NPSN: 022/078/79

Annual Report

2077/78 (2020/21)

Government of Nepal

Nepal Agricultural Research Council

National Cattle Research Program

Rampur, Chitwan, Nepal

2021

Calves at NCRP, Rampur

Biogas Plant with Solid Liquid separator

Annual Report

2077/78 (2020/2021)

Government of Nepal

Nepal Agricultural Research Council

National Cattle Research Program

Rampur, Chitwan, Nepal

2021

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

Citation:

NCRP. 2021. Annual Report 2077/78 (2020/21). National Cattle Research Program (NCRP), NARC, Rampur, Chitwan, Nepal.

Editor:

Dr. Sagun Malla

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 fiscal year 2077/78. 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 in total AGDP livestock sector contributes 28 % and dairy sector contributes 63 % among livestock contribution. Within dairy, cattle contribute 34.28 %. Total annual milk production is 2000500 M.T (MoALD, 2075) and now only 586500 M.T milk is deficit annually.

Due to emergence of COVID-19, we were not able to complete our planned activities as expected. Despite the condition some outputs has been achieved which can be extended in the farmer's field. This fiscal year 2077/78 we conducted research works related to management of mastitis and infertility, molecular detection of blood protozoan, antibiotic residue in raw milk, isolation and molecular characterization of SIGA toxin producing E.coli o157:h7 in cow's milk, we studied on outbreak of Lumpy Skin Disease(LSD), study on different timing of AI, comparison of hand milking and machine milking, package of practices for Yak/Chauri, Heat Stress Management, Study on Hydroponics Fodder 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 is under Dairy Cattle Improvement Program (DCIP) headed by NLBO, Pokhara. Adoption of the exotic semen & sexed semen in the NCRP farm 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. We stalled the Solid liquid separator Machine and 3 sets of Milking Machine. 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. Sagun Malla, Mr. Devi Prasad Adhikari, Mr. Bishnu Bahadur

K.C, Dr. Yagya Raj Pandeya, Dr. Shiva Hari Ghimire, Dr. Gita Pandey 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. Swoyam Prakash Shrestha (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.

……...

Sagar Paudel
Coordinator/Senior Scientist (S_3)
National Cattle Research Program
Rampur, Chitwan

ABBREVIATIONS

^{o}C	Degree Centrigrade
%	Percent
@	At the rate of
ADS	Agriculture Development Strategies
AFU	Agriculture and Forestry University
AGDP	Agricultural Gross Domestic Product
AI	Artificial Insemination
APP	Agriculture Prospective Plan
approx.	Approximately
AST	Aspartate Aminotransferase
AST	Antibiotic sensitivity Test
BCS	Body Condition Score
BQ	Black Quarter
CIDR	Controlled Internal Drug Release
CMT	California Mastitis Test
CNS	Coagulase-Negative Staphs
COVID	Corona Viral Disease
CTEVT	Council for Technical Education and Vocational Training
DAP	Diammonium Phosphate
DCIP	Dairy Cattle Improvement Program
DDC	Dairy Development Cooperative
DLS	Department of Livestock Service
DM	Dry Matter
ELISA	Enzyme-Linked Immunosorbent Assay
ESBL	Extended-spectrum beta-lactamases
FAO	Food and Agriculture Organization
FMD	Foot and Mouth Disease
FY	Fiscal Year
FYM	Farm Yard Manure
GDP	Gross Domestic Product
Ha	Hectare
HF	Holstein – Friesian
HS	Haemorrhagic Septicemia
Ig G	Immunoglobulin G

INGO	International Non government Organization
Kg	Kilogram
Km	Kilometer
L	Litre
LSD	Lumpy Skin Disease
Masl	Meters above sea level
Mg	Milligram
Min	Minute
Ml	Milliliter
MoAC	Ministry of Agriculture and Cooperatives
MOP	Muriate of Potash
MRL	Maximum Residue Limit
MRSA	Methicillin-resistant *Staphylococcus aureus*
MS	Microsoft
MT	Metric Ton
NABGRC	National Animal Breeding and Genetics Research Centre
NARC	Nepal Agricultural Research Council
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
No.	Number
NPFRP	National Pasture and Fodder Research Program
NPK	Nitrogen, Phosphorous and Potassium
PATWG	Provential Agricultural Technical Working Group
PPRS	Pedigree Performance Recording System
RR	Rapid Response
Rs	Rupees
SNF	Solid Not Fat
UHT	Ultra High Temperature
UMMB	Urea Molasses Mineral Block
USG	Ultrasonogram
WHO	World Health Organization
Wt.	Weight

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ANNEXES

संक्षिप्त वार्षिक प्रतिवेदन

राष्ट्रिय गाई अनुसन्धान कार्यक्रम, रामपुर, चितवनले प्रत्येक वर्ष गाईपालन गर्ने कृषकहरूका लागि आवश्यक पर्ने विषय र नेपालमा दुग्ध उत्पादन र उत्पादकत्वमा सुधार गर्ने विषयमा विभिन्न अनुसन्धानात्मक कार्यहरू गर्दै आइरहेको छ । यसै सम्बन्धमा आ. व. २०७७/७८ मा यस कार्यक्रमले चारवटा आवधिक अनुसन्धान परियोजनाहरू, अंतर्भाग परियोजनाहरू मध्य फार्म व्यवस्थापन परियोजना, उत्पादन कार्यक्रम, बाह्य अनुसन्धान कार्यक्रम र खुमलटारस्थित राष्ट्रिय पशु प्रजनन तथा आनुबंशिक अनुसन्धान केन्द्रको लुलुगाई सम्बन्धी अनुसन्धनात्मक परियोजनाहरू संचालन गरेको थियो । यस आर्थिक वर्षमा कार्यक्रमले विभिन्न जात तथा उमेरका २०१ ओटा गाईहरूको व्यवस्थापन गर्ने र किसानका लागि प्रजनन योग्य बहरहरू वितरण गर्ने कार्यहरू सम्पन्न गर्यो | यसको अलावा अवलोकन भ्रमण र परामर्श लिन आउने ठुला तथा साना सङ्ख्याका कृषक तथा गैर कृषकहरूलाई परामर्श सेवा दिनेजस्ता कार्यहरू सम्पन्न भयो ।

यस वर्ष गरिएको अनुसन्धानका नतिजाहरू अनुसार एन्टिबायोटिकको संवेदनशीलता परीक्षण गर्दा चितवन र नवलपरासीका २०० वटा दुधको नमुना परीक्षण गर्दा १२ वटा नमुनाहरूमा एन्टिबायोटिकको अवशेष पाइयो । धेरैजसो किसानहरूले आफुखुसी थुप्रै एन्टिबायोटिकहरू प्रयोग गर्ने गरेको पाइयो भने केही किसानहरू चाहिँ मह र मेथीको पेष्ट, घिउकुमारी, ज्वानो जस्ता घरेलु उपचार पद्दतिद्वारा सुन्निएको फाँचोको उपचार गर्ने गरेको पाइयो ।त्यसैगरी गाईको थुनेलो सम्बन्धी अनुसन्धानमा ४२.६६% (९६/२२५) स्टाफाइलोकोकस जीवाणुले हुने लक्षण नदेखाउने प्रकारको थुनेलो सङ्क्रमण देखियो ।

विभिन्न समयको अन्तरालमा नेपियरको हाइब्रिड जातहरूको उत्पादकत्व हेर्दा ६० दिनको अन्तरालमा हरियो घाँसको उत्पादन ५० दिन र ७० दिनको अन्तरालमा भन्दा राम्रो देखिएको पाइयो, त्यसमा पनि सुपर नेपियरको उत्पादन अझ राम्रो देखियो । घाँस काट्ने अवधि लम्बिदा घाँसहरूमा सुख्खा पदार्थ पनि क्रमिक रूपमा बढेको पाइयो । वर्षैभरिको लागि हरियो घाँस उत्पादनको लागत हेर्दा हिउँदयामको घाँस मध्य जै घाँसको उत्पादन मूल्य रु २.१७ र कोषे घाँस (वर्षिम र भेच) को उत्पादन मूल्य रु ३.४५ पाइयो भने वर्षे घाँसहरूको उत्पादन मूल्य क्रमशः टियोसेन्टीको लागि रु १.३२, बाज्राको लागि रु ३.६४, जुनेलोको लागि रु ३.३७ र मकैको लागि रु २.९२ पाइयो । विभिन्न वर्षे तथा बहुवर्षे घाँसहरूबाट साईलेज बनाउँदा एक के. जी. साइलेजको उत्पादन मूल्य रु ९.७६ पाइयो ।

उत्पादन कार्यक्रम अन्तर्गत यस आ. व. मा ६५ वटा बाच्छा बाच्छी जन्मिए, जसमा ४१ वटा बाच्छी र २४ वटा बाच्छा थिए भने १३ वटा होलिस्टीन फ्रेजियन क्रस, ४४ वटा जर्सी क्रस, ५ वटा शुद्ध लुलु र २ वटा शुद्ध तराई गाईका बाच्छा बाच्छी थिए । बाच्छा बाच्छीको औषत जन्म

तौल २१.३९ के. जी. पाइयो भने मृत्युदर १६.९२% पाइयो । त्यसैगरी ११२२.५० के. जी. विभिन्न घाँसका बिउ र बहुवर्षे घाँसका ८००० जति सेट्स उत्पादन गरियो । दुध उत्पादनको १५५,३७३.५० लिटर मध्य १३६,०८९.३ लिटर दुध बिक्री गरेर बाँकी रहेको दुधबाट ९९५.८५ के. जी. पनिर, १७ लिटर दही, ७ के. जी. आईसक्रिम, १९.५० के. जी. घ्यु, २३४.५० के. जी. खुवा र ३६० पिस रसवरी उत्पादन गरियो । यस वर्ष उत्पादित दुधमा औसत घृतांश ४.६८%, एस. एन. एफ. ९.०५%, प्रोटिन ३.३२% र कन्डक्टिभिटी ४.५१% रहेको थियो ।

उत्पादन भएका बाच्छाहरू मध्य १२ वटा बहरहरू चितवन र मकवानपुरका किसानहरूलाई नश्ल सुधारका लागि बिक्री वितरण गरियो भने १६५.५ के. जी. टियोसेन्टीको बिउ, ११० के. जी. जै घाँसको बिउ र सुपर नेपियर लगायतका विभिन्न बहुवर्षे घाँसहरूको सेट्स बाह्य अनुसन्धान स्थल तथा अन्य जिल्लाका कृषकहरूलाई वितरण गरियो ।

यो आर्थिक वर्षको राजश्व सङ्कलन रू. ९०,९१,५९५.५६ रहेको छ । गाईको दुध र दुग्ध पदार्थ बिक्री बाट जम्मा रू. ८७,९३,०७१.०६ राजश्व सङ्कलन भयो भने बाच्छा-बाच्छी र मल बिक्रीबाट जम्मा रू. १०,६८०.००, घाँसको बिउबाट रू. ३२,९९५.०० तथा प्रशासनिक कार्यक्रमबाट रू. १,८२,८४९.५० राजश्व सङ्कलन भयो ।

यस आर्थिक वर्षमा १५७३ भन्दा बढी किसान, विद्यार्थी तथा सम्बन्धित सरोकारवालाहरू लाई फार्म भ्रमण/अबलोकन तथा गाईपालन सम्बन्धी जानकारी प्रदान गरिनुका साथै देवदह, रूपन्देहीमा पशु-स्वास्थ्य तथा बाँझोपन निवारण शिविर संचालन गरियो जसमा गाईहरूका साथै अन्य पशु वस्तुहरूको उपचार र परामर्श सेवा प्रदान गरिएको थियो ।

राष्ट्रिय गाई अनुसन्धान कार्यक्रममा हालसम्म पाँच वटा गाईगोठ, १ वटा बाच्छा बाच्छी गोठ, १ वटा बहर गोठ, १ वटा आईसोलेसन गोठ, १ वटा मेटाबोलिक क्रेटसहितको गोठ, १ वटा हे बार्न, २ वटा साईलो पिट, १ वटा दुध तथा दुग्ध पदार्थ बिक्री कक्ष निर्माण भएका छन । प्रयोगशाला भवन निर्माण भए पनि पूर्ण रूपमा संचालन हुन बाँकी रहेको छ । त्यसैगरी २०० घन मिटर क्षमताको बायोग्यास निर्माण भै राष्ट्रिय गाई अनुसन्धान कार्यक्रम र राष्ट्रिय मकैबाली अनुसन्धान कार्यक्रम, रामपुरका ६० घर परिवारलाई ग्यास वितरण गर्दै आइरहेको छ ।

EXECUTIVE SUMMARY

National Cattle Research Program (NCRP) is executing several research works every year on felt-need issues of dairy cattle farmers and on improving the production and productivity of dairy cattle in Nepal. Accordingly, this program implemented four time-bound research projects on development of year round forage on cost effectiveness, production performance of different hybrid Napiers, bacterial loads and antibacterial residues in cattle milk, core research projects as Farm Management Project, Source seed/breed Production and Management, an outreach research project and one Multilocation project of Lulu cattle form NABGRC in fiscal year 2077/78. The production program supported the maintenance and production of the herds of 201 different breed and age group of cattle in the program's farm and outreach programs supported to outreach (OR) sites to verify and validate a couple of technologies in the year 2077/78.

As a part of Research work on Anitibiotics sensitivity test, out of 200 milk samples of Chitwan and Nawalparasi, 12 samples indicate presence of drug residue and field questionnaire survey revelaed most of farmers using antibiotic randomly without lab culture & AST. Some farmers also used herbal medicine (Ajwami, honey &fenugreek paste, aleovera etc) for treatment of swollen udder. Farmers have no idea about drug residue & its side effect. Gentamicin, Ceftriaxone, Tetracycline, Enrofloxacin & penicillin group of drugsare commonly used for treatment of mastitis by the farmers. Similarly, epidemiological studies on cattle mastitis shows 42.66 % (96 positive samples out of 225 milk samples) prevalence of staphylococcal subclinical mastitis.

For productivity of Hybrid Napier varieties on different cutting intervals, biomass production is highest for Super Napier (Pakchong) at 60 days interval comparing to 50 and 70 days intervals. Also, biomass yield is highest at 60 days interval for other two (CO_3 and CO_4) varieties. DM percentage increases as the cutting interval increases for all three varieties. On calculating the production cost of winter forage, summer forage and perennial fodder for silage production, final cost of production of one kg of winter legumes is Rs. 3.45 and oat is Rs. 2.17; for summer forages, per kg cost of production is Rs. 1.32 for Teosinte, Rs. 3.64 for Bajra, Rs. 3.37 for Sorghum and Rs. 2.92 for Maize. For silage preparation from different perennial forages and summer annual fodders, the cost of production is Rs. 9.76 per kg.

In cattle herd management and production program, total 65 calves were born in this FY, out of which 13 were Holstein Friesian cross, 44 were Jersey cross, 5 were Pure Lulu and 2 were Pure Terai. Similarly, 41 were female calves and 24 were male. The overall birth weight was found 21.39 kg with average birth weight for male and

female calves is 22.65 kg and 20.69 kg respectively with mortality rate of 16.92%. Regarding fodder seed and sapling production, this program had produced 1122.50 kg seeds of annual forage and approximately 8000 sets of different perennial fodder sets for propagation. 155,373.50 litres of milk was produced from around 60 milking cattle from which 995.85 kg of Paneer, 17 kg of Yoghurt, 7 kg of Ice cream, 19.50 kg of Ghee and 234.50 kg of Khuwa and 360 pieces of Raswari was prepared after distributing 136,089.3 litres of milk. Analysis upon the milk composition, the whole milk contains 4.68% of fat, 9.05% of SNF, 3.32% of Protein respectively with 4.51 % conductivity.

Twelve crossbred male calves were distributed to farmers of Chitwan and Makwanpur district 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. Different sets of super napier were distributed to farmers of outreach sites. 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.

Total revenue of this fiscal year was Rs. 90,91,595.56. Revenue from sale of milk and milk products was Rs. 87,93,071.06. Revenue from sale of calves and manure was Rs. 10,680.00. Revenue from sale of forage seeds was Rs. 32,995.00 and revenue from administrative program was Rs. 1,82,849.50.

In this FY more than 1573 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 at Devdaha, Rupandehi.

National Cattle Research Program is still in constructive phase in Rampur, Chitwan. Till date, there are five cattle sheds, one calf shed, one bull shed, one isolation shed, one shed with metabolic crates, two silo pits, one hay barn and one dairy unit constructed. Other structure like laboratory building is constructed and still in need of partition & decoration. Biogas plant of 200 cubic meters has been constructed and is regularly supplying biogas for 60 families in their kitchens.

1. WORKING CONTEXT

National Cattle Research Program (NCRP) is a commodity program among the various commodity programs of Nepal Agricultural Research Council (NARC) comprising cattle. Cattle are the main source of milk production, animal traction and manure in Nepal. This commodity is prioritized by the government in different long-term plan such as Agriculture Prospective Plan (APP) and Agriculture Development Strategies (ADS). Contribution of agriculture 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 40.0% in milk production of Nepal (Livestock Diary, 2076). Contribution of dairy sub-sector is 8% in national GDP and it shares 63% of total livestock contribution (ADS, 2013). In Nepal, the total annual milk production is 2169714 MT (Livestock Diary, 2076). As concept developed by WHO and FAO availability of milk should be 250 ml/head/day. 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 1below.

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

Source: Statistical Information on Nepalese Agriculture, 2075/76 (2018/19)

National Cattle Research Program is located in Rampur Chitwan of Bagmati Province Nepal with sub-tropical climate. Land occupancy of the program in Rampur is chiefly rain-fed while a portion of the total occupancy being irrigated through deep tube

wells. Chitwan in particular is marked as one of the leading districts in dairy sector in the country and was recognized as self sufficicient 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 one among the various commodity programs under the Nepal Agricultural Research Council (NARC), administered directly by the director for livestock and fisheries research. It has evolved from the Livestock Development Farm of the Department of Livestock Development and Animal Health after the establishment of Nepal Agricultural Research Council in 2048 B.S. (1991AD) and named as National Bovine Research Program (NBRP) at Khumaltar, Lalitpur to conduct research works on cattle and buffaloes. Realizing the importance of the commodity specific research in the country, NARC management decided to separate the cattle from NBRP. In 2069 B.S. (2013 AD) NBRP was re-structured to form National Cattle Research Program and National Buffalo Research Program as two separate commodity programs. National Buffalo Research Program was established in Tarahara, Sunsari and NCRP was shifted from Khumaltar to Rampur, Chitwan in 2071 B.S. (2014 AD). It is situated in the central region of Nepal (270 65′ N latitude; 840 35′ E longitude and 187 masl.) at Rampur, Chitwan. It has humid and subtropical climate with cool winter (2-3 oC) and hot summer (43 0C). The annual rainfall is over 1500 mm with a distinct monsoon period (>75% of annual rainfall) from mid-June to mid-September. This is 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 nutritional security and livelihood improvement of Nepalese people and be a leading research institute in the country.

2.4 Mission

- Improving cattle production and productivity by conducting problem based, farmer oriented, participatory 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 ß and) progesterone (4-pregnene-3, 20 di-one) in the ratio of 1:2.5. It was more effective in terms of induction and average milk yield as compared to the hormone ratio of 1:1.
- Milk yield is affected significantly by the increased feeding frequency of lactating animals. Dividing the daily concentrate requirement of high yielding cattle (> 10 liters/day) into three parts and feeding them three times a day (7 a.m., 12 noon & 4 p.m.) produced an additional 495 liters of milk per lactation as compared with two times feeding (7 a.m. & 4 p.m.) 2268 liter/ lactation.
- Urea 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 roung 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 nation wide 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, residential quarters and rest for other use such as for pasture and fodder production as a feed stuffs required for daily consumption throughout the year, research/trial plot, pastureland, fodder trees cultivation area as demonstrated in the table 2.

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

S.N.	Utilization	Area, ha	%
1	Forage cultivation	12	48.00
2	Infrastructure (farm structure, roads, office 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 maintained around 201 cattle heads of Jersey and Holstein Friesian crosses, Terai, Lulu and Achhami cattle breed in its farm with average daily milk production of around 350 liters. Milk is either sold as whole milk or as products 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 with in 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. NCRP had constructed biogas plant of 200 cubic meters capacity which supply regular biogas for 60 families of NCRP and NMRP, Rampur, Chitwan in their kitchen. The slurry from the biogas plant is separated through solid liquid separator which is installed in this FY 2077/78.

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 this fiscal year 2073/74 with the facility of estimation of crude protein, crude fiber, ether extract, ash and dry matter. The instruments available in nutrition laboratory are sox-holet apparatus, muffle furnace, k-jeldhal apparatus, fiber digester, hot air oven etc. The program lacks many other types of equipments 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.

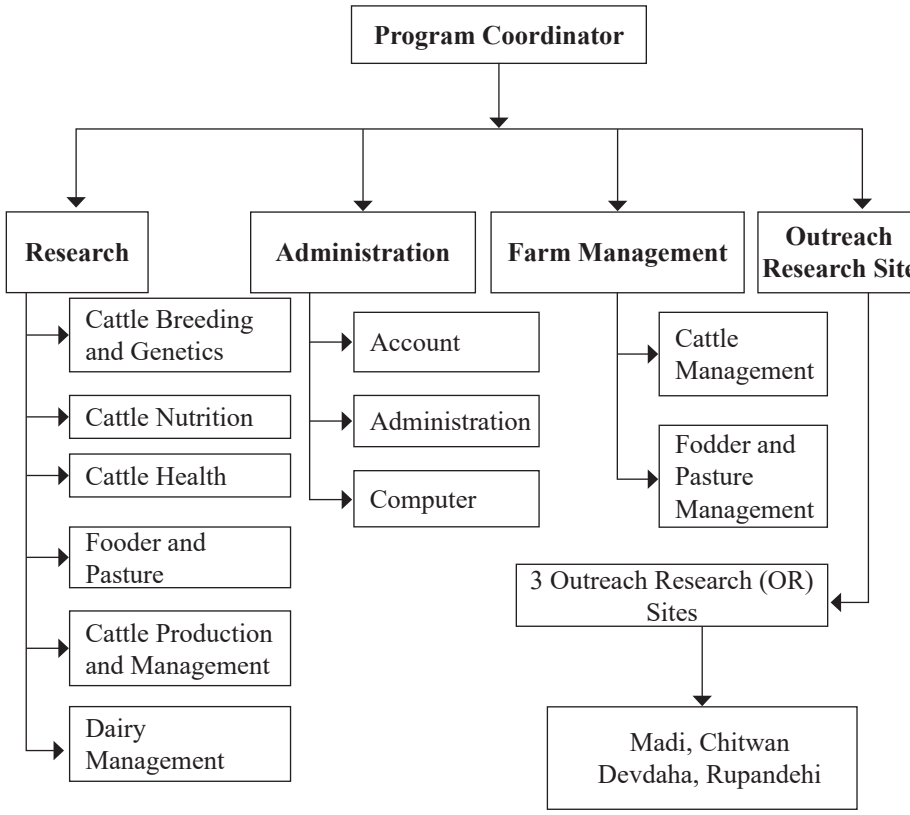


Figure 1. Organizational structure of NCRP, Rampur, Chitwan

The program is basically coordinated by Principal Scientist (S_5)but in recent years, it was coordinated by the Senior Scientist (S_3) and supported by other scientists, technical officers, technicians and admin/finance staffs as shown in Annex 2.2 with Human Resource allocated chart as shown in Annex 2.3.

3. RESEARCH HIGHLIGHTS

In FY 2077/78, NCRP carried out 8 projects of which 2 projects are core types: Farm Management Project and Seed Source/Breed production, 1 was Outreach Project, 1 Multilocation Project as Genetic Evaluation of Lulu cattle from National Animal Breeding and Genetics Research Centre (NABGRC), Khumaltar, Lalitpur and 4 are time-bound research projects from cattle management, pasture and fodder, bacterial load and antibiotics residues in cattle milk. Summary of the projects implemented in FY 2077/78 is presented in Annex 3.1. The highlights of the research projects carried out by the scientists and technical officers of NCRP in FY 2077/78 are as mentioned below.

3.1 Cattle Health

3.1.1 Screening of Antibiotic Residues in Raw Milk in Dairy Pocket Area of Nepal

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

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

antimicrobial treatments, insufficient withdrawal period and lack of records are the most common causes of theses residue in milk, which lead to the increase of these residues in milk above the acceptable maximum residue limits (MRLs).

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

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

In Nepal only a few studies have been done regarding quantitative analysis of antibiotic residue in raw milk. Only limited numbers of research reports are available for qualitative and semi-quantitative analyses. Due to lack of the proper government policies and guidelines to prevent the risk of antibiotic residues in milk & milk product, still haphazard use of antibiotics in livestock and dairy sector prevail. It has become very much important to aware all the stakeholders about withdrawal period of antibiotics in milk and possible hazards due to the consumption of residue bearing milk. Due to the emergence of COVID-19 in the country we couldn't perform the planned activity in this FY. Specifically, we couldn't purchase the ELISA test kits. Only RR rapid test kits were used for the detection of drug residue in milk.

Methodology

A total 200 milk sample obtained from individual farms and milk collection center of Chitwan &Nawalparasi. Random sampling method was followed. The milk samples were collected in sterile bottles followed by coding and kept in refrigerator (4^0C) for further analysis. Survey was done in cattle rearing farmers of Chitwan &Nawalparasi.

RR Rapid test kit was used for detection of drug residue in milk. Test was done according manufacturer protocol. 3 drops (~0.1 mL) of milk sample added into the prepared tube. 0.1 mL of UHT fresh milk added into another prepared tube for negative control. All the tubes were incubated for 2 hours 45 minutes in water bath when the temperature reaches 64 ± 2 ° C, Keeping medium in the tube under water level, or until the color of medium in negative control tube changes completely from purple to yellow. Then, observed the color change of medium in sample tubes.

Figure 2. Preparation of samples for Analysis

Result

From survey we found that most of farmers used antibiotic randomly without lab culture & AST. Some farmers also used herbal medicine (Ajwami, honey &fenugreek paste, aleovera etc) for treatment of swollen udder. Farmers have no idea about drug residue & its side effect. Gentamicin, Ceftriaxone, Tetracycline, Enrofloxacin & penicillin group of drugsare commonly used for treatment of mastitis.Out of 200 milk sample 12 samples indicate presence of drug residue. RR test kit can be tested for at least 12 kinds of drug residue: ampicillin, amoxicillin, bacitracin, chlortetracycline, erythromycin, kanamycin, oxytetracycline, penicillin, rifampicin, sulfadimethoxine, tetracycline and tylosin.

3.1.2 Epidemiological Studies 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 managemental practices in country like Nepal. The mastitis-associated losses include loss of milk production, cost of treatment and control of disease, cost of extra labor, discarded milk due to mastitis 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 study we have planned to compare the efficacy and adaptability of different available diagonostic test for subclinical mastitis. Use of these tests will help to know the risk of mastitis by early diagnosis and warn farmer to prevent the clinical mastitis in their dairy animal.

Also serotyping of the Staphylococcus aureus will be carried out by 6 pairs of primers including genes encoding coagulase (coa), clumping factor (clfA), the IgG-binding region and the X-region of protein A (spa), enterotoxin A (entA), and thermonuclease (nuc). Result with different bp helps to determine the strain of bacteria responsible for the clinical and subclinical mastitis.

Methodology

Milk samples were collected from individual farms and milk collection centers of Chitwan &Nawalparasi 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 milk samples were brought to the NCRP laboratory by placing 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 -400 C for further molecular analysis.

Result

A total of 225 samples were collected from western Chitwan &Nawalparasi district of Nepal. Overall prevalence of staphylococcal subclinical mastitis was found to be 42.66 % (96 positive samples out of 225 milk samples). All the bacteria isolated through microbiological procedures were subjected to antimicrobialsusceptibility test by disc diffusion method to a large number of antibiotics. Antibiogram profile indicated that Tetracyclins, Chloramphinicol, Gentamicin, Ceftriaxone & enrofloxacin are effective antibiotic. Ampicillin was found to be least effective antibiotic against bacterial isolates. It may bedue to indiscriminate and frequent use of this antibiotic in dairy animals leading to development of antibiotic resistance.

3.2 Cattle Breeding

3.2.1 Evaluation of the Local Dairy Cows through Crossbreeding with Exotic Breed Semen at NCRP Farm, Rampur

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 BS. 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 (In this FY we used sexed semen). Pure Terai breed was also maintained by breeding pure Terai bulls and pure Terai cows.

In this FY 2 pure Terai calves were born and 5 Terai cows are pregnant. Daily milk production of pure Terai cattle is being recorded. Similarly, growth and reproductive parameter of new born calves were also recorded routinely.

3.3 Cattle Nutrition and Pasture and Fodder Research

3.3.1 Biomass yield and quality assessment of different hybrid Napiers in relation to cutting intervals and FYM application in Terai region of Nepal

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. The per capita consumption of milk, meat and eggs is 62 kg, 11 kg and 32 eggs per year (MOLD, 2016).

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 (Hannaetal.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 (Andersonetal.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. The issues evaluation of newly introduced forage was also raised in Provincial Agricultural Technical Working Group Meeting (PATWG) in this year. That's why this project is designed to identify the appropriate technology of hybrid Napier production for increasing the productivity of ruminant livestock.

3.3.1.1 Collection of hybrid Napier sets and plantation

The hybrid Napier forage slips or sets were collected from National Pasture and Fodder Research Program (NPFRP), Khumaltar as well as from other government/private farm. The hybrid Napier fodders like CO-3, CO-4 and Pakchong (super Napier) were tested initially at NCRP farm, Rampur, Chitwan. These hybrids Napier were planted for production of fodder and sets/slips. The sets were also distributed to selected farmers of OR-sites for propagation.

3.3.1.2 Performance evaluation of hybrid Napier

Forage trial was carried out on three commercial dairy farmers in each outreach sites as well as in NCRP Farm. Chemical fertilizer NPK @ 80:60:40 t/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. FYM application according to pre designed doses was

done at the time of land preparation before preparing ridges. The trial was established and 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–50, 60 and 70 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. 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, second and third harvesting/cut were done and shown following result in Table 3.

Table 3. Green biomass, Dry Matter (DM) and Tillers/plants of Hybrid Napier in different cutting intervals

Parameters	Cutting Intervals		
	50 days	60 days	70 days
Green biomass (t/ha)			
CO3	43.75	86	78
CO4	44	82	74
Super Napier	52.12	**97.25**	91.5
DM (%)			
CO3	15.3	18	19.3
CO4	16	17.4	18.5
Super Napier	18	17.4	17.8
Tillers/plant			
CO3	37	44	40
CO4	38	42	41
Super Napier	28	38	39

The green biomass (52.12 kg) and dry matter (18%) was found highest in super hybrid napier variety and lowest green biomass (43.75) and dry matter (15.3%) was found in Co3 hybrid napier variety in first cut of 50 days of cutting interval. The effects of hybrid Napier cultivar and stage of maturity (cutting interval) on green fodder yield and plant morphology was studied by Sarkar et. al. (2019) and showed that the cultivar had a significant effect on biomass yield, plant height, leaf yield, sheath yield, stem yield and LSR. Sarkar et. al. (2019) also reported that highest biomass yield and plant height were obtained from Pakchong (PK). On the other hand, BN-3 performed better than PK interms of leaf yield and LSR. The highest

stems were yielded from PK. Similarly, Turanoet. al. (2016) reported that the DM concentration of PMN hybrids was higher than that of Napier grass varieties, with DM% of PMN2 (24.3%) and PMN3 (22.9%) being significantly higher ($P<0.05$) than those of 5344 (18.5%), Bana grass (18.1%) and N51 (17.9%). But numbers of tillers /plant were highest (38) in CO4 hybrid nepier variety which was followed by CO3 hybrid nepier variety (37) and lowest was found in super hybrid nepier variety (28). While the number of tillers declined significantly for all cultivars with increasing cutting intervals, at all cutting intervals CO-3 gave the highest number of tillers followed by Co-4 and Pakchong-1gave the least (Wangchuk et.al,2015) . The effects of cultivar and cutting interval on plant height, basal circumference, tiller number and diameter and leaf number of hybrid Napier was studied by some researchers. There was a significant cultivar x cutting interval effect on the number of tillers per plant.

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

Nepal is an agrarian country in which 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 adoptability 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.

3.3.2.1 Evaluation for winter forage

3.3.2.1.1 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 200kg) 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.

3.3.2.1.2 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 4. Bio-mass and dry matter yield of winter forages cultivated in NCRP, Rampur

Crop	Bio-mass yield ton/ha	Dry matter ton/ha
Oat	34.50	7.67
Common Vetch	19.00	4.28
Pea	20.50	4.97

3.3.2.1.3 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:

3.3.2.1.4 Production requirement

Table 5. Input requirement for production of winter forage

Crop	Area (ha)	Seed (kg)	DAP (kg)	MOP (kg)	Urea (kg)	No. of labor for sowing	Tractor use time for cultivation (min)	No. of labor for harvesting
Vetch	0.5	25	65	25	2	2	75	30
Pea	1	50	130	50	4	4	150	40
Oat	2	200	260	130	240	8	300	120

3.3.2.1.5 Production cost

Table 6. Production cost for winter forages

Crop	Rent of land (Rs.)	Seed cost (Rs.)	DAP (Rs.)	MOP (Rs.)	Urea (Rs.)	Labour cost (Rs.)	Tractor cost (Rs.)	Harvesting labour cost (Rs.)	Total cost (Rs.)
Vetch	5000	3750	2944.5	832.5	32.6	1034	1650	15510	30753.6
Pea	10000	7500	5889.0	1665.0	65.2	2068	3300	20680	51165.2
Oat	20000	12000	11778.0	4329.0	3912.0	4136	6600	62040	124759.0

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. 517/labor per day.

3.3.2.1.6 Per kg biomass production cost

Table 7. Per kg production cost of winter forage

Crop	Average bio-mass production (kg/m^2)	Total production (kg)	Cost/kg (Rs.)	Overhead + Contingency (20%) (Rs.)	Final price/kg (Rs.)
Legume combined	**2.025**	**15000**	**2.87**	**0.58**	**3.45**
Vetch	1.90	9500	3.24	0.65	3.89
Pea	2.15	20500	2.50	0.50	3.00
Oat	3.45	69000	1.81	0.36	**2.17**

3.3.2.2 Evaluation for summer/rainy season forage

3.3.2.2.1 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.

3.3.2.2.2 Yield assessment of summer/rainy season forage (Bio-mass and dry matter production of summer/rainy season forage)

The different parameter (biomass yield and dry matter) of summer/rainy forage crops were recorded as presented in table 8 below.

Table 8. Bio mass and dry matter of summer forages cultivated at NCRP, Rampur

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

3.3.2.2.3 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.

3.3.2.2.4 Production requirement

Table 9. Input requirement for production of summer forage

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
Teosinte	1	40	90	35	30	8	4	150	40
Bajra	0.5	3	55	35	90	5	2	75	20
Sorghum	0.5	15	50	38	80	5	2	75	24
Maize	0.5	20	45	18	15	5	2	75	24

3.3.2.2.5 Production cost

Table10. Production cost for summer forages

Crop	Rent of land (Rs.)	Seed cost (Rs.)	DAP (Rs.)	MOP (Rs.)	Urea (Rs.)	Cow dung cost (Rs.)	Labour cost (Rs.)	Tractor cost (Rs.)	Harvesting labour cost (Rs.)	Total cost (Rs.)
Teosinte	10000	4400	4077.0	1165.5	489.0	32000	2068	3300	20680	78179.5
Bajra	5000	450	2491.5	1165.5	1467.0	20000	1034	1650	10340	43598.0
Sorghum	5000	1800	2265.0	1265.4	1304.0	20000	1034	1650	12408	46726.4
Maize	5000	1000	2038.5	599.4	244.5	20000	1034	1650	12408	43974.4

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. 517/labor per day. Cow dung @ Rs. 4000/trolley.

3.3.2.2.4 Per kg biomass production cost

Table11. Per kg production cost of summer forage

Crop	Average bio-mass production (kg/m^2)	Total production (kg)	Cost/kg (Rs.)	10% Overhead + 10% Contingency (Rs.)	Final price/kg (Rs.)
Teosinte	7.13	71300	1.10	0.22	1.32
Bajra	2.88	14400	3.03	0.61	3.64
Sorghum	3.33	16650	2.81	0.56	3.37
Maize	3.62	18100	2.43	0.49	2.92

3.3.2.3 Evaluation for perennial forage/silage preparation

3.3.2.3.1 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.

3.3.2.3.2 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. Eighteen ton of silage was prepared and

overall cost during the preparation were recorded to calculate the per unit cost of the silage during preparation.

Input requirement for silage preparation

During silage preparation 92 labor were used for grass cutting 18000 kg of grass, chopping it and putting the chopped grasses in the silo pit. Ten number of tractor driver were used as labor during the entire process of silage preparation from 18 ton of forage grasses. While cutting the grasses content around 80% water which was reduced to 60% before putting in the silo pit. So, the overall silage prepared became 14400 kg by reducing 20% 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, thus the total input for silage preparation requires:

- 92+10 labor
- 144 kg molasses
- roll plastics
- 18000 kg green grasses

Table 12. Expenditure of silage

SN	Materials	Unit	Per unit price	Quantity used	Total cost (Rs.)
1	Labor	Person	Rs. 517	102	52734.00
2	Molasses	Kg	Rs. 35	144	5040.00
3	Plastic roll	Roll	Rs. 4000	4	16000.00
4	Green grass	Kg	Rs. 3	18000	54000.00
	Total				127774.00
	Overhead 10%				12777.40
	Grand total				**140551.40**
	Per kg cost of silage (Final silage quantity 14400 kg)				**9.76**

3.4 Cattle Production and Management

3.4.1 Cattle Herd Management and Production Program

Dairy cattle herd management is important factor for dairy farms to maintain long-term high production. For this, continous and successful management is required. Factors like cattle nutrition, reproduction, health, housing management, production and marketing are important. Alongside these essentials, all dairy farms must deal with the logistics of weather, transportation, and expenses. It can be a lot to balance,

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

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

Concentrate feed (pellet), seasonal green grasses (legume and non legume), perennial forages, straw, silage and tree fodder were provided as per feeding requirement of cattle in the farm. Commonly maize and teosinte were cultivated as summer forage and oat & common vetch as winter forage. Bajra, signal grass, setaria, mulato, joint-vetch, stylo, fleminzia, napier, perennial sorghum etc. were grown as perennial fodder/forage and fed to the animals in appropriate feeding regime. Animals were vaccinated against HS, BQ and FMD as per the recommended schedule. Regular drenching against flukes/worms and use of ectoparacidal drug as per need was done. Regular observation of estrus in the cows and treatment of diseased animal as per requirement was done. Milk produced from the lactating animals was either sold as whole milk or used for making dairy product like paneer, ghee, khuwa, dahi, etc. Farmyard manure produced in the farm was used for fertilizing the forage/fodder blocks of the NCRP farm and surplus amount was sold. Biogas was also produced from manure of farm and supplied to residential area of NCRP and NMRP, Rampur. Seeds of seasonal forage were produced for planting for self and distribution.

3.4.1.1 Clean milk production (udder cleaning, utensil, teat dipping)

Milk is a sterile product when secreted in the udder of a healthy cow. It is constituted with nutrients, which makes it fertile ground for microbial growth. Due to its susceptibility to microbial spoilage, there is a need to adopt clean milk production principles to reduce chances of contamination.We had taken consideration into internal factors *(*general health of cow esp. mastitis) andexternal factors which includescow's body, milker's hygenic habit, cleaning of milking and storage utensils, methods of milking, feed/water supplies, milking environment etc. In our farm to prevent the mastitis, regular teat dipping with the dipping solution (Povidine iodine: Glycerine=9:1) instantly after completion of milking was carried out. Regular

grooming with brush and bathing with clean & fresh water was done twice a day to remove dirt and dung from external body surface especially hind parts. Milking and storage utensils were cleaned by washing with detergents and maintained aseptic. Both hand and machine milking technique are in practice. To maintain cleanliness and prevent the transmission of infections, milking machines were disinfected after completion of individual milking and in case of hand milking personal hygiene was properly followed. Currently we do have 3 sets of 4 bucket system milking machine in our farm. Cleaning and disinfection of farm was done regularly to maintain clean milking environment.

3.4.1.2 Health and infertility status monitoring

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 antihelmintic drug was done in consecutive drenching program. Tick infestations were found higher in early summer months. Use of ectoparacidal drugs such as cypermethrine derivatives and ivermectin was made. Animals encountered problems like mastitis, milk fever, retention of placenta, dystocia, bloat, wound, diarrhea, anestrus and repeat breeding in this fiscal year.

Mastitis was a major problem in NCRP farm. Microbiological culture and Antibiotic Sensitivity Test (AST) was conducted before 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.

Problems of infertility (anestrus and repeat-breeding) were observed in farm. Underlying conditions of infertility were presence of persistent corpus luteum, follicular cyst, uterine tumor, cervicitis and pyometra.

Out of 13 infertile cows at NCRP farm, 2 were treated with single dose prostaglandin analogue (Chloprochem Injection: *Cloprostenol* @ 500 mcg) having problem of persistent corpus luteum. Out of 2 treated with single *Cloprostenol injection*, both of them displayed estrus signs and 1 became pregnant. Similarly, 3 cows were treated with Ovsynch protocol, of which 2 became pregnant. Two cows with cervicitis were treated with 2% povidone iodine douching solution and one was douched with OTC solution. Among 3 cows, two became pregnant. Similarly in 5 anestrus cows, CIDR Synch protocol was applied and only one became pregnant.

Figure 3. Ultrasonography, Hormones and CIDR for syncronization

Ultrasonography was used for scanning ovarian condition and early pregnancy diagnosis in our cattle farm.Hormones used for treatment of infertility in NCRP Farm and early pregnancy diagnosis in cow by Ultrasonography (39 days).

3.4.3 Evaluation of growth record of calves

In this fiscal year, total 65 calves were born, out of which 13 were Holstein Friesian cross, 44 were Jersey cross, 5 were Pure Lulu and 2 were Pure Terai. Similarly, 41 were female calves and 24 were male. The overall individual birth weight of calves that were born in NCRP during the FY 2077/78 is presented in Table 13 below.

Table 13. Average birth weight of calves in NCRP farm during FY 2077/78

S.N.	Date of Birth	Tag no.	Sex	Birth Wt. (Kg)	Breed	Remarks
1	4/5/2077	12496	Male	25	Jersey Cross	
2	4/5/2077	12497	Male	32	HF Cross	
3	4/19/2077	No tag	Male		HF Cross	Abortion
4	4/19/2077	21527	Male	27	Jersey Cross	Death (2/9/78)
5	4/29/2077	21528	Male	33	HF Cross	
6	4/32/2077	21529	Female	30	Jersey Cross	
7	5/3/2077	21530	Male	26	HF Cross	
8	5/4/2077	21531	Male	21	Jersey Cross	Death (2/9/78)
9	5/4/2077	21532	Male	24	Jersey Cross	
10	5/15/2077	21533	Female	18	Jersey Cross	
11	5/18/2077	21534	Female	14.4	Lulu Pure	

12	5/19/2077	21535	Male	20.6	Jersey Cross	Death (10/4/77)
13	5/22/2077	21536	Female	24.8	HF Cross	Death (2/11/78)
14	5/23/2077	21537	Male	25	Jersey Cross	
15	6/1/2077	21538	Female	15.5	Jersey Cross	
16	6/5/2077	21539	Female	20	Jersey Cross	
17	6/11/2077	21550	Female	12.9	Jersey Cross	
18	6/14/2075	21543	Female	15.9	Jersey Cross	
19	6/14/2077	No tag	Male	-	Jersey Cross	
20	6/20/2077	21542	Female	20	Jersey Cross	
21	6/22/2077	21541	Female	16.5	Jersey Cross	
22	6/25/2077	21544	Female	30	HF Cross	
23	6/26/2075	21545	Female	15.5	Jersey Cross	
24	7/3/2077	21546	Female	24	Jersey Cross	
25	7/4/2077	21547	Female	18.4	Jersey Cross	
26	7/10/2077	21548	Female	20.9	Jersey Cross	
27	7/10/2077	21549	Male	19.7	Jersey Cross	
28	7/12/2077	21550	Female	18.9	Jersey Cross	Death (8/4/77)
29	7/13/2077	21551	Male	27	HF	Death (8/2/77)
30	7/15/2077	21552	Female	16.7	Jersey Cross	
31	7/28/2077	21553	Male	15.5	Jersey Cross	
32	8/2/2077	21554	Male	20.5	Jersey Cross	
33	8/3/2077	21555	Female	21	Terai Pure	
34	8/4/2077	21556	Male	12	Jersey Cross	
35	8/7/2077	No tag	Female	12	Jersey Cross	Death (8/24/77)
36	8/10/2077	21557	Male	17.5	Jersey Cross	
37	8/13/2077	21558	Female	17	Jersey Cross	
38	8/17/2077	21559	Female	19.5	Jersey Cross	
39	8/23/2077	21560	Female	24	HF Cross	
40	9/1/2077	21561	Female	30	HF Cross	
41	9/4/2077	21562	Female	33.9	HF Cross	
42	9/24/2077	21563	Female	24.4	Jersey Cross	
43	10/2/2077	21564	Female	22	HF Cross	
44	10/2/2077	21565	Female	20.7	Jersey Cross	
45	10/17/2077	21566	Female	23	Jersey Cross	
46	10/19/2077	21567	Female	26.5	Jersey Cross	
47	10/21/2077	21568	Female	8	Lulu Pure	
48	10/25/2077	21569	Male	16	Lulu Pure	

49	11/3/2077	21570	Male	21	Terai Pure	
50	11/6/2077	21571	Female	13.4	Lulu Pure	
51	11/12/2077	21572	Male	24	Jersey Cross	Death (12/6/77)
52	11/16/2077	21573	Female	22.5	Jersey Cross	
53	11/21/2077	21574	Male	31.5	HF Cross	
54	11/21/2077	21575	Female	22.5	Jersey Cross	
55	11/24/2077	No tag	Female	-	Jersey Cross	Death
56	12/7/2077	21576	Female	26	Jersey Cross	
57	12/16/2077	21577	Female	23.5	Jersey Cross	
58	12/31/2077	No tag	Male	24	Jersey Cross	Death (1/15/78)
59	1/6/2078	21578	Female	22	Jersey Cross	
60	1/10/2078	21579	Female	13.5	Lulu Pure	
61	1/29/2078	No tag	Female	19.7	Jersey Cross	Death (2/12/78)
62	2/13/2078	21580	Female	25.7	Jersey Cross	
63	2/14/2078	21581	Female	24.7	Jersey Cross	
64	2/15/2078	21582	Male	23	HF Cross	
65	3/8/2078	No tag	Male	13	Jersey Cross	

The above table for birth weight is summarized in Table 14 below according to breed and sex. The overall birth weight was found 21.39 kg with average birth weight for male and female calves is 22.65 kg and 20.69 kg respectively. Similarly, average birth weight of Holstein Friesian crossbred calves was 28.10 kg, Jersey crossbred calves was 20.51 kg, Pure Terai was 21.00 kg and Pure Lulu was 13.06 kg respectively.

Table 14. Average birth weight of calves in respect to sex and breed in NCRP farm during FY 2077/78

Breed	Birth weight (Mean ± S.E., in kg)		
	Average	Male	Female
Overall	21.39±5.64	22.65±1.22	20.69±0.87
HF Cross	28.10±1.19	27.45±1.86	28.75±1.63
Jersey Cross	20.50±0.66	20.44±0.79	20.63±1.25
Lulu	13.06±1.35	12.32±1.46	16.00±0.00
Terai	21.00±0.00	21.00±0.00	21.00±0.00

The average daily weight gain of the calves for each month is presented in figure 4 below. The lowest average daily weight gain was observed in the month of Shrawan

whereas the highest average daily weight gain was observed in the month of Mangshir followed by adjacent month Poush. The average daily growth rate was recorded as 434 gm/day for the calves.

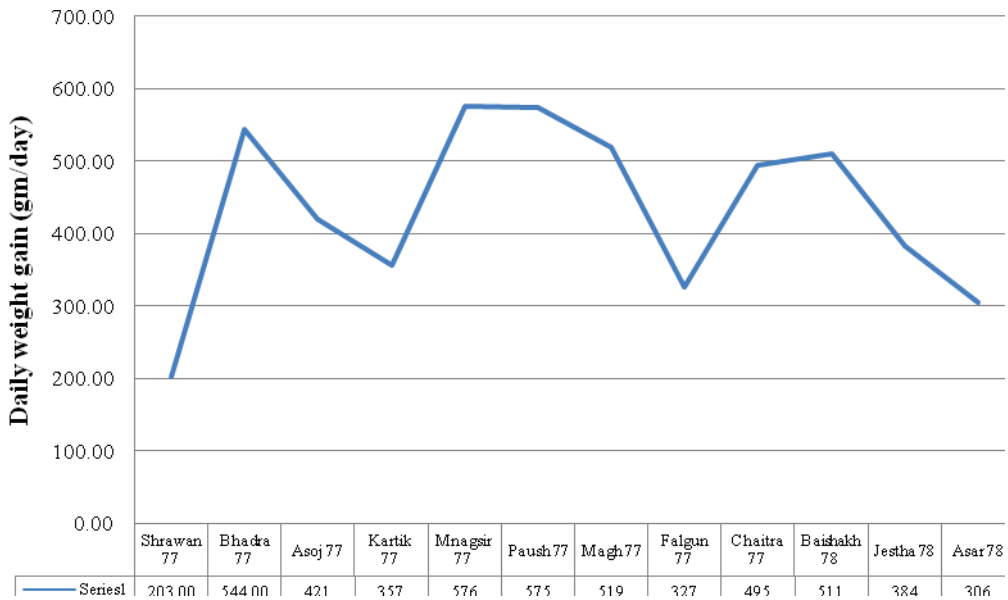


Figure 4. Average weight gain (gm/day) of calves at NCRP farm in FY 2077/78

During this fiscal year 11 calves died with mortality rate of 16.92%. The highest number of mortality was found in Jersey cross (8), but the mortality rate was found highest in HF cross (23.07%), and no mortality was recorded in both indigenous breed (Lulu and Terai). The mortality pattern of calves is illustrated in table 15 below.

Table 15. Mortality of calves at NCRP in FY 2077/78

	Breed				Total
	HF Cross	Jersey Cross	Lulu	Terai	
Overall	3 (13)	8 (45)	0 (5)	0 (2)	11(65)
Male	1 (7)	0 (15)	0 (1)	0 (1)	1(24)
Female	2 (6)	8 (30)	0 (4)	0 (1)	10 (41)

**Number in parenthesis indicates the number of calf born*

3.4.4 Maintenance of pedigree record and updating of data management

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

3.4.5 Use of improved/latest technologies in breeding practices

Use of portable USG was made in Madi Chitwan, DevdahaRupandehi and different places of Lamjungdistrict for early pregnancy diagnosis and to know the ovarian dynamics of cow.

3.4.6 Routine recording of feeding and milk production

Daily recording of feeding of each animal was done in both hard and soft copies (MS-Excel). Similarly, milk production record of each lactating animal was done both in soft and hard copy.

3.4.7 Processing & distribution of clean milk

Unfortunately, we were unable to distribute processed milk from our dairy unit in this FY too. We distributed raw milk to staffs of NCRP and NMRP Rampur, DDC collection center, Sharadanagar and Pawan Dairy, Bijayanagar. This year milk distribution to people of surrounding community was not done due to COVID-19 issue.

3.4.8 Routine Milk Analysis

Milk samples from all lactating animals were collected in regular basis (monthly) and monitored for its composition. Average milk composition of cows of NCRP farm is presented in table 16 below.

Table 16. Average milk composition of NCRP cows in FY 2077/78

Parameters	Fat	SNF	Protein	Conductivity
Average Value	4.679208	9.050868	3.320665	4.511824184

3.4.9 Effects of feeding milk replacer on body growth and its economic feasibility in dairy calves

In this FY we have planned to feed commercial milk replacer for calves in NCRP farm but due to unavailability we could not make this trial. In previous 3 years trial period we found control group (whole milk feeding) better than medicated and non medicated milk replacer made by us from locally available raw material.

3.4.10 Health and infertility status monitoring

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. Rotation of antihelmintic drug was done in consecutive drenching program. Tick infestations were found higher in early summer months. Cypermethrine derivatives and ivermectin was used against ectoparasite. Animals encountered problems like mastitis, milk fever, retention of placenta, dystocia, bloat, wound, diarrhea, anestrus& repeat breeding. Lumpy Skin Disease (LSD) first time diagnosed in NCRP farm in this fiscal year.

Mastitis was a major problem in NCRP farm. Routine California mastitis test (CMT) was done to identify sub clinical mastitis in cattle. Bacterial culture and Antibiotic Sensitivity Test (AST) was conducted in NCRP lab to identify causative pathogen & effective drug for treatment. Supportive therapies as well as preventive measures were applied for prevention and control of mastitis. Post milking teat dipping using Betadine iodine (9):glycerine (1) solutionwas practiced in NCRP farm for control of mastitis.

2.4.11 Product diversification

During the Fiscal year 2077/78, different products listed below were prepared from milk and distributed. There is the high demand of such milk products in the vicinity of National Cattle Research Program. All the products were prepared following standard norms of the product preparation protocol.

Table 17. Product deiversification and their price per unit in NCRP, Rampur

S.N.	Milk products	Unit	Total quantity	Per unit price (Rs.)	Remarks
1	Paneer	Kg	995.85	550	
2	Khuwa	Kg	234.50	600	
3	Dahi	Liter	17 .00	90	
4	Ghee	Kg	19.50	750	
5	Ice-cream	Liters	7.00	300	
6	Rasbari	Piece	360	15	

2.4.12 Study on different agent to add value to silage

Maize, Teosinte, Sorghum, Bajra & Napier grasses were used for preparation of silage. To add value to silage the chopped grass was treated by spraying 10% molasses solution. Total of 41 ton of silage was prepared in this fiscal year. After 2 months of fermentation, feeding of silage at the rate of 4-5kg per adult animal was done. Milk production was

recorded daily and milk composition was recorded monthly. Feeding of molasses treated silage helps to enhance palatability and digestibility roughages.

3.5 Outreach

Several promising technologies have been generated by Nepal Agricultural Research Council (NARC) for the enhancement of livestock production and productivity from time of its establishment to date but the technology has not been adopted by the farmers as expected due to lack of proper extension and validation in farmer's field. So as to make generated technology adaptable to the farmers we are working by establishing outreach sites. In outreach sites, demonstration and verification of technologies developed in research station are made. Since outputs generated in research station may not work in the real scenario of farmer's field. It is only justice to recommend technology to farmers which are validated in farmer's field. In this FY we have worked 2 in outreach sites, one is Madi Municipality, Chitwan and other is Devdaha Municipality, Rupandehi for verification and dissemination of generated technology. These outreach sites will be developed as model village for technology demonstration and also as a resource center for livestock and fodder/forage species.

Madi, Chitwan is almost 48 km far away from Bhartapur. Some part of Madi area lies in buffer zone of Chitwan National Park. Madi is very much popular for productive agricultural land. In this place most of the farmers used to rare local cattle but nowdays farmers are shifted to crossbred cattle farming. In Madi, local government has emphasized on promotion of cattle farming & milk production. They are providing subsidy on the basis of milk production as Rs. 3 per liter of milk production. Farmers of this area are more interested on commercial cattle farming by adopting latest technology.

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

3.5.1 Evaluation of teat dipping in farmer's management condition

Demonstration of post milking teat dipping was carried out in Devdaha& Madi OR site. Different small dairy farms of Madi &Devdaha area were purposively selected. Cattle without clinical mastitis were selected for the experiment. Demonstration of

post milking teat dipping was carried out and farmers were advised to use the post milking teat dip solution immediately after milking because it checks the entry of pathogen into the teat and prevent mastitis. Dipping solution was prepared by mixing povidone iodine and glycerol (9:1).

Inputs like post milking teat dip container & solution were distributed to selected dairy farmers. Milk samples were collected from lactating cattle on 0 day of teat dipping and thereafter on 60 day of teat dipping. Milk sample were collected in sterile sample collection bottle in a cool box & tested for mastitis using California Mastitis Test (CMT) as soon as possible. Post milking teat dipping helps to reduce mastitis. Teat dipping did not have any impact on the teat injury, irritation of teat or redness over teats.

3.5.2 Effectiveness of vaccination for major economic diseases and drenching against major internal and dipping/spraying for external parasites

Vaccination & drenching program were held in Madi, Chitwan &DevdahaRupandehi where more than 100 cattle were vaccinated against FMD, HS and BQ & more than 200 cattle were dewormed with broad spectrum antihelmintics.

3.5.3 Health campaign

Animal health & infertility management camp was oraganized at OR- Site, Devdaha, Rupandehi in fiscal year 2077/78 BS. A formal program was organized at the beginning and remarks were given by senior scientist Sagar Poudel regarding activities of NCRP, objective of program and need of different approach for maximum farmers participation in the program. Our invited guest assistant professor Dr. Gokarna Gautam (AFU) put forward about objectives of animal health campaign to improve animal production and productivity. General health examinations of animals presented at camp was done and respective medicines were distributed to farmers for their animals. Pregnancy diagnosis of cattle was done using USG. “Door to Door” service was provided to more than 30 cattle farmers in the health camp. More than 100 animals have benefited in camp with problems of infertility, repeat breeding, anestrous, cough, diarrhoea, internal/external parasitic infestations, indigestion, emaciation, wound and so on.

Figure 5. Some glimpses of Health Campainge

3.5.4 Demonstration of silage making

Silage making is promising and economic option for providing nutrients through forage/fodder during the dry season. This is a way of feed conservation. Surplus green grasses at flush season are conserved to feed at dry season. In context of Nepal major problem is scarcity of nutritious feed to livestocks for limiting production. To make year-round availability of nutritious feed to animal, silage is very good alternative. This year silage making process was demonstrated in Madi, Chitwan and approximately 500 kg grass was used for making silage in plastic bags.

3.5.5 Demonstration of Urea Molasses Mineral Block (UMMB)

To overcome nutrient (especially mineral) deficiency in ruminant, use of urea molasses mineral block (UMMB) is recommended. An UMMB is generally composed of urea, molasses, vitamins and minerals. A composition of UMMB consists of urea (10%), molasses (30-32%), rice bran (35%), minerals (6%), salt (5%), cement (6%), di calcium phosphate (5%) etc. These ingredients are collected as per recommended ratio and mixed throughly. With the aid of pressing machine, block was pressed and sun dried for 3-4 days. Use of UMMB in dairy cattle has improved body growth, fertility and milk production. UMMB making process was demonstrated in farmers of Nawalpur, Nawalparasi East.

3.5.6 Demonstration & making of milk Product

Different milk products like paneer, dahi, rasbari and khuwa were prepared and demonstrated in the outreach site of Madi, Chitwan. Total thirty cattle raising farmers of Madi municipality were involved in the program. All the farmers were highly enthusiastic to make different products from milk. As milk is highly perishable product it cannot be stored long time. So, product diversification will help to strengthen the self-

life of the milk. As, there is still the problem of milk holidays in the rural area of the country this diversification technique will help the farmers not to through the surplus milk as wastages. In this COVID-19 pandemic situation also, all the farmers in the outreach sites were highly motivated to make different products from the milk. Product diversification from milk will help to increase the net profit, self-life and reduces the milk holidays problem in the rural area of the country.

3.5.7 Travelling Seminar

During travelling seminar we visited different places like Goat Research Center, Bandipur, Tanahu, Fishery Research Station Begnas, Horticulture Research Station, Malepatan, Directorate of Agricultural Research, Gandaki Province, Lumle, One of the largest cattle farm of Nepal situated in Rupandehi, Outreach site Devdaha, and a commercial cattle farm of Nawalpur.

Visit reflected that some of the private cattle farms are really doing better in cattle farming. They have cultivated fodder and forage which is available year round for their animals.Lumbini Agro product and Research Center located at TillotamaMuncipality, Ruapandehiis a one of the largest cattle farm with herd strength of more than 500 and cow dung is used in biogas plant also producing electricity and with solid-liquid separator for slurry management.Subharambha Farm located in Devdaha Municipality, Rupandehi is with good BCS of animal, making feed and silage in their own farm (with silage making mchine).Farm of Dadhiram Adhikari in Gaidakot Municipality, Nawalpurwas found to be well managed with minimum labor use. Fifty lactating cows managed by 3 persons of a family.Infertility and mastitis seems to be major problem in cattle farming. Visit and interaction of different NARC stations made exposure of staffs and knowledge was broadened.

Figure 6. Some glimpses of Cattle shed of farmers of Rupandehi and Palpa

3.5.8 Village Level Workshop

In this FY, one village level workshop was conducted in Dumarwana of Bara district. Thirt participants including farmers engaged to dairy cooperatives, veterinary technicians were presented in the program. Participants shared their problems on cattle raising, mastitis, infertility, repeat breeding, feed and fodder shortage, management of male calf, raw milk price as their major issues in their areas.

4. PRODUCTION

4.1 Cattle Production Program

The station had maintained a herd of 201 heads of cattle in its farm. It included different stages of animals of Jersey crossbreds, Holstein Friesian crossbreds, Pure Terai, Terai crossbreds, Pure Lulu and Pure Achhami. The initial and closing herd composition of fiscal year 2077/78 is given in table 18 below.

Table 18. Herd composition of cattle in the beginning and by the end of FY 2077/78

Breed	Opening Balance							Closing Balance						
	Adult		H	YB	Calves		Total	Adult		H	YB	Calves		Total
	F	M			F	M		F	M			F	M	
HF Pure	1	0	0	0	0	0	**1**	0	0	0	0	0	0	**0**
HF Cross	23	0	14	0	2	0	**39**	24	0	14	0	6	5	**49**
Jersey Cross	57	0	13	6	12	7	**95**	65	0	13	6	12	7	**103**
Terai Pure	20	3	0	0	1	2	**26**	20	3	2	0	0	0	**25**
Terai HF Cross	0	0	0	0	3	0	**3**	0	0	0	0	3	0	**3**
Terai Jersey Cross	0	0	0	0	1	0	**1**	0	0	0	0	2	0	**2**
Lulu	8	2	2	1	1	1	**15**	8	2	2	0	3	2	**17**
Achhami	0	0	2	0	0	0	**2**	0	0	2	0	0	0	**2**
Total	**109**	**5**	**31**	**7**	**20**	**10**	**182**	**117**	**5**	**33**	**6**	**26**	**14**	**201**

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

Regarding the parturition, total 65 calves were born at the farm in this FY,of which 24 are male calves and 41 were female calves. Among them, 13 are HF crossbred calves, 45 were Jersey crossbred calves, 5 were Lulu and 2 were Terai calves.

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

During this FY, this program had produced 1122.50 kg production seeds of annual forages for the culativation purposes of which Summer annual forage Teosinte consists of 867.30 kg and winter forage Oat (variety Bundel) consists of 255.20 kg. Similarly, different perennial grasses sets were produced for the propagational

purposes which includes the sets of Super Napier (Pakchong), Signal, Setaria and Mulato. For the feeding puposes, this program had produced more than 1200 MT of Green Matter (biomass) from differen 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, aroung 41 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.

Amongst the produced forage seeds and saplings, this program had distributed aome of the forage seeds and sets/saplings amongst the promishing farmers of different districts in this FY. Amongst 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 weredistributed 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 155373.50 litres of milk was produced from more than 55 lactating cows throughout the FY 2077/78 in the farm of NCRP, Chitwan. Monthly total milk and milk products produced during this FY is presented in the table 19 below.

Table 19. Monthly milk and milk products production in FY 2077/78

Month	Whole Milk (l)	Milk Products (kg)					Raswari (no.)
		Paneer	Yoghurt	Ice cream	Ghee	Khuwa	
Shrawan 2077	6468.30	11.35	0.00	0.00	0.00	0.00	0
Bhadra 2077	8050.10	38.95	0.00	7.00	2.25	35.00	0
Ashwin 2077	8483.40	34.25	0.00	0.00	2.00	14.00	0
Kartik 2077	9335.10	75.00	0.00	0.00	4.50	48.00	0
Magshir 2077	11755.80	171.50	0.00	0.00	5.50	0.00	0
Poush 2077	13501.90	59.50	0.00	0.00	0.00	22.50	360
Magh 2077	14741.30	12.75	0.00	0.00	0.00	0.00	0
Falgun 2077	16507.50	101.50	0.00	0.00	0.00	41.00	0
Chaitra 2077	16488.80	0.00	0.00	0.00	0.00	0.00	0
Baisakh 2078	17486.70	121.50	17.00	0.00	3.00	48.50	0
Jestha 2078	16241.50	135.00	0.00	0.00	0.00	25.50	0
Ashad 2078	16313.10	234.55	0.00	0.00	2.25	0.00	0
Total	**155373.50**	**995.85**	**17.00**	**7.00**	**19.50**	**234.50**	**360**

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 "Village level workshop" on cattle production and management was organized in Dumarwana of Bara district. Total 30 cattle raising farmers associated in dairy cooperatives and scientists/officers from NCRP. During the workshop, interaction was made on health, nutrition, management and marketing issues of cattle. Problem and researchable issues on cattle were collected from the participants. Participants of workshop shared mastitis, repeat breeding, anestrus, feed and nutrition management and male calf management as major issue of cattle farming. Thus, collected problems were priotrized for conductiong research in days to come.

One day Silage preparation practical assessment was organised in Outreach site – Madi, Chitwan. A technical team led by Scientist Mr. Bishnu Bahadur K.C. gave the basic principle of silage preparation and the team illustrated the Silage preparation method to the farmers associated with dairy in the outreach sites. Similarly, one day Urea Mollases Mineral Block (UMMB) preparation practical training was organised in Nawalpur form the technical team of NCRP, Rampur led by Scientist Mr. Bishnu Bahadur K.C. to increase the milk production in the fodder deficit periods.

Different cattle farms of Kaski, Palpa and Rupandehi districts were visited and interacted with the dairy farmers under "Travelling Seminar" by the Coordinator and othe technical staffs of NCRP for five days. During the seminar, technologies generated under cattle raising were desimminated to the farmers and problems arising during cattle raising were discussed.

5.2 Service

5.2.1 Councelling 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 1573 people were benefitted 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 Devdaha Municipality of Rupandehi district. More than 100 animals 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 antihelmintics, minerals, vitamins and livertonics. Ectoparacidal drug was also distributed for animals. One case of upper fixation of patella (Jhayankhure) in female 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 2076/77 were published. Similarly, four papers were published in Proceedings of 12th National Workshop on Livestock and Fisheries Research in Nepal which was organised in Rampur, Chitwan by Directorate of Livestock and Fisheries Research, NARC, Kathmandu and details presented in Annex 5.3.

5.4 Information dessiminated through media

An informative news on currently raising disease of cattle “Lumpy Skin Disease in Cattle” was dessiminated through Online new portal –Kalika news. Similarly, an informative talk with our Coordinator, Mr. Sagar Paudel about Cattle farming was aired on Ujyalo FM.

6. OTHER ACHIEVEMENTS

6.1 Training/Workshop attended

Nepal Livestock System Innovation Project (NLSIP), Hetauda had organised 3 days "Pedigree Performance Recording System (PPRS) Training" where three technical personnels, Mr. Kapur Bhusal, Mr. Prabin Sapkota and Mr. Pashupati Khanal had participated.

Similarly, Senior Scientists, Scientists, Senior Technical offices and Technical Officers had participated in 3 days "Planning Workshop" for FY 2078/79 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 2078/79. Also, Coordinator and Senior Scientist Mr. Sagar Poudel had participated as Reviewer in Planning Workshop for FY 2078/79 held at Directorate of Agricultural Research, Lumbini Province, Khajura.

Diretorate of Livestock and Fisheries Research, NARC had organised two day "12th National Workshop on Livestock and Fisheries Research in Nepal" at Rampur, Chitwan on research outputs of Livestock and Fisheries researches where several technical personnels from NCRP had participated. Coordinator Mr. Sagar Poudel had presented the Coordinators' Report on Current Status on Cattle Research in Nepal, Dr. Gita Pandey and Dr. Yagya Raj Pandeya had oral presentation on Cattle health and Cattle Breeding and Cattle Health respectively. Technical Officer Dr. Chet Raj Pathak had both oral and poster presentation on cattle health related research.

7. BUDGET AND EXPENDITURE

Total annual budget of this program was NRs 5,12,62,000.00 and the expenses was only NRs 4,50,55,139.91 in this fiscal year which is 87.89% of the total budget released. The details of the annual budget and expenditure is presented in annex 7.1. This program is in the need of more budgets to strengthen its research work. Program needs budget to build cattle sheds, milk parlour, laboratory and farm machineries. Details of special project budget and expenditure, revenue status and beruju status of the program are mentioned in annexes 7.2, 7.3 & 7.4 respectively.

8. KEY PROBLEMS

The major problems of the programs are:

- Inadequate number of scientists, technicians (50% less than approved posts).
- Inadequate farm mechanization machines/tools, laboratory facilities and cattle sheds
- Poor mechanism of technology dessimination
- Lack of carrier 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

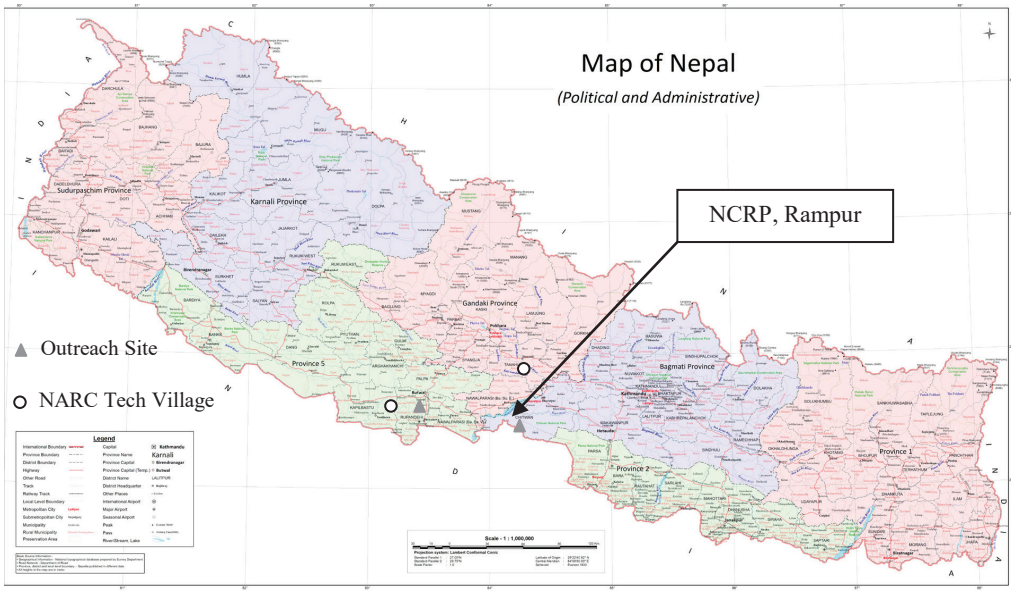


Photo Source:image--000_20200828140422.jpg(1987×1176)(theannapurnaexpress.com) Retrievedon Sept 28, 2021

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

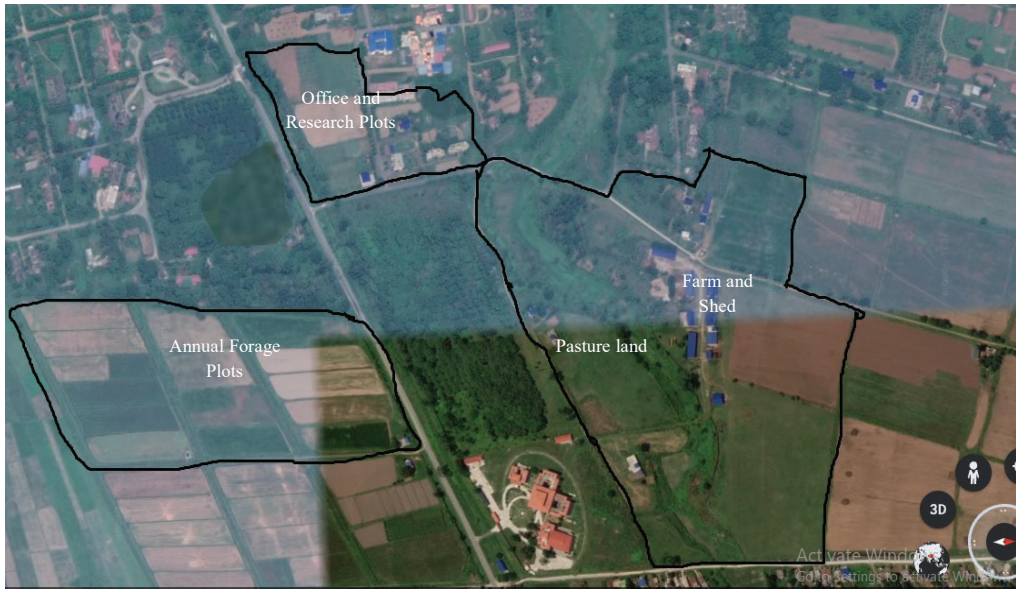


Photo Source: Google Earth Retrieved on Sept 28,2021

Annex 1.3 Map of Cattle Shed Area

Photo Source: Google Earth Retrieved on Sept 28,2021

Annex 1.4 Meteorological data at National Maize Research Program, Rampur in 2020/21

Months	Temperature		Percipitation	Humidity
	Max (^{o}C)	Min (^{o}C)	mm	%
July, 2020	32.80	25.16	1064.7	84
August, 2020	31.00	25.90	288.7	88
September, 2020	32.69	24.71	843.79	85
October, 2020	33.30	21.05	-	82
November, 2020	29.09	12.03	-	82
December, 2020	24.04	8.73	-	82
January, 2021	24.04	9.43	-	62
February, 2021	26.95	9.08	-	59
March, 2021	31.59	14.12	-	59
April, 2021	35.42	16.62	33.8	50
May, 2021	31.76	21.67	339.5	77
June, 2021	33.29	24.60	564.2	83

Annex 2.1 List of Laboratory Facilities at 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 NCRP, Rampur in 2077/78 (2020/21)

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. Bodh Raj Baral	Scientist (S_1)	M .Sc.An.Sc	Pasture, Fodder and Agroforestry
5	Dr. Gita Pandey	Scientist (S_1)	M .V. Sc.	Veterinary Science
6	Dr. Shivahari Ghimire	Sen. Tech. Officer (T_7)	M .Sc.An.Sc	LPPM
7	Dr. Yagya R. Pandeya	Tech. Officer (T_6)	M. V. Sc.	LPPM
8	Dr. Chet R. Pathak	Tech. Officer (T_6)	M. V. Sc.	Veterinary Science
9	Mr. Hem Sharma	Admin Officer (A_6)	B. A.	Administration
10	Ms Nanda Kala Sapkota	Admin Officer (A_6)	B. A.	Administration
11	Mr. Raju P. Subedi	Admin Officer (A_6)		Administration
12	Ms. Pushpa P. Bhandari	Admin Officer (A_6)	B. A.	Administration
13	Mr. Binod C. Adhikari	Account Officer (A_6)	B. Com, MA	Account
14	Ms. Laxmi Parajuli	Account Officer (A_6)	B. Com	Account
15	Dr. Pratik Hamal	J. T. (T_5)	B. V. Sc. & A. H	
16	Mr. Prabin Sapkota	J. T. (T_5)	I. Sc. Ag. (An Sc)	
17	Mr. Kapur Bhusal	J. T. (T_5)	B. Sc. Ag.	
18	Mr. Khadka B. Khadka	J.T.A. (T_4)	J.T.A., 10+2	
19	Mr. Pasupati Khanal	J.T.A. (T_4)	J.T.A., B.A.	
20	Ms. Mitra Maya Gurung	Lower Technician	I.A	
21	Ms. Aasha Gurung	Lower Technician	IX	
22	Ms. 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	Ms. Manju Rai	Lower Technician	10+2	

Annex 2.3 Human Resource Chart of NCRP in FY 2077/78 (2020/21)

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	2	2	0
4	Senior Technical Officer (T_7)	LPPM	1	1	0	0	0
5	Technical Officer (T_6)	LPPM Veterinary PFAF	3	1	0	0	2
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)		5	3	1	2	2
10	Tech Helper (T_1)		12	8	0	2	4
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	1	0	1	0
	Total		**37**	**23**	**4**	**7**	**14**

Annex 3.1 Summary of NARC research project and activities in FY 2077/78 (2020/21)

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**	**1498**	
1	Farm security	S. Paudel		341	Security of Office premices and farm well maintained. Seven security guard used daily over the year.
2	Farm Maintenance, (NARC Day, Gai Puja)	S. Paudel		765	Cattle farm well maintained round the year.
3	Annual Report publication	S. Paudel		152	100 pcs Annual Report published
4	Technology demonstration	D. P. Adhikari		240	Technologies related to cattle breeding, health, feeding were demonstrated at Simara, Bara and in OR sites.
2	**Cattle herd management and production project**	**S. Paudel**	**Core**	**18936**	
1	Feeding of animals with appropriate roughage and concentrate.	B. R. Baral B. B. K.C.		12245	Fed 190,550 kg concentrate, 693,125 kg - green roughage and 55,700 kg rice straw
2	Health and infertility status of animal monitored bi-weekly	G. Pandey Y. R. Pandeya		1045	72 samples were tested for LSD by ELISA. 50% were found positive. 188 AI done and 15 samples tested by PCR for LSD found positive
3	Vaccination and antihelmintics of animal in prescribed time frames.	C R Pathak G. Pandey		1018	Deworming against internal parasites, treatment of external parasites and vaccination against HS, BQ and FMD done regularly following the standard protocal
4	Epidemiological studies on cattle mastitis	G. Pandey		242	Thirty milk samples were collected from Makawanpur district and 70 from Nawalparasi. Staphylococus spp issolated from milk samples
5	Clean milk production (udder cleaning, utensils, teat Dipping etc.)	Y.R. Pandeya		170	Daily cleaning of utensils and clean milk production regularly going on.
6	Processing and distribution of clean milk	Y. R. Pandeya		183	155373.5 liters of milk produced and distributed
7	Product diversification (Paneer, Khuwa, Yoghurt, Ghee and Ice cream) and its study on different consumer's acceptance	S. H. Ghimire		220	995.85 kg Paneer, 234.5 kg Khuwa, 7 liter Icecream, 19.5 kg Ghee, 360 pieces of rusbari and 17 kg of Dahi prepared and distributed
8	Heat stress management for farm animal during summer months	D. P. Adhikari		230	Bathing of all cattle by using cold water was done twice daily to reduce the heat stress during summer months

9	Routine milk analysis.	C R Pathak Y. R. Pandeya	118	Average milk parameters were as: Fat-4.20, SNF-8.67, Protein-3.23, Conductivity-4.25. Milk analysis done in monthly basis
10	Identification of blood level of crossbred cattle	S. Paudel	240	Due to covid-19 pandemic situation lab materials not available
11	Introduction and evaluation of different forage for permanent pasture	B. R. Baral B. B. K.C.	550	16400 sets of super napier introduced in NCRP Farm and different fodders are cultivated as required
12	Seed production of major forage crops	B. R. Baral B. B. K.C.	400	Teosinte and oat cultivated for seed production. 800 kg of teosinte and 255.2 kf oat seeds produced
13	Production of green forage	B. R. Baral B. B. K.C.	532	Seed sowing of berseem-2.5 kg was done. Teosinte 465 kg and maize 150 kg, Sudan 20kg and Bajra 13 kg cultivated for forages production
14	Study on hydroponic fodder production and use in dairy Animal	B. R. Baral B. B. K.C.	190	30 kg maize used for fodder productiton. Biomass production performance of 5 different variety of maize was done. Seed rate was @3kg/tray and Biomass yield was @12kg/tray
15	Study on different agent to add value to silage (urea + molasses, probiotic culture, yeast etc.)	S. H. Ghimire	167	Silage preparation completed using 41 Mt Teosinte + Napier+ Sorghum+ Bajra (with addition of 2% molasses solution)
16	Routine recording of feeding and milk production	Y. R. Pandeya	66	Routine recording of milk production and feeding done over the year
17	Maintenance and evaluation of Terai cattle and its crossbred	Devi P. Adhikari	999	26 pure & 4 crossbbred Terai cattle maintained. Pregnancy diagnosis of Terai cattle done and AI done in F1 Terai. Production performance of Terai cattle performed regularly.
18	Maintenance of pedigree record and updating of data management	Y. R. Pandeya	61	Pedigree record of all the animals maintained regularly
19	Effects of feeding milk replacer on body growth and its economic feasibility in dairy calves	Y. R. Pandeya	175	Growth rate of all calves born were recorded regularly
20	Growth records of calves	Y. R. Pandeya	85	55 calves produced and recorded

3	**Participatory technology development and varification at Outreach sites**	**S. Paudel**	**Out reach**	**871**	
1	Evaluation of teat dipping in farmers management conditions	G. Pandey		67	Demponstration of teat dipping was done in OR sites. Thirty farmers were participated in the demonstration. Teat dipping solution was distributed to all farmers for teat dipping evaluation. Teat dipping was found very effective to reduce the case of mastitis in farmers field conditions.
2	Effectiveness of vaccination for major economic diseases and drenching against major internal and dipping/spraying for external parasites.	C R Pathak G. Pandey		58	Vaccination against FMD to 63 cattle was conducted. About 100 cattle were dewormed. Vaccination against major economic diseases and deworming reduces the risk factor associated with dairy animals.
3	Health campaign	G. Pandey		161	Health camp was conducted in Devdaha municipality of Rupandehi district. More than 100 animals were treated duing the camp
4	Fortification of UMMB using sustained release urea (SRU) and probiotic cultures	B. R. Baral B. B. K.C.		65	UMMB was prepared and demonstrated among farmers of outreach site. Total 24 (15 male and 9 female) farmers from Devdaha were involved in UMMB preparation
5	Demonstration of silage making	B. R. Baral B. B. K.C.		52	Silage making demonstration was conducted in Madi Chitwan. Where 22 farmers were involved in silage making and produced 250 kg silage.
6	Community forage and forage seed production	B. R. Baral B. B. K.C.		131	119 KG Oat (Bundel) seed distributed to 17 farmers for forage and seed production
7	Travelling Seminar	Y. R. Pandeya		155	Different farms like Goat Research Station Bandipur, Horticulture Research Station Malepatan, Fisheris Research Station Begnas, DOAR, Lumle, Lumbini Agro and research centre Rupandehi, Subharambha Agrofarm Devdaha, Cattle farm of Dadhiram Subedi Gaidakot were observed and monitored. Total 17 staffs from NCRP were involved in this seminar.

8	Demonstration and making of milk product	S. H. Ghimire		55	Milk product like paneer and rasbari was prepared and demontrsted in OR sites. Thirty farmers were participated in the product diversification
9	Village Level Workshop	D. P. Adhikari		50	1 day village level workshop conducted at Simara, BARA
10	Use of improved/latest technologies in breeding practices	Y. R. Pandeya		77	USG was used as technology to know the existing conditions of reproductive organs and pregnancy in cattle of OR sites. Syncronization protocal was followed in anestrus and repeat breeding cattle.
4	**Multilocation Project**	**S. Paudel**	**Multi**	**822**	
1	Genetic evaluation of Lulu cattle	S. Paudel		822	Lulu cattle is found to be adopted in Chitwan. Maximum milk production from Lulu found to be 4 liter/day.
147	**Development of Year round cost effective forage based milk production technology for crossbred cattle**	**S. H. Ghimire**	**2080**	**619**	
1	Collection and cultivation of winter legume and non-legume forages germplasm.	S. H. Ghimire		126	Oat, Berseem and cowpea Seed collected and sown on prepared farm land
2	Yield assessment of winter forage	S. H. Ghimire		29	Per ha productivity of oat, vetch and pea were 25.23, 19.65 and 22.77 ton respectively
3	Economic Analysis of winter forage	S. H. Ghimire		21	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	S. H. Ghimire		126	Teosinte, maize, bajra and sudan seeds cultivated
5	Prepare different feeding regime and conduct feeding trial at different season	S. H. Ghimire		45	Feeding trial of winter forages completed
6	Performance recording, milk parameter analysis and monitoring	S. H. Ghimire		26	Production data recording taken
7	Cost benefit analysis of feeding trial at different season	S. H. Ghimire		79	Experiment completed, work of data analysis remaining
8	Cost benefit analysis of silage preparation and milk production	S. H. Ghimire		64	Experiment on silage feeding is conducted in 20 milking cattle
9	Prepare different feeding regime and conduct feeding trial at different season	S. H. Ghimire		65	Feeding trial of summer/rainy season fodder done
10	Performance recording, milk parameter analysis and monitoring	S. H. Ghimire		21	Production data recording taken
11	Cost benefit analysis of feeding trial at different season	S. H. Ghimire		17	Experiment completed, work of data analysis remaining

478	**Effect of cutting interval and spacing on production performance of different hybrid Napier**	**B. R. Baral B. B. K.C.**	**2080**	**540**	
1	Collection of different hybrid napier sets and plantation on station	B. R. Baral B. B. K.C.		198	6500 Super napier sets were planted on station
2	Performance evaluation of Hybrid napier fodders	B. R. Baral B. B. K.C.		198	Data recording and sample collection upto first and second cut completed
3	Analysis of nutrient content of hybrid napier at different growth stages	B. R. Baral B. B. K.C.		89	108 samples of 3 hybrid napier were collected for Proximate analysis
4	Logistic supports to farmers, report writing and publication	B. R. Baral B. B. K.C.		55	100 super napier sets were distributed to farmers at OR sites
142	**Isolation and molecular characterization of Siga toxin producing *E.coli* O157:H7 in milk**	**C. R. Pathak G. Pandey**	**2080**	**512**	
1	Collection and Preparation of Samples from raw milk from cow	C R Pathak G. Pandey		192	100 milk samples were collected from Rupandehi, Makawanpur and Chitwan district
2	Bacterial isolation	C R Pathak G. Pandey		48	47 isolate of *E.coli* were stored in refreezerator. Molecular part incomplete.
3	Characterization for *E. coli O157:H7*	C R Pathak G. Pandey		30	
4	DNA Extraction	C R Pathak G. Pandey		80	
5	Multiplex Polymerase Chain Reaction (mPCR) and Gel Electrophoresis	C R Pathak G. Pandey		162	
158	**Screening of antibiotic residues in raw milk in dairy pocket area of Nepal.**	**G. Pandey**	**2079**	**733**	
1	Milk sample collection	G. Pandey		86	200 milk samples from Rupandehi, Nawalparasi and Chitwan were collected
2	Survey of Antibiotics used for treatment of Livestock	G. Pandey		33	80 house hold survey was done in Chitwan and Rupandehi
3	Detection of antibiotic residue by use of Rapid test kit.	G. Pandey		299	Antibiotic residue were dectected in 12 milk samples among 200 samples
4	ELISA test for detection of antibiotic residue in milk	G. Pandey		123	
5	Quantification of antibiotic residue in milk (HPLC)	G. Pandey		192	

Annex 4.1 Production of commodities and products in FY 2077/78 (2020/21)

SN	Commodity / Product	Variety/Breed	Type (Breeder/ Foundation/ Blood level)	Unit	Target	Production
1	**Calves**	Jersey Cross HF Cross Terai x Jersey Terai x HF Terai Lulu	- - 50% 50% 100% 100%	No.	30	55.00
2	**Milk**	Whole Milk		Lit	90000	155373.50
3	**Milk Products**					
3.1	Paneer			Kg		995.85
3.2	Yoghurt			Lit		17.00
3.3	Ice cream			Kg		7.00
3.4	Ghee			Kg		19.50
3.5	Khuwa			Kg		234.50
3.6	Raswari			Pieces		360.00
4	**Forage Seed**					
4.1	Teosinte			Kg	800	867.30
4.2	Oat			Kg		255.20
5	**Silage**			MT		41.00

Annex 4.2 Distribution of Commodity products in FY 2077/78 (2021/21)

SN	Commodity / product	Breed / Type	Quantity	Major stakeholder (s)	Distributed districts
1	Male Calf	Jersey Cross HF Cross	12 nos	Farmers	Chitwan and Makwanpur
2	Forage seeds/sets	Teosinte Oat Super Napier Signal Setaria Mulato	165.5 kg 110.0 kg 5158 sets 550 sets 750 sets 100 sets	Farmers, Seed Suppliers, Offices	Chitwan, Nawalparasi and Rasuwa
3	Milk	Whole Milk	136089.3 lt	Staffs of NCRP, NMRP, DDC and Dairy Cooperatives	Chitwan
4 5 6 7 8 9	Paneer Yoghurt Ice cream Ghee Khuwa Raswari		973.05 Kg 17.00 Kg 6.50 Kg 21.50 Kg 209.75 kg 360 pcs	Staffs of NCRP and NMRP, Rampur, Visitors from NARC Offices and local community	Different Districts

Annex 5.1 Training/Workshop/Seminar Organized in FY 2077/78 (2020/21)

SN	Name of Training/ Workshop/ Seminar	Duration	Target group	Location	No. of participant
1	Village Level Workshop on Cattle Production and Management	1 day	Farmers of Dairy Cooperatives	Dumarwana, Bara	30
2	Travelling Seminar	5 days	Technical Personnels	Cattle farms of Kaski, Palpa and Rupandehi Districts	16
3	Silage Preparation	1 day	Farmers	Madi, Chitwan	
4	UMMB Preparation	1 day	Farmers	Nawalpur	

Annex 5.2 Services Provided by NCRP, Rampur in FY 2077/78 (2020/21)

SN	Laboratory/Field test/ Counseling services provided	Numbers	Major clients
1	Farm Observation and Technical Briefing and Councelling	1573	Farmers, Students, Enterprenuers, Extension Officials, NGOs Officials
2	Laboratory Skills, ELISA test, Pregnancy Diagnosis, Disbuding, Weight and age determination	23	B. V. Sc. & A. H. Internee, Masters Students
3	Treatments and Simple lab skills	10	On Job Trainings Students/ J.T.A.

Annex 5.3 Publications of the NCRP, Rampur in FY 2077/78 (2020/21)

SN	Name of publications	Type	Language	Authors	No. of copies
1	Annual Report (FY 2076/77)	Report	English	NCRP, Rampur	100
2	Cattle Research in Nepal: Current Status, Challenges and Way forward	Proceedings	English	S. Paudel, S. H. Ghimire and Y. R. Pandey	
3	Use of Ovsynch protocol for reproductive management of cattle in National Cattle Research Program, Rampur	Proceedings	English	Y.R. pandeya, A.K. Sah, L.R. Pathak, P. Sapkota and P. Khanal	
4	Molecular detection of *Anaplasma* in Cattle of Morang, Rupandehi and Surkhet districts of Nepal	Proceedings	English	C.R. Pathak, G. Pandey, M.P. Acharya, Y. R. pandeya, P. Hamal, P. Khanal and H. Luitel	
5	Molecular ans Serological detection of Lumpy Skin Disease in Cattle of Western Chitwan, Nepal	Proceedings	English	G. Pandey, C.R. Pathak, R. Bastakoti, P. Hamal, P. Khanal, P. Sapkota, Y. R. Pandeya and S. Paudel	

Annex 5.4 Information dessiminated through Media in FY 2077/78 (2020/21)

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

Annex 5.5 Visit of NCRP, Rampur by Farmers, Students, Extension Officials/Technicians, Entrepreneurs, Cooperatives, NGO/ CBO Officials etc. in FY 2077/78 (2021/21)

SN	Category	Number	Districts	Area of major interest
1	Farmers	1129	Different districts of Country	Cattle Raising and Farm Visit
2	Extension Officials	152	Different districts and municipalties	Technology generated in the station
3	NGOs Officials	121	Different districts	Cattle Husbandry Practices
4	Students and Instructors	249	AFU, IAAS, Nepal Polytechnique 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 2077/78 (20/21)

SN	Name of Staffs	Position	Name of Training / Seminar/ Workshop	Duration	Place/ Country	Organizer
1	S. H. Ghimire G. Pandey Y. R. Pandeya C. R. Pathak P. Hamal	T_7 S_1 T_6 T_6 T_5	Nepal Veterinary Council Genral Assembly	1 day	Sundhara, Kathmandu	Nepal Veterinary Council
2	S. H. Ghimire G. Pandey Y. R. Pandeya C. R. Pathak P. Hamal	T_7 S_1 T_6	NVA – Provential GA, Bagmati	1 day	Hetauda, Makawanpur	NVA Bagmati Province
3	K. Bhusal P. Sapkota P. Khanal	T_5 T_5 T_4	Pedigree Performance Recording System (PPRS) Training	3 days	VDRC, Gaindakot	NLSIP, Hetauda
4	S. H. Ghimire G. Pandey Y. R. Pandeya P. Hamal	T_7 S_1 T_6 T_5	Nepal Veterinary Association Genral Assembly	1 day	Sanepa, Lalitpur	Nepal Veterinary Association
5	S. Paudel D. P. Adhikari B. B. KC S. H. Ghimire G. Pandey Y. R. Pandeya C. R. Pathak	S_3 S_3 S_1 T_7 S_1 T_6 T_6	Planning Workshop for FY 2078/79	3 days	Khumaltar, Lalitpur	NARC
6	S. Paudel	S_3	Planning Workshop for FY 2078/79	3 days	DoAR, Lumbini Province	NARC
7	S. Paudel B. B. KC S. H. Ghimire G. Pandey Y. R. Pandeya C. R. Pathak	S_3 S_1 T_7 S_1 T_6 T_6	12th National Workshop on Livestock and Fisheries Research in Nepal	2 days	Rampur, Chitwan	Dir. of Livestock and Fisheries Research, NARC

Annex 7.1 Annual Budget and Expenditure Record of FY 2077/78 (2020/21)

(in Nepalese Rupees)

Code	Account Heading	Annual Budget	Total expenses	Budget Balance
	Staff expenses	**1,53,49,000.00**	**1,13,76,100.00**	**39,72,000.00**
21111	Staffs Basic Salary	1,42,24,000.00	1,05,57,634.00	36,66,366.00
21121	Staff Uniform	2,90,000.00	2,30,000.00	60,000.00
21132	Staff Allowance	6,96,000.00	4,90,266.00	2,05,734.00
21213	Contribution based insurance fund	1,39,000.00	98,200.00	40,800.00
	Operational exp.	**2,45,31,000.00**	**2,36,43,832.09**	**8,87,167.91**
22212	Vehicle Fuel & Lubricants	5,17,000.00	5,16,215.82	784.18
22312	Animal Feed	1,14,45,000.00	1,10,84,753.00	3,60,247.00
22512	Training, workshop, seminar	150,000.00	99,320.00	50,680.00
22521	Farm Supplies, Lab supplies & Labor wages	1,05,25,000.00	1,00,50,871.27	4,74,128.73
22611	Monitoring and Evaluation	1,34,000.00	1,33,760.00	240.00
22612	Travel Expenses	17,60,000.00	17,58,912.00	1,088.00
	Administrative exp.	**53,96,000.00**	**49,86,477.23**	**4,12,522.77**
22111	Water & Electricity Supplies	12,06,000.00	11,70,000.00	36,000.00
22112	Communication	2,34,000.00	1,78,888.00	55,112.00
22213	Vehicle Maintenance	3,20,000.00	3,19,809.00	191.00
22214	Insurance and Renewal Expenses	2,10,000.00	1,15,915.00	94,085.00
22221	Machinary and tools maintenance and operational Expenses	3,70,000.00	3,69,865.00	135.00
22231	Public property Maintenance Expenses	5,74,000.00	5,71,930.00	2,070.00
22311	Office supplies	5,47,000.00	5,46,809.00	191.00
22314	Fuel Other purpose	2,52,000.00	2,46,883.23	5,116.77
22315	Newspaper, printing and Notice publishing expenses	50,000.00	50,000.00	0.00
22413	Contract and other services	13,39,000.00	12,36,672.00	1,02,328.00
22711	Contingency	94,000.00	93,790.00	210.00
28143	Vehicle and Machinery Rent	2,00,000.00	1,32,916.00	67,084.00
	Capital Exp.	**59,86,000.00**	**50,51,730.59**	**9,34,269.41**
31112	Non-residential building construction	12,46,000.00	12,33,473.29	11,526.71
31122	Equipment & Machinery	29,40,000.00	20,63,874.00	8,76,126.00
31161	Constructed Building Structural Improvement	18,00,000.00	17,54,383.30	9,33,269.70
	Grand total	**5,12,62,000.00**	**4,50,55,139.91**	**62,06,860.09**

Annex 7.2 Revenue Status of FY 2077/78 (2020/21)

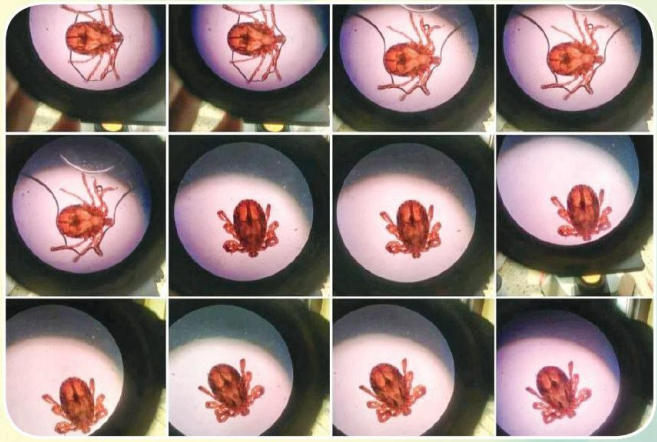
(in Nepalese Rupees)

Source	Total	Remarks
Animal Production, Research	88,03,751.06	
Calves (male and Female)	6,000.00	
Raw Milk	81,04,124.06	
Dairy Product	6,88,947.00	
Manure	4,680.00	
Fodder/Forage seed and sets	32,995.00	
Administrative income	1,82,849.50	
Other Income	0.00	
Total	**90,91,595.56**	

Annex 7.3 Beruju Status of FY 2077/78 (2020/21)

Beruju	Amount (NRs '000)	Remarks
Beruju till FY 2074/75	15253.112	
Beruju in FY 2075/76	1137.587	
Beruju cleared in this FY	898.500	
Remaining Beruju	**16155.954**	

Village Level Workshop at Dumarwana, Bara



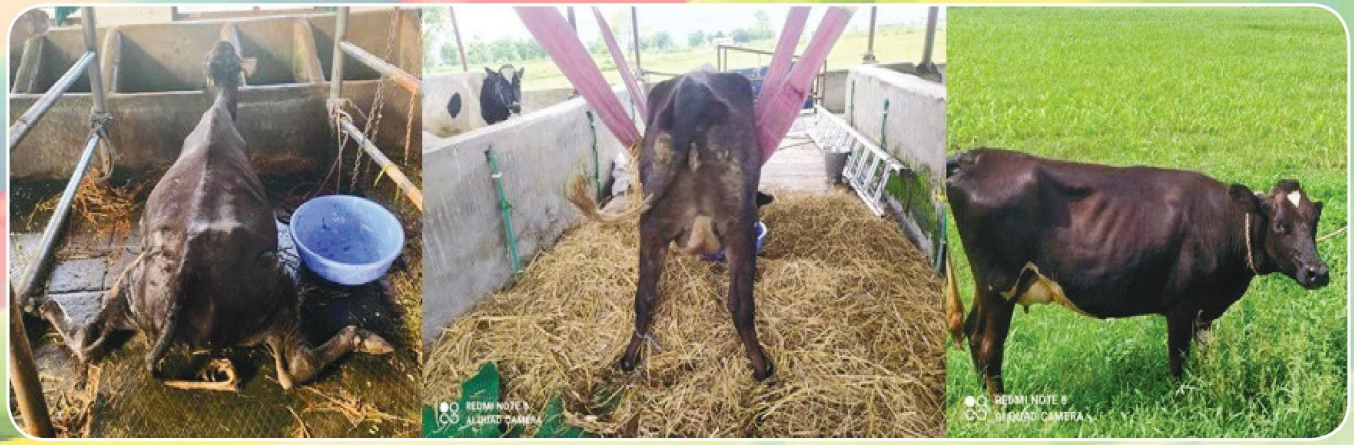
Ticks of cattle under microscope

Preparation of teat dip

Cultivation field of forage pea

Demonstration of Plastic Silage and UMMB at Outreach site

Preparation of different Dairy Products



Correction of Hip Dislocation of Cattle

Cattle shed area

Dr. Deepak Bhandari, ED, NARC and Dr. Sudha Sapkota, Chief, Monitoring and Evaluation Division, NARC at NCRP, Rampur, Chitwan