

Annual Report

2078/79 (2021/22)



Government of Nepal
Nepal Agricultural Research Council



National Cattle Research Program

Rampur, Chitwan, Nepal

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Government of Nepal

Nepal Agricultural Research Council (NARC)

National Cattle Research Program (NCRP)

Bharatpur -15, Rampur, Chitwan, Nepal

Telephone : 977-056-591071/591009

Fax : 977-056-591255

Email : ncrprampur@gmail.com / ncrp@narc.gov.np

URL : [http:// www.ncrp.gov.np](http://www.ncrp.gov.np)

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Editor:

Dr. Shiva Hari Ghimire

Mr. Uddhav Paneru

Cover Page Photo:

Administrative building of National Cattle Research Program, Rampur, Chitwan, Nepal

FOREWORD

National cattle research program has been mandated for research on cattle breeding, cattle health, cattle production & management, cattle nutrition/pasture and fodder so as to improve production and productivity of cattle reared in Nepal. This report presents the overall glimpse of National Cattle Research Program (NCRP) and concise information on developed technology by NCRP on different aspects of cattle farming so as to improve efficiency and make cattle farming a more profitable business in the fiscal year 2078/79. I am very pleased that our total efforts are towards the fulfillment of milk and milk products demand in the country. Present data shows that out of total Agricultural Gross Domestic Product (AGDP), livestock sector contributes 28% and dairy sector in particular contributes 63% within livestock GDP. Dairy sector in Nepal constitutes both cattle and buffalo, and cattle alone contribute 42.76% of total annual milk production, which was 24.8 lakh M.T in 2077 (MoALD, 2077/78). Despite the condition some outputs has been achieved which can be extended in the farmer's field. In the last fiscal year, we conducted research works related to management of mastitis and infertility, studied effect of different non-genetic factors that affect productive and reproductive performance of cattle, nutritional trial on cattle, study of different timing of AI on conception, heat stress management, study on use of hydroponics technology for forage production, year round forage based milk production, establishment of terai cattle herd for the evaluation of productive & reproductive performance and conservation as well maintenance of Lulu cattle for further research. Our cattle herd was included under Dairy Cattle Improvement Program (DCIP), which is headed by NLBO, Pokhara. We use the exotic semen & sexed semen in the NCRP farm that has been received from National Livestock Breeding Office (NLBO) for the further multiplication was helpful to produce the high- quality female calves for the replacement in the NCRP farm. In the fiscal year 2077/78, we were successful to run biogas plant of 200 m³ capacity in full-fledged, and is still continuous in the current fiscal year. We installed the neck collar in 20 cows for smart monitoring of cow reproduction and health. Likewise, use of sexed semen is giving promising outcomes to minimize the major constraint of cattle farming, which is effective for the management of male calves. This report is the outcome of the inevitable efforts of NCRP team. I express my sincere gratitude to Dr. Shiva Hari Ghimire, Mr. Uddhav Paneru, Mr. Devi Prasad Adhikari, Mr. Bishnu Bahadur K.C, Dr. Yagya Raj Pandeya, Dr. Sagun Malla and Dr. Pratik Hamal. I would like to extend my sincere appreciation to all staff of NCRP who worked restlessly

for reporting, data recording, data processing and analyzing progress report timely. Without that this report publication would not have published. Finally, I am sincerely thankful to management team of NARC for their support in implementing and monitoring the program smoothly. I am very much indebted to Dr. Deepak Bhandari, Executive Director of NARC, Dr. Yug Nath Ghimire, Director of Planning and Coordination NARC, Nepal for their continuous support, motivation & guidance. I am very much thankful to Dr. Doj Raj Khanal (Director of Livestock & Fisheries Research, NARC) and other directors of NARC. Likewise support from the NASRI and all the research centers under NASRI and outside NARC are gratefully acknowledged for their collaboration and partnership with us during the year.



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Sagar Paudel
Coordinator/Senior Scientist (S3)
National Cattle Research Program
Rampur, Chitwan

ABBREVIATIONS

%	Percent
@	At the rate of
ABPSD	
AD	After Death
ADG	Average Daily Gain
ADS	Agriculture Development Strategies
AGDP	Agricultural Gross Domestic Product
AFSP	Agriculture and Food Security Project
AFU	Agriculture and Forestry University
AI	Artificial Insemination
APP	Agriculture Prespective Plan
approx.	Approximately
ARS	Agriculture Research Station
AST	Antibiotic Sensitivity Test
BCS	Body Condition Score
BS	Bikram Sambat
BQ	Black Quarter
BWG	Body weight gain
CBO	Community Based Organization
CF	Crude Fiber
cm	Centimetre
CMT	California Mastitis Test
CNS	Coagulase-Negative Staphs
CP	Crude Protein
CRD	Completely Randomized Design
CTEVT	Council for Technical Education and Vocational Training
DAP	Diammonium Phosphate
DCIP	Dairy Cattle Improvement Program
DLS	Department of Livestock Service
DLSO	District Livestock Service Office
DM	Dry Matter
E	East
ELISA	Enzyme-Linked Immunosorbent Assay
ESBL	Extended-spectrum beta-lactamases
ET	Embryo Transfer

F	Female
FAO	Food and Agriculture Organization
FMD	Food and Mouth Disease
FY	Fiscal Year
FYM	Farm Yard Manure
GDP	Gross Domestic Product
GI	Gastro intestinal
Gm	Gram
GO	Governmental Organization
GRS	Goat Research Station
Ha	Hactare
HF	Holstein Friesian
HH	Household
HICAST	Himalayan College of Agricultural Science and Technology
HS	Haemorrhagic Septicemia
IAAS	Institute of Agriculture and Animal Science
INGO	International Non Governmental Organization
Kg	Kilo Gram
Km	Kilometer
LPPM	Livestock Products Production and Management
M	Male
Masl	Meter Above Sea Level
Mg	Milligram
Mm	Millimeter
MoAC	Ministry of Agriculture and Co-operatives
MoALD	Ministry of Agriculture and Livestock Development
MOP	Muriate of Potash
MRSA	Methicillin-resistant <i>Staphylococcus aureus</i>
Mt	Metric Ton
N	North
NABGRC	National Animal Breeding and Genetic Research Centre
NARC	Nepal Agricultural Research Council
NARI	National Agriculture Research Institute
NASC	
NASRI	National Animal Science Research Institute
NBRP	National Bovine Research Program
NCRP	National Cattle Research Program

NGO	Non Government Organization
NLBO	National Livestock Breeding Office
NMRP	National Maize Research Program
NPK	Nitrogen, Phosphorus, Potash
NSSRC	National Soil Science Research Centre
°C	Degree Centrigade
OM	Organic Matter
OR	Outreach sites
P	Phosphorous
P	Probability
PAMS	
PATWG	Provincial Agricultural Teachnical Working Group
PG	Prostaglandin
Ph	Percentage of Hydrogen
Ppm	Parts per million
PPRS	Pedigree Performance Recording System
RARS	Regional Agricultural Research Station
RATWG	Regional Agricultural Technical Working Group
RCBD	Randomized Completely Block Design
SE	Standard Error
SNF	Solid Not Fat
sq m	Square Meter
T	Ton
TA	Total Ash
UMMB	Urea Molasses Mineral Block
USA	United States of America
USG	Ultrasonogram
WHO	World Health Organization
wt	Weight

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सङ्क्षिप्त वार्षिक प्रतिवेदन

राष्ट्रिय गाई अनुसन्धान कार्यक्रमले किसानको आवश्यकता अनुसार गाईको उत्पादन र उत्पादकत्व सम्बन्धी अनुसन्धानको नेतृत्व लिइरहेको छ । यस कार्यक्रमले आ.व. २०७८/७९ मा ४ वटा आवधिक अनुसन्धान संचालन गरेको थियो । यस अन्तर्गत उन्नत जातका गाईहरू र स्थानीय तराई जातका गाईहरूसँग प्रजनन गराई वर्णशंकर जातका गाईहरूको संरक्षण र अनुसन्धान, कम उत्पादन लागतमा वर्षभरी हरियो घाँस उत्पादन गर्ने प्रविधि, विभिन्न जातका नेपियर घाँसको उत्पादन क्षमता अध्ययन, विभिन्न वातावरणीय तत्वहरूले गाईहरूको उत्पादन र प्रजनन क्षमतामा पार्ने प्रभावको अध्ययन गरियो । त्यसैगरी, सालबसाली कार्यक्रम अन्तर्गत फार्म व्यवस्थापन परियोजना, उत्पादन कार्यक्रम, बाह्य अनुसन्धान कार्यक्रम र लुलु गाई र वर्षिम घाँसको भेरिफिकेसन परिक्षण गरियो । उत्पादन कार्यक्रम अन्तर्गत २०३ वटा विभिन्न जात र उमेर समूहका गाईहरूको संरक्षण र सम्बर्धन गरियो ।

थुनेलो रोगसम्बन्धी अध्ययन गर्दा चितवन र नवलपरासी जिल्लाका विभिन्न गाईहरूको दुधको नमुना CMT प्रविधिद्वारा परिक्षण गर्दा २९० वटा नमुनामध्ये १९२ वटा नमुनामा लक्षण नदेखाउने खालको थुनेलो रोगको संक्रमण रहेको पाइयो । संक्रमित नमुनाहरूबाट जीवाणु पृथकीकरण गर्दा ६६ वटा नमुनामा स्ट्याफाइलोकोकस जीवाणु र ५५ वटा नमुनामा ई.कोली जीवाणुको संक्रमण भेटियो । त्यसैगरी विभिन्न घाँसहरूको उत्पादन क्षमता अध्ययन गर्दा टियोसेन्टी, बाज्रा, जुनेलो, मकैको उत्पादन क्रमशः ७१.३, २८.८, ३३.३ र ३६.२ टन/हेक्टर र उत्पादन लागत रु. १.३७, ३.७७, ३.४९ र ३.०४ प्रति केजी हरियो घाँस पाइयो । त्यसैगरी, भेच, केराउ र जै घाँसको उत्पादन क्रमशः १९.५, २१.५ र ३४.५ टन/हेक्टर तथा उत्पादन लागत क्रमशः रु. ३.७०, ३.०२ र २.१२ प्रति के.जी. हरियो घाँस पाइयो । यसैगरी साइलेजको उत्पादन लागत अध्ययन गर्दा प्रति केजी रु. ९.३८ पाइयो ।

उत्पादन कार्यक्रम अन्तर्गत ९३ वटा बाच्छाबाच्छी उत्पादन गरियो । जसमध्ये २९ वटा होलिस्टिन जातका वर्णशंकर, ५२ वटा जर्सीका वर्णशंकर, ५ वटा लुलु, २ वटा तराई, ४ वटा तराई जर्सीको वर्णशंकर र १ वटा आछामी उत्पादन भएका थिए । जसमा ४८ वटा बाच्छी र ४५ वटा बाच्छा थिए । बाच्छाबाच्छीको जन्मदाको तौल अध्ययन गर्दा औसत तौल २१.३९ केजी, जसमा बाच्छाको २२.६५ केजी र बाच्छीको २०.६९ केजी पाइयो र मृत्युदर १६.९२% रहेको पाइयो । यस कार्यक्रम अन्तर्गत

आ.व. २०७८/७९ मा ११५० केजी घाँसको बीउ र ८००० विभिन्न घाँसको सेट उत्पादन गरियो । त्यसैगरी सरदर ६० वटा दुहुना गाईबाट १७५,३२४.७ लिटर दुध उत्पादन गरियो। उक्त दुध मध्ये केही दुधबाट ८६५.३५ केजी पनीर, ४ केजी घीउ, २९७.५० केजी खुवा उत्पादन गरियो र बाँकी रहेको १३६०८९.३ लिटर दुध बिक्री गरियो । दुधमा रहेको विभिन्न तत्वहरूको अध्ययन गर्दा ४.६८% घिटांस, ९.०५% एस.एन.एफ., ३.३२% प्रोटीन र ४.५१% कण्डकटीभिटी रहेको पाइयो । १२ वटा उन्नत साढेहरू स्थानीय गाईहरूको स्तरोन्नतिको लागि चितवन, कास्की, बाँके र मकवानपुर जिल्लामा बिक्री वितरण गरियो । यसैगरी १६५.५० केजी टीयोसेन्टी र ११० केजी जै चितवन, नवलपुर र रसुवाका कृषकहरूलाई बिक्री वितरण गरियो । बहुवर्षीय घाँसहरू स्टाईलो, सेटारिया, सिग्नल, नेपियर, सोरघम, ज्वाइन्ट भेच, मुलाटो, पाराग्रास यस गाई अनुसन्धान कार्यक्रममा उत्पादन गरी गाईलाई खुवाइयो । गाईको जात, दूध दिने चरण (ल्याक्टेशन) र बेतले वर्णशंकर गाईको दूध उत्पादन एवं दूधको संरचनामा असर गरेको देखियो । नेपियरका विभिन्न जात CO3, CO4 र सुपर नेपियरको उत्पादन र उत्पादन लागतको अनुसन्धान गर्दा सुपर नेपियर अरू जातभन्दा राम्रो पाइयो ।

यस कार्यक्रमले आ.व. २०७८/७९ मा जम्मा रु. १,०१,३७,६६४.३८ बराबरको राजस्व सङ्कलन गरेको छ र जसमध्ये दुध र दुग्ध पदार्थको बिक्री वितरणबाट रु. ९८,००,२७३.८५ र बाँकी आम्दानी प्रशासनिक क्रियाकलापबाट भयो । यस आ.व.मा ७०३१ जना कृषक, विद्यार्थी, प्रसार सम्बन्धी सरोकारवालाहरू, विभिन्न राष्ट्रिय तथा अन्तरास्ट्रिय गैर सरकारी संस्थाहरूका प्रतिनिधिहरू, स्थानीय तहका प्रतिनिधिहरू र सम्बन्धित अन्य सरोकारवालाहरूको भ्रमण भयो र गाईपालन सम्बन्धी आवश्यक जानकारी प्रदान गरियो ।

यस आ.व.मा एक वटा पशु स्वास्थ्य शिविर यस कार्यक्रमको बाह्य अनुसन्धान स्थल माडीमा संचालन गरियो । जसमा २५० भन्दा बढी विभिन्न जातका पशुहरूको स्वास्थ्य परीक्षण गरी औषधी उपचार गरियो । यसैगरी माडीका १६ जना कृषकहरूलाई १ दिने युरिया मोलासेस मिमरल ब्लक बनाउने तालिम प्रदान गरियो भने देवदह, रुपन्देहीका १३ जना कृषकहरूलाई प्लास्टिकको झोलामा साइलेज बनाउने सम्बन्धी १ दिने तालिम प्रदान गरियो । यसैगरी नार्क प्रविधि गाउँ बरादी, तनहुँका १८ जना कृषकहरूलाई गाईपालन सम्बन्धी विभिन्न प्रविधिहरू हस्तान्तरण गरियो ।

EXECUTIVE SUMMARY

National Cattle Research Program (NCRP) is entitled to take a leading role in research related to improving the production and productivity of dairy cattle in Nepal based on farmer's needs. This program implemented four time-bound research projects in the fiscal year 2078/79: Maintenance and evaluation of exotic, Terai and its crossbreeds to develop improved Nepalese cattle breed, development of cost effectiveness year round forage production, evaluation of production performance of different hybrid Napier and effect of non-genetic factors on productive and reproductive performance of dairy cattle. Core research projects implemented were farm management project, source seed/breed production and management project, an outreach research project and multi-location project on Lulu cattle from NABGRC and evaluation of different varieties of berseem from NSSRC.

The production program supported the maintenance of the herds of 203 different breeds and age group of cattle. Cattle milk from Chitwan and Nawalparasi districts were tested by CMT. It was observed that out of 290 milk samples, 192 samples were found positive for mastitis. In bacterial isolation, 66 were infected with *staphylococcus* and 51 with *E.coli*. Average biomass and cost of production of annual forages: Teosinte, Bajra, Sorghum and Maize were calculated in Chitwan district. It was observed that average biomass yield of Teosinte, Bajra, Sorghum and Maize were 71.3, 28.8, 33.3 and 36.2 ton/hectare, and cost of production was Rs. 1.37, 3.77, 3.49 and 3.04, respectively. Similarly, average biomass yield of vetch, pea and oat were 19.5, 21.5 and 34.5 ton/hectare and cost of production was Rs. 3.70, 3.02 and 2.12 respectively. In addition, cost of production of silage was Rs. 9.38/kg.

In cattle herd management and production program, total of 93 calves were born in this FY, out of which 29 were Holstein Friesian cross, 52 were Jersey cross, 5 were pure Lulu, 2 were pure Terai, 4 Terai×Jersey and 1 Achami calve. Similarly, 48 were female calves and 45 were male. The overall birth weight of calves were 21.39 kg, with average birth weight for male and female calves were 22.65 kg and 20.69 kg respectively with mortality rate of 16.92%. Regarding fodder seed and sapling production, this program produced 1150 kg seeds of annual forage and approximately 8000 sets of different perennial fodder sets for propagation. Total milk production was 175,324.7 litres from around 60 milking cattle. Some of the milk produced were used to produce 865.35 kg of Paneer, 4 kg of Ghee and 297.5 kg of Khuwa and remaining milk (136,089.3 litres) were sold as a raw milk. Analysis upon the milk composition, the whole milk contains 4.68% of

fat, 9.05% of SNF, 3.32% of Protein and 4.51 % conductivity. Twelve crossbred male calves were distributed to farmers of Chitwan, Makwanpur, Kaski and Banke districts for upgrading of local cattle in the area. Similarly, 165.5 kg of Teosinte and 110 kg oat was distributed to the farmers of Chitwan, Nawalparasi and Rasuwa. Perennial grasses like stylo, setaria, signal grass, napier, sorghum, vetch, mulato, para grass were cultivated in fodder cultivating area of the program which were harvested and fed to cattle of NCRP farm. There was significantly differences in milk production and its composition by breeds, parity and stage of lactation. Super napier was better in biomas production and CP composition as compere to CO3 and CO4 varities.

Total revenue of this fiscal year was Rs. 1,01,37,664.38. Revenue from sale of milk and milk products was Rs. 98,00,273.85 and remaining income was from administrative work. In this FY more than 7,031 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 animal health & infertility management camp was organized in our outreach site at Madi Municipality and more than 250 animals of different species were treated and provided medicine. Similarly, total of 16 farmers were provided one day training on UMMB preparation in Madi Municipality. Thirteen farmers of Devdaha, Rupandehi were provided one day training on silage preparation in plastic bag. Further, different technologies related to cattle farming were disseminated in NARC technology village, Baradi, Tanahun and total of 18 farmers were benefitted.

1. WORKING CONTEXT

National Cattle Research Program (NCRP) is one of the main organization entitled to carry out research on cattle. It is a national commodity program level of Nepal Agricultural Research Council (NARC). 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 plan such as Agriculture Prospective Plan (APP) and Agriculture Development Strategies (ADS). Agriculture is one of the main contributor of the national gross domestic product (GDP) of the country, which is 28.1% in GDP (MoF, 2019). Livestock contributes 25.68 % in AGDP and about 11% in GDP. Cattle stand second after buffalo, which contributes 42.76% in milk production of Nepal (MoALD, 2079). Contribution of dairy sub-sector is 8% in national GDP and it shares 63% of total livestock contribution (ADS, 2013). Annual total milk production in a country is 2169,714 Mt (Livestock Diary, 2076). World health Organization (WHO) and Food and Agriculture Organization (FAO) recommends 250 ml/person/day of milk. In present situation actual availability of milk is 202.90 ml/head/day considering population of Nepal as 29.3 million. There is gap between recommended and actual available amount i.e. 47.1ml/head/day. So overall 515745 Mt milk is still deficient for approx 30 millions of Nepalese people. The growth trend of cattle population in the country is described in the table 1.

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	2301000
2020/21	7466841	1209041	1060487	2479899

Source: Statistical Information on Nepalese Agriculture, 2077/78 (2020/21)

National Cattle Research Program is located in Rampur, Chitwan of Bagmati Province, which has a 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 in the country and was recognized as self-sufficient district in milk production in 2076 BS. The volume of the milk being collected and its contribution in terms of the supply of the fluid milk to the national milk grid is outstanding.

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

2. INTRODUCTION

2.1 Background Information

National Cattle Research Program (NCRP) is commodity program of Nepal Agricultural Research Council that take a leadership role on research related to livestock development of Nepal. Nepal Agricultural Research Council has many commodities program and it is one of the younger commodity program of Nepal. It's history goes back to establishment of Livestock Development Farm under 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. Its major role was 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 AD). 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 situated 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, 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 livelihood improvement and nutritional security of Nepalese people, lead cattle research in a country.

2.4 Mission

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

2.5 Mandate

- Research, technology development and promotion by preparing roadmap related to cows on priority basis
- Study, research, monitoring and guidelines preparation on cow husbandry, milk and dairy products at national level
- Conservation, promotion and use of indigenous and endemic/endangered cow breeds found in their area of jurisdiction (Sphere of influence)
- Necessary assistance to the concerned bodies/offices to prepare policies and programs related to cows
- Production and distribution of improved breeds of cows, milk and dairy products
- Capacity building enhancement of manpower related to cows research and husbandry
- Coordination and cooperation with National and International Organizations/Institutions/Universities with the approval of the Nepal Agricultural Research Council.

2.6 Objectives

- To generate, verify and recommend suitable adaptable technologies in feeding, breeding, production and health management 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 all aspects of cattle.

2.7 Achievements

- Fifty percent gene level of crossbred Jersey or Holstein-Friesian (HF) is suitable for 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 butter milk 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.
- Use of post milking teat dipping solution (povidone iodine: glycerol=9:1) for prevention of mastitis.
- Use of mastitis detector for detection of sub-clinical mastitis.
- 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 the technology on cattle promotion suitable for different agro ecological zone of the country. The strategies are short term, medium term and long-term research. The research strategies are based on the cattle breeding, feeds and feeding, health, product processing and socioeconomic of the farming.

2.9 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:

- Genetic improvement of cattle using the genetic material (semen) generated by DCIP and other programs
- Evaluation of the local dairy cows through crossbreeding with exotic breed semen at NCRP Farm, Rampur, Chitwan
- Adaptation of Lulu cattle in tropical region
- Improve the fertility status of cattle by focusing on the problems related to infertility and its management
- Development of package of practices for Yak/Chauri
- The effects of feeding milk replacer on body growth and its economic

feasibility in dairy calves

- Status of haemoprotozoans in dairy cattle of Nepal
- Status of antibiotic residue in cow milk
- Prevalence of Siga toxin producing E. coli in raw cow milk
- Year round fodder production and low-cost milk production

2.10 Infrastructure and facilities

The program has undergone significant administrative and technical changes significantly as decision made earlier by the NARC management so as to give full fledge structure that can perform nationwide research and development in cattle. The program is located in Bharatpur Metropolitan City of Chitwan district at Rampur. It is 10 km far from the main city of Chitwan district in south west region and 157 km far from the headquarter of the country Kathmandu.

Currently, the program has access to 25 ha land, out of which about 5 ha is allocated for the farm structures, laboratory buildings, office buildings, and residential quarters and remaining of the lands are used for pasture and fodder production for livestock. Green forage and fodder are very important in livestock and is required for daily consumption throughout the year. Land use patter for different purpose including research/trial plot, pastureland, and fodder trees cultivation area is 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 buildings, laboratory, residential 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 been maintaining around 203 cattle heads of Jersey and Holstein Friesian crosses, Terai, Lulu and Achhami cattle breed in its farm with average

daily milk production of more than 480 liters. Most of the milk is mostly sold as whole milk and sometime diversification of different products were made, like paneer, khuwa, yoghurt, ghee, ice cream etc. Fodder trees are cultivated in around 1 ha of land and other seasonal/perennial forages are produced as necessary in the farm within 10-12 ha 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, 2 silage pits, chain link fence around farm area, one bull shed with yard, one isolation shed, one shed with metabolic crates and 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 which provides regular gas supply for 60 households by pipeline system primarily for staff quarter buildings and office/labs of NCRP and NMRP, Rampur.

Similarly, there is a dairy processing unit with the facility of raw milk storage and product processing like yoghurt, ghee, paneer, ice cream and khuwa. Likewise, mini veterinary laboratory is operative to support the study of animal health parameters having the facilities of autoclave, incubator, laminar flow, hot-air oven, water bath, mastitis detector, microscopes, ELISA reader, semi-automatic biochemical analyzer, haematology analyzer etc. and there is facility of artificial insemination under artificial insemination unit where frozen semen straw can be stored, and inseminated with appropriate handling and processing. At the moment there is the facility of ultrasound machine (USG) for assessing ovarian dynamics of cow and early pregnancy diagnosis. Estrus detector is available to help in getting 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 new born 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 the 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. The program lacks many other types of equipment's needed in different unit to sophisticate the laboratories. Facility of irrigation is quite good in the area. 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.

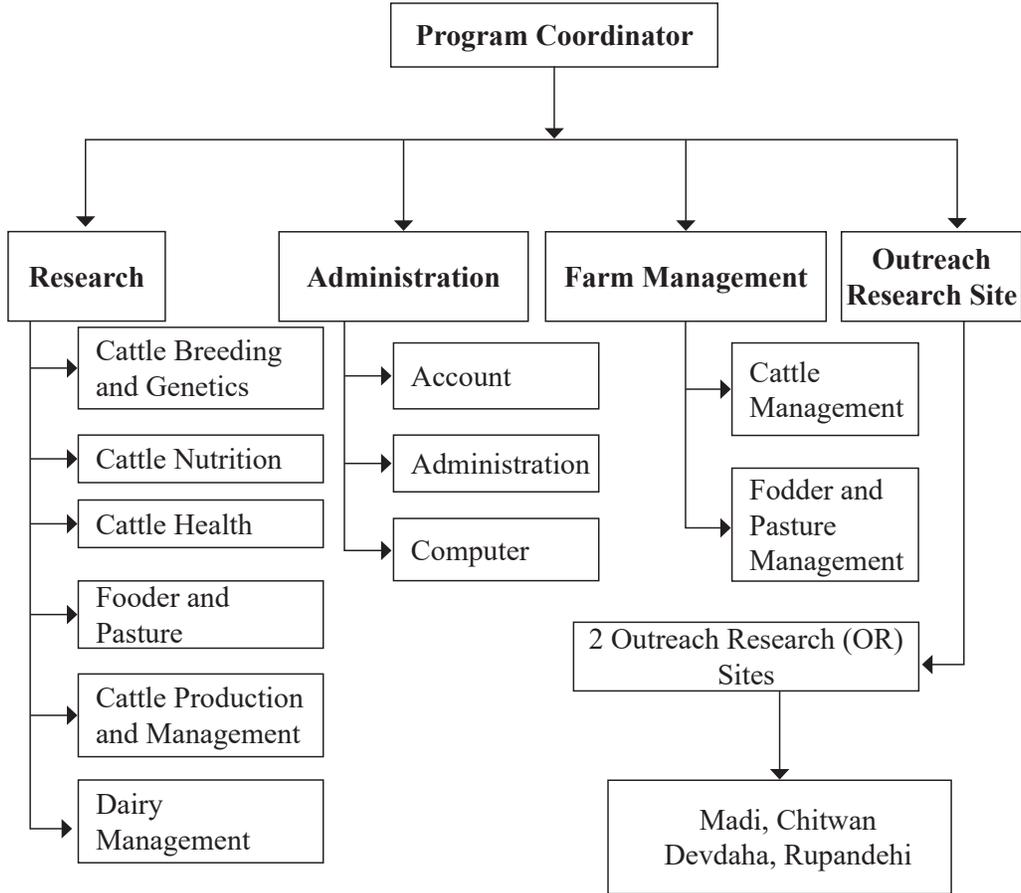


Figure 1. Organizational structure of NCRP, Rampur, Chitwan

The program is basically coordinated by Principal Scientist (S5) but in recent years, it was coordinated by the Senior Scientist (S3) and supported by other scientists, technical officers, technicians and admin/finance staffs as shown in annex 2.2.

3. RESEARCH HIGHLIGHTS

In FY 2078/79, NCRP carried out total of 7 projects, out of which two were core projects: Farm Management and Seed Source/Breed production, one was outreach, two multi-location activities, that comprise genetic evaluation of Lulu cattle from national Animal Breeding and Genetics Research Centre, Khumaltar, Lalitpur and effect of phosphorus and Boron on seed production of egyption clover of NSSRC Khumaltar. Similarly, 3 are time-bound research projects from cattle management, pasture and fodder and effect of non-genetic factors on productive and reproductive performance of dairy cattle. Summary of the projects implemented in FY 2078/79 is presented in Annex 3.1. The highlights of the research projects carried out by the scientists and technical officers of NCRP in FY 2078/79 are as mentioned below.

3.1 A Project on Cattle Herd Management and Production

3.1.1 Activities on cattle herd health management

General health examinations of animal were done on regular basis at NCRP farm. Fecal examination of cattle was done as per need and drenching was done routinely in every 4 months or as per the prevalence of internal parasites in need. Rotation of anthelmintic drug was done in consecutive drenching program. Tick infestations were found higher in early summer months. Use of ectoparasidal drugs such as cypermethrine derivatives and ivermectin was made. Animals that encountered problems like mastitis, milk fever, retention of placenta, dystocia, bloat, wound, diarrhea, localized *E.coli* infection, and anestrus and repeat breeding in this fiscal year.

Mastitis was a major problem in NCRP farm and still remains the major disease. Microbiological culture and Antibiotic Sensitivity Test (AST) was conducted before the treatment. Supportive therapies as well as preventive measures were applied for prevention and control of mastitis. Routine milk examination was done to identify sub clinical mastitis in cattle using California Mastitis Test (CMT).

Major reproductive problems observed in the farm were anestrus and repeat-breeding. Underlying conditions of infertility were presence of persistent corpus luteum, follicular cyst, uterine tumor, cervicitis and pyometra. Bimonthly routine examination were regularly conducted for the determination and treatment of infertile cows maintained in the farm.

Vaccination against major disease of economic importance such as Hemorrhagic Septicemia (HS), Black Quarter (BQ) and Foot and Mouth Disease (FMD) was done routinely. HS and BQ vaccination were done annually and FMD biannually. FMD vaccine is safe for pregnancy. Teat dipping with povidone iodine and glycerine solution (9:1) was done regularly after milking to prevent mastitis.

3.1.2 Activity on epidemiological study on cattle mastitis

Mastitis is major economic disease-causing huge loss due to impairment in milk production and permanent mammary gland damage. Rather than the sporadic, it is herd disease due to poor management practices in country like Nepal. The mastitis-associated losses include loss of milk production, cost of treatment for the control of the disease, cost of extra labor, management of discarded milk and drug residues and replacement cost of culled cows, loss of milk quality and increased risk of other diseases.

Subclinical mastitis is difficult to detect due to the absence of any visible clinical sign and has major cost implications associated with decreased milk production (Viguier et al., 2009). Due to unjudicial use of the antibiotics and treatment protocols, development of drug resistance bacteria which also impacts on the public health aspect like MRSA (11.25% according to Joshi, 2012), ESBL producing *E. coli* (43% according to Sascha, 2012).

The most growing concern about unsuccessful treatment of this disease is due to the evolution of antibiotic resistivity. Haphazard use of antibiotic and incomplete treatment course leads to the resistant bacteria like ESBL *E. coli*, MRSA.

Development of antibiotic resistant bacterial species possesses great threat to the treatment protocol as well as in public health concerns. Local farmers are unaware about the udder and teat hygiene and also proper biosecurity measures. Due to the risk of quick and permanent damage to the alveolar cells of the mammary gland, we need to have knowledge about prevalence of predominant cause of mastitis and their antibiogram so that therapeutic as well as preventive protocols can be established. In this year, we have just planned to see the prevalence of Staphylococcal and Coliform bacteria in Subclinical mastitis positive samples.

Methodology: Milk samples were collected from individual farms and milk

collection centers of Chitwan and Nawalpur district. Samples were collected at the early morning and random sampling method was followed. The milk samples were collected in sterile bottles followed by coding. After collection of milk samples, these samples were brought back to the NCRP laboratory in a cool box. These samples were tested immediately after arrival at the laboratory. All the samples were subjected to cultural examination on Nutrient agar, Mac-Conkey agar plate & Mannitol agar plate. They were incubated at 37°C for 24 hours. Cultural isolates were identified on the basis of colony characteristics, gram's staining and biochemical tests.

Identification of *Staphylococcus* was done by gram staining (purple grape like cluster) and various biochemical tests like catalase test and oxidase test. Slide coagulase test was done to identify *S. aureus* and CNS. All the bacteria isolated through microbiological procedures were subjected to antimicrobial susceptibility test by disc diffusion method to a large number of antibiotics. Isolated *Staphylococcus* colony preserved in 20% glycerol & stored at -40°C for further molecular analysis.

Results: Total of 290 milk samples from Chitwan and Nawalpur districts were tested first by CMT and 192 samples were found positive for sub-clinical mastitis. In bacterial isolation 66 were infected with *staphylococcus* and 51 with *E.coli*. Antibiogram profile indicated that Tetracyclins, Chloramphenicol, Gentamicin, Ceftriaxone & enrofloxacin are effective antibiotic. Ampicillin was found to be least effective antibiotic against bacterial isolates. It may be due to indiscriminate and frequent use of this antibiotic in dairy animals leading to development of antibiotic resistance.



Figure 2 : Performing California Mastitis Test in farmers condition



Figure 3 : Performing Antibiotic Sensitivity Test in Lab

3.1.3 Activity on maintenance and evaluation of exotic, terai cattle and crossbred

Twenty local terai heifers (phenotypically) were brought from the Rautahat district of Nepal and introduced at NCRP farm in the first trimester of FY 2074/75. For pure breeding, we also introduced two bulls of Terai breed from Tribeni area of Nawalparasi in the same FY. Routine work like feeding, breeding, deworming, vaccination against HS, BQ and FMD, recording of breeding and production performances were carried out. In this core project, productive and reproductive performances of pure and crossbreds are being evaluated. For the production of crossbreds, artificial insemination by Jersey and Holstein Friesian bull's semen with pure Terai cow is undergoing (Also used sexed semen). Pure Terai breed was also maintained by breeding pure Terai bulls and pure Terai cows.

In this FY 2078/79, seven pure Terai cows calved. Daily milk production of pure Terai cattle is being recorded routinely. Similarly, growth and reproductive parameter of new born calves were also recorded routinely.

3.1.4 Activity on study on breeding management techniques

Use of portable USG was made in Madi-Chitwan, Devdaha-Rupandehi and different places of Chitwan, Dang, Pyuthan and Kanchanpur district for early

pregnancy diagnosis and to know the ovarian dynamics of cow.

Similarly hormonal protocols like Ovsynch, single PG, double PG were applied in NCRP farm and cattle farms of outreach station Madi and Devdaha. Good results were obtained in ovulation and conception of cattle by using estrus synchronization protocol.

3.1.5 Activity on database management of cattle herd

Pedigree record was maintained in a herd book. But this year we were unable to update data on software due to technical error in the software.

3.2 Biomass Yield and Quality Assessment of Different Hybrid Napiers in Relation to Cutting Intervals and FYM Application in Terai Region of Nepal

3.2.1 Introduction

Livestock is an integral part of agricultural production system in Nepal. However, the existing rearing system and practice is less productive and inefficient due to little attention on livestock feeding, breeding and health management. Animal feed have been one of the major production inputs drawing attention of the producers as it alone shares nearly 65-70 percent of the production cost of milk and meat from ruminants (Sharma, 2012). One of the major constraints on livestock development in dairy sector is high feed cost, unavailability of adequate, nutritious fodder throughout the year. Livestock subsector contributes 26.8% of agricultural GDP; which is nearly 11% of national GDP (MOLD, 2016). Nepalese livestock are underfed and milk and meat production does not meet the requirement.

More feed deficit occurs in winter season but fewer deficits in summer. In other hand, concentrate feed is more expensive as a result it increases the cost of milk production. Major problems associated with feeds and feeding, include both their quality and quantity during winter and summer, whether it is in migratory, sedentary or stall fed systems. Diminishing of pasture and community grazing land, decreasing feed resources, unavailability of cereal and legume by-products for feeding animals etc. have led to the quantity related problems in fodder production. The available feeds and forages are mostly poor in nutritive value. Grazing in the forest area has been prohibited to a great extent causing some

problems in the availability of feeds and fodders. Heavy dependence on poor quality roughages and degraded pasture and grazing lands has reduced the production and productivity of the livestock. Varieties of fodder species have been introduced in the course of time and tested at different research farms and farmer's field condition in Nepal. The farmers are curious on newly imported forage species about their nutrient content, biomass production, number of cutting, suitable climate, their harmful effect to animals etc. The nutritional improvement of livestock diets is dependent upon continued efforts from different subject disciplines, and so a multidisciplinary approach is important to develop technology to increase the availability of fodder both quantitatively and qualitatively.

To maximize the milk production, it is essential to feed animals with optimum quantity of quality green fodder. Moreover, the forage based dairy farming not only enhances the ruminant performance but also lowers the cost of production. Due to various reasons, growing forage crops is a new concept for most of farmers, unlike growing food and other cash crops. However, the scenario has been changed for the commercial dairy farmers as they are now cultivating the improved forages on farm. Consequently, high yielding forages including the promising hybrid Napier fodders have been introduced in Nepal.

To obtain nutritionally good quality forage year roundly hybrid Napier (under proper agronomical management) may be an option especially at Terai, and mid hills. Hybrid Napier grass has gained considerable importance in dairy industry because of its quick sprouting and rejuvenating capacity and also the ability to maintain its productivity for 4-5 years (Das V. R. and Y. B. Palled, 2014). It is the forage of choice not only in the tropics but also worldwide (Hanna et al. 2004) due to its desirable traits such as tolerance to drought and a wide range of soil conditions, and high photo synthetic and water-use efficiency (Anderson et al. 2008). There is a felt need to evaluate this forage on adaptability, suitable method of establishment, production potential, nutrient content and feeding value etc on dairy pocket areas of our country. In Nepalese context, little study has been carried out on yield and quality response of hybrid Napier to different cutting intervals and level of manure application.

3.2.2 Collection of hybrid napier setts and plantation

The hybrid Napier forage slips or setts were collected from National Forage Pasture Program, Khumaltar as well as from other government/private farm. The hybrid Napier fodders CO-3, CO-4 and Pakchong (super Napier) were tested initially at National Cattle Research Program (NCRP) farm, Rampur, Chitwan. These hybrids Napier were planted for production of fodder and setts/slips. The 8000 sets were also distributed to selected farmers of NARC Technology Village, Baradi, Tanahun and OR-sites of Madi, Chitwan and Devdaha, Rupandehi for propagation.

3.2.3 Performance evaluation of hybrid Napier

Forage trial was carried out in National Cattle Research Program (NCRP) Farm, Rampur. For land preparation one disc Ploughing followed by 2/3 fork Ploughing and leveling were done. Randomly five soil samples were taken for soil test. Chemical fertilizer NPK @ 80:60:40 kg/ha was applied at land preparation. Half dose of N as basal and remaining half dose was applied as top dress at 30 days after planting. Farm yard manure (FYM) application according to pre designed doses was done at the time of land preparation before preparing ridges.

The trial was established in Shrawan/Bhadra 2077. The research trial was carried out in RCBD with 3x3x2 factorial experiment. The factorial arrangement was 3 cultivars– hybrid Napier cultivars; CO-3, CO-4 and Pakchong (super Napier) x 3 cutting intervals–40, 60 and 75 days and 2 level of FYM application 5 t/ha and 10 t/ha). Twenty four stem cuttings per plot with 2 healthy nodes per cutting were planted at 50 cm x 100 cm spacing.

First cutting was taken after well establishment (after 60 days of planting). Plants along the borders of plots were excluded from measurement and were cut and forage disposed of at the time of field measurements. Different data like plant height, plant population and number of leaves per plant, leaf area per plant, leaf weight, stem weight, green biomass etc. were measured at first, second and third harvesting/ cut. The first and second harvesting/cut were done till now and shows following result in Table 3. In the 1st cutting of 60 days harvesting, the green biomass yield was found highest in CO3 hybrid Napier (6.6kg/m²) and lowest was found in super Napier variety (5.79 kg/m²). The number of tillers per plants was also highest in CO3 hybrid Napier (40) and lowest in super Napier (25). But lowest DM% (20.6%) was found in CO4 hybrid Napier. In 60

days and 80 days interval of 2nd cutting, the highest biomass yield was found in super Napier variety (5.14 kg/m²) and lowest was in CO3 variety (2.9 kg/m²) but in 70 days of 2nd cutting interval, the highest biomass yield was in CO4 hybrid Napier (4.77kg/m²) and lowest was in CO4 hybrid Napier (3.21 kg/m²). In 60 days, 70 days and 80 days of 2nd cutting intervals, the number of tillers per plant was highest in CO3 hybrid Napier (18), (34), (38) and lowest number of tillers per plants was in super Napier variety (13), (15), (19). The DM% of 60 days,70 days and 80 days 2nd cutting intervals, the highest was in CO3 (26.6%), super Napier (34.4%) and CO4 (31%) variety.

Table 3: Biomass yields and morphological characters of different hybrid Napier varieties.

Variety	Cutting interval			
	1 st cutting 60 days	2 nd cutting		
		60 days	70 days	80 days
CO3				
Green biomass, kg/m ²	6.3	2.9	3.21	3
Dry Matter (DM%)	21.93	26.2	34	37.8
Number of tillers/plant	40	18	34	38
CO4				
Green biomass, kg/m ²	5.9	4.14	4.77	3.24
Dry Matter (DM%)	20.6	24.4	27.6	31
Number of tillers/plant	28	13	28	24
Super Napier				
Green biomass, kg/m ²	5.79	5.14	4.56	3.83
Dry Matter (DM%)	20.67	19.8	34.4	32.5
Number of tillers/plant	25	13	15	19

Table 4: Per kg biomass production cost of different hybrid Napiers.

Crop	Total Cost, Rs	Total Production, kg	Cost/kg, Rs	Overhead Contingency (20%)	20% Content	Final price/kg (Rs)
CO3	68586	36497	1.87	37.58	0.37	2.25
CO4	68586	42750	1.60	32.08	0.32	1.92
Super	68586	46705.26	1.46	29.36	0.29	1.762

Per kg biomass production cost of different hybrid Napiers were presented in Table 4. In economic analysis of production cost of hybrid napier variety, 60 days of cutting interval of first and second cutting, 70 days of cutting interval of second cutting and 80 days of cutting interval of second cutting, per kg forage production cost of hybrid nepier was found highest in CO3 Hybrid nepier variety (Rs. 2.25) and lowest was found in Super nepier hybrid variety (Rs. 1.76).

3.3 Development of Year-Round Cost-Effective Forage Based Milk Production Technology for Crossbred Cattle

Nepal is an agrarian country where more than 65% population (MoAC, 2008) are dependent on agriculture to sustain their livelihood. Livestock sector is an integral part of Nepalese agriculture system. Livestock provides nutritious food for human consumption, draft power for agricultural operations, transportation, manure for maintaining and increasing soil fertility. Livestock sector contributes about 28% to Agricultural GDP of the country (ABPSD, 2016) and dairy sector contributes about 2/3rd of Livestock GDP and about 20% of AGDP. Milk alone shares 63% of Livestock GDP (MoAC, 2016).

The breeding as well as feeding problem are perceived more serious in cattle than in buffaloes. Average production from a cow lies between 3-4 liters per day with broad range from 2-32 liters per day. This wide variation provides ample opportunity for improvement in milk production of herd.

The small holder farmers of developing countries have limited resources available for feeding their ruminant livestock. They do not have the luxury of being able to select the basal diet but use whatever is available at no or low cost. Many of the available feed resources are with low digestibility such as tropical pastures

(both green and mature), crop residues and agricultural by-products which are also with low protein.

The livestock raising system in country is traditional one. Most of the farmers rear local breeds which have better adaptability and needs less feed and other managements but they have lower productivity. Thus, farmers earn lower return. Also, the production from these local breeds is not sufficient to fill the gap between demand and supply of livestock products in the country.

Population of local breeds of cattle is very high compare to exotic breeds. Most of the farmers are rearing their animals by feeding low quality concentrate feed and low-grade roughage like straw and stover. Green grasses which are available seasonally are also poor-quality ensuing high production cost and less return in livestock sector. Nowadays population of exotic dairy cattle breeds is increasing but unable to get expected production, it may be due to lack of proper feeding regime. This study will help to make proper feeding regime to improve milk production in cattle.

3.3.1 Collection and cultivation of winter forages germplasm

The different germplasm of winter legume (common vetch 100 kg and pea 50 kg) and non-legume (oat 200 kg) were collected from different sources like Forage and Pasture Division, Khumaltar; Forage Seed Production Farm Ranjitpur, Sarlahi and National Livestock Breeding Office, Gaughat, Banke. The collected seed were cultivated at pasture/fodder cultivation plot of National Cattle Research Program, Rampur.

3.3.1.1 Yield assessment of winter forage

Three winter forages oat, common vetch and pea were cultivated in the forage cultivation plot of NCRP. Oat was cultivated in two hector of land following 100 kg seed rate per hector and used chemical fertilizer in the ratio of 80:60:40 NPK. Similarly, common vetch was cultivated in half hector of land with the seed rate of 50 kg per hector using 25:60:30 NPK ratio. Pea was cultivated in one hector of land using 50 kg seed rate per hector and 25:60:30 kg NPK ratio of chemical fertilizer.

Table 5: Bio-mass and dry matter yield of winter forages cultivated in NCRP, Rampur

SN	Crop	Bio-mass yield ton/ha	Dry matter ton/ha
1	Oat	34.50	7.72
2	Common Vetch	19.50	4.31
3	Pea	21.50	5.03

3.3.1.2 Economic analysis of winter forage

The economic analyses of winter forage (legume and non-legume) were analyzed at the end of harvesting, which is given below:

3.3.1.3 Production requirement

Table 6: Input requirement for production of winter forage

SN	Crop	Area (ha)	Seed (kg)	DAP (kg)	MOP (kg)	Urea (kg)	No. of labor for sowing	Tractor (Min)	No. of labor for harvesting
1	Vetch	1	50	130	50	4	4	150	50
2	Pea	1	50	130	50	4	4	150	40
3	Oat	2	200	260	130	240	8	300	100

3.3.1.4 Production cost

Table 7: Production cost for winter forages

Crop	Land rent (000)	Seed cost (Rs.)	DAP (Rs.)	MOP (Rs.)	Urea (Rs.)	Labour (Rs.)	Tractor (Rs.)	Labour harv.(Rs.)	Total cost (Rs.)
Vetch	10	7500	5889	1665	65	2308	3750	28850	60027
Pea	10	7500	5889	1665	65	2308	3750	23080	54257
Oat	20	12000							
11778	4329	3912	4616	7500	57700	121835			

Note: Vetch seed @ Rs. 150/kg, Pea @ Rs. 150/kg and Oat @ Rs. 60/kg. DAP @ Rs. 45.3/kg, MOP @ Rs. 33.3/kg and Urea @ Rs. 16.3/kg. Labor coat @ Rs. 577/labor per day.

3.3.1.5 Per kg biomass production cost

Table 8: Per kg production cost of winter forage

SN	Crop	Average bio-mass production (kg/m ²)	Total production (kg)	Per kg cost (Rs.)	20% Overhead+ Contingency (Rs.)	Per kg final price (Rs.)	Per kg average cost of legume (Rs.)
1	Vetch	1.95	19500	3.08	0.62	3.70	3.36
2	Pea	2.15	21500	2.52	0.50	3.02	
3	Oat	3.45	69000	1.77	0.35	2.12	

3.3.2 Collection and cultivation of summer/rainy season forages

The summer/rainy season forages like teosinte, maize, sorghum and bajra were collected from different sources and cultivated at NCRP cultivation plot.

3.3.2.1 Yield assessment of summer/rainy season forage

The different parameter (biomass yield and dry matter) of summer/rainy forage crops were recorded as presented in table below:

3.3.2.2 Bio-mass and dry matter production of summer/rainy season forage

Table 9: Bio mass and dry matter of summer forages cultivated at NCRP, Rampur

SN	Crop	Bio-mass yield (ton/ha)		Dry matter (ton/ha)	
		First cut	Second cut	First cut	Second cut
1	Teosinte	29.5	41.8	6.68	11.98
2	Maize	36.2	-	8.54	-
3	Sorghum	33.3	-	7.27	-
4	Bajra	28.8	-	5.92	-

3.3.2.3 Economic analysis of summer/rainy season forage

The cost benefit analysis was estimated by considering different parameters like seed to bio-mass yield, rent of land, labour charge, seed cost, fertilizer cost, ploughing cost etc. Detail is provided in the table below:

3.3.2.4 Production requirement

Table 10: Input requirement for production of summer forage

SN	Crop	Area (ha)	Seed (kg)	DAP (kg)	MOP (kg)	Urea (kg)	Cow dung (Trolley)	No. of labor for sowing	Tractor use time for cultivation (min)	No. of labor for harvesting
1	Teosinte	2	80	180	70	60	16	8	300	80
2	Bajra	0.5	3	55	35	90	5	2	75	20
3	Sorghum	0.5	15	50	38	80	5	2	75	24
4	Maize	0.5	20	45	18	15	5	2	75	24

3.3.2.5 Production cost

Table 11: Production cost for summer forages in (NRs)

Crop	Rent of land	Seed	DAP	MOP	Urea	Cow dung	Labour	Tractor cost	Harvesting labour cost	Total cost
Teosinte	20000	8800	8154.0	2331.0	978.0	64000	4616	7500	46160	162539.0
Bajra	5000	450	2491.5	1165.5	1467.0	20000	1154	1875	11540	45143.0
Sorghum	5000	1800	2265.0	1265.4	1304.0	20000	1154	1875	13848	48511.4
Maize	5000	1000	2038.5	599.4	244.5	20000	1154	1875	13848	45759.4

Note: Teosinte seed @ Rs. 110/kg, Bajra @ Rs. 150/kg, Sorghum @ Rs. 120 and Maize @ Rs. 50/kg. DAP @ Rs. 45.3/kg, MOP @ Rs. 33.3/kg and Urea @ Rs. 16.3/kg. Labor coat @ Rs. 577/labor per day. Cow dung @ Rs. 4000/trolley.

3.3.2.6 Per kg biomass production cost

Table 12: Per kg production cost of summer forage

SN	Crop	Average bio-mass production (kg/m ²)	Total production (kg)	Per kg cost (Rs.)	10% overhead + 10% contingency (Rs.)	Per kg final price (Rs.)
1	Teosinte	7.13	142600	1.14	0.23	1.37
4	Bajra	2.88	14400	3.14	0.63	3.77
5	Sorghum	3.33	16650	2.91	0.58	3.49
6	Maize	3.62	18100	2.53	0.51	3.04

3.3.3 Collection and cultivation of perennial forage germplasm

The different perennial forages like Stylo, Super Napier, Signal, Setaria, Perennial sorghum were collected and cultivated at NCRP Rampur.

3.3.4 Silage preparation and production cost analysis

Different annual summer/rainy season forages like maize, teosinte, sorghum, bajra & napier were used for preparation of silage. To add value to silage 3% molasses solution was sprayed over the chopped grass. Fifty-six ton of silage was prepared and overall cost during the preparation were recorded to calculate the per unit cost of the silage during preparation.

3.3.4.1 Input requirement for silage preparation

During silage preparation 270 laborer were used for grass cutting 56,000 kg of grass, chopping it and putting the chopped grasses in the silo pit. Thirty number of tractor driver were used as labor during the entire process of silage preparation from 56 ton of forage grasses. While cutting the grasses content around 80% water which was reduced to 65% before putting in the silo pit. So, the overall silage prepared became 47,600 kg by reducing 15% moisture. Molasses was sprayed over the chopped grasses at the rate of one percent of total silage weight. The production cost of green grasses was estimated as Rs. 3 per kg.

So,

The total input for silage preparation
 270+30 labor
 476 kg molasses
 12 roll plastics
 56000 kg green grasses

Table 13: Expenditure of silage

SN	Materials	Unit	Per unit price	Quantity used	Total cost (Rs.)
1	Labor	Person	Rs. 577	300	173100.00
2	Molasses	Kg	Rs. 35	476	16660.00
3	Plastic roll	Roll	Rs. 4000	12	48000.00
4	Green grass	Kg	@ Rs. 3/kg	56000	168000.00
	Total				405760.00
	Overhead 10%				40576.00
	Grand total				446336.00
	Per kg cost of silage (Final silage quantity 47600 kg)				9.38

3.4 Study on Non-Genetic Factors Influencing Milk Yield and its Composition in Different Crossbred Cattle.

3.4.1 Background:

Non-genetic factors include feeding (nutrition), housing and management conditions; climate, including ambient temperatures; calving year, season and age; Parity; stage of lactation; number of lactations; body weight; estrus; number of pregnancies; disease; and milking frequency and duration tend to suppress or inhibit the expressivity of the true genetic ability of the animals in various ratios according to climatic conditions. Very limited studies have been carried out with respect to overall influences of different factors on productive and reproductive performance in jersey and Holstein crosses cow in Nepal. Besides,

milk production performance of Jersey and Holstein and its crossbred under different feeding regimes have not been compared to date which is the utmost need for recommending this breed to the commercial farmers. Milk quality and composition is another important trait of cow with respect to increased profitability of cattle rearing and human health perspectives. To find out the true genetic ability of the animals it is essential to estimate the contribution of environmental factors in milk production in the model. In Nepal we do not know which is the non-genetic factors affecting the milk production. Types of farms, Number of animals in farm, number of species in farm, different management practices, housing systems for hot and cold weather, feed, health services, timely artificial insemination these factor affects the production performances in cattle. There are several factors affecting the milk production with this background, this study aimed to evaluate the effects of season, parity and stage of lactation, types of feed on productive performance of jersey and Holstein crossbred cattle, which will help to formulate suitable evaluation procedures especially in organized farms for improving economic traits of this breed in Nepal. The study of milk composition and non-genetic factors influencing milk constituents in Nepalese dairy animals is scanty. The present study was undertaken to assess the effect of non-genetic factors on major constituents of milk of crossbred dairy cattle in National Cattle Research Program farm.

3.4.2 Methods and materials:

Pedigree and Performance Recording Scheme (PPRS) Herd record book maintained at NCRP, Rampur since 2016 and it will be continued for December, 2022. Milk samples and yield records from Jersey and Holstein crossbred cattle that were in different parity and stage of lactation were collected from National Cattle Research Program farm in Rampur Chitwan. The milk samples were collected in raw conditions randomly without any known partiality. The milk samples were analyzed for fat, SNF, protein, and lactose content by Lactoscan milk analyzer. The stage of lactation is recorded and was gathered into early, mid and late lactations.

3.4.3 Results:

Table 14. The least-squares mean for test day milk constituents of crossbred cattle.

Factors	n	Fat%	SNF%	Protein%	Lactose%	Milk yield
Breed						
Jersey cross	365	4.71±0.06	9.03±0.02	3.35±0.02	4.88±0.08	8.06±0.20
Holstein cross	116	3.88±0.07	8.96±0.04	3.31±0.03	5.06±0.09	9.57±0.20
Significance		***	NS	NS	NS	**
Parity						
Early	197	4.49±0.08	8.89±0.28	3.22±0.10	5.01±0.15	7.69±0.25
MiD	233	4.48±0.08	9.04±0.19	3.30±0.07	4.95±0.10	9.19±0.30
Late	51	4.71±0.14	9.13±0.19	3.31±0.07	4.98±0.10	8.43±0.33
Significance		NS	**	NS	NS	**
Stage of Lactation						
Early (7-105)	173	4.17±0.07	9.02±0.04	3.35±0.03	4.99±0.09	10.86±0.33
Mid (106-200)	107	4.16±0.09	8.97±0.04	3.33±0.03	4.99±0.09	9.05±0.37
Late (200 above)	201	4.99±0.08	9.03±0.04	3.35±0.03	4.93±0.08	6.00±0.16
Significance		***	NS	NS	NS	***

The fat content (4.71 ± 0.06 %) was observed to be more in Jersey crossbreds. Holstein Friesian crossbred showed high milk yield (9.57 ± 0.20) and lactose content (5.06 ± 0.09). All the differences for these traits between the breeds were statistically not significant ($P > 0.05$) except fat and milk yield. The respective

yields were observed to be following a similar trend. However, the yields of SNF and lactose differed significantly ($P < 0.05$) among the breeds. The present finding of non-significant differences for SNF between the breeds Whereas, significant higher fat and SNF content in Jersey crossbreds compared to the Friesian crossbred.

The differences observed for the milk contents, fat and lactose yield between different stage of lactations were significant ($P > 0.05$). However, the SNF, Protein and Lactose were differed ($P > 0.05$) non significantly. Influence of stage of lactation was observed on the milk fat traits and their yields. Early lactation

cattle yield more milk compare to mid and late lactation cattle.

3.5 Multilocation Project :

3.5.1 Effect of Phosphorus and Boron on seed production of Egyptian clover (*Trifolium alexandrinum* L.) In different locations of Eastern and Central Nepal

Egyptian clover is the most popular winter legume fodder of Nepal. Demand for Egyptian clover seed is very high and large amount of seed is imported every year. In Nepal, Egyptian clover seed could be grown successfully in specific localities of 24 districts. In other parts of Nepal, there is a problem of seed setting in Egyptian clover. Therefore, this experiment will be designed to study the effect of phosphorus and boron in seed formation of Egyptian clover. The experimental trial will be laid out in a Split Plot Design with three replication National Cattle Research Program, Rampur as a part of Multi-location Project of National Soil Science Research Centre, Khumaltar.

The amount of seed production is decreasing in recent years and most of the seed produced by farmers are consumed domestically (Pande, 2014; Pariyar et al., 2018; Ghimire, 2019). Whereas, the demand of farmers for Egyptian clover seed is high and huge amount of Egyptian clover is imported every year. In Nepal, Egyptian clover could be grown successfully in more than 24 districts of Nepal however, only the specific localities of Dhanusha, Mahotatri, Sarlahi, Rautahat, Dang, Banke and Bardiya have been found suitable for seed production. This research is conducted to identify the effect of Phosphorous and Boron on seed formation of Berseem with acquiring optimum requirement of Phosphorous and Boron for Berseem seed production.

The field preparation for the experiments was started in 14th November, 2021 with 36 plots of size 4m x 3m. The experimental trial was laid out in a Split Plot Design with three replications. The phosphorus factor has three levels of different doses @ 0 kg P₂O₅/ha, 60 kg P₂O₅/ha and 90 kg P₂O₅/ha was applied as basal dose at the time of planting and four levels of different doses of Boron (0, 2 kg/ha, and 4 kg/ha was applied at the time of planting and remaining 0.2% boron was sprayed at flowering initiation stage and at 50% flowering stage) were tested in the experiment. The required amount of Phosphorous and Boron were applied in each plot with recommended N and K₂O dose on the following day

after plot preparation and Berseem seed (Green gold Variety) were sown on 16th November, 2021.

The combination of treatments are as follows:

P₀B₀: P₂O₅@ 0 kg/ha, B@ 0 kg/ha, N@20kg/ha and K₂O@40kg/ha

P₀B₁: P₂O₅@ 0 kg/ha, B@ 2 kg/ha, N@20kg/ha and K₂O@40kg/ha

P₀B₂: P₂O₅@ 0 kg/ha, B@ 4 kg/ha, N@20kg/ha and K₂O@40kg/ha

P₀B₃: P₂O₅@ 0 kg/ha, B spray, N@20kg/ha and K₂O@40kg/ha

P₁B₀: P₂O₅@ 60 kg/ha, B@ 0 kg/ha, N@20kg/ha and K₂O@40kg/ha

P₁B₁: P₂O₅@ 60 kg/ha, B@ 2 kg/ha, N@20kg/ha and K₂O@40kg/ha

P₁B₂: P₂O₅@ 60 kg/ha, B@ 4 kg/ha, N@20kg/ha and K₂O@40kg/ha

P₁B₃: P₂O₅@ 60 kg/ha, B spray, N@20kg/ha and K₂O@40kg/ha

P₂B₀: P₂O₅@ 90 kg/ha, B@ 0 kg/ha, N@20kg/ha and K₂O@40kg/ha

P₂B₁: P₂O₅@ 90 kg/ha, B@ 2 kg/ha, N@20kg/ha and K₂O@40kg/ha

P₂B₂: P₂O₅@ 90 kg/ha, B@ 4 kg/ha, N@20kg/ha and K₂O@40kg/ha

P₂B₃: P₂O₅@ 90 kg/ha, B spray, N@20kg/ha and K₂O@40kg/ha

The treatment combinations layout was as follows in the field:

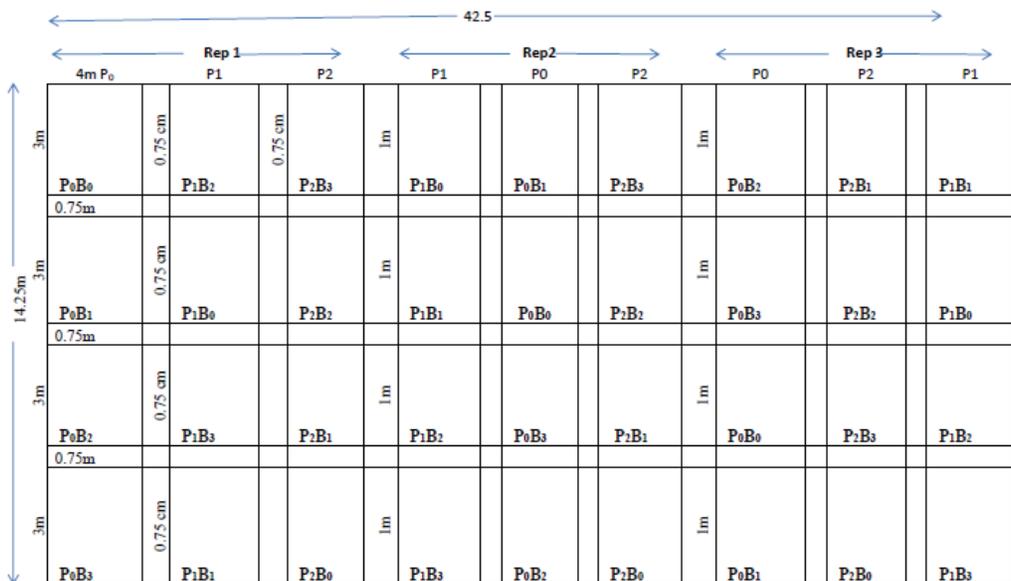


Figure 4: Treatment combination layout

Data were recorded on Plant establishment (germination percentage), germination date (5%, 50% and 90% germination days), Plant height from randomly selected 5 plants per plot at maturity i.e. 60 days after germination, green fodder yield at 60 days from randomly selected 1 m² area of each plot. The results on average plant height and biomass yield on of Berseem at 60 days after sowing under different Phosphorous and Boron combination and Phosphorous dose at NCRP, Rampur is presented in Table below.

Table 15 : Average Biomass and Green Biomass Yield of Berseem at 60 days after sowing under different Phosphorous and Boron combination at NCRP, Rampur in 2078

Treatment Combination	Average Plant Height (Mean±SE)cm	Biomass Yield (Mean±SE) kg/m²
P ₀ B ₀	25.00±4.81	2.20±0.46
P ₀ B ₁	24.20±2.36	2.61±0.48
P ₀ B ₂	25.60±8.05	2.89±1.83
P ₀ B ₃	24.60±4.77	2.24±0.60
P ₁ B ₀	23.87±5.26	2.72±1.06
P ₁ B ₁	18.93±2.56	1.48±0.39
P ₁ B ₂	26.73±1.13	3.68±0.67
P ₁ B ₃	22.73±0.63	1.90±0.17
P ₂ B ₀	21.00±1.53	2.12±0.32
P ₂ B ₁	24.93±1.59	2.67±0.88
P ₂ B ₂	21.07±2.45	1.79±0.29
P ₂ B ₃	22.60±2.12	2.43±0.56

The result shows that there is no significant difference in average plant height and biomass yield of berseem under different combination of Phosphorous and Boron harvested at 60 days after sowing. The maximum plant height was observed in Phosphorous Boron combination of P₁B₂ and lowest average plant height was observed in P₁B₁. Similarly, the highest biomass yield was observed in combination of P₁B₂ and lowest in P₁B₁ resembling the observation of plant

height which is supported by the marginal plot illustrated below.

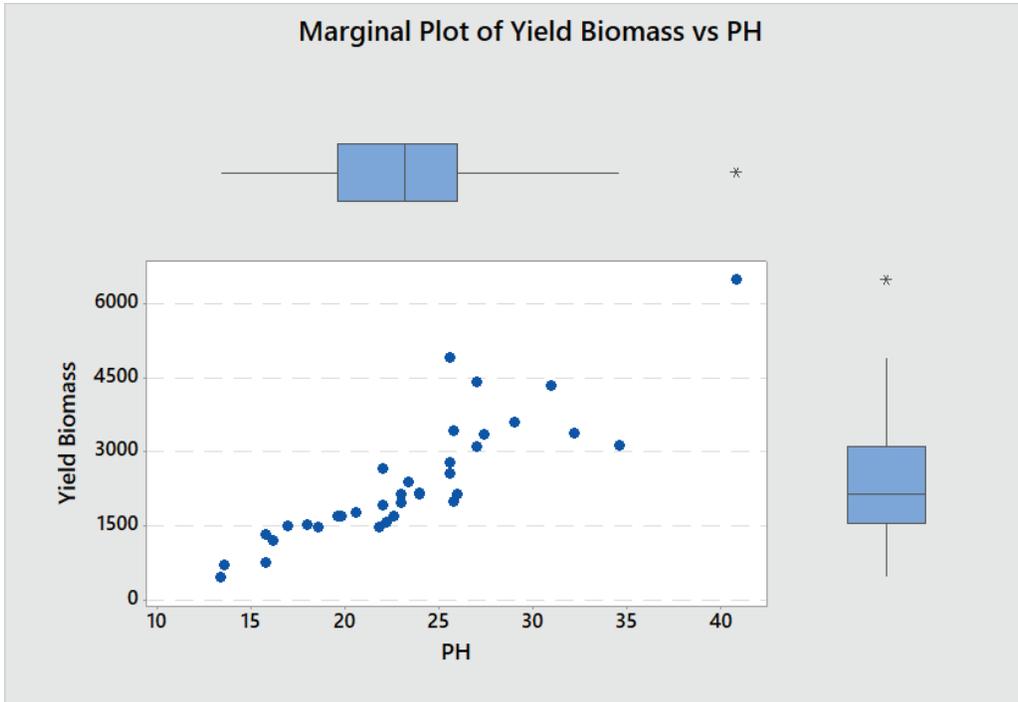


Figure 5: Marginal plot of Biomass Yield (kg/m^2) vs Plant height (cm)

3.5.2 Genetic evaluation of Lulu

Two males and 8 females Lulu cattle were brought from National Animal Breeding and Genetics Research Center, Khumaltar in Falgun 2074 BS as a collaborative research program between NCRP Rampur and NABGRC, Khumaltar. Main purpose of this study was to look adaptation of mountainous cows Lulu in Terai region (Chitwan) of Nepal. Lulu cattle were managed in normal condition as other cattle of NCRP farm. This year 6 cows calved and average birth weight of calf was 11.75 kg. Average lactation length and lactation yield was 101days (28-171 days) and 281 L (94-539 L.), respectively.

4. PRODUCTION

4.1 Cattle Production Program

The station has been maintaining a dairy herd of cattle as a resource flock. There were a total of 203 heads of cattle in this farm. It includes animals of Jersey crossbreds, Holstein Friesian crossbreds, pure Terai, Terai crossbreds, pure Lulu and pure Achhami in different stages. The initial and closing herd composition for the fiscal year 2078/79 is presented in table below.

Table 16: Herd composition of cattle in the beginning and by the end of FY 2078/79

Breed	Opening Balance							Closing Balance						
	Adult		H	YB	Calves		Total	Adult		H	YB	Calves		Total
	F	M			F	M		F	M			F	M	
HF Cross	24	0	14	0	6	5	49	23	0	10	4	8	4	49
Jersey Cross	65	0	13	6	12	7	103	50	0	21	5	21	8	105
Terai Pure	20	3	2	0	0	0	25	19	3	0	0	2	0	24
Terai HF Cross	0	0	0	0	3	0	3	3	0	0	0	0	0	3
Terai Jersey Cross	0	0	0	0	2	0	2	1	0	6	0	0	0	8
Lulu	8	2	2	0	3	2	17	7	1	0	0	1	1	10
Achhami	0	0	2	0	0	0	2	2	0	0	0	0	0	4
Total	117	5	33	6	26	14	201	105	4	37	9	32	13	203

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

A total 93 calves were born in the farm in this FY 2078/79, of which 45 were male calves and 48 were female calves. Among them, 29 were HF crossbred calves, 52 were Jersey crossbred calves, 5 were Lulu, 2 were Terai calves, 4 Terai×Jersey and 1 Achhami calve.

Similarly, 12 male calves of Jersey crossbred and Holstein Friesian crossbred were distributed to the farmers of Chitwan and Makwanpur districts for the breeding purposes.

4.2 Forage seed and Sapling production

This research program had produced 1150 kg seeds of annual forages for the cultivation purposes of which summer annual forage. Teosinte consists of 650 kg and winter forage Oat (variety Bundel) consists of 500 kg. Similarly, different perennial grasses sets were produced for the propagation purposes were the sets of Super Napier (Pakchong), Signal, Setaria and Mulato. For the feeding purposes, this program had produced more than 1200 Mt of Green Matter (biomass) from different annual (Teosinte, Bajra, Annual Sorghum, Oat, Maize, Rice bean, Berseem, Vetch) and perennial (Super Napier, Signal grass, Setaria, Hybrid Jowar, Perennial Sorghum, Mulato, Stylo, Joint vetch) forages. This program has been practicing in producing silage to feed the cattle during the lean winter period, and for this purpose, around 56 Mt of silage was prepared from annual summer forages like maize, napier varieties, sorghum and bajra. Year round fodder production and feeding of green grasses was strictly followed in NCRP farm.

Among the produced forage seeds and saplings, this program had distributed some of the forage seeds and sets/saplings amongst the promising farmers of different districts in this FY. Among them, 165.5 kg of Teosinte seeds and 110 kg of oat seeds were distributed as and annual forage while 5158 sets of Super Napier, 550 sets of signal grass, 750 sets of Setaria and 100 sets of Mulato grasses were distributed to the farmers of Chitwan, Nawalparasi and Rauswa districts for further propagation.

4.3 Milk and milk products production

Milk is the major product of the dairy cattle and 175324.70 litres of milk was produced from more than 55 lactating cows throughout the FY 2078/79 in the farm of NCRP, Chitwan. Monthly total milk and milk products produced during this FY is presented in the table below.

Table 17: Monthly milk and milk products production in FY 2078/79

Month	Whole Milk (l)	Milk Products (kg)		
		Paneer	Ghee	Khuwa
Shrawan 2078	8525.30	7.30	0.00	21.00
Bhadra 2078	10406.20	79.85	0.00	0.00
Ashwin 2078	10455.10	140.45	0.00	16.50
Kartik 2078	11606.80	135.50	0.00	46.00
Magshir 2078	12063.01	32.25	0.00	0.00
Poush 2078	12864.00	50.50	0.00	38.00
Magh 2078	16642.00	78.00	2.50	51.50
Falgun 2078	19610.00	42.25	0.00	43.00
Chaitra 2078	19980.00	46.00	0.00	22.00
Baisakh 2079	19810.50	98.25	0.00	21.50
Jestha 2079	17633.50	39.00	1.50	0.00
Ashad 2079	15728.50	116.00	0.00	38.00
Total	175324.70	865.35	4.00	297.50

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 which were beneficial to them are shared amongst them.

5.1 Training/workshops

One day technology demonstration at NARC technology village was conducted at Baradi, Tanahun. Demonstration about UMMB preparation, teat dipping practices for mastitis reduction and fodder cultivation practices were done during the workshop. Altogether 18 farmers were participated in the workshop. During the workshop, interaction was made on health, nutrition, management and marketing issues of cattle. In addition, Napier sets were also demonstrated to these farmers.

One day training on silage preparation was provided to farmers of Madi Municipality. Total of 16 farmers were beneficiaries in the training. In addition, farmers of Devdaha municipality were provided training on preparation of silage on plastic bag.

5.2 Services

5.2.1 Counseling Services

Technical briefing useful for cattle farming was done to the farmers, students, extension officials, co-operative members, farmers group, staffs of NGOs/INGOs. More than 7031 people were benefited through our counseling and farm visit.

5.2.2 Dairy Product Services

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 150 household for daily consumption. Milk products like khuwa, paneer, ghee etc. were also sold to some of the households dwelling nearby vicinity of NCRP.

5.2.3 Cattle Health Services

One animal health and infertility correction camp was organized at Madi Municipality of Chitwan district. More than 250 animals of different species were brought at the camp. 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 with problem of repeat breeding and anestrus and they were treated accordingly. Animals with poor BCS were supplied anthelmintic, minerals, vitamins and liver tonics. Ectoparasiticide drug was also distributed for animals. Four case of upper fixation of patella (Jhayankhure) in cattle and buffalo was corrected by surgical intervention (Medial Patellar Desmotomy). Early pregnancy diagnosis of cattle was done by using USG.

5.3 Publication

The program had published 100 copies of Annual Report for FY 2077/78. Similarly, one paper entitled “Effect of climate change on livestock production

in Nepal, adaptation measures and mitigation strategies” was published in 8th National Animal Science Convention @2022, NASA.

5.4 Information disseminated through media

An informative news on currently raising disease of cattle “Lumpy Skin Disease in Cattle” was disseminated through online new portal –Kalika news.

6. OTHER ACHIEVEMENTS

6.1 Publication of the research finding

6.1.1 PREVALENCE AND RISK FACTORS OF STAPHYLOCOCCAL SUBCLINICAL MASTITIS IN DAIRY ANIMALS OF NAWALPUR DISTRICT, GANDAKI PROVINCE, NEPAL

Nabina Dhakal¹, Dr. Shiva Hari Ghimire²

¹B.V.Sc & A.H Intern, Agriculture and Forestry University, Rampur, Chitwan, Nepal

²Senior Technical Officer, National Cattle Research Program, Rampur, Chitwan, Nepal

ABSTRACT

Mastitis is one of the leading cause of heavy economic losses to dairy industry and farmers, also a public health hazard globally. In Nepal, the prevalence of subclinical mastitis in cattle is higher due to poor knowledge of farmers, poor management practices, and lack of early detection facilities. The prevalence of subclinical mastitis in cattle has been calculated to be 30-40 times higher than that of clinical mastitis in cattle. The indiscriminate use of antibiotics without AST for both prophylactic and therapeutic purposes could be the cause of increased resistance to antibiotics. The cross sectional study was conducted in dairy cattle of Nawalpur District, one of the highest milk producing district. This study has shown that subclinical mastitis mediated by *S. aureus* and CoNS is prevalent in dairy herds in Nawalpur District. The prevalence of *Staphylococcus* SCM was 38.76% (n = 88/227) among which 66 milk samples (29.07%) were identified with *S. aureus* and 22 milk samples (9.69%) with CoNS. Of the five commonly used antibiotics, *Staphylococcus* isolates have the highest sensitivity to Gentamicin (68.2%), followed by Enrofloxacin (67%), Tetracycline (56.8%), and Ceftriaxone (34.1 %) while 100% of the isolates showed resistance to Amoxicillin.

Keywords: Cattle, California Mastitis Test, Subclinical Mastitis, Multidrug Resistant.

6.1.2 PREVALENCE AND RISK FACTOR OF *Escherichia Coli* ISOLATED FROM SUB-CLINICAL MASTITIS OF DAIRY CATTLE IN NAWALPUR, GANDAKI PROVINCE NEPAL

Y.R. Pandeya

Technical Officer, National Cattle Research Program, Rampur, Chitwan, Nepal

ABSTRACT

A cross sectional study was carried out in Nawalpur District of Nepal with objective of finding the prevalence and risk factor of *E. coli* from sub-clinical mastitis of dairy cattle. Total 216 samples were tested, and overall prevalence of *E. coli* was found to be 23.61% (51 out of 216) by culture method and antibiogram pattern of *E. coli* was evaluated by disk diffusion method. Among the potential risk factor parity number ($\chi^2 = 12.754$; $P=0.002$) and history of mastitis ($\chi^2 = 7.230$; $P=0.005$) was found significantly associated with *E. coli* occurrence. The highest percentage of *E. coli* isolates were found in parity more than 4th and previously mastitis positive cattle. While on the other hand breed of cattle, highest milk yield, Stage of lactation do not show significant value with *E. coli* isolates. The antimicrobial pattern revealed that, the most sensitive antibiotic was Enrofloxacin (90.2%) followed by Tetracycline (76.5%), Gentamicin (68.6%), Ceftriaxone (62.7%) and most resistance was seen with Amoxicillin (94.12%). Now to protect the quality of milk, health of animals and consumer; people who involved in the milk and dairy production chain should be taught proper sanitary procedures and knowledge of mastitis.

Keywords: Antimicrobial pattern, *Escherichia Coli*, mastitis, prevalence.

6.2 Training/Workshop attended

Two senior scientists, Sagar Paudel and Devi Prasad Adhikari had participated in the Managerial training for Officers from Jesta 17 to Jesta 27, 2079 in Nepal Administrative Staff College (NASC), Jawalkhael Lalitpur. Similarly, Dr. Shiva hari Ghimire, Bishnu Bahadur K.C, Dr. Yagya Raj Pandey and Dr. Pratik Hamal participated in the training on “Experimental design and statistical analysis” from 6th to 10th Asar 2079. Puspa Prabha Bhandari who work as a administrative officer in the station had participated in the Public Asset Management System (PAMS) training on Magh 5 to 6, organized by NARC in Parawanipur, Bara, Nepal. Bishnu Bahadur K.C. had also participated in the Pedigree and Performance Recording System training from Poush 22 to 29 in Harihar bhawan, Lalitpur. Administrative Officer, Puspa Prabha Bhandari has also participated in the administrative level empowerment training on “Public Asset Management System (PAMS) from Poush 14-22. Similarly, Laxmi Devi Parajuli, account officer had participated in the empowerment training for account officer in Nepal Administrative Staff College from 23rd Mansir to 2nd of Poush. Moreover, Senior Scientists, Scientists, Senior Technical offices and Technical Officers had participated in 4 days “Planning Workshop” for FY 2079/80, where they presented the project details and thoroughly discussion and correction was made on the ongoing projects and new projects to be implemented for FY 2079/80. In addition, coordinator and senior scientist Mr. Sagar Paudel had participated as Reviewer in planning workshop for FY 2079/80 held at Nepal Agricultural Research Institute (NARI) hall in Kathmandu.

7. BUDGET AND EXPENDITURE

Total annual budget of this program was NRs 5,84,82,000 and the expenses was NRs 5,52,34,371 in this fiscal year which is 94.45% of the total budget released. The details of the annual budget and expenditure is presented in annex 7.1. This program requires 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:

- Inadequate number of scientists, technicians (50% less than approved posts).
- Inadequate farm mechanization machines/tools, laboratory facilities and cattle sheds.
- Poor mechanism of technology dissemination.
- Lack of career development opportunities and encouragement for the staffs.

9. WAY FORWARD

To increase the production and productivity of the cattle according to the guidelines of national plan and policies, following activities should be carried out in coming days.

- 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.
- Conduct farmer's field and applied research to demonstrate and disseminate the technologies for their wider adoption.
- Upgrade the native zebu cattle by strengthening AI facilities and distribution of upgraded breeding bulls to the farmers.
- Conduct research to mitigate the methane production by dairy cattle and make farming more environmentally friendly.
- Develop low cost milk production technology.
- Maintenance and production of improved grasses for animal feeding, silage production and forage seed distribution to the farmers.
- Conduct research on cattle vaccines.

ANNEXES

Annex 1.1 Map of the command area

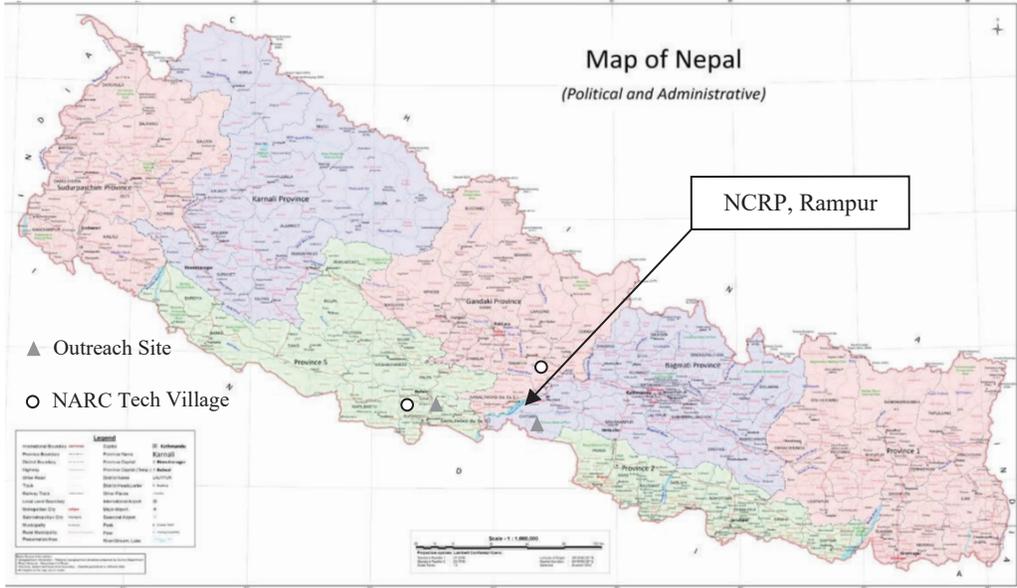


Photo Source: *image--000_20200828140422.jpg(1987×1176)*
(theannapurnaexpress.com) Retrieved on Sept 28, 2021

Outreach Research Sites

District	Site	Eco –zones
Chitwan	Madi Municipality	Inner Terai
Rupandehi	Devdaha Municipality-2	Terai

NARC Technology Village Sites

District	Site	Eco –zones
Tanahun	Aabukhaireni Rural Municipality, Baradi	Mid Hills
Rupandehi	Motipur Municipality	Terai

Annex 1.2 Map of the office



Photo Source: Google Earth Retrieved on Sept 28,2021

Annex 1.3 Map of Cattle Shed Area



Photo Source: Google Earth Retrieved on Sept 28,2021

Annex 2.1 List of Laboratory Facilities at the NCRP, Rampur, Chitwan

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 Scientists Sen Tech Officer Tech Officers J.T. T ₁	Milk Quality, Milk products Quality
2	A.I. Laboratory	AI Gun, Refree with liquid nitrogen, Estrus detector, USG, Liquid nitrogen mother tank	Technical Officer, J.T.A.	Artificial Insemination 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 (S ₁), Technical Officer, J.T.	AST, Bacterial culture, Fecal examination, Biochemical Tests for mastitis, Different infectious diseases test, PCV test
4	Nutrition Laboratory	Sox-holet apparatus, Muffle furnace, Kjeldhal apparatus, Fiber digester, Hot air oven, Titration unit	Scientist (S ₁) J.T.	Estimation of crude protein, Crude fiber, Ether extract, Ash, Dry matter

Annex 2.2 Human Resource at the Program in 2078/79 (2021/22)

SN	Name	Position	Qualification	Specialization/ Working area
1	Mr. Sagar Paudel	Coordinator and Sen. Scientist (S ₃)	M .Sc.An.Sc.	Livestock Product Production and Management
2	Mr. Devi P. Adhikari	Sen. Scientist (S ₃)	M .Sc.An.Sc.	LPPM
3	Mr. Bishnu B. K.C.	Scientist (S ₁)	M .Sc.An.Sc	LPPM
4	Dr. Sagun Malla	Scientist (S ₁)	M.Sc.An.Sc	ANU
5	Mr. Uddhav Paneru	Scientist (S ₁)	M .Sc.An.Sc	Animal Breeding and Genetics
6	Dr. Gita Pandey	Scientist (S ₁)	M .V. Sc.	Veterinary Science
7	Dr. Shiva Hari Ghimire	Sen. Tech. Officer (T ₇)	M .Sc.An.Sc	LPPM
8	Dr. Yagya R. Pandeya	Tech. Officer (T ₆)	M. V. Sc.	LPPM
9	Mrs. Pushpa P. Bhandari	Admin Officer (A ₆)	B. A.	Administration
10	Mrs. Laxmi Parajuli	Account Officer (A ₆)	B. Com	Account
11	Dr. Pratik Hamal	J. T. (T ₅)	B. V. Sc. & A. H	
12	Mr. Prabin Sapkota	J. T. (T ₅)	I. Sc. Ag. (An Sc)	
13	Mr. Mukendra Upadyhya	J. T. (T ₅)	I.Sc.Ag	
14	Mr. Khadka B. Khadka	J.T.A. (T4)	J.T.A., 10+2	
15	Mr. Pasupati Khanal	J.T.A. (T4)	J.T.A., B.A.	

	Mrs. Mitra			
16	Maya Gurung	Lower Technician	I.A	
21	Mrs. Aasha Gurung	Lower Technician	IX	
22	Mrs. Sushma Praja	Lower Technician	S.L.C	
23	Mr. Dipendra Ojha	Lower Technician	IX	
24	Mr. Aas B. Darai	Lower Technician	J.T.A.	Driving
25	Mrs. Manju Rai	Lower Technician	10+2	

Annex 3.1 Summary of NARC research project and activities in 2078/79 (2021/22)

Project No.	Name of project and activities	Project/Activities Leader	End Year	Annual Budget in Rs. '000'	Major Progress/Achievements
1	Farm and Office Management Project	S. Paudel	Core	1597	
1	Farm security	S. Paudel			Security of Office premises and farm well maintained. Seven security guard used daily over the year.
2	Farm Maintenance, (NARC Day, Gai Puja)	S. Paudel			Cattle farm well maintained round the year.
3	Annual Report publication	S. Paudel			100 pcs Annual Report published
4	Technology demonstration	D. P. Adhikari			Technologies related to cattle breeding, health, feeding were demonstrated at at technology village Baradi, Tanahun.
2	Cattle herd management and production project	S. Paudel	Core	19344	
1	Nutritional management of cattle herd	B. B. K.C.			Total of 246,385 Kg feed concentrate, 1,075,000 green roughages, 28,150 kg Straw and 58,400 kg silage was provided to animals.

2	Cattle heard health management	G. Pandey Y. R. Pandeya	Deworming against internal parasites, treatment of external parasites and vaccination against HS, BQ and FMD done regularly following the standard protocol 290 milk samples were collected from Nawalparasi district, out of these samples 192 were CMT positive. Among the positive samples 66 were <i>staphylococcus</i> and 51 were <i>E. Coli</i> positive.
3	Epidemiological studies on cattle mastitis	G. Pandey	
4	Evaluation of ectoparasidal properties of different indigenous plants	G. Pandey	Evaluation of different plants for ectoparasites resistance were done.
5	Clean milk production, processing and distribution	B.B. K.C.	Daily cleaning of utensils and clean milk production regularly done. 16000 sets of Napier cultivated in two hectors of land.
6	Production and evaluation of pasture and forage	Y. R. Pandeya	Oats, berseem, rai, pea and stylo were also cultivated and evaluated.

7	Identification of blood level of crossbreed cattle	Y.R. Pandeya	DNA extraction from the blood samples completed and further activities going on.
8	Database management of cattle herd	D. P. Adhikari	Bathing of all cattle by using cold water was done twice daily to reduce the heat stress during summer months
9	Maintenance and evaluation of Exotic, Terai cattle and its crossbreed	Y. R. Pandeya	Average milk parameters were as: Fat-4.20, SNF-8.67, Protein-3.23, and Conductivity-4.25. Milk analysis done in monthly basis
10	Study on breeding management techniques	Y.R. Pandeya	Due to covid-19 pandemic situation lab materials not available

3	Participatory technology development and verification at Outreach sites	S. Paudel	Out reach	895
1	Transfer of technologies for improved cattle management (Health, nutrition and breeding)	Y.R. Pandeya		Deworming was done to 220 animals from 29 farmers in Madi of Chitwan and Devdaha of Rupandehi. Demonstration of UMMB preparation was done to 16 farmers of Madi. Demonstration of silage preparation in plastic bag was done to 13 farmers in Devdaha. Vaccination against FMD was done to 104 cattle in OR site. Health camp was conducted in Madi
2	Health campaign	Y.R. Pandeya		municipality of Chitwan district. More than 250 animals were treated during the camp

4	Multi-location Project	S. Paudel Multi	1346
1	Field experiment on Egyptian clover	S. Malla	The result shows that there's no significant difference in average plant height and biomass yield of Berseem under different combination of Phosphorous and Boron harvested at 60 days after sowing. Lulu cattle is found to be adopted in Chitwan. Maximum milk production from Lulu found to be 4 liter/day.
2	Genetic evaluation of Lulu cattle	Y.R. Pandeya	
147	Development of Year round cost effective forage based milk production technology for crossbred cattle	S. H. Ghimire	796
1	Collection and cultivation of winter legume and non-legume forages germplasm.	S. H. Ghimire	Different winter grasses seeds like oat, berseem, common vetch, pea were collected and cultivated in the fodder land of NCRP.
2	Yield assessment of winter forage	S. H. Ghimire	Data about the yield and expenditure of oat cultivated recorded.

3	Economic Analysis of winter forage	S. H. Ghimire	per kg production cost of winter forage oat, vetch and pea was found Rs.1.70, 3.23 and 3.10 respectively.
4	Collection and cultivation of summer/rainy season legume and non-legume forage Yield	S. H. Ghimire	Teosinte, maize, bajra and sudan seeds cultivated
5	assessment of summer/rainy season legume and non-legume forage	S. H. Ghimire	Feeding trial of winter forages completed
6	Economic analysis of summer/rainy season legume and non-legume forage	S. H. Ghimire	Production data recording taken
7	Collection and cultivation of perennial legume and non-legume forage germplasm	S. H. Ghimire	Experiment completed, work of data analysis remaining
8	Yield assessment of perennial legume and non-legume forage	S. H. Ghimire	Experiment on silage feeding is conducted in 20 milking cattle
9	Economic analysis of perennial legume and non-legume forage	S. H. Ghimire	Feeding trial of summer/rainy season fodder done

10	Cost benefit analysis of silage preparation and milk production	S. H. Ghimire	Production cos of silage was observed 9.97/kg.
11	Prepare different feeding regime and conduct feeding trial at different season	S. H. Ghimire	Experiment completed, work of data analysis remaining
12	Cost benefit analysis of feeding trial at different season	S.H. Ghimire	
478	Effect of cutting interval and spacing on production performance of different hybrid Napier	BB KC	588
1	Performance evaluation of hybrid Napier fodders.	BB K.C	6500 Super napier sets were planted on station
2	Analysis of nutrient content of hybrid Napier at different growth stages	BB K.C	Data recording and sample collection up to first and second cut completed
3	Logistic supports to farmers , report writing and publication	BB K.C	108 samples of 3 hybrid Napier were collected for Proximate analysis

620	<p>Study on non-genetic factors influencing milk yield and its composition in Jersey and Holstein crossbreed cattle</p>	S. Paudel	882
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1	<p>Productive and reproductive performance evaluation of Jersey and Holstein crossbreeds</p>	S. Paudel	<p>Data recording on productive and reproductive performance of 60 lactating cattle was taken by dividing lactation period into three groups: early lactation from 7-105 days mid lactation from 106-210 days and late lactation from 211 days onwards.</p>
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2 Evaluating the cross-breeds cattle's under different feeding regimes S. Paudel

In order to evaluate nutrient digestibility, 12 animals were divided into different dietary protein level with three replication where crude protein level were 14, 16 and 18 and 20% protein was offered at the rate of 2.5% DM and additional 1 kg concentrate was added for every 2-3 liters of milk production. Data on feed intake and milk production recorded.

3 Milk quality and composition analysis S. Paudel

Completed.

Annex 4.1 Production of commodities and products in FY 2078/79 (2021/22)

SN	Commodity / Product	Variety/ Breed	Type (Breeder/ Foundation/ Blood level)	Unit	Target	Production
1	Calves	Jersey Cross	-	No.	35	93
		HF Cross	-			
		Terai x Jersey	50%			
		Terai x HF	50%			
		Terai	100%			
	Lulu	100%				
2	Milk	Whole Milk		Lit	90000	175,324.7
3	Milk Products					
3.1	Paneer			Kg		865.35
3.2	Ghee			Kg		4.0
3.3	Khuwa			Kg		297.5
4	Forage Seed					
4.1	Teosinte			Kg	400	650.00
4.2	Oat			Kg		500.00
5	Silage			MT		56.00

Annex 4.4 Distribution of Commodity products in FY 2078/79 (2021/22)

SN	Commodity/ product	Breed / Type	Quantity	Major stakeholder (s)	Distributed districts
1	Male calf	HF Cross	1	National Livestock Breeding Office (NLBO)	Kaski
2	Male calf	Jersey cross	3	National Livestock Breeding Office (NLBO)	Banke
3	Male calf	Jersey and HF cross	6	Farmers	Chitwan and Mekanpur

4	Female cow	Infertile cow of different breed	38 Farmers	Chitwan	
5	Forage seeds/ sets	Teosinte	165.5 kg	Farmers, Seed Suppliers, Offices	Chitwan, Nawalparasi and Rasuwa
		Oat	110.0 kg		
		Super Napier	5158 sets		
		Signal	550 sets		
		Setaria	750 sets		
	Mulato	100 sets			

Annex 5.1 Training/Workshop/Seminar Organized in FY 2078/79 (2021/22)

SN	Name of Training/ Workshop/ Seminar	Duration	Target group	Location	No. of participant
1	Animal health camp	1 day	Farmers	Madi, Chitwan	> 250 animals of different species
2	Silage preparation on plastic bag	1 day	Farmers	Devdaha, Rupandehi	13
3	UMMB preparation	1 day	Farmers	Madi, Chitwan	16

Annex 5.2 Services Provided by NCRP, Rampur in FY 2078/79 (2021/22)

SN	Laboratory/Field test/ Counseling services provided	Numbers	Major clients
1	Farm Observation and Technical Briefing and Counselling	7031 (M: 3616, F:3315)	Farmers, Students, Entrepreneurs, Extension Officials, NGOs Officials
2	Laboratory Skills, ELISA test, Pregnancy Diagnosis, Disbudding, Weight and age determination	5	B. V. Sc. & A. H. Internee, Masters Students
3	Treatments and Simple lab skills	6	On Job Trainings Students/ J.T.A.

Annex 5.3 Publications of the NCRP, Rampur in FY 2078/79 (2021/22)

SN	Name of publications	Type	Language	Authors	No. of copies
1	Annual Report (FY 2077/78) Effect of climate change on livestock production in Nepal, adaptation measures and mitigation strategies. Published in 8th National Animal Science Convention@2022, Nepal Animal Science Association (NASA)	Report	English	NCRP, Rampur B.B. KC, M. Dahal, U. Paneru, H.R. Dhakal, L.N. Pandey and M.R. Tiwari	100

Annex 5.4 Information disseminated through Media in FY 2078/79 (2021/22)

SN	Information Disseminated / Media Coverage	Type	Name/ type of Media	Date
1	Lumpy Skin Disease in Cattle	Information	Kalika News/ Online	

Annex 5.5 Visit of NCRP, Rampur by Farmers, Students, Extension Officials/ Technicians, Entrepreneurs, Cooperatives, NGO/ CBO Officials etc. in FY 2078/79 (2021/22)

SN	Category	Number	Districts	Area of major interest
1	Farmers	4113	Different districts of Country	Cattle Raising and Farm Visit
2	Extension Officials	210	Different districts and municipalities	Technology generated in the station
3	NGOs Officials	131	Different districts	Cattle Husbandry Practices
4	Students and Instructors	2577	AFU, IAAS, Nepal Polytechnic Institute and other technical Schools	Farm Visit, Internship, On Job Training and Cattle Husbandry Practices

Annex 6.1 Training/Workshop/Seminar Attended by Staff in FY 2078/79 (21/22)

S N	Name of Staffs	Position	Name of Training / Seminar/ Workshop	Duration	Place/ Country	Organizer
1	BB KC	S ₁	Pedigree Performance Recording System (PPRS) Training	3 days	Harihar Bhawan	NLSIP, Hetauda
2	S. H. Ghimire Y. R. Pandeya P. Hamal	T ₇ T ₆ T ₅	Nepal Veterinary Association General Assembly, Vetcon	1 day	Pokhara	Nepal Veterinary Association
3	S. Paudel D. P. Adhikari B. B. KC S. Malla U Paneru S. H. Ghimire Y. R. Pandeya	S ₃ S ₃ S ₁ S ₁ T ₇ T ₆	Planning workshop for FY 2079/80	7 days	Khumaltar, Lalitpur	NARC
4	S Paudel D.P Adhikari	S ₃ S ₃	Managerial training for officers	10 days	Jawalakhel, Lalitpur	NARC

BBK.C	S ₁					
5	Dr. S. H. Ghimire	T ₇	Experimental design and statistical analysis	5 days	Rampur, Chitwan	NARC
	Dr. Y.R. Pandey	T ₆				
	Dr. P. Hamal	T ₅				
6	Puspa Prabha Bhandari	A ₆	Public asset management systems	2 days	Parawanipur, Bara	NARC
7	Puspa Prabha Bhandari	A ₆	Administrative excellent training	10 days	Ktm.	Administrative staff college, Jawalakhel, Lalitpur
8	Laxmi Devi Parajuli	A ₆	Empowerment training for account officer	10 days	Jawalakhel, Lalitpur	NARC
9	Dr. Y.R. Pandey	T ₆	Workshop on Yak and Chauri production	2 days	Pokhara	ICIMOD DLS NARC
10	Sagar Paudel	S ₃	Annual General Meeting	1 day	Lalitpur	NASA
11	Sagar Paudel Devi Prasad Adhikari	S ₃ S ₃	General Assembly	1 Day	Lalitpur	SAS
12	Sagar Paudel	S ₃	Internalization on New Technologies about Animal Feed	1 Day	Lalitpur	National Animal Feed and Livestock Quality Management Laboratory

Annex 7.1 Annual Budget and Expenditure Record of FY 2078/79 (2021/22)

(in Nepalese Rupees)

Code	Account Heading	Annual Budget	Total expenses	Budget Balance
	Staff expenses	1,40,98,000.00	1,22,10,119.20	18,87,880.80
21111	Staffs Basic Salary	1,31,64,000.00	1,13,15,619.20	18,48,380.80
21121	Staff Uniform	2,20,000.00	2,10,000.00	10,000.00
21132	Staff Allowance	5,28,000.00	5,04,000.00	24,000.00
21213	Contribution based insurance fund	1,06,000.00	1,02,000.00	4,000.00
21139	Other Allowance	80,000.00	78,500.00	1,500.00
	Operational exp.	2,54,48,000.00	2,53,98,051.99	49,948.01
22212	Vehicle Fuel & Lubricants	4,70,000.00	4,69,999.16	0.84
22312	Animal Feed	1,20,20,000.00	1,20,18,183.00	1,817.00
22512	Training, workshop, seminar	1,20,000.00	1,19,665.00	335.00
22521	Farm Supplies, Lab supplies & Labor wages	1,11,75,000.00	1,11,28,279.83	46,720.17
22611	Monitoring and Evaluation	1,67,000.00	1,66,000.00	1,000.00
22612	Travel Expenses	14,96,000.00	14,95,925.00	75.00
	Administrative exp.	52,66,000.00	45,81,870.79	6,84,129.21
22111	Water & Electricity Supplies	12,90,000.00	10,00,000.00	2,90,000.00
22112	Communication	2,16,000.00	1,96,820.00	19,180.00
22213	Vehicle Maintenance	4,00,000.00	3,95,174.00	4,826.00
22214	Insurance and Renewal Expenses	1,70,000.00	72,989.80	97,010.20

22221	Machinery and tools maintenance and operational Expenses	3,33,000.00	3,29,596.00	3,404.00
22231	Public property Maintenance Expenses	90,000.00	89,984.00	16.00
22311	Office supplies	5,31,000.00	5,30,628.00	372.00
22314	Fuel Other purpose	2,80,000.00	2,73,653.49	6,346.51
22315	Newspaper, printing and Notice publishing expenses	1,03,000.00	97,807.00	5,193.00
22413	Contract and other services	15,63,000.00	13,05,376.00	2,57,624.00
22711	Contingency	90,000.00	89,942.50	57.50
28143	Vehicle and Machinery Rent	2,00,000.00	1,99,900.00	100.00
	Capital Exp.	1,36,70,000.00	1,30,44,329.17	6,25,670.83
31112	Non-residential building construction	2,00,000.00	197887.00	2,113.00
31114	Land development	5,00,000.00	4,97,889.00	2,111.00
31122	Equipment & Machinery	55,70,000.00	50,58,173.66	5,11,826.30
31155	Irrigation channel development	35,00,000.00	34,66,590.10	33,409.90
31155	Other public construction	14,00,000.00	13,84,737.41	15,262.59
31161	Constructed Building Structural Improvement	25,00,000.00	24,39,052.00	60,948.00
	Grand total	5,84,82,000.00	5,52,34,371.15	32,47,628.85

Annex 7.2 Special Project Budget and Expenditure Record of FY 2078/79 (21/22)

(in Nepalese Rupees)

Name of the Project	Funded by	Project Period	Annual Budget	Expenses
None				

Annex 7.3 Revenue Status of FY 2078/79 (2021/22)

(in Nepalese Rupees)

Source	Total	Remarks
Animal Production, Research	98,00,273.85	
Calves (male and Female)		
Raw Milk		
Dairy Product		
Manure		
Fodder/Forage seed and sets		
Administrative income	3,37,390.53	
Other Income	0.00	
Total	1,01,37,664.38	

Annex 7.4 Beruju Status of FY 2078/79 (2021/22)

Beruju	Amount (NRs '000)	Remarks
Beruju till FY 2076/77	16155.954	
Beruju in FY 2077/78	101.688	
Beruju cleared in this FY	3353.089	
Remaining Beruju	12,665.466	

Annex 8.1 Human Resource Chart of NCRP at the end of FY 2078/79 (2021/22)

SN	Post	Group	Number of post	Post fulfilled	In	Out	Vacant Post
1	Principal Scientist	LPPM	1	0	0	0	1
2	Senior Scientist (S ₁)	LPPM	1	1	1	0	0
3	Scientist (S ₁)	LPPM AB	3	3	3	2	0
4	Senior Technical Officer (T ₇)	LPPM	1	1	0	0	0
5	Technical Officer (T ₆)	LPPM Veterinary PFAF	4	1	0	0	3
6	Account Officer (A ₆)	Finance	1	1	0	0	0
7	Admin Officer (A ₆)	Admin	2	1	0	0	1
8	J.T. (T ₅)		5	3	0	0	2
9	J. Tech. Asst. (T ₄)		4	2	0	1	2
10	Tech Helper (T ₁)		12	6	0	0	6
11	Admin Helper (A ₁)	Admin	1	0	0	0	1
12	Driver Heavy	Admin	1	0	0	0	1
13	Driver Light	Admin	1	0	0	0	1
Total			37	19	4	3	18

Annex 8.2 Meteorological data at National Maize Research Program, Rampur in 2021/22

Months	Temperature				Rainfall		Average RH %
	Avg Max	Avg Min	Max	Min	Total mm	No. of Days	
January	28.1	13.3	24.04	9.43	NA	NA	62
February	23.64	9.68	26.95	9.08	NA	NA	59
March	23.46	16.99	31.59	14.12	NA	NA	59
April	28.06	21.66	35.42	16.62	33.8	NA	50
May	27.86	20.36	31.76	21.67	339.5	NA	72
June	27.32	23.42	33.29	24.60	564.2	NA	83
July	26.60	22.88	32.80	25.16	1064.7	NA	84
August	27.41	24.01	31.00	25.90	288.7	NA	88
September	25.58	22.01	32.69	24.71	843.79	NA	85
October	25.40	18.91	33.30	21.05	NA	NA	82
November	19.66	13.97	29.09	12.03	NA	NA	82
December	16.92	11.98	24.04	8.73	NA	NA	82