have also low productivity because lack of proper feeding regime as well as quality green grasses supplementation therefore milk production cost also high. Effective milk production is the most important researchable issue.

Thus, this practice is not properly documented so the proposed study will address on this issues. Therefore, the objective of this study was to determine the effect of the inclusion of incremental levels of silage and hay based forages or roughages on feeding behavior, digestion efficiency, microbial diversity, milk yield and milk quality parameters. Economic cost-effective milk production technology

This study was to develop the feeding behavior improves, to evaluate digestion efficiency, microbial diversity, milk yield and milk quality parameters and most economic use of forages and roughages feeding practices of dairy heifers animals for the long term effects of the most alternative forage based roughages as corn silage feeding for heifers.

An experiment will be carried out in NCRP farm, Rampur to study on the performance evaluation of crossbreed heifers feeding different silage based forage diets combinations in Chitwan conditions. Sixteen (16) Holstein-Friesian and Jersey of twelve month of age female crossbred growing heifers cattle from the NCRP, Rampur, and dairy herd were allotted in CRD design to one of four silage and hay based forage feeding combinations. The growing crossbreed heifers were selected from the three birth-period groups resulted from calving in April to July, 2023 (group I), September to October, 2023 (group II) and December to January, 2023 to 2024 (group III). Feed consumption, refusals, milk production, feed samples were recorded daily and monthly. Samples of milk will be taken for analysis of fat, protein, and lactose on two consecutive milking weekly and Solids- corrected milk yield will be calculated from the formula derived by Tyrrell and Reid using milk yield, fat, protein, and lactose percents in FY 2081/082. The expected output of the design proposal was the feeding behavior and digestion efficiency of dairy heifers' animals improved, microbial diversity, milk yield and milk quality parameters evaluated and cost-effective milk production technology on silage and hay forage-based feeding identity.

This study was to determine the long effects of feeding corn silage as the only forage in comparison with combinations of corn and grain silage or chopped hay. In reviewing this, it can be concluded that this study was to develop the long effects of feeding corn silage as the only forage in comparison with combinations of corn and grain silage or chopped hay. This study, therefore, aims to determine the effect of the inclusion of incremental levels of forage viz corn silage and hay on improving feeding behaviors, digestion efficiency, and milk production of dairy heifers' cattle.

3.4.2 Performance evaluation of silage on growing heifers' cattle

Average body weight (BW) and body weight reduction test (BWRT) percentage in heifer at NCRP, Rampur, Chitwan is presented in Table 1. The average body weight (mean $\pm$ SE) in 30, 60 and 90 days of experiment period were not significant in treatment group but the body weight reduction test (BWRT) were observed significantly differences among the treatments in 30, 60 and 90 days of experiment period .The average body weight reduction test were found highest in T₂(concentrate feed +green hay) (11.46 $\pm$ 1.42^a), (17.26 $\pm$ 1.48^a),19.49 $\pm$ 0.70^a in 30, 60 and 90 days of experimental period respectively but lowest was recorded in T₁ (grain silage+ green hay) (4.24 $\pm$ 1.89^b),(4.12 $\pm$ 1.28^b),(4.48 $\pm$ 1.55^b) in 30, 60 and 90 days of experimental period respectively.

Table 7: Average body weight (BW) and body weight reduction test (BWRT) percentage in heifer at NCRP, Rampur, Chitwan.

Treatment	Day wise body weight (BW) and body weight reduction test (BWRT) in heifer at NCRP, Rampur					
	0 days	30 days	BWRT in 30 days	60 days	BWRT in 60 days	BWRT in 90 days
Trt 1	167.25±29.87	175.25±32.81	4.24±1.89 ^b	174.75±32.08	4.12±1.28 ^b	174.25±29.25 4.48±1.55 ^b
Trt 2	164.75±21.18	186.50±24.67	11.46±1.42 ^a	199.50±26.37	17.26±1.48 ^a	204.75±26.50 19.49±0.70 ^a
Trt 3	164.50±11.70	174.25±14.74	5.19±1.79 ^b	190.25±15.57	13.26±1.20 ^a	196.50±18.67 15.60±2.54 ^a
Trt 4	165.25±9.80	177.25±10.70	6.70±2.15 ^{ab}	177.00±10.67	6.57±2.14 ^b	179.00±9.28 7.72±2.32 ^b
Total	165.43±8.87	178.31±10.12	6.90±1.09	185.37±10.52	10.30±1.52	188.62±10.48 11.82±1.77
F- value	0.004	0.062	3.048	0.26	14.702	0.416 12.923
P- value	1.000	0.979	0.04	0.853	0.000	0.745 0.000
Sig-value	NS	NS	*	NS	**	NS **

* $p < 0.05$, ** $p < 0.01$, and ^{NS} $p > 0.05$, DMRT was used to analyzed Mean superscripted by different letters differed significantly from each other.

3.5 Cattle production and management

Study on non-genetic factors influencing milk yield and its composition in different exotic cattle and its crossbreeds

3.5.1 Introduction

Milk is a biological fluid with high nutritional value, consisting of water, milk fat, proteins, lactose, minerals, etc. and is the first food for infant mammals. In addition to being consumed from ancient times, different dairy products, such as cheese, milk powder, cream and evaporated milk, have evolved. Food products of animal origin play an important role in sufficient and balanced nutrition of human beings. Milk and milk products are among the most important food products of animal origin (Tasci, 2011). Kabil et al. (2015) reported lower fat, protein and total solid content in milk during summer than in winter attributed to the variation in climatic variables, plane of nutrition and housing pattern. Milk production depends on various factors such as the breed of cows, age of cows, stage of lactation and number of lactations, genetic makeup as well as the nutritional status of the animals, genotype environment interaction and so on. Lactation has a significant effect on milk yield and quality. Milk yield increases gradually with advances of lactation number. The stage of lactation has also significant effects on milk yield. Milk yield decreases but fat, SNF and TS content increases with advancement of stages of lactation. Therefore, the lactation and stage of lactation has remarkable effects on milk yield and quality (Ahmad et al., 2011). Milk, which is secreted sterile often gets contaminated during hand milking increases the bacterial load and decreases the quality of milk, Machine milking, ensures clean milk production and welfare of animal at large, but may incur many deleterious effects on the udder health (Twardon et al., 2001).

Non-genetic factors in animal farming pertain to influences on animals that are not inherited through their genes but are rather determined by their environment. When a particular trait is primarily shaped by environmental conditions rather than genetic inheritance, it signifies the significance of the environment in determining that trait. This environmental influence can sometimes mask an animal's true genetic potential. Consequently, the selection of animals in optimal environments becomes crucial as it allows genes to express their potential more effectively and enhances the outcomes of our selection processes. Moreover, changes in the environment can introduce inaccuracies in genetic studies. To gain a more comprehensive understanding of animals' genetic milk-producing abilities, it is imperative to identify and assess the impact of non-genetic environmental factors on milk production.

In Nepal, there exists a gap in our understanding of the non-genetic factors that influence milk production. These factors encompass a wide range of variables such as farm types, the number of animals, species diversity, management practices, housing conditions,

feed quality, health services, and breeding timing. All of these elements significantly influence the milk production and quality of cattle. Milk itself is a complex fluid comprising water, proteins, fats, minerals, carbohydrates, and various minor components including vitamins and hormones. It is crucial to note that milk can rapidly spoil when left at room temperature. Spoilage may occur due to bacterial growth or the breakdown of fats and vitamins. Inadequate care in the handling, processing, transportation, and storage of milk can accelerate its deterioration, leading to an increased presence of harmful bacteria in raw milk.

This fiscal year study's primary focus is to evaluate how various factors, including feed, the number of calving a cow has undergone, the stage of lactation, and dietary choices, impact the performance of jersey and Holstein crossbred cattle. The overarching goal is to develop effective evaluation methods, particularly for organized farms, with the aim of enhancing the economic traits of these cattle breeds in Nepal.

Methodology

Chitwan, dairy pocket district of Nepal, is located at geographical coordinates 27.5291°N to 84.3542°E where the commercialization of dairy industry has been rapid in last few years. The study was conducted at National Cattle Research Program, Rampur, Chitwan from shrawan 2080 to asad 2081. Animals were maintained under intensive housing system with concrete floor with cow mat over the floor. Information regarding the animals were recorded and generated from different registers (Livestock register, milking register) maintained at National cattle research Program (NCRP), Rampur, Chitwan.

Result

The analysis also met the assumption of multicollinearity given that the tolerance values range from 0.965 to 1.00 while the value inflation factor (VIF) range from 1 to 1.037. The result of the hierarchical regression show that the inclusion of milking system accounted for 2.7% variance in milk yield, $\Delta R^2 = 0.027$, $F(1, 479) = 13.139$, $P < 0.001$, and the analysis showed significant negative predictor of milking system on milk yield in dairy cow ($\beta = -0.16$, $CI = -2.96, -0.87$, $P < 0.001$). We accept the research hypothesis. Inclusion of stage of lactation into the model 2 added additional 29.2% variance in predicting milk yield $\Delta R^2 = 0.292$, $F(1, 478) = 204.37$, $P > 0.001$, result shows that significant and negative predictor of milk yield in dairy cow ($\beta = -0.540$, $CI = -2.86, -2.17$, $P < 0.001$). Where the research hypothesis is accept in model 2. Inclusion of Parity into the model 3 added additional 0.04% variance in predicting milk yield $\Delta R^2 = 0.004$, $F(1, 477) = 2.70$, $P > 0.05$, where non-significant positive predictor on milk yield ($\beta = 0.63$, $CI = -0.03, 0.30$, $P > 0.05$), indicating that the hypothesis 3 was rejected. The analysis showed that the addition of season showed additional 4.3% variance in Model 4 on milk yield of dairy cow, $\Delta R^2 = 0.043$, $F(1, 476) = 32.56$, $P > 0.001$, In model 4 season was added and result

showed that season was significant and negative predictor on milk yield ($\beta = -0.21$, CI = -9.15, 0.47 $P > 0.05$), indicating that the hypothesis 4 was accept.

Table 8. Hierarchical regression analysis of non-genetic factor on milk yield

Hierarchical regression analysis of non genetic factor on milk yield							
Variable	Model1	Model2		Model3		Model4	
		CI; 95%	CI; 95%		CI; 95%		CI; 95%
Milking	-0.16***	-2.96,	-0.20***	-3.31,	-0.20***	-3.20,	-0.19***
System		-0.87		-1.56		-1.43	
Stage of			-0.54***	-2.86,	-0.54***	-2.87,	-0.50***
Lactation				-2.17		-2.18	
Parity					0.63 ^{NS}	-0.03,	0.60 ^{NS}
						0.30	0.30
Season						-0.21***	-9.15,
							0.47
Model Fit Statistics							
F-value	13.139***		204.372***		2.708 ^{NS}		32.56***
R ²	0.027		0.318		0.322		0.365
ΔR^2	0.027		0.292		0.004		0.043

3.6 Effect of different probiotics strains in milk composition, milk yield and nutrient digestibility in dairy cattle at NCRP, Rampur, Chitwan

Introduction

In dairy production, feed is the most crucial component, accounting for 60 to 65 percent of overall raising costs. To obtain for maximum profitability, a balanced diet is required for both economically and nutritionally. Adopting scientific feeding practices for dairy animals is necessary to maximize profitability in the dairy industry. Various feed additives, including probiotics, enzymes, buffering agents, and herbs, can be utilized in these circumstances to enhance the health condition and productivity of the farm animals. To increase livestock productivity, probiotics including yeast (*Saccharomyces cerevisiae*) and bacteria (*Bacillus subtilis*) are frequently used. In nursing cows, adding yeast has increased milk output and milk fat (Ayad *et al.*, 2013). Increased dry matter intake, nutrient digestibility, milk yield, composition, decreased somatic cell count, in lactating ruminant animals when supplemented with *Bacillus subtilis* (Luan *et al.*, 2015).

Materials and method

Present experiment was conducted on cross breed cow at National Cattle Research Program (NCRP), Rampur, Chitwan. 15 cross breed cows were used in experiment. Breed, lactation stage and daily milk output were taken into consideration when choosing the animals. Selected cow were divided in 5 groups T_0 (control) T_1 (20gm bacillus subtilis), T_2 (40 gm bacillus subtilis), T_3 (20 gm Saccharomyces cerevisiae) and T_4 (40gm Saccharomyces cerevisiae). Concentrate ration, Napier grass, rice straw according to Dry matter requirement (On the basic of body wt & their milk production) were used for the during experiment. For all treatment groups, observations about the daily milk yield in record book, weekly milk composition and somatic cell count, and feed intake were taken during the study period. At weekly intervals, the milk composition was examined in terms of milk protein, fat, density, lactose; SNF and electric conductivity by Lacto scan milk analyzer. The Somatic cell count was determined at fortnightly interval by using Lacto scan somatic cell counter. Milk production was recorded daily both in the morning and evening for whole experimental period. Milk sample were drawn for analysis from morning and evening milking once in every week through the experimental period. Milk component (Fat%, SNF%, Density, Lactose, Protein and electric conductivity) and Somatic cell count were determined by Lacto scan milk analyzer. Overall performance of dairy cow from experimental groups is present in Table 1.

Table 9. Average milk yield and milk composition of treatments groups.

Treatments	Milk yield	Milk Composition					
		Fat%	SNF%	Density%	Protein%	Lactose%	Conductivity
T_0	5.42±0.72	4.99±0.20	8.07±0.12	26.46±0.36	2.87±0.87	4.40±0.76	5.46±0.21
T_1	6.36±0.81	4.30±0.18	8.19±0.14	34.35±6.86	3.04±0.06	4.53±0.07	5.21±0.15
T_2	6.10±1.03	4.72±0.19	8.29±0.85	27.29±0.26	3.02±0.30	4.55±0.04	5.06±0.19
T_3	6.32±0.08	4.72±0.18	8.36±0.22	27.58±0.94	3.05±0.08	4.59±0.12	5.54±0.25
T_4	6.08±0.78	4.61±0.28	7.94±0.19	26.08±0.61	2.89±0.07	4.35±4.11	5.48±0.26
Overall	6.05±0.30	4.67±0.09	8.17±0.73	28.35±1.40	2.97±0.03	4.48±0.04	5.35±0.09
F-value	0.248	1.373	1.070	1.193	1.517	1.247	0.379
P- value	0.904	0.260	0.384	0.329	0.215	0.307	0.435

Preliminary result like milk composition and milk yield were included. There was no significant different in milk yield and milk composition among the different groups. Average milk yield of T_1 group have found higher than other group while lowest milk yield was observed in T_0 . Mean±SE of milk component like SNF (8.36±0.22), protein (3.05±0.08) lactose (4.59±0.12) and conductivity (5.54±0.25) were observed highest in T_3 group with insignificant but average mean value of Fat and Density increase in T_0 and T_1 respectively.

Reference

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Luan, S., Duersteler, M., Galbraith, E. A., & Cardoso, F. C. (2015). Effects of direct-fed *Bacillus pumilus* 8G-134 on feed intake, milk yield, milk composition, feed conversion, and health condition of pre-and postpartum Holstein cows. *Journal of Dairy Science*, 98(9), 6423-6432.

3.7 Outreach research project

3.7.1 Background

Several promising technologies have been generated by Nepal Agricultural Research Council (NARC) for the enhancement of livestock production and productivity from time of its establishment to date but the technology has not been adopted by the farmers as expected due to lack of proper extension and validation in farmer's field. So as to address the issue of extension and validation in farmer's field and align with principle of "seeing is believing" for adaptation of technology we are working by establishing outreach sites in different places. In outreach sites, demonstrations and verification of technologies developed in research station are made. Since outputs generated in research station may not work in the real scenario of farmer's field. It is only justice to recommend technology to farmers which are validated in farmer's field. In this FY we have 2 outreach sites, one in Madi Municipality, Chitwan and other in Devdaha Municipality, Rupandehi for verification and dissemination of generated technology. These outreach sites were terminated from this fiscal year because we are running our proven technologies in these outreach site for more than five years.

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.

Madi, Chitwan is almost 48 km far away from Bhartapur, Chitwan and have to go through area of Chitwan National Park. Some parts of Madi area lies in buffer zone.

Madi area is very popular for productive agricultural land. In this place most of the farmers used to rear local cattle but nowadays farmers are shifted to crossbred cattle farming. In Madi, local government has emphasized the promotion of cattle farming & milk production. They are providing subsidy on the basis of milk production as Rs. 3 per liter of milk production. Farmers of this area are more interested in commercial cattle farming by adopting latest technology.

Devdaha of Rupandehi is almost 18 km away from Butwal city. It is a semi urban area with most of the farmers with crossbred cattle. Local government has focused on dairy sector improvement especially by breed improvement in Devdaha. Some commercial farms with large herd size of 100 cattle have been established. Farmers are involved in cattle farming through cooperatives by making groups. Different activities tested in farmer's field conditions are described below:

3.7.2 Adaptation of teat dipping in farmers management condition

Teat dipping technology was demonstrated to farmers of the new OR site of Sindhuli and requested to make this practice for their dairy animals to prevent mastitis. Similarly, farmers of OR site Madi were also made aware about teat dipping technology again and again. Commercial farmers are interested in using this technology compared to small holder with 1-3 cows. In summary, adaptation rate is low as expected in OR sites.



Fig: Teat dipping solution preparation and distribution in OR site Sindhuli

3.7.3 Health campaign

Free animal health camp was conducted in kakare village of Hariharpurgadhi gaupalika-1, Sindhuli. 23 cows and 2 buffaloes were brought in the camp by farmers. Anestrus and repeat breeding were found to major problem in dairy cattle and buffalo in the kakare area. Some cows had problem of diarrhea and hygroma of joints too. Scarcity of AI technician for animals was observed in the village. Farmers have not got payment of their sold milk since long time (more than 6 months).

Biyearly conduction of door to door animal health camp with expert service for animal will be important. Farmers should keep high merit bull for breeding until proper facility for AI available. Similarly, farmers of this village should provide good feeding scheme to their animals for good productive and reproductive performance.



Fig: Opening program of 1 day animal health campaign, Hariharpurgadhi-1, Sindhuli



Fig: Rectal palpation for infertility checkup in cow

3.7.4 Transfer of technology related to cattle breeding and reproduction

We have made good discussion with farmers about benefits of artificial insemination and good time for insemination in cows all three OR sites. Cross breeding with good merit animal will help to produce good quality offspring. Use of estrus synchronization protocols for timed breeding, use of ultrasound machine for early pregnancy diagnosis were also informed to farmer. Demonstration of USG for early pregnancy diagnosis was made in all OR sites.

3.7.5 Vaccination, drenching and dipping

Drenching and dipping were done in outreach sites Madi, Chitwan and Hariharpurgadhi, Sindhuli. Vaccination was not done this year in any site. Local government veterinary section has done vaccination against FMD, HS BQ and LSD.

3.8 Farm management and production project

Dairy cattle herd management is an important factor for dairy farms to maintain long-term high production. For this, continuous and successful management is required. Factors like cattle nutrition, reproduction, health, housing management, production and marketing are important. Alongside these essentials, all dairy farms must deal with the

logistics of weather, transportation, and expenses. It can be a lot to balance, but proper planning and thoughtful utilization of the latest dairy farm training and technology make it possible. We have planned for proper management of dairy herd to maintain high milk production and happy cows as far as possible we can. NCRP farm is mainly established as a research farm and functions as an elite herd for cattle in the country as well.

NCRP cattle herd comprises of various blood levels of Holstein and Jersey crossbreds, Terai cattle, Achhami and Lulu cattle. The review of past work revealed that 62.5% blood level of Jersey or Holstein Friesian is better in existing management system in Nepal.

Concentrate feed (pellet), seasonal green grasses (legume and non-legume), perennial forages, straw, silage and tree fodder were provided as per feeding requirement of cattle in the farm. Commonly Maize and Teosinte were cultivated as summer forage and Oat & Common Vetch as winter forage. Bajra, Signal grass, Setaria, Mulato, Joint-Vetch, Stylo, Fleminzia, Napier, Perennial Sorghum etc. were grown as perennial fodder/forage and fed to the animals in appropriate feeding regime. Animals were vaccinated against HS, BQ and FMD as per the recommended schedule. Regular drenching against flukes/worms and use of ectoparasiticide drug as per need was done. Regular observation of estrus in the cows and treatment of diseased animal as per requirement was done. Milk produced from the lactating animals was either sold as whole milk or used for making dairy product like paneer, ghee, khuwa, dahi, ice cream, etc. Farmyard manure produced in the farm was used for fertilizing the forage/fodder blocks of the NCRP farm and surplus amount was sold. Biogas was also produced from manure of farm and supplied to residential area of NCRP and NMRP, Rampur. Seeds of seasonal forage were produced for planting for self and distribution.

3.8.1 To implement the activities of good husbandry practices to produce clean milk (Breeding, health, nutrition):

Milk is a sterile product when secreted in the udder of a healthy cow. It is constituted with nutrients, which makes it 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 cow esp. mastitis) and external factors which includes cow's body, milker's hygienic habit, cleaning of milking and storage utensils, methods of milking, feed/water supplies, milking environment etc. In our farm to prevent the mastitis, regular teat dipping with the dipping solution (Povidine iodine: Glycerine = 9:1) instantly after completion of milking was carried out. Regular grooming with brush and bathing with clean & fresh water was done to remove dirt and dung from external body surface especially hind parts. Milking and storage utensils were cleaned by washing with detergents and maintained aseptic. Both hand milking and machine milking technique are in practice in NCRP farm. To maintain cleanliness and prevent the transmission of infections, milking

machines were disinfected after completion of individual milking and in case of hand milking personal hygiene was properly followed. Cleaning and disinfection of farms was done regularly to maintain clean milking environment.

In this FY Day to day activity of GHP for milk production was followed in the farm and 134233.5 liters of clean milk was produced. Artificial insemination was done 122 times to different cows.

3.8.2 Disease prevalence related to infertility on station and on farm

Ninety-two (92) serum samples of infertile cows having problems of repeat breeding, anestrus and abortion were collected from Nawalpur area, eastern Chitwan and NCRP farm. Brucellosis test by using ELISA test kit (ID vet France) was conducted and 1 sample from Nawalpur was found to be positive.



Fig: Blood sample collection in Kawasoti Municipality, Nawalpur (Dr. Yagya, Dr. Shivahari, Dr. Risav and technician team from Kawasoti)



Fig: Brucellosis test (ELISA kit) by B.V.Sc. & A.H. intern student Bhumika and Ganesh in NCRP lab

3.8.3 Outbreak investigation on station and on farm

In this fiscal year there was no any outbreak of new cattle disease in NCRP farm and other parts of country. Investigation was made on infertility and mastitis of cows. In case of mastitis major bacterial infection was from *Staphylococcus* followed by *E. coli* and sensitive antibiotics were Gentamicin, Amikacin, Penicillin etc.

In case of infertility nutritional anestrus, persistant corpus leutem, delayed ovulation, cystic ovary, cervicitis and metritis were found to be major causes.

3.8.4 Assessment of heat stress in different cattle breeds (Terai, exotic and Terai crossbreds) in sub-tropical

Data recording for assessing heat stress, parameters like rectal temperature, vaginal temperature, respiration rate and ruminal motility were carried out. Parameters recording was done from Asar to Bhadra daily in NCRP farm

Table 10. Environmental conditions in NCRP, Rampur

Breed	Vaginal Temp (°F)	Rectal Temp (°F)	Respiration rate	Ruminal motility (per 2 min)	Minimum temp. of shed (°C)	Maximum temp. of shed (°C)
HF Pure	102.1	102.3	68	2.8	25.1	34.8
HF Cross	101.9	101.7	52	2.7	25.5	35.1
Jersey Cross	101.6	101.3	70	2.6	25.5	35.1
Terai Cross	100.9	100.9	46	2.5	27.5	36.5
Pure Terai	101.1	101.7	31	1.6	24.9	34.6

3.8.5 Fodder and forages seed production

Seed production of oat and teosinte is not possible this year due to low production of forage. All the forage used in cattle feeding so no seed production.

3.8.6 Silage production for feeding cattle

Maize, Teosinte, Sorghum, Bajra & Napier grasses were used for preparation of silage. To add value to silage this year chopped grass was treated by spraying 10% molasses solution. About 97 tons of silage was prepared in this fiscal year. After 2 months of fermentation, feeding silage at the rate of 4-5kg per animal was done. Milk production was recorded daily, and milk composition was recorded monthly. In feeding experience of molasses treated silage, palatability and digestibility has increased.

3.8.8 Nutritional management with appropriate proportion of concentrate and roughage:

Concentrate feed 1,99,600 kg and roughages green grass 13,15,000 kg was given to cattle. Paddy straw, wheat straw and silage were also fed as required.

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.

3.8.9 Milk and milk product preparation and quality analysis

609.75 kg of paneer produced from 4955 liters of milk, 215-liter dahi from 215 liters of milk and 96 kg khuwa produced from 446 liters of milk.

3.8.10 Maintenance and proper use of bio-gas plant

Regular maintenance and use of bio-gas continued. In winter and cloudy days fermentation of gas is decreased and gas production is less compared to sunny

Growth record of calves

In this fiscal year, total 51 calves were born, out of which 18 were Holstein Friesian cross, 26 were Jersey cross, 4 were Pure Lulu, 2 were Lulu and HF cross, 5 were Terai cross, 1 were Pure Terai and 1 was Lulu. 9165 liters of milk was fed to the calves in this fiscal year.

3.8.11 Routine milk analysis

Milk samples from all lactating animals were collected on a regular basis and monitored for its composition. On average the milk composition of cattle of NCRP farm were as presented in following table:

Table 11: Average milk composition of NCRP cows in the fiscal year 2080/81

Breed	Fat	Density	Lactose	SNF	Protein
Jersey Cross	5.02	29.6	4.82	8.60	3.15
Holstein Freisian Cross	4.70	31.38	5.12	8.68	3.11
Pure Lulu	5.90	30.00	5.07	9.30	3.39
Pure Terai	5.98	22.65	4.02	7.40	2.70
Average	5.11	29.66	4.93	8.87	3.25

3.8.12 Product diversification

During this FY 609.75 kg paneer, 96 kg khuwa, 215 liters dahi, 2 kg ghee were prepared in the dairy unit and sold. Price of different products was Rs 700/kg, 700/kg, 90/lit and 1000/kg respectively.

3.8.13 Introduction and evaluation of different forage for permanent pasture

Different forages like super napier, Co3, Co4, setaria, signal grass, perennial sorghum, mulato, gautemala, stylo were introduced and their production performance and quality were evaluated.

Production of green forage

Approximately 13 ha land was used for cultivation of green forage at NCRP. Stylo, setaria, signal grass, napier hybrids (Super napier, Co3, Co4), perennial sorghum, joint vetch, mulato, desmodium were cultivated as perennial forage. Maize, teosinte, annual sorghum, bajra and rice bean were cultivated in summer. Similarly, common vetch & oat were cultivated in winter.

Seed production of major forage crops

The major forage crop for winter was oat and teosinte, sorghum, bajra and maize are the major summer forage crops. In this fiscal year we couldnot produce seed because of fodder deficit in the farm.

3.8.14 Field gene bank management

More than 170 cattle of different breeds are managed in the NCRP farm. Terai, Lulu, Achhami cattle are maintained as indigeneous cattle of Nepal and Holstein and Jersey crossbred are maintained as exotic breeds.

3.8.16 Coordination and collaboration

Coordination and collaboration was done with NLBO Pokhara, MoLMAC Bagmati province, Agriculture and Forestry University Chitwan, Bharatpur Metropolis, Madi Municipality, Devdaha Municipality, Bandipur Rural Municipality etc.

3.8.17 NARC Day, milk day celebration

NARC day was celebrated by planting trees and fruit trees in office area, quarter area and farm area. Also, an interaction program with farm workers and office staff (scientist, technicians, finance and admin) was made.



Fig: Plantation of trees by staffs of NCRP, Rampur on occasion of NARC Day 2081



Fig: Interaction program between NCRP farm workers and staffs

3.8.18 Maintenance of herd book

Herd books were maintained regularly. Primarily data entry was done in loose sheet, MS excel and afterward maintained in herd book as summary.

To maintain cattle with good health and hygiene

Cattle were observed daily and treated in case of illness promptly. Also, regular deworming, vaccination, dipping was done. Sanitation of the farm and providing vitamin and mineral time to time. Regular teat dipping practice to prevent mastitis.

3.8.19 Vaccination for major economic diseases, drenching against major internal and spraying for external parasites

Vaccination & drenching program were held in Madi, Chitwan & Devdaha Rupandehi where more than 120 cattle were vaccinated against FMD, HS and BQ & more than 160 cattle were dewormed with antihelmintics.

Anthelmintics drug for cattle was distributed to twenty farmers of Madi for 120 animals and FMD vaccination was done to 120 cattle of Madi Municipality

3.8.20 Health campaign to monitor health and infertility of cattle

Animal health & infertility management door to door camp was organized at Devdaha, Rupandehi. General health examinations of animals presented at home was done and respective medicines were distributed to farmers for their animals. Pregnancy diagnosis of cattle was done using USG. Service was provided to more than 12 cattle farmers in the health camp. More than 150 animals have benefited in camp with problems of infertility, repeat breeding, anestrus, mastitis, diarrhoea, internal/external parasitic infestations, indigestion, emaciation, wound and so on.



Fig. Activities at Animal Health Camp Devdaha, Rupandehi

3.8.21 Collaborative/Support Research Highlights

Such research activities are jointly conducted in collaboration with other research stations, institutes and universities (to support the students of bachelor or master degree). Here are some of the projects works carried out in the FY 2079/80.

4. PRODUCTION

4.1 Cattle Production Program

The Program had maintained a herd of 181 heads of cattle in its farm. It includes different stages of animals of Jersey crossbreds, Holstein Friesian crossbreds, Terai, Terai crossbreds, Lulu and Achhami. The initial and closing herd composition of fiscal year 2080/81 is given in table 10 below:

Table 12. Herd composition of cattle at the beginning and the end of fiscal year 2080/81

Stock record of NCRP 2080/81														
Opening Balance								Closing Balance						
Breed	Adult		H	YB	Calves		Total	Adult		H	YB	Calves		Total
	F	M			F	M		F	M			F	M	
HF Cross	23	0	10	4	8	4	49	20	0	15	1	8	7	51
Jersey Cross	50	0	21	5	21	8	105	35	0	33	0	5	17	90
Terai Pure	19	3	0	0	2	0	24	9	1	2	0	2	0	14
Terai HF Cross	3	0	0	0	0	0	3	3	0	0	0	0	1	4
Terai Jersey Cross	1	0	6	0	0	0	8	2	0	5	0	1	0	8
Lulu	7	1	0	0	1	1	10	9	0	0	0	1	2	12
Achhami	2	0	0	0	0	0	2	2	0	0	0	0	0	2
Total	105	4	37	9	32	13	201	80	1	55	1	17	27	181

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

Table 13. Monthly milk and milk products production in the FY 2080/81

Month	Total Milk (litr.)	Paneer (kg)	Khuwa (kg)	Ghee (kg)	Dahi (Liter)	Rasbari (Piece)
Shrawn 2080	9467.9	10	-		-	
Bhadra 2080	11058	51.5	-		9.5	
Aswin 2080	11988.5	93	40			
Kartik 2080	13192	103	27			
Mangsir 2080	14683.5	117	39.5			

Poush 2080	13337	104.5	17			
Magh 2080	14790.5	57	19.5			
Falgun 2080	12989	84.25	-			
Chaitra 2080	13133	78	-		59.5	
Baisakh 2081	11480	50.5	29	1.2	82	
Jestha 2081	11091	63				
Ashad 2081	11495.5	22.5		2.3	50	145
Total	117694.9	834.25	172	5	201	145

Table 14. Calf production in the 2080/81

Calf Production	Sex	Number	Total
Jersey cross	M	27	33
	F	6	
Holstein Friesian Cross	M	7	15
	F	8	
Pure Lulu	M	2	4
	F	2	
Terai X Jx	M	1	2
	F	1	
Pure lulu			4
Total		No.	61

5. TECHNOLOGY TRANSFER AND SERVICES

Technology generated by the research has no meaning unless it is extended to the farmers. Technology developed by NCRP and other institutes useful for different stakeholders was shared in this FY also. We hoped that it has become useful to stakeholders.

5.1 Training/workshops

In this FY one day Cattle and buffalo working group meeting was conducted in NCRP Rampur. Researchers from NARC, Academics from AFU and senior extensionists DLS working on bovine commodity were participated in the workshop. Currents research issues of cattle and buffalo in Nepal were discussed in the problem.



Fig. Participants of one day cattle and buffalo research workshop in Rampur

5.2 Service

Technical briefing useful for cattle farming was done to the farmers, students, extension officials, co-operative members, farmer groups, staffs of NGOs/INGOs. More than 4200 people were benefitted through our counseling and farm visit. Beside this, program distributed the high-quality bulls as a seed animal to the farmers for the further multiplication of the superior quality progeny. Moreover, program also supplied clean and fresh whole milk continuously to at least 80 household for daily consumption besides DDC. Milk products like khuwa, paneer, ghee and Rasbary were also sold to staffs of NCRP and NMRP.

One door to door Animal Health and Infertility Correction Camp was organized at Devdaha, Rupandehi. A general health examination of animals presented at the camp was done and respective medicines were distributed to farmers for their animals. Most of the animals were presented with the problem of repeat breeding and anestrus and they were treated accordingly. Animals with poor BCS were supplied antihelmintics, minerals, vitamins and liver tonics. Ectoparasiticide drug was also distributed for animals. Early pregnancy diagnosis of cattle was done by using USG.

5.3 Publication

A fifty copies of Annual Report 2080/81 were published.

5.4 Research Publication

SEROPREVALENCE AND RISK FACTORS ASSESMENT FOR CATTLE BRUCELLOSIS IN KANCHANPUR DISTRICT

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ABSTRACT

Brucellosis, is one of the most important contagious bacterial zoonotic disease of livestock reported throughout the world is considered endemic in Nepal causing significant loss in production and productivity of dairy farming. A Cross-sectional study was done to determine the seroprevalence and risk factor associated with cattle brucellosis in Kanchanpur district of Sudurpaschim province. The estimated size was 162; however, only 127 samples were taken purposively from a population of 152,601 cattle due to fund limitation. Three (3) ml of blood was collected from jugular vein in plain vacutainer using sterile equipment. Blood was transported to laboratory of NCRP in icebox maintaining cold chain. Serum was separated by centrifuging blood samples at 3000 rpm for 5 minutes and serum samples were stored in deep freezer at -21°C. Epidemiological data for the study was collected by using questionnaire developed in mWater surveyor. Population characteristics about age, sex, breed, parity, herd size, housing system, introduction of new animals, history of retention of placenta, repeat breeding and abortion, sign of hygroma of carpal joint-arthritis, method of insemination and rearing of other animal species in proximity within herd, history was included in questionnaire. Samples were subjected to i-ELISA test. The overall prevalence was found 0.78% (1/127). The presence of positive case implies that the community is not disease free. Thus, robust and well-designed further study has to be done taking larger

sample size and study should be extended to other region to assess the prevalence and distribution of disease.

Keywords: Zoonotic, Sudurpaschim province, serum, ELISA

SEROPREVALENCE OF BRUCELLOSIS IN CATTLE OF RUPANDEHI DISTRICT, NEPAL

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ABSTRACT

Brucellosis is a contagious zoonotic disease affecting both cattle and humans, with notable economic and public health implications in Nepal. Despite previous studies indicating varying prevalence rates in different regions of the country, there is limited recent data on the status of Brucellosis in Rupandehi district. A cross-sectional study was conducted in Rupandehi district, Nepal, from 1st July to 30th September 2023. A total of 141 cattle blood samples from 92 farms were collected and tested using ID Screen® Brucellosis Indirect ELISA kits. Epidemiological surveys were also conducted to gather information on risk factors associated with Brucellosis. All 141 blood samples were tested negative for Brucellosis, resulting in a seroprevalence rate of 0%. This study provides valuable data indicating a zero prevalence of Brucellosis in cattle of Rupandehi district, Nepal. This research doesn't show any association for the prevalence of Brucellosis regarding the risk factor.

Keywords: Abortion, Brucellosis, Cattle, iELISA, Nepal

FARMERS' PERSPECTIVE ON VETERINARY SERVICES IN BHARATPUR METROPOLITAN CITY, CHITWAN, NEPAL

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ABSTRACT

Livestock farming is an integral part for developing countries like Nepal and their health status becomes one of the major aspects of concern. Bharatpur metropolis is popular for livestock and poultry farming and veterinary academic institutions. This

study aims to find out how farmers of Bharatpur metropolis feel about the veterinary services available to them. Questionnaire survey was conducted in 19 wards out of 29 wards of Bharatpur metropolitan city with 100 purposively taken household samples. It showed that majority (72%) of the farmers are moderately to highly satisfied from the veterinary services they are getting; Satisfaction level of farmers was found to be significantly higher (P-value= 0.118) for the service provided by the veterinary doctors (satisfaction score= 4 out of 5) than that by the veterinary technicians (satisfaction level= 2.5 out of 5). Practice of keeping financial record of farm was found to be another factor significantly associated with the satisfaction level (P-value= 0.017), with record keepers being less satisfied. Out of 100 respondents, only 39% reported to receive service from veterinarians. In the field level, veterinary technicians were found to be more available to farmers than veterinary doctors. About half of the respondent (49%) reported the veterinary service/ treatments to be expensive to very expensive. The practice of financial record keeping was found to be the only factors significantly affecting (P-value: 0.001) the expensiveness of veterinary service/ treatment felt by the farmers with the record keepers reporting more expensive veterinary cost. Although in general, the veterinary service was found to be in satisfactory level, much improvement is to be done in quality of service being delivered to the farmers.

Keywords: Livestock, veterinarian, veterinary technician, satisfaction level

5.5 Papers in Submission/Review for publication

Paneru U., Adhikari DP, Paudel S, Pandeya YR, Ghimire S, Malla S, KC BB, Hamal P, Dahal M. 2024. Use of neck collar in cattle for monitoring health, welfare and fertility, experience from NCRP, Rampur.

Adhikari DP., Pandeya YR, Ghimire SH, Paneru, U. 2024. Cattle research in Nepal: current status, challenges and way forward.

Pandeya YR., Gautam, G, Sah Satrugan, Guragain R, Ghimire S, Gautam P, Kshetri S, Chaudhary M and Paneru U. 2024. Study on causes of infertility in buffaloes of central Nepa. Paper presented in Asian buffalo Congress in Bangladesh.

6. OTHER ACHIEVEMENTS

The detail of staffs' participated in different trainings is presented in the annex 6

7. BUDGET AND EXPENDITURE

The total annual budget and expenditure of the program for this fiscal year are provided in details in annex 7.1. Program is in the need of more budgets to strengthen its research work. Program needs budget to build cattle sheds, milk parlour, laboratory and farm machineries. Details of special project budget and expenditure, revenue status and beruju status of the program are mentioned in annexes 7.2, 7.3 & 7.4 respectively.

8. KEY PROBLEMS

The major problems of the programs are:

1. Inadequate number of scientists, technicians (50% less than approved posts).
2. Inadequate farm mechanization machines/tools, laboratory facilities and cattle sheds.
3. Poor mechanism of technology dessimination.
4. Lack of carrier development opportunities and encouragement for the staffs.

9. WAY FORWARD

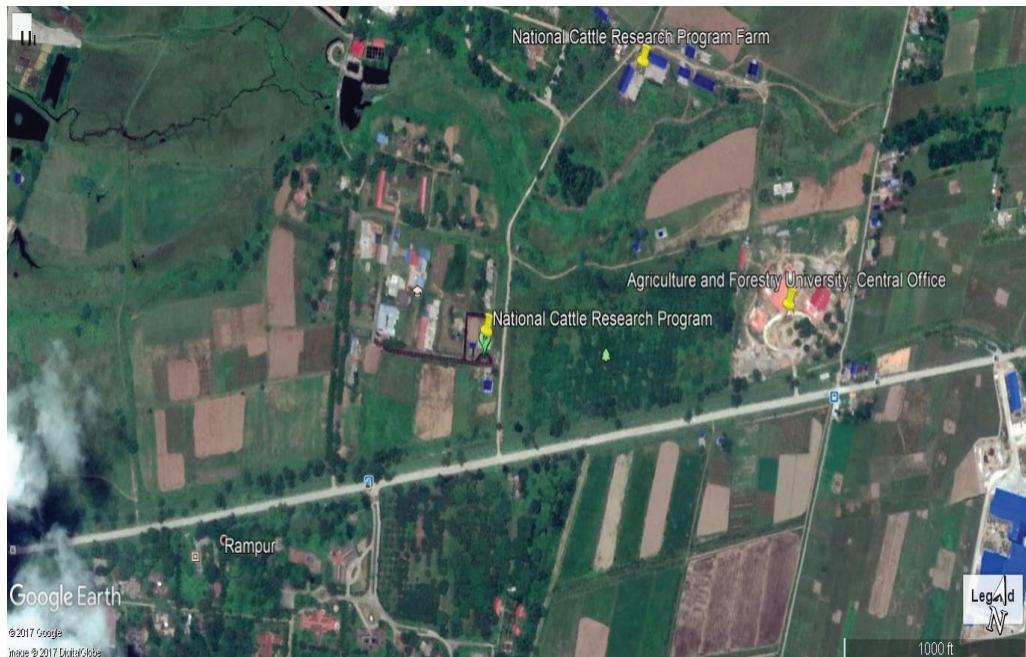
1. Conduct various research programmes either in sole authority or in collaboration with other institution on production & management, nutrition, feeding, breeding and health care of cattle to enhance their production & productivity.
2. Conduct farmer's field and applied research to demonstrate and disseminate the technologies for their wider adoption.
3. Upgrade the native *zebu* cattle by strengthening AI facilities and distribution of upgraded breeding bulls to the farmers.
4. Conduct research to mitigate the methane production by dairy cattle and make farming more environmentally friendly.
5. Develop low-cost milk production technology.
6. Maintenance and production of improved grasses for animal feeding, silage production and forage seed distribution to the farmers.
7. Conduct research on cattle vaccines.

Annexes

Annex 1.1. Map showing site of NCRP Office



Annex 1.2. Map of showing areas of NCRP in Rampur, Chitwan



Annex 2.1. Lists of Laboratory Facilities

SN	Name of Laboratory	Major instruments	Manpower in Laboratory	Testing facilities		
1	Dairy Laboratory	Lacto-scanner, Khuwa maker machine, Paneer vat, Sealing and filling machine, Milk pasteurizer (Batch pasteurizer), Milk analyser, Ice cream vat, Deep freeze, Refrigerator, Cream separator, Chilling vats	Senior Scientist/ Senior /Technical Officer, J.T., T1	Milk products	Quality	Milk
2	AI Laboratory	AI Gun, Refree with liquid nitrogen, Estrus detector, USG, Liquid nitrogen mother tank	Technical Officer, J.T.A.	Artificial Insemination of cattle, Pregnancy test		
3	Health Laboratory	Microscopes, Incubator, Laminar flow, Autoclave, Water bath, Hot-air oven, Mastitis detector, Centrifuge, ELISA reader, Hematocrit centrifuge, Refrigerator, Deep Freeze	Scientist (S1), Technical Officer, J.T.	AST, Bacterial culture, examination, Biochemical for mastitis, Different infectious diseases test, PCV test		Fecal tests
4	Nutrition Laboratory	Sox-holet apparatus, Muffle furnace, Kjeldhal apparatus, Fiber digester, Hot air oven, Titration unit	Scientist (S1), J.T.	Estimation of crude protein, Crude fiber, Ether extract, Dry matter		Ash,

Annex 2.2. Human Resources in 2080/81 (2023/24)

S.N.	Name	Designation	Qualification	Specialization/ Working area
1.	Mr. Devi Prasad Adhikari	Coordinator/ Senior Scientist (S3)	M.Sc.An.Sc.(LPPM)	LPPM
2.	Mr. Bishnu Bahadur KC	Senior Scientist (S2)	M.Sc.An.Sc.(LPPMf)	LPPM
3.	Dr. Uddhav Paneru	Scientist (S2)	Ph.D. (ANB)	ANB
4.	Dr. Hemraj Dhakal	Scientist (S1)	Ph.D. (LPM)	LPPM
5.	Dr. Shiva Hari Ghimire	Senior Technical Officer (T8)	M.Sc., An. Sc. (LPM)	LPPM
6.	Mrs.Durga Rawat	Technical Officer	M.Sc., An. Sc. (LPM)	LPPM
7.	Dr. Yagya Raj Pandeya	Technical Officer	M.V.Sc.(Therigenology)	LPPM
8.	Mrs. Laxmi Parajuli	Account Officer	B.A.	Finance
9.	Mrs. Puspa Prabha Bhandari	Administrative	B.A.	Administration
10.	Dr. Pratik Hamal	Technical Officer	B.V.Sc. & A.H., MSc (LPM)	Lab and Animal Health
11.	Mr. Nabaraj Subedi	J.T.A. (T4)	J.T.A. (Animal Science)	
12.	Mr. Khadka Bahadur Khadka	J.T.A. (T4)	J.T.A. (Plant Science), 10+2	
13.	Mr. Pasupati Khanal	J.T.A. (T4)	J.T.A. (Animal Science), B.A.	
14.	Mrs. Mitra Maya Gurung	Lower Technician	J.T.A. (Animal Science), I.A.	
15.	Mrs. Aasha Gurung	Lower Technician	IX	
16.	Mr. Dipendra Ojha	Lower Technician	IX	
17.	Mr. Aash Bahadur Darai	Lower Technician	J.T.A. (Animal Science)	

Annex 3.1. Summary of NARC Research projects in FY 2080/81 (2022/23)

S.N	Project/Activity	Annual Budget (Rs. 000)	Progress description
1	3 Participatory approaches for technologies verification and demonstration at outreach sites	1243	
1.01	Site Selection	92	
1.02	Baseline survey and establishment of new OR site	95	Baseline was done in Hariharpurgadi rural municipality of Sindhuli district. This area was decided as new OR site of NCRP
1.03	Adaptation of teat dipping in farmers management conditions	137	Teat dipping technology was demonstrated to farmers of new OR site of Sindhuli and requested to make this practice for their dairy animals to prevent mastitis. Similarly, farmers of OR site madi were also made aware about teat dipping technology again and again. Commercial farmer are quiet interested to use this technology compared to small holder with 1-3 cows. In summary adaptation rate is quiet low as expected in OR sites.
1.04	Vaccination for major economic diseases, drenching against major internal and spraying for external parasites.	169	Drenching and dipping was done in outreach sites of Madi, Chitwan and Hariharpurgadhi, Sindhuli. Vaccination was not done this year in any site. Local government veterinary section has done vaccination against FMD, HS and BQ, LSD.
1.05	Preparation and demonstration of UMMB and silage at farmers field of OR sites	221	Demonstration of UMMB and silage making was done in Hariharpurgadi, Sindhuli. 25 farmers were actively involved in this work.

1.06	Community forage and forage seed production demonstration	161	Sets of different Napier (CO3, CO4, Super) were distributed to different farmers of the OR sites. Teosinte, oat and sudan grasses seeds were also provided to the farmers of OR sites. Production performance of these fodders and forages will be evaluated
1.07	Transfer of technology related to cattle breeding and reproduction	161	Good discussion was done with farmers about benefits of artificial insemination and good time for insemination in cows all three OR sites. Cross breeding with good merit animal will help to produce good quality offspring. Use of estrus synchronization protocols for timed breeding, use of ultrasound machine for early pregnancy diagnosis were also informed to farmer. Demonstration of USG for early pregnancy diagnosis was made in all OR sites.
1.08	Health campaign to monitor health and infertility of cattle	207	Health campaign was organized at Kakare, Hariharpurgadi rural municipality, Sindhuli. Cattle and buffaloes of farmers were tested for infertility problem, pregnancy diagnosis, repeat breeding cases, hygroma, parasitic infestations, wounds, mastitits and other related diseases. Medicines and supplements were provided as needed to the farmers for their animals.
2	4 Multilocation project of National Cattle Research Program (NCRP), Rampur, Chitwan	682	
2.01	Field experiment of Egyptian clover	172	Field experimental activities were done and completed. Data recording were done and completed. Data entry, processing and analysis are in progress.

2.02	Evaluation of forage and fodder crops	172	Different fodders were compared in the experimental plots
2.03	Evaluation of teosinte for genetic diversity and agronomic traits under different sowing dates	169	Teosinte was cultivated in different sowing dates for genetic diversity and agronomic traits evaluation.
2.04	Evaluation of maize varieties for fodder and silage production in Terai region of Nepal	169	Cultivation of different maize varieties was done. Laboratory analysis of different varieties were done. Ensiling of 11 tested maize varieties has been done at NCRP. Physical Properties (Colour, Taste, Aroma and pH) of prepared silage from 11 tested varieties has been recorded and Laboratory analysis (CP, NDF, ADF, ADL and Energy) of all varieties has been done at Animal Nutrition Research Centre, Khumaltar
3	620 Study on non-genetic factors influencing milk yield and its composition in different crossbred cattle	903	
3.01	Effect of different feeding regimes digestibility in production performance of lactating cows	196	Completed
3.02	Effect of body weight of calves due to different feeding regime assigned in pre-partum stage of cows	40	Completed
3.03	Milk quality and quantity on Station	106	Completed
3.04	Economic analysis of the different feeding results and dissemination of technologies	42	Completed
3.05	Milk Quality on farm	187	Completed

3.06	Evaluation of production performance of crossbred cattle	55	Data on production performance of Jersey and HF crossbred cattle were taken
3.07	Evaluation of reproductive performance in crossbred cattle	2	Reproductive parameters of Jersey and HF crossbred cattle were taken
3.08	Feed formulation and nutritive analysis of feed	180	Experimentation was done by preparing different protein level feed and samples were taken for lab analysis
3.09	Selection of animals and maintain in different feeding regimes	60	Experimentation with different protein level feed done
3.10	Maintenance of crossbred cattle on station	35	Crossbred of Jersey and Holistein were maintained regularly on station
4	724 Farm management and production project (FMPP)	17454	
4.01	Admin support and management	272	Completed
4.02	Office/lab and farm security	152	Completed
4.03	Farm beautification	128	Completed
4.04	Field gene bank management	116	About 200 animals of different breed are kept for research and conservation purpose
4.05	Day celebration (NARC, Milk, World Animal, Veterinary etc.)	53	NARC day was celebrated by planting different plants in the office premises and small workshop among staffs including farm workers was done for regular updates of the farm and discussion in different problems in the farm. Similarly, World Milk day was celebrated by interaction among office staffs.
4.06	Office level proposal seminar	23	Proposals prepared by all scientists and officers discussed and presented in the seminar. Ten different proposals presented and finalized for uploading in the PRMS

4.07	Trimonthly progress review workshop	86	First trimestar progress review completed virtually
4.08	Planning workshop	85	Participated in Second trimestar and next year planning workshop
4.09	Participation in different training and workshop	50	Staffs from NCRP were participated in different training and workshops
4.10	Monitoring and Evaluation	102	Regular activities to be done in the research project monitored regularly
4.11	Coordination and collaboration	60	Coordination and collaboration done regularly with government agencies and related stakeholders
4.12	To implement the activities of good husbandry practices to produce clean milk (Breeding, health, nutrition)	2220	Cleaning of the farm and bathing of the animals was done regularly to clean the farm and animals. Disinfection of the farm and milking equipments regularly with commonly available disinfectants. Pre-cooling of the milk before processing to remove bacterial load. Vacuum packing of milk product to keep it for longer duration.
4.13	To maintain cattle with good health and hygiene (Vaccination, deworming, routine fecal test, routine blood test for economically important diseases, routine quality tests of milk using CMT, special care of high yielders during first trimester of lactation, treatment whenever required etc.)	873	Cattle were observed daily and treated in case of illness promptly. Also, regular deworming, vaccination, dipping was done. Sanitation of farm and providing vitamin and mineral time to time. Regular teat dipping practice to prevent mastitis.
4.14	Nutritional management with appropriate proportion of concentrate and roughage	11347	Concentrate feed 13500 kg and roughages green grass 115000 kg was given to cattle.
4.15	Development of calendar for year-round fodder production and cultivation of fodders according to calendar	342	Different fodders were cultivated in 4 hector of land

4.16	Silage production for feeding cattle	391	
4.17	To manage heat stress during summer months	195	
4.18	Maintenance of herd book (pedigree record, health and feeding record, production record) and maintain high genetic merit cattle population	36	Herd book is maintained regularly. Primarily data entry is done in loose sheet and afterward maintained in herd book.
4.19	Milk and milk product preparation and quality analysis	547	Completed
4.20	Maintenance and proper use of bio-gas plant	301	Completed
4.21	Technology demonstration on NARC tech village	75	
5	826 Cattle breed development for sub-tropical and tropical region of Nepal	2185	
5.01	Maintenance of Terai cattle population on station	581	Currently we have maintained 11 pure terai cattle. Among them 5 are cows, 5 heifers and 1 female calf. They are managed in optimum husbandry practice. Eleven pure terai cows causing very much difficulty in handling were culled in fiscal year 2080/81.
5.02	Maintenance of different blood level of crossbred (TXJ) (TXHF)	591	We have maintained 13 terai exotic crossbreds. Seven (50% T & 50% J) crossbreds, 2 (25% T & 75% J) crossbreds and 4 (50% T & 50% HF) are maintained in NCRP farm. Estrus synchronization with ovsynch protocol was applied in some cows for breeding and some are bred on their natural heat for producing crossbreds.

5.03	Productive and reproductive performance of cattle evaluated on station	123	Jersey cross have good productive performance than Holstein Friesian cross, Terai Jersey cross, Terai HF cross and pure terai. But Holstein Friesian cross have superior reproductive performance than Jersey cross, Terai Jersey cross, Terai HF cross and pure terai.
5.04	Disease prevalence related to infertility – on station and on farm	303	92 serum samples of infertile cows having problem of repeat breeding, anestrus and abortion were collected from Nawalpur area, eastern Chitwan and NCRP farm. ELISA test kit for brucellosis and BVD are brought and ready to test sample soon.
5.05	Outbreak investigation on station and on farm	312	There was no any outbreak of new cattle disease. So, regular examination of blood samples from the farm was done
5.06	Assessment of heat stress in different cattle breeds (Terai, exotic and Terai crossbreds) in sub-tropical	275	Data recording for assessing heat stress, parameters like rectal temperature, vaginal temperature, respiration rate, heart rate, ruminal motility are being carried out. Parameters recording daily for 3 months is being going on in NCRP farm. Final results are yet to come.
6	827 Inception of selection index values and improved reproductive technologies for genetic improvement of dairy cattle for overall genetic merit	910	
6.01	Selection of farmers	37	
6.02	Examination of health status of animals	129	
6.03	Data recording and collection of milk sample	163	
6.04	Analysis of milk sample	163	

6.05	Application and evaluation of different estrus detection methods	17	Visual method (mounting behaviour, mucus discharge, drop in milk yield, bellowing) Allflex software detection were being compared in NCRP farm. Visual method with good history worked well for detection. Allflex software also make supplementary support in heat detection, since we have limited number of neck collar at this time.
6.06	Ovarian dynamics study of cows	17	Ovarian dynamics study was done in both cyclic and non-cyclic cows and heifers. Persistent corpus leutem was found in more cows and some of cows have follicular cystic condition.
6.07	Evaluation of different estrus synchronization protocols in cows	153	This year we compared Ovsynch protocol, single PG and CIDR synch (0 day GnRH and CIDR insert, 9 th PG injection and 10 th day CIDR removal) protocol in cows. CIDR synch protocol was found to have high estrus expression and ovulation compared to rest two protocols.
6.08	Data entry	20	Completed
6.09	Selection and tagging of the animals	158	Completed
6.10	Data modelling and analysis	22	Completed
6.11	Estimating EBVs of animals	10	Completed
6.12	Creation of NCRP selection index	21	Completed
7	828 Assessment of probiotics strains on the health and productive parameters of dairy cattle in Chitwan conditions	519	
7.01	Feeding trial for digestion efficiency	160	Feeding experimented for digestibility completed. Second lactation 16 animals were used for the experiment

7.02	Assessment of digestibility of CP, NDF, ADF etc.	201	Data and samples collected. Feed samples were tested for CP, NDF, ADF and digestibility in the lab
7.03	Monitoring of Milk Yield	68	Milk yield of all experimental animals taken during the 90 days experiment
7.04	Monitoring of milk quality parameters	65	Milk composition analysis was done. Milk quality parameter were observed under 30 day interval during 3 month period
7.05	Financial analysis of the experiment	25	All the cost and expenditure during the experimental period were recorded for financial analysis
8	958 Evaluation of silage feeding on health and reproductive and productive parameters of growing heifers cattle in Chitwan conditions.	533	
8.01	Collection and cultivation of annual legume or non-legume forage and germplasm.	118	The different germplasm of non-legume forages were collected from different government offices and cultivated in NCRP. The required amount of different non-legume forages were prepared on station
8.02	Assess the effect of supplementing NPN (with or without Ca:P@2:1) on ensiling materials during silage preparation on station.	129	The 5000 kg of normal silage and 4000 kg of corn silage were procured from Private silage feed industries of Dang and Chitwan District. During feeding trial, to assess the effect of supplementing NPN (with or without Ca:P@2:1) on ensiling materials, NPN source (Optigen II) and Dicalcium phosphate were procured from Private feed industries of Chitwan District.

8.03	Conduct feeding trial for voluntary feed intake	103	The growing heifers were selected from the three birth-period April to July, 2023 (group I), Sep to Oct, 2023 (group II) and Dec to Jan, 2023 to 2024 (group III). Experiment was carried out in NCRP farm and 16 HF and Jersey crossbred growing heifers of twelve to fourteen month of age were allotted in CRD design with four treatment and four replication.
8.04	Monitoring of health status of animals.	106	Physical health of the dairy heifer is being taken. Fortnightly scoring of body conditions is being taken.
8.05	Assess the impact of ensiling materials on blood parameters	77	Blood samples were taken from each treatment and replication before experiment. Hematological and biochemical parameters are being taken in laboratory for health monitoring. Hemoglobin, Hematocrit, ESR, total and differential blood count plus lipid profile, glucose, minerals is being assessed in laboratory.
9	959 Participatory approach for improving Yak and Chauries production and productivity in Nepal	667	
9.01	Site selection, baseline survey and study of vegetation characteristics and compositional analysis	107	Different sites of Rasuwa district and Mustang district were selected and vegetation were collected for further analysis
9.02	Develop mating plan to exploit the selection potential	28	Information about the mating plan was given to the farmers. Yak from Solukhumbu district were distributed to the farmers of Mustang by provincial government to check the inbreeding
9.03	Performance recording of yak chauries	101	Performance of Yak/Nak and chauries from Mustang and Rasuwa were recorded in the sheet

9.04	Collection and examination of fecal samples	108	Faecal samples from different farms of Rasuwa and Mustang district were collected and analyzed in NCRP lab. 22 samples from Rasuwa and 36 samples from Mustang were analyzed.
9.05	Blood metabolic profiling	100	Blood samples of 20 animals collected from Rasuwa and 50 animals collected from Mustang. Haematology and serum biochemistry test were done
9.06	Screening diseases of economic importance	128	For the diseases of economic importance serum samples were collected. Brucellosis test was done.
9.07	Collection and analysis of different milk product samples of Yak and chauries	95	Milk samples were collected from 36 Nak from Mustang district. SCC and composition analysis was done
Total operational budget		25096	

Annex 3.2. Summary Progress of Special Research Projects and Activities in 2080/81 (2023/24)

Name of project/ activity	Project/ Activity leader	Begin Year	End year	Budget allocated for this year (,000)	Major progress/ Achievements
Sustainable animal productivity for livelihoods, nutrition and gender inclusion-animal health-SAPLING in Nepal: Forage Adaptation trial	Sagar Paudel	2080 Baisak	2080 Asar	1.745	Plantation of 8 grass species for trials
HEIFER International				1700000.00	

Annex 4.1. Production of (commodity/product) in FY 2080/81 (2023/24)

SN	Commodity/ Product	Variety/ Breed	Type (Breeder/ Foundation/ Blood level)	Unit	Target Quantity	Produced Quantity
1	Calves	Jersey Cross	-	No.	25	26
		HF cross	-		10	18
		Terai Cross	-			5
		Lulu Pure	- 100%			1
		Terai Pure	- 100%			1
			- 100			
2	Grasses	Green grasses	Annual and Perennial	Mt.		
3	Milk	Whole milk		Lit.	90000	134233.5
4	Paneer		-	Kg	600	609.75
5	Khuwa	-	-	Kg	120	96
6	Ghee	-	-	Kg	4	2.4
7	Dahi	-	-	Liter	200	215
8	Ice cream			Kg	-	-
9	Rasbary			Piece	-	-
10	Silage	-	-	Mt.	-	-
11	Forage Seed			Kg		
12	Manure	-	-	Kg	-	

Annex 4.2. Distribution of (commodity/product) in FY 2080/81

S.N.	Commodity/ Product	Type	Quantity	Major stakeholders	Distributed district
1	Cow (Adult)	Jersey cross, Holstein Freisian cross, Terai, Lulu	30	Farmers	Chitwan & Makawanpur
	Bull		31	Farmers	

Annex 5.1. Training/Workshop/Seminar Organized in FY 2080/81 (2023/24)

S. N.	Name of Training/ Workshop/ Seminar	Duration	Target group	Location	No. of Participants
11111	Cattle Buffalo Research Working Meeting	1 day	Reseachers and extensionists	Rampur, Chitwan	25

Annex 5.2. Services Provided in FY 2080/81 (2023/24)

SN	Laboratory/field test/ counseling services provided	Numbers	Major clients
1.	Farm observation and technical briefing	4050	Farmers, Students, Entrepreneurs, Extension officials, NGOs
2.	Laboratory skills, pregnancy diagnosis, disbudding	60	B.V.Sc. & A.H. Internee
3.	Laboratory skills/ ELISA test	40	M.V.Sc. /M. Sc. An. Sc. Students
4.	Treatment and lab skills	50	J.T.A. OJT (students)
Total		4200	

Annex 5.3. Publications in FY 2080/81 (2022/23)

SN	Name of publications	Type	Language	Authors	No. of copies
1	Annual Report 2079/80	Book	English	NCRP	100

Annex 5.4. Information Disseminated Through Media in FY 2080/81 (2023/24)

SN	Information disseminated/ Media Coverage	Type	Name/ Type of Media	Date
1	News on Neck collar	Newspaper	Gorkhapatra, Ujaloonline, Kantipur	Bhadra 2079
2	News about cattle research and farming	TV	NTV Plus	March 1

Annex 5.5. Visits of the Office/Station by Farmers, Extension Officials/Technicians, Entrepreneurs, Cooperatives, Farmer Groups, NGO/CBO Officials etc.

SN	Category	Number	Districts Interest	Area of major
1	Farmers	1200	Different districts of country.	Cattle raising and farm visit.
2	Extension officials	100 Lalitpur, Pachthar, Rukum, Rasuwa, Kanchanpur	Practices Pyuthan, Rasuwa, Gorkha, Gulmi, Janakpur, Kavreplanchock	Cattle husbandry Cattle husbandry practices
3	NGOs officials	250	Nepal Poly- technique Institute and other technical Schools	Farm visit, Cattle husbandry practices
4	Students and instructor	2500		
Total		4100		

Annex 6. Training/Workshop/Seminar Attended by Staff in FY 2080/81 (2023/2024)

SN	Name of Staff	Position	Name of training/ seminar/workshop	Duration	Place/ Country	Organizer
1	Dr. Uddhav Paneru	Scintist (S2)	GIS training	2080/9/12-2080/9/16)	NGRP (Bandipur Tanahu)	NASRI
2	Dr. Yagya Raj Pandeya	Technical Officer (T6)	Dairy cattle genetic improvement workshop	May 10, 2023 (Baishakh 27, 2080)	Khumaltar, Lalitpur	Heifer Nepal and Heifer Korea
3	Mr. Sagar Paudel	Senior Scientist (S4)	Joint monitoring of ADRA Nepal program in Rupandehi and Kapilbastu	11-13 June, 2023 (Jestha 28-30, 2080)	Rupandehi and Kapilbastu	ADRA Nepal

Annex 7.1. Regular Annual Budget and Expenditure Record of FY 2080/81 (2022/23)

CURRENT EXPENSES				
Code no	Budget Heads	Annual budget (Rs.)	Expenses (Rs.)	Balance (Rs.)
21111	Staff Basic Salary	13794000	13611,684.3	182315.70
21132	Staff Dearness Allowance	504000	500,000	28000
21139	Other Allowance	100000	67,500	32500
21121	Staff Uniform Expenses	210000	200,000	20000
21213	Insurance	101,000	99,600	1,400
22111	Water and Electricity Cost	1104000	802,610	301,390
22112	Communication Expenses	198000	113,070	84930
22212	Fuel and Lubricant (Vehicle)	822000	820,316.2	1683.8
22213	Repairs & Maintenance Cost	150000	123,154	26846
22214	Insurance and its Renewal	188000	1557,911	30089
22221	Machinery and Equipment Maintenance	525000	343,985	181015
21213	Insurance	101000	99,600	1400
22311	Office Expenditure	304000	302,263	1737
22312	Livestock Feed Expenditure	10647000	10645,718	1282
22313	Newspaper and Publication Cost	199000	197,515	1485
22314	Fuel (for other use)	374000	369,500	4500
22231	Public Property Repairs & Maintenance	150000	123,154	26846
22413	Contract Service Cost	1563000	1448,795	114205
22512	Skill Development and Awareness	174000	167,970	6030
22521	Production Materials Cost	10972000	10459,809.4	512190.6
22521	Labor cost	57775000	5673,923	101077
22521	Lab Equipment	1037000	784,858	252142
22521	Farm Equipment	4160,000	4001,028	158971
22611	Monitoring and Evaluation	250,000	250,000	0
22612	Travel Expenses	2231,000	2228,034	2966
22711	Miscellaneous Expenses	116,000	115,895	105
28143	Vehicle and Machinery	213,000	211,460	1540
Total		45,314,000	437,73,153.9	1,574,846.1

CAPITAL EXPENSES				
Code No.	Budget Heads	Annual budget (Rs.)	Expenses (Rs.)	Balance (Rs.)
31161	Capital Maintenance Expenditure	1150000	1,115,841	34159
31159	Other public construction	3230000	261,871	616129
31171	Capital improvement and public construction	200000	196,606	3394
31122	Machinery Equipment	10278000	8,190,329.64	2087670.4
31155	Public Construction Expenditure	900000	894,268	5732
31114	Land Development			
31131	Livestock and Horticulture Development			
Total		15758000	13,010,915.64	2,747,084.36

Annex 7.2. Special Project Budget and Expenditure of FY 2080/81 (2023/24)

(In '000 Nepalese Rupees)

Name of the project	and other technical Schools	Project period	Annual budget	Expenses
Sustainable animal productivity for livelihoods, nutrition and gender inclusion-animal health-SAPLING in Nepal: Forage Adaptation trial	ILRI	3 months	1745.00	1745.00
HEIFER International			1700000.00	1693349.00

Project Title: Sustainable animal productivity for livelihoods, nutrition and gender inclusion-animal health SAPLING in Nepal: Forage Adaption Trial

Budget Code	Budget Head	Budget	Expenditure	Balance
22212	Vehicle, fuel, Lubricants	1745.0	1745.0	0
22521	Wages to Labor	0	0	0
22521	Laboratory Research Supplies	0	0	0
22521	Other Farm Supplies	0	0	0
22611	Monitoring & Evaluation Exp.	0	0	0
22612	Travel Expenses	0	0	0
Total		1745.0	1745.0	0

Project Title: HEIFER International

Budget Code	Budget Head	Budget	Expenditure	Balance
22212	Vecicle fule, Lubricants	50000.0	49850.0	150.0
22521	Wages to Labor	150000.0	145146.0	4854.0
22521	Laboratory Research Supplies	40000.0	39763.0	237.0
22521	Other Farm Supplies	105000.0	104955.0	45.0
22611	Monitoring & Evaluation Exp.	30000.0	30000.0	0
22612	Travel Expenses	100000.0	100000.0	0
22312	Animal Feed	350000.0	349735.0	265.0
27211	PhD Student Support	275000.0	275000.0	0
31122	Metabolic Crate procure	600000.0	598,900.0	1100.0
Total		1700000.0	1,693,349.0	6651.0

Annex 7.3. Revenue Status of FY 2079/80(2022/23)

B.N.	Sources of Revenue	Revenue Collected (NRs.)
5300	Livestock and Fisheries	4,885,132.74
5510	Other administrative	291,668.07
Total		5,176,800.81

Annex 7.4. Beruju Status of FY 2080/81 (2023/24)

Beruju	Amount (Rs. in thousands)	Remarks
Beruju till 2061	1494.87	
Beruju from 2060/61 to 2070/71	10213.64	
Beruju till 2075/76	12511.196	
Beruju in 2076/77	7263.983	
Beruju cleared in 2076/77	6126.396	
Remaining Total Beruju	13648.783	

Annex 7.5. Human Resources Chart at NCRP

SN	Post	Group	Number of post	Post fulfilled	In	Out	Vacant Post
1	Principal Scientist	LPPM	0	0			
2.	Senior Scientist	LPPM	1	1			
3.	Scientist	LPPM & AB	3	3			
4	Senior Technical Officer	LPPM	1	1			
5	Technical Officer	LPPM, Veterinary and PFAF	4	3			
6	Account Officer	Admin & Finance	1	1			
7	Admin Officer	Admin	2	1			
8	J. Technician (JT)		5	0			
9	J. Technical Asst. (JTA)		4	3			
10	Technical Helper	-	12	4			
11	Admin Helper	Admin	1	0			
12	Driver Heavy	Admin	1	0			
13	Driver Light	Admin	1	0			
Total			37	17			