NPSN: 001/081/082

Annual Report
2080/81 (2023/24)

Government of Nepal
Nepal Agricultural Research Council
National Agricultural Environment Research Centre
Khumaltar, Lalitpur, Nepal

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Cover page photo: The NAERC office in the NAHRC building

FOREWORD

The National Agricultural Environment Research Centre (NAERC), Khumaltar under the Nepal Agricultural Research Council, is mainly involved in agricultural research activities which is related to weather/climate and environmental concerns in agriculture. Greenhouse gas (GHG) emissions and their impact on climate change are major global issues. Although Nepal is not a significant contributor of GHGs, it is the fourth most vulnerable country to climate change. In this context, NAERC has been collaborating within and outside NARC to develop and disseminate the most effective adaptation and mitigation measures to limit the negative impacts of climate change and other environmental concerns. The NARC has developed many climate-resilient crop varieties and technologies. This centre has published a compilation of these technologies in the Nepali language. We publish agro-met advisory bulletins regularly with the support of agricultural and weather/climate experts. The centre is also conducting activities on assessment of farmers' perspectives on the consequences of climate change; calculation of GHG emissions and carbon sequestration; effect of pesticide use; and the impact of increased temperature on cereal and vegetable crops. Now, the centre focuses on the identification, participatory research, and dissemination of climate-smart agricultural technologies to address the vulnerability of climate change in agriculture.

This annual report provides a detailed look at the activities and outcomes of the research undertaken by the centre during the fiscal year 2080/81. Researchers, extension staff, students, and national policymakers are likely to find this report valuable in their research and decision-making processes.

I would like to extend my sincere thanks to Mr. Rameshwar Rimal, Dr. Pradeep Shah, Dr. Roshan Babu Ojha, Mr. Kumar Mani Dahal, and Mr. Hem Lal Bhandari for their efforts to bring this annual report into publication. In acknowledgment of its financial support, the Nepal Agricultural Research Council (NARC) has been praised. I would greatly appreciate constructive comments and suggestions on how to make the report better.

Dr. Dhruba Raj Bhattarai

Senior Scientist and Chief

National Agricultural Environment Research Centre (NAERC)

Khumaltar, Lalitpur, Nepal

LIST OF ABBREVIATIONS

AAB	Agromet Advisory Bulletin
AGB	Above Ground Biomass
AWS	Automatic Weather Station
BGB	Below Ground Biomass
DAP	Dia-Ammonium Phosphate
DAS	Days After Sowing
DAT	Days afterTransplanting
DBH	Diameter at Breast Height
DoAR	Directorate of Agricultural Research
F.Y.	Fiscal Year
GDP	Gross Domestic products
GHGs	Greenhouse Gases
HRS	Horticulture Research Station
masl	Meter above sea level
MOP	Muriate of Potash
NAERC	National Agricultural Environment Research Centre
NARC	Nepal Agricultural Research Council
NMRP	National Maize Research Program
NRRP	National Rice Research Program
OTC	Open Top Chamber

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यो वार्षिक प्रतिवेदनमा राष्ट्रिय कृषि वातावरण अनुसन्धान केन्द्रले आर्थिक वर्ष २०८०/८१ मा सम्पन्न गरेको अनुसन्धानात्मक र प्रर्वधनात्मक कार्यहरू समेटिएका छन्। यस अवधिमा गर्मीयाममा तापक्रम बृद्धि गरी खेती गर्दा गहुँका जातहरूमा पर्ने प्रभाव, स्याउको बोटमा हुने कार्वन स्थिरीकरणको मात्रा, धान बाली खेती गर्दा हुने कार्वन उत्सर्जन जस्ता कार्यक्रमहरू सञ्चालन गरिएका थिए। विगत वर्षमा जस्तै यो वर्ष पनि कृषि मौसम सल्लाह बुलेटिनको प्रकाशन र सरोकारवालाहरुलाई वितरण गरियो। यस वर्ष सवै ७५३ वटै स्थानिय तहमा बुलेटिनको पहुँच स्थापित गरियो। जलवायु परिवर्तनको असर र त्यससँग अनुकूल हुने प्रविधिहरू बारे जानकारी गराउन कृषक स्तरीय तालिमहरु सञ्चालन गरिए। यस वर्ष प्राप्त भएका मुख्य उपलब्धिहरूलाई यहाँ छोटकरीमा प्रस्तुत गरिएको छ।

- तापक्रम बढाउँदा गहुँको उत्पादनमा पर्ने प्रभाव बारे जानकारी हासिल गर्न गहुँका ४ वटा जातहरु (WK 3166, WK 3324, सुर्मा र खुमल शक्ति) लाई खुला ठाउंमा र माथि खुला भएको प्लास्टिकको भकारी जस्तो संरचना (Open Top Chamber) भित्र छर्दा, जातहरु मध्ये WK 3324 ले सबै भन्दा बढी उत्पादन दियो भने Open Top Chamber भन्दा खुला ठाउँमा छर्दा बढी उत्पादन हुने परिक्षणले देखायो।

- उच्च घनत्व स्याउ फलको रुखमा स्थीरीकरण हुने कार्वनको मात्रा मापन गर्न मनाङ जिल्लाको विभिन्न स्याउ वगानमा रहेका वोटहरूको तथ्याङ्क लिइयो। यसरी नमूनाको रुपमा तथ्याङ्क सङ्कलन गरिएका स्याउको बोटको उमेर १० वर्षसम्म रहेको थियो। यस्तो तथ्याङ्क १२१ वटा स्याउका रुखहरुबाट लिईएको थियो। स्याउको रूखहरूमा स्थिरिकरण हुने कार्वनको मात्रा, बोटको उमेर र डाँठको व्यासमा निर्भर हुने देखियो।

- यस वर्ष कृषि मौसम सल्लाह बुलेटिनका ५२ अङ्क तयार पारी वितरण गरियो। यस बुलेटिनमा खाद्यान्न बाली, फलफूल बाली, तरकारी बाली, पशुपालन, मत्स्यपालन तथा घाँसेवाली सम्बन्धी प्राविधिक जानकारी लगायत आउँदो हप्ताको मौषमी पुर्वानुमान समेटिएको हुन्छ। यस केन्द्रले रेडियो नेपालबाट हरेक शनिबार ६:२५ देखि प्रसारण हुने तथा नेपाल टेलिभिजनको NTV News Channel बाट हरेक शनिवार ८:०० बजेको समाचार पछि प्रसारण हुने कृषि गतिविधिको लागि आवश्यक सूचनाहरू उपलब्ध गराउँदै आएको छ।

- इन्डो–ब्लाइट कास्ट (IBC) लेट ब्लाइट पूर्वानुमान मोडेल प्रयोग गरी NAERC, खुमलटारमा आलु लेट ब्लाइट परिक्षणको लागि पूर्वानुमान मोडेल सञ्चालन गरिएको थियो। यो परिक्षण Split plot design मा गरिएको थियो। Main plot मा तीन वटा आलुका जातहरु कुफ्रीज्योति, कार्डिनल र डेजिरे थिए। Sub-plot मा तीन वटा स्प्रे (i) कुनै स्प्रे नभएको, (ii) सिफारिस गरिएको स्प्रे र (iii) प्रणाली निर्देशित स्प्रे (मोडेल आधारित) थिए। परिक्षणको नतिजा हेर्दा आलुका जातहरु र स्प्रे प्रणालीको आलुको

उत्पादनमा उल्लेख्य प्रभाव देखिएन ।

- C-SUCSeS परियोजना अन्तर्गत धान खेतमा पालैपालो पानी लगाउने र सुकाउने प्रविधि सम्बन्धी बुकलेट तयार गरियो । सहभागितामुलक अनुसन्धान क्रियाकलाप अन्तर्गत चितवनको हरनरी र कठारमा चैते धानमा पालैपालो पानी लगाउने र सुकाउने प्रविधि र पर्सा जिल्लाको बिजबनिया र पर्सागढ़ीमा छरुवा धान खेति प्रविधि र शुन्य खनजोतको गहुँ खेति प्रविधि कृषकको सहभागीतामा कृषकको खेतमा सम्पन्न गरियो । त्यस्तै तनहुँको बरादीमा तरकारी बालीमा थोपा सिंचाई र काभ्रे जिल्लाको ठकुरीछापमा तरकारी बालीमा थोपा सिंचाई र मकैसंग भटमासको अन्तरबाली प्रविधिको सहभागीतामामुलक अनुसन्धान गरियो । चितवन जिल्लाको हरनरी र कठार, पर्साको बिजबानिया र पर्सागढी, तनहुँको बरादी र काभ्रेको ठकुरीछापमा जलवायु मैत्री कृषि प्रविधिहरु सम्बन्धि एक दिने किसानहरुको सहभागितामुलक तालिम सम्पन्न गरियो । विभिन्न स्थानीय तहमा कार्यरत प्राविधिकहरुलाई बागवानीमा जलवायु मैत्री कृषि प्रविधि सम्बन्धी एक दिने तालिम दिइएको थियो । त्यस्तै जलवायु मैत्री कृषि प्रविधि सम्बन्धि वैज्ञानिक–पत्रकार अन्तरक्रिया कार्यक्रम पनि सम्पन्न गरियो ।

EXECUTIVE SUMMARY

This annual report summarizes all the research and promotion activities completed by the National Agricultural Environment Research Centre (NAERC) during the fiscal year 2080/2081 (2023/2024). During this period activities such as performance of wheat genotypes under elevated temperature, carbon sequestration, and GHG emission estimation were carried out. The centre has regularly published agro-met advisories and distributed to the concerned stakeholders including all 753 local bodies (governments). NAERC also published compilation of climate smart technologies developed by NARC along with the agro-met advisory. The following are some of the centre's major research outputs and other noteworthy accomplishments in fiscal year 2023/24:

- ❖ Four wheat varieties (WK 3166, WK 3324, Surma and Khumal Shakti) were evaluated in a plastic open-top chamber (OTC) and open field conditions. Earlier days to heading and higher plant height were observed in OTC while higher number of spike/m^2, number of grains, and grain yield were observed in open field conditions. Among the varieties, WK 3324 recorded a higher number of spike/m^2, number of grains, and grain yield.
- ❖ The carbon sequestrating capacity of the apple (Malus domestica) was measured from the different farms of Manang districts of Nepal. The age of the sample apple trees ranged from 9 to 10 years. A total of 131 apple trees were sampled from different farms. The carbon sequestration by apple trees (ton/tree) was found based on diameter and the age of the trees.
- ❖ During the fiscal year 2080/81, 52 episodes of the weekly agro-met advisory bulletin were prepared and distributed by the centre. The bulletin comprises agro-advisories for food crops, fruits, vegetables, livestock, fisheries, pasture and fodder, and weather forecasts for the upcoming week. The centre is assisting the NTV News program after eight p.m. and the Radio Nepal at 6:25 p.m. each Saturday to broadcast agro-met advisories. The centre is helping to prepare the necessary materials to broadcast the bulletin through NTV News Channel after eight p.m. Prime News and the Radio Nepal at 6:25 p.m. each Saturday.
- ❖ The forecasting model for potato late blight experiment was conducted using Indo Blast Cast (IBC) model at NAERC, Khumaltar. The experiment was conducted in split plot design. There were three varieties of potato viz. Kufri Jyoti, Cardinal and Desire in main plot while three spray methods viz. (i) No spray, (ii) Recommended spray, and (iii) System guided spray (model based) in sub-plot. Unfortunately, blight did not appear in Khumaltar area during the experimentation. The variety and spraying system had non- significant effect on the total tuber yield of potato.

- ❖ Under C-SUCSes project, a booklet on Alternate Wetting-Drying (AWD) practices in rice (in Nepali language) was published. Participatory research on AWD in spring rice was practiced in Harnari and Kathar of Chitwan district. Similarly, DSR, and Zero Tillage wheat was initiated in Bijbania and Parsagadhi of Parsa district. Drip irrigation technology in vegetable crops was practiced at Baradi of Tanahu district; and drip irrigation and intercropping of maize with soybean at Thakurichhap of Kavre district. Farmers participatory trainings on Climate Smart Agricultural (CSA) technologies were accomplished at Harnari and Kathar of Chitwan district, Bijbania and Auraiya of Parsa district, Baradi of Tanahu district and Thakurichaap of Kavre district. Similarly, training on Climate Smart Horticultural crops was conducted to technicians working in different local governments. Scientist-Journalist interaction program on CSA Technology was also accomplished.
- ❖ Atlas of Climate Adaptation in South Asian Agriculture (ACASA) project accomplished all of its activities planned for the F.Y. 2080/81. Commodity specific climate risk characterization and mapping were completed for rice, wheat, maize, mustard, potato, cattle, buffalo, goat, pig, and poultry. More than twenty adaptation practices were prioritized using a heuristic approach specific to hazards and commodities across Tarai, Hill, and Mountains.

1. WORKING CONTEXT

About two-thirds of Nepalese people work in agriculture, which accounts for about one-third of the nation's gross domestic product. Moreover, as the population and food demand grow, it becomes imperative that the country achieve food security. Warming in the climate, in time and space, along with other abnormalities, is beginning to be a problem for all agricultural production. The collection of agro-meteorological records (Annex 1) from numerous stations is a good source for researching the causes and effects of weather and the relationship between different weather patterns and crop yield. The crop modelling can also be aided by agro-meteorological datasets. Crop production is a result of crop genetic make-up, the environment, and the methods used for management.

An open-top chamber study of crop performance on high temperatures might aid agricultural researchers with their breeding and crop management plans. GHG emissions are of major concern and are exacerbating climate change. Agriculture has also an important role in the emission of CO_2 by agricultural practices. Some of these experiments are being conducted at Khumaltar representing mid-hill condition (Annex 2). Similarly, horticultural fruit crops help to sequestrate the CO_2 in the form of trees and organic matters in soil. Currently, the centre is tracking CO_2 emissions from various types of crops and pasture land that are grown under various management practices across the country. Another objective of the centre is to create an inventory of carbon sequestration of different types of fruit tree.

Nepalese agriculture is deeply affected by climate change effects like increased temperature, unpredictable rainfall patterns, increasing drought, and heat wave events. To limit the adverse impact, the centre is cooperating with the Ministry of Agriculture and Livestock Development (MoALD) and the Department of Hydrology and Meteorology (DHM) to prepare and distribute the agro-met advisory bulletin to farmers since 2071/72. After starting with one district, the bulletin has grown to seventy-seven districts and Nepal Agricultural Research Council (NARC) has internalized AAB generation process by its internal fund after termination of PPCR project. In addition to upcoming weather forecasts, this bulletin also has other agricultural resources such crops, fruits, vegetables, livestock, grazing, and fisheries agro advisories. The centre is helping to prepare the necessary materials to broadcast the bulletin through a national broadcaster (NTV NEWS).

The centre is currently collaborating with several national and international organizations on various areas of researchable subjects as part of its collaboration strategy.

2. INTRODUCTION

2.1 History of National Agricultural Environment Research Centre

The Agricultural Environment Unit was established in the fiscal year 2000 AD in Khumaltar, Lalitpur under the Directorate of Planning and Coordination, Nepal Agricultural Research Council (NARC). It was upgraded to Agricultural Environment Research Division (AERD) in the F.Y. 2013 AD. Further, the division has been upgraded as National Agricultural Environment Research Centre (NAERC) from 1st Shrawan 2077 BS (2020 AD).

2.2 Vision

A climate resilient agriculture with maximum system productivity for transformed livelihoods of farmers.

2.3 Mission

National Agricultural Environment Research Centre (NAERC) strengthens the development and adaptation of the environment-friendly, accessible and affordable improved agricultural technologies through collaborative research to advance and promote on right solutions to climate-related issues in the agriculture sector.

2.4 Mandate

The overall mandate of NAERC is to act as a key institution within NARC to develop and promote agricultural technologies adaptive to climate change and support on policy guidelines.

The specified mandates are:

- ❖ Involve in agricultural environment related research, education, monitoring, and coordination activities
- ❖ Generation and promotion of technologies for climate change related adaptations
- ❖ To help central, provincial and local governments to prepare policy guidelines related to environment-related issues in the agriculture sector.
- ❖ Human resources development to work on agro-environment related issues.
- ❖ Coordinate and co-operate with national and international organizations.

2.5 Current Thrust Areas for Research

- ❖ Understand farmer's perception on climate change
- ❖ Climatic variability of various locations and response of crop
- ❖ Crop performance under simulated environment (e.g. elevated temperature)
- ❖ GHGs emission under different agricultural land and system.
- ❖ Carbon sequestration in horticultural crops
- ❖ AAB preparation and its performance and efficacy at farmers' field

2.6 Infrastructure and Facilities

Automatic weather stations (11): Daily agro-meteorological data recording (Temperature, rainfall, solar radiation, relative humidity, soil temperature etc.)

NAERC has installed 11 meteorological stations on various locations of the Nepal (Table 1).

Table 1: Automatic weather stations installed by NAERC on different NARC research stations.

S.N.	Station Name	Sensor Used	Remarks*
1	NAgRC, Khumaltar	Temperature Humidity Sensor - HC2 Tipping Bucket Pyranometer (LICOR)	
2	NRRP, Hardinath, Janakpur	Temperature Humidity Sensor - HC2 Tipping Bucket Pyranometer (LICOR) Soil Sensor (HydraProbe)	
3	Pasture FRC, Rasuwa	Temperature Humidity Sensor - HC2 Tipping Bucket Pyranometer (LICOR) Soil Sensor (HydraProbe)	
4	CRP, Baletaksar, Gulmi	Temperature Humidity Sensor - HC2 Tipping Bucket Pyranometer (CMP3) Soil Sensor (HydraProbe) Wind Speed & Direction Sensors (FST) Leaf Wetness Sensor	
5	NGRP, Bandipur	Temperature Humidity Sensor - HC2 Tipping Bucket Pyranometer (CMP3) Soil Sensor (HydraProbe) Wind Speed & Direction Sensors (FST) Leaf Wetness Sensor	
6	NCRP, Paripatle, Dhankuta	Temperature Humidity Sensor - HC2 Tipping Bucket Pyranometer (CMP3) Soil Sensor (HydraProbe) Wind Speed & Direction Sensors (FST) Leaf Wetness Sensor	
7	ORP, Nawalpur, Sarlahi	Temperature Humidity Sensor - HC2 Tipping Bucket Pyranometer (CMP3) Soil Sensor (HydraProbe) Wind Speed & Direction Sensors (FST) Leaf Wetness Sensor	
8	NSRP, Jitpur, Bara	Temperature Humidity Sensor - HC2 Tipping Bucket Pyranometer (CMP3) Soil Sensor (HydraProbe) Wind Speed & Direction Sensors (FST) Leaf Wetness Sensor	
9	NMRP, Rampur, Chitwan	Temperature Humidity Sensor Tipping Bucket Pyranometer Soil Sensor Wind Speed & Direction Sensors	
10	DoAR, Bhagetada, Doti	Temperature Humidity Sensor Tipping Bucket Pyranometer Soil Sensor Wind Speed & Direction Sensors	
11	DoAR, Tarahara, Sunsari		

* None of these 11 stations are under working condition.

- Open Top Chamber (3): Experimentation on elevated temperature and CO_2 level
- CO2 Monitor: Measuring CO2 emission
- GPS meter: Taking coordinates of different locations
- Soil pH and moisture meter: Measuring soil pH and moisture
- Leaf area index meter
- Multi-gas analyzer

2.7 Organizational Structure and Human Resources

The organogram of this centre is given in Fig. 1 and detail of human resources in 2080/81 has been presented in Annex 3.

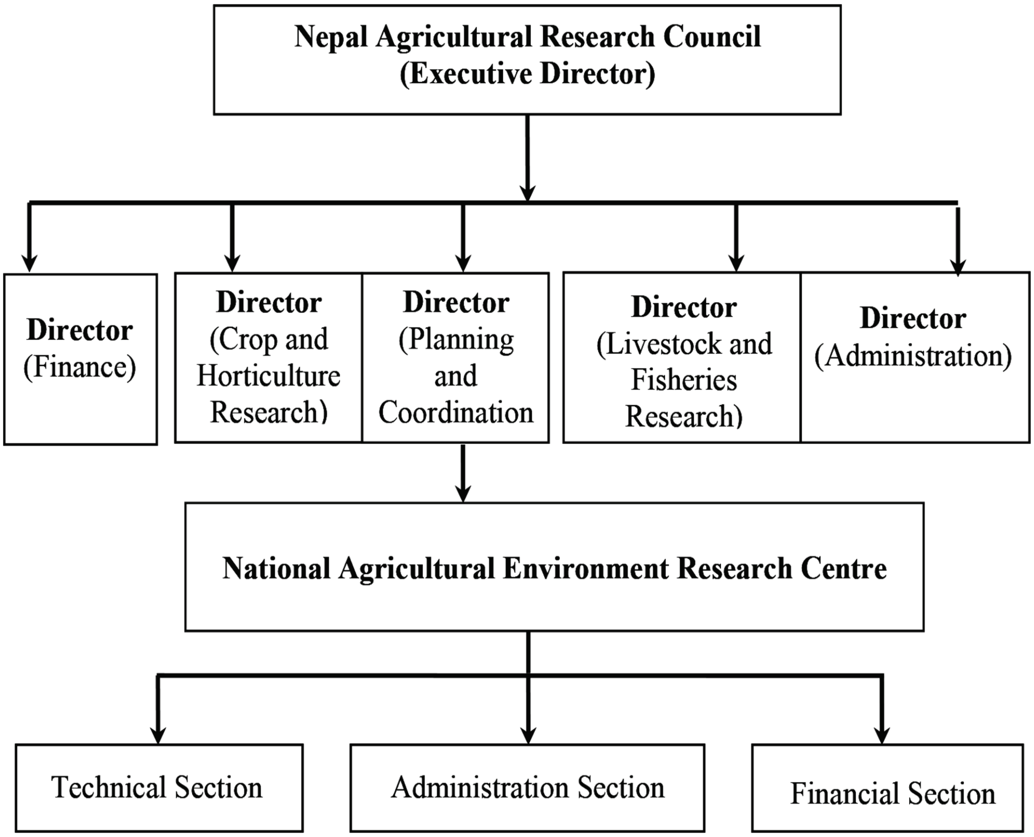


Figure 1: Organizational structure of National Agricultural Environment Research Centre

3. RESEARCH HIGHLIGHTS

The summary of the research highlights mentioned below are presented in Annex 4.

3.1 Collection, Processing and Dissemination of Meteorological Data of Various Locations of Nepal

The meteorological data (maximum and minimum temperature, rainfall, and relative humidity) from various meteorological stations situated in different locations of Nepal was collected, and these data were processed and disseminated to different stakeholders as per their requirement.

3.2 Estimation of carbon (CO_2-C) emission from rice field

Carbon emission refers to the release of carbon dioxide (CO_2) and other greenhouse gases into the atmosphere. These gases trap heat from the sun, causing the Earth's temperature to rise and leading to climate change. The primary driver of global climate change is carbon dioxide emissions. As the second largest carbon flux in terrestrial ecosystems, the soil CO_2 flux is closely related to the atmospheric CO_2 concentration. Soil CO_2 flux is the amount of carbon dioxide (CO_2) that is released from the soil into the atmosphere. It is a measure of the rate of CO_2 flux from the soil surface. CO_2 flux from agricultural soil mainly depends on microbial activities on organic matter and several abiotic and biotic factors can also affect it. It generally increases with a rise in temperature. Low levels of soil moisture limit microbial and root respiration. Higher emissions of CO_2 from soil depletes the organic matter content and thus reduces the soil productivity as well as fertility. So, it is necessary to monitor CO_2 emission rates in different cropping patterns to formulate the plan to reduce overall agricultural emissions.

Measurement of soil CO2 flux is important for understanding the carbon cycle and its impact on the environment. Soil CO_2 efflux can be determined by measuring the CO_2 concentration in the air above the soil surface using a chamber. The amount of CO_2 released from the soil is then calculated based on the change in CO_2 concentration over time. The measurement of soil CO_2 flux is used in various fields, including agriculture, forestry, and climate change research. However, it is generally believed that CO_2 emission from the soil and CO_2 fixation by the plant during photosynthesis process is a self-sustaining system and there is balance between carbon released from soil and fixed by the plant through photosynthesis.

The study was carried out at the National Agronomy Research Centre, Khumaltar to estimate CO2 -C emissions from rice fields with different planting methods; transplanting rice (TR) and direct seeded rice (DSR). Soil temperature, pH and moisture were recorded in the study. The collection of gas samples was done by the Japanese closed chamber technique and finally subjected to measurement with the help of a CO_2 monitor. Soil moisture and pH were taken by a combined soil moisture and pH meter. The temperature of the soil was measured at a depth of 8 cm. The gas samples were collected at one month interval.

Table 2: CO_2-C emission from rice fields with different planting methods at Khumaltar, Lalitpur in 2080/81

Rice growing days during data colle-tion	Air temp (°C)	CO_2-C flux in DSR mg/hr/m²	CO_2-C flux in TPR mg/ hr/m²	Soil Temp. (°C)	Soil pH	Moisture
60 days of seeding (n=3)	24.7	469.37	180.32	DSR=25.06 TPR=24.87	DSR=6.5 TPR=6.1	Saturated
90 days of seeding (n=3)	29.4	830.02	246.62	DSR=24.3 TPR=29.4	DSR=6.03 TPR=5.93	Saturated
120 days of seeding (n=3)	27.4	588.7	448.16	DSR=23.1 TPR=22.26	DSR=6.13 TPR=6.10	Saturated

Source: field data, 2024

3.3 Estimation of CO_2 sequestration by high density apple trees in Manang district

Plant biomass is the major sink of atmospheric carbon dioxide as trees store it for a long period (Brahma et al., 2021). Therefore, plantation plays a crucial role for removing CO_2 from the atmosphere and has an important role in mitigating climate change. Moreover, fruit orchards are not only the source of fruits but also the sink of atmospheric carbon dioxide (Shrestha and Malla 2016). According to the Kyoto Protocol from 1997, every nation on earth is required to help reduce greenhouse gas emissions by either increasing carbon sequestration or reducing emissions. The process of taking carbon dioxide from the atmosphere and storing it in soil, water, or plant biomass is known as carbon sequestration. As Nepal has also contributed to carbon stocking, its national carbon stock has been estimated to be 246 to 393 M t carbon (Gibbs et al 2007). Though the forestry sector has done a quite good job in quantifying carbon sequestration by forest trees, the process is also started in the agriculture sector too.

To estimate the carbon sequestration of Apple trees (Malus domestica) a study was done in Ngisyang and Disang rural municipality of Manang district. Total production of apples in Manang district is 1545 MT from 131 Ha of land. The district ranked 5th position in terms of apple production.

The 1st study site was Agro Manang Private Limited situated at Ngisyang Rural Municipality-1, Bhratang, Manang. The farm introduced the high-density farming technology by planting apple saplings brought by former lawmaker Polden Chhopang Gurung from Italy and Serbia. The farm has grown 70k HDP Apples in 735 ropanies of land. The orchard was established in 2015. It has been growing apple species of gala, golden and Fuji. Plant to plant and row to row distance was observed 3 x 11 feet². Another study site was Sorgadwari Krishi farm located at Disang-1, Pisaang Manang. The farm has grown 3200 HDP Apples in 35 ropanies of land. Plant to plant distance and row to row distance is 1.1*2.3 meter² in the farm. The farm was established in 2071 BS.

The age of the sample Apple tree was 9 and 10 years old. A total of 121 trees were sampled from different farm. To calculate the carbon sequestration the diameter at breast height (DBH) of the plant was measured at 1.3 m above ground level using measuring tape. The plant height was calculated using tangent value of angle (clinometers is used), observer height and its distance from plant. The DBH for the tree is found by taking the square root of the sum of all branches girth squares at breast height explained in Nature Conservation Practice Note No. 02 (Rev. Jun 2006). The above and below-ground tree biomass and carbon sequestered by apple trees were calculated following the procedure described in Timilsina et. Al., 2019. The below-ground biomass was determined by multiplying above ground biomas by 0.26 as a factor as proposed by Cairns et al. (1997). Wood density values (0.83 for apple trees) were compiled from Zanne et al (2009) to calculate biomass of the plant. The carbon stored in angiosperms were calculated multiplying total biomass by 0.521 as a factor as proposed by SERC (2015). The canopy size, height, age of the tree, and girth diameter are the major determinants of sequestered carbon as tree biomass.

Table 3: Carbon Sequestration by Apple trees in Manang district

S. N.	Farm's name and Location	Variety	No. of samples	Tree age (year)	Diameter at breast height (M)	Tree height (M)	Carbon sequestrated (kg/tree)
1	Agro Manang Pvt. Ltd. (Ngisyang-1, Bhratang)	Gala	31	9	0.134	4.4	3.64
2	Agro Manang Pvt. Ltd. (Ngisyang-1, Bhratang)	Fuji	30	9	0.131	4.52	3.43
3	Sorgadwari Krishi farm (Disang-1, Pisaang)	Fuji	30	10	0.176	5.5	7.67
4	Sorgadwari Krishi farm (Disang-1, Pisaang)	Gold-en deli-cious	30	10	0.155	6.71	7.38

Source: Field data, 2024

The highest carbon sequestration (7.67 kg/tree) was observed in the 10 years Fuji apple trees grown at Sorgadwari Krishi farm and lowest carbon sequestration (3.43 kg/tree) was observed in the 9 years fuji apple trees grown at Agro Manang Pvt. Ltd. Similarly, Gala apple trees sequestrated 3.64 kg of carbon per tree and 10 years Golden delicious apple trees sequestrated 7.38 kg of carbon per tree. In general, it seems carbon sequestration is directly proportional to its age and depends on its variety within a species.

3.4 Generation of weather forecast based agro advisory bulletin (AAB)

A total of 52 episodes of the agro-met advisory bulletin have been prepared by an expert team in collaboration with the Department of Hydrology and Meteorology (DHM). The bulletin continued to encompass all 77 districts of Nepal. The seven-day weather forecast was received for Terai, the Hills, and the Mountains in the respective provinces. The problems faced by the farmers were collected from Kisaan Call Centre (KCC) service of the NARC as well as AITC and were provided to the expert team regularly. The expert team used crop and livestock status as well as weather forecast to prepare agro-met advisories which have been disseminated through Google group, television, mobile SMS, web service, email, etc. Through the google group, "NARC Agro-met Services" AAB is disseminated weekly to the emails of MOALD, provincial MOLMACs, PMAMP-PIUs, provincial DOAD and DOLS, AKCs and VHLECs, MUAN, NARMIN, and 753 local levels and their staffs. A sample of the latest agro-met advisory bulletin for FY 2080/81 has been provided in Annex 7.

3.5 Performance study of promising wheat varieties under elevated temperature

Wheat is the third most important crop after rice and maize in Nepal. It is grown under different agroclimatic conditions i.e. Terai, Hills and Mountains. In Nepal, wheat was grown in 716, 978 ha of land with production of 2144568 mt and productivity is 2.99 mt/ha during 2021/22 (MoALD 2023). In Lalitpur district, wheat was grown in 3485 ha area of land with production of 11858 mt and productivity of 3.40 mt/ha during 2021/22 (MoALD 2023). In Nepal, only 28% of the total area is irrigated. Climate change and its consequences have severely affected the productivity of wheat. The elevated temperature could have adverse effects on different growth stages and yield of wheat. Due to genetic make-up, crop varieties respond differently with weather and rising temperature. Therefore, it is necessary to find out the wheat varieties, which perform better in rising temperature. For this, open top chambers were used.

The experiment was conducted during the winter season of 2080 at National Agricultural Environment Research Center, Khumaltar. The experiment was laid out in split plot design with four replications. Two production environments (Open top chamber and open field condition) were tested in main plot and four wheat varieties (WK 3166, WK 3324, Surma and Khumal Shakti) in sub-plot. The seed rate used was 120 kg/ha. Sowing was done continues in line keeping 25 cm distance between rows. The individual plot size was 1 m^2. The crop was fertilized with 150-50- 50 N-P_2O_5-K_2O kg/ha through urea, DAP and muriate of potash, respectively. The full dose of P_2O_5, K_2O and one-third dose of nitrogen were applied at sowing time as basal and the remaining one-third of N top dressed at 25 DAS and one-third at 50 DAS. The experiment was conducted in irrigated condition.

There was significant effect of production environment in days to heading, plant height, spike/m^2, grains/spike, and grain yield. Earlier heading days were observed in open top chamber (104.9 DAS) as compared to open field condition (114.1 DAS). Similarly, it also recorded higher plant height (116.3 cm) as compared to open field condition (105.2 cm). The number of spike/m^2, and number of grains/spikes was also higher in open field condition. Higher grain yield was observed in open field condition (5451 kg/ha) as compared to open top chamber (3926 kg/ha).

In case of variety, significant effect was observed on number of spike/m^2, number of grains/spikes, and grain yield. Among the variety, significantly higher number of spikes was observed with variety WK 3324 (437.9) which was statistically similar with variety WK 3166 (404.3) and Khumal Shakti (393.4). Higher number of grains/spikes was observed with variety WK 3324 (52.38) which also recorded the higher grain yield of 4995 kg/ha. Hence, based on the results obtained from this study, it was concluded that temperature increments inside the open top chamber have not increased the yield of wheat and higher yield was observed in open field condition. Among the varieties, WK 3324 produced significantly higher yield.

Table 4: Growth and yield attributes of wheat under open top chamber and open field condition at NARC, Khumaltar, Lalitpur, Nepal, 2080

Treatments	Heading (DAS)	Plant height (cm)	Spike/ m^2	Grains/ spike	Thousand grain wt. (g)	Grain yield (kg/ ha)
Production environment						
Open Top Chamber	104.9b	116.3a	372.6b	41.94b	49.31a	3926b
Open field	114.1a	105.2b	436.3a	53.00a	50.56a	5451a
SEm ±	0.87	1.23	7.88	1.74	1.61	36.53
LSD (P=0.05)	2.53	3.55	22.74	5.02	4.65	105.4
Variety						
WK 3166	108.1a	110.3a	404.3ab	47.13b	50.50a	4606b
WK 3324	107.6a	114.0a	437.9a	52.38a	52.13a	4995a
Surma	110.4a	108.4a	382.4b	44.75b	48.38a	4546b
Khumal Shakti	111.9a	110.3a	393.4ab	45.63b	48.75a	4607b
SEm ±	1.39	3.12	16.54	1.48	2.73	86.75
LSD (P=0.05)	4.02	9.02	47.72	4.28	7.87	250.2
CV, %	1.80	3.99	5.78	4.43	7.74	2.62
Grand mean	109.50	110.75	404.46	47.46	49.93	4688.34

Means followed by the common letter (s) within a column are non-significantly different based on DMRT at P = 0.05. Figures in the parentheses are original data.

3.6 Sharing adaptation strategies on climate resilient technologies to the farmers of NARC technology village

One day trainings were given to the farmers of NARC Technology Village, Baradi, Tanahu district. Total 35 participants; 29 farmers; 5 scientist and technicians from NAERC and one ward member of the Aanbu-1, Tanahu were participated in the training. The subject matter covered during the trainings were: Climate change and its' effect on Agriculture, Positive and negative impact of climate change, climate adaptation technologies at farm level. CSA technologies of Nepal, CSA technologies in Vegetable production, Vegetable production under plastic tunnel, Pesticide use and their negative impact on human health, Dry Direct Seeded Rice (DSR) system of rice cultivation.

We also visited farmer's field to observe their crops. We discussed with the farmers about their vegetable production and marketing problems and suggested to possible solutions to solve their problems.

Farmers were interested to take training on vegetable production and they were enthusiastic while participating in climate change and adaptation solutions classes. Most of the farmers in Baradi area experienced the negative impacts of climate change on vegetable and agronomical crops. It has also been observed that improper use of pesticides is prevalent in these areas. Farmers were actively participated in trainings to understand the CSA technologies. At the end of the training participated farmers reviewed the training on CSA technologies became very effective meanwhile these CSA technologies will help to cope with the negative impacts of climate change. Similarly, Representative of local government, Ward member Mrs. Ganga BK said this type of training will help to support the farmers in their farming. She also asked for coordination and close contact while running the programs in their locality. In Baradi of Tanahu district, farmers are adopting plastic tunnel and drip irrigation for vegetable farming, since these areas have scarcity of irrigation water, so, this training will help them to gain advance knowledge on CSA technologies. Similarly, DSR system of rice cultivation is very effective in their water scarcity area and to reduce methane emissions and cost of cultivation.

There is need of coordination with local government while running the programs in their locality. Despite of that cooperation from stakeholders were highly appreciable. These trainings will help to gain advance knowledge on CSA technologies to the farmers. Previously our office has given drip irrigation to some of the farmers of Aanbu-1, Tanahu. Now, farmers of the locality demanded the drip irrigation system sets for larger area. Since, majority of farmers lack knowledge on adaptation and mitigation strategies of climate change and this training program have not covered large number of farmers, so, there should be more training programs involving other farmers on Climate change and CSA technologies.

Figure 2: Training to the farmers of NARC technology village

3.7 Potato late blight forecasting model

3.7.1 Verification of potato late blight forecasting model in mid-hill and Terai condition

Weather is one of the major factors to influence incidence of disease and insect in various crops. The appropriate forecasting of diseases and pests could minimize the anticipated losses from their occurrence. Late blight (Phytophthora infestans) of potato is the major disease that leads to complete loss of potato production. This disease is economically important disease-causing substantial yield loss each year in Nepal (Sharma et al 2009) which is highly dependent on the weather parameter prevailing during crop growing period. Late blight develops when humidity is high, and the temperature is about 20°C (Crosier 1934). The loss has been recorded more than 75% in high hills and up to 50-90% in Terai region (Shrestha 2000).

A pest forecasting model expected to develop will help to predict out-break or changes in intensity of pests based on information about weather, crops, and pests. Forecasting helps to notify the favorable or unfavorable weather conditions for potato blight and fruit borer, thereby adapting the control measures in appropriate time. Forecasting model assists the growers for spray schedule and reduces the costs involved by eliminating the unnecessary sprays and labour cost without increasing the risk of losing the crop. Moreover, forecasting is an ecological and economically sound approach like cultural, biological control methods which play an important role in the management of diseases and insect.

The forecasting model for potato late blight experiment was conducted at NAERC, Khumaltar using Indo-blight Cast (IBC) late blight forecasting model. The experiment was conducted in split plot design. In the main plot, there were three varieties of potato viz. Kufri Jyoti, Cardinal and Desire. In sub-plots, there were three spray methods viz. (i) No spray, (ii) Recommended spray i.e. 1st spray Mancozeb at 35 days after planting (DAP), 2nd spray Dimethomorph at 45 DAP, 3rd spray Sectin at 55 DAP, and 4th Spray Dimethomorph at 65 DAP, and (iii) System guided spray (model based). For the application of pesticides, a standard protocol developed by the National Potato Research Program, Khumaltar was followed.

The individual plot size was 7.2 m^2 (3m x 2.4m) and the planting distance was 60 cm row to row, 25 cm plant to plant, hence, there were 4 rows each having 12 plants. The distance between the two plots was 60cm and block to block distance was 1 meter. Fertilizer dose applied was FYM @ 3 ton/ha, and NPK @ 70:50:40 kg/ha. Thus, FYM applied @ 14.4 kg/plot, DAP @ 156 gm/plot, MOP @ 72 gm/plot and Urea @ 35 gm/plot as basal dose while Urea @ 60 gm/plot was top dressed at 40 days after seeding (DAS). Similarly, the first earthing up was done at 40 DAS while second was done at 60 DAS. Two irrigations were provided after these two earthing-up. The date of potato sowing was the 1st Kartik 2080.

Unfortunately, blight did not appear in Khumaltar area during the experimentation. Potato tubers were categorized into three different sizes viz. 0-25gm, 25-50 gm, and >50 gm and total weight of tubers per plot based on these three categories were recorded. Significant effect of varieties on potato tubers size of 0-25 gm was observed, while non-significant effect was observed in other categories of potato tuber size. The highest potato tuber yield was observed from variety Desire (1.85 kg/plot) which was also statistically similar with variety Cardinal (1.48 kg/ plot) from the tuber size of 0-25 gm. In case of spraying system, non-significant effects were observed on all these three categories of potato tuber size. Similarly, the variety and spraying system had a non-significant effect on the total tuber yield of potato.

Table 5: Plant height, yield and yield attributes of potato as influenced by varieties and spray system during 2080

Treatments	**Weight of different categories of potato tuber size (kg/plot)**			**Total yield (kg/ plot)**
	0-25 g	**25-50 g**	**>50 g**	
Varieties				
Kufri Jyoti	1.35b	2.00a	7.16a	10.52a
Desire	1.85a	2.11a	6.15a	10.13a
Cardinal	1.48ab	1.87a	6.26a	9.63a
SEm ±	0.14	0.19	0.88	0.91

Treatments	Weight of different categories of potato tuber size (kg/plot)			Total yield (kg/plot)
	0-25 g	25-50 g	>50 g	
LSD (P=0.05)	0.40	0.56	2.56	2.64
Spraying system				
Symptom based spray	1.55a	1.85a	6.50a	9.91a
No spray	1.64a	2.12a	6.48a	10.26a
System guided spray	1.50a	2.01a	6.60a	10.11a
SEm ±	0.17	0.13	0.68	0.69
LSD (P=0.05)	0.51	0.40	1.99	2.02
CV, %	34.18	20.87	31.53	20.65
Grand mean	1.56	1.99	6.53	10.09

Means followed by the common letter (s) within a column are non-significantly different based on DMRT at P = 0.05.

3.7.2 Training on potato late blight disease forecasting models to NARC scientists and technicians

One day training in the title "Potato late blight disease forecasting models" was conducted at NAERC, Khumaltar in 27th Chaitra, 2080. Out of total 24 participants, 16 were male and 8 were female. Trainees were Scientists and technical officers working in pathology and Horticulture disciplines under NARC. In the interactive training, chief of the NAERC Dr. Dhruba Raj Bhattarai highlighted the importance of the training and impact of climate change in disease outbreak and occurrence.

Common potato disease and disease data recording techniques shared by Mr. Suraj Baidya. Dr. Buddhi Prakash Sharma presented disease forecasting models and potato late blight disease management using a decision support system. At the end, the participants, Mr. Basistha Acharya, said the training is fruitful and this type of training helps to capacitate the scientists and technicians. Mr. Laxman Aryal suggested the training would be more fruitful if modelling was done using real-time field data.

Training Glimpse

Figure 3: Potato late blight training to NARC scientists and technicians

3.8 Consortium for scaling-up climate smart agriculture in South Asia (C-SUCSeS)

The Programme titled "Consortium for Scaling-up Climate Smart Agriculture in South Asia (C-SUCSeS)" is a three-year joint initiative between the South Asian Association for Regional Cooperation (SAARC) Agriculture Centre (SAC), the International Food Policy Research Institute (IFPRI) and the International Fund for Agricultural Development (IFAD). The programme fosters partnership and cooperation between the SAARC, National Agricultural Research and Extension Systems (NARES), IFPRI and other Consultative Group for International Agricultural Research (CGIAR) centres, and SAARC governments on the Climate-Smart Agriculture (CSA) agenda. It is intended to support agricultural researchs' roles to generate and facilitate delivery of technological solutions to smallholders, with a specific priority on the intensification and resilience of smallholder agriculture, contributing inter alia to increasing water management efficiency; and promote innovative, pro-poor approaches and technologies with demonstrated scaling-up potential; strengthen partners' institutional and policy capacities; enhance policy engagement; and generate and share knowledge. The programme promotes bottom-up applied research with active participation of smallholder farmers based on the experience of other participatory research experiences in the region, including the climate smart village concept. This Programme was co-developed by the SAC, the International Food Policy Research Institute (IFPRI) and IFAD in close consultation with the SAARC Member States.

Activities and achievements during the fiscal year:

3.8.1 Participatory research on CSA technologies at farmers field in Parsa, Chitwan, Dhading, Tanahu and Kavrepalanchowk district

The selected technology was validated through participatory research on farmer's field. At this point, Harnari and Kathar (Chitwan district), Bijbania and Parsagadhi (Parsa district), Jugedi (Dhading district), Baradi (Tanahu district) and Thakurichaap (Kavrepalanchok district) are selected for participatory research. The cropping system of Chitwan district was rice-mustard-rice, Parsa district was rice-wheat, Dhading and Tanahu district was highland mixed cropping system. At Chitwan district, AWD (alternate wetting and drying) system of irrigation system was practiced while AWD, DSR and ZT wheat system at Parsa district. In Dhading, Tanahu and Kavrepalanchok district, drip irrigation system was practiced. Similarly, the technology of maize-based intercropping with legumes (soybean) was scaled out in Kavrepalanchok district.

The brief discription of the CSA technologies conducted at different Participatory Research (PR) sites are as follows:

Alternate wetting and drying (AWD) system of rice cultivation in spring rice

The AWD system of rice cultivation was practiced at Harnari and Kathar of Chitwan district and the number of farmers participating were 41 (21 at Harnari and 20 at Kathar) in spring season. The rice variety used was Chaite-5 and the total area of rice cultivation was 3.32 and 3.2 ha in Harnari and Kathar, respectively. The seed rate used was 40 kg/ ha. About 20 days old seedlings were used for transplanting. Pretilachlor 50% EC (pre-emergence herbicide) 500 g a.i./ ha (1000 ml/ha) was applied one day after transplanting. Similarly, Bispyribac sodium 10% SC (Nominee Gold) (post- emergence) @ 25 g a.i./ha (250 ml/ha) was applied 20 days after transplanting. Now, rice crops were just harvested and data are being taken.

Figure 4: AWD system of rice cultivation in spring rice

In AWD, field water tube (pani pipe) having 4 inch in diameter and 30 cm in length was installed in field (3 tube in 1 Kattha of land). The tube consisted of many perforated holes on all side of 20 cm length which was installed inside the soil while 10 cm length of tube was above the soil surface. Irrigation was applied till the water level in tube was 5 cm above the soil surface. When the water level was dropped to about 15 cm below the surface of the soil, irrigation was applied to re-flood the field to a depth of about 5 cm above the soil surface. It was implemented 2 weeks after transplanting of rice whereas in DSR, it was started when the plants were 10 cm tall.

In Harnari, the mean grain yield of rice (21 farmers) under AWD was 4907 kg/ha while it was 4763 kg/ha in Farmers Practice (FP) during 2023. The range of grain yield under AWD was 4110 to 5890 kg/ha while it was 4023 to 5702 kg/ha in FP. Likewise, in Kathar, the mean grain yield of rice (20 farmers) under AWD was 5145 kg/ha while it was 4948 kg/ha in FP during 2023. The range of grain yield under AWD was 3574 to 6628 kg/ha while it was 3407 to 6431 kg/ha in FP.

Zero tillage (ZT) wheat

Zero tillage wheat was practiced in 19 farmers field of Parsa district (15 from Bijbania and 4 from Parsagadhi). The variety used for planting was NL 971 at Bijbania while Bijay was used at Parsagadhi and the total cultivated area was 5.14 ha. Seeding was accomplished using zero-till seed drill. Before seeding, laser land leveller was used for levelling the land. In case of fertilizer, DAP was used through zero-till seed drill while urea and potash was broadcasted manually. For weed management, Metribuzin (70 WP), a post-emergence herbicide, was sprayed mixing 250 gram herbicide in 500 liter of water for 1 hectare of land and it was sprayed 30 days after seeding of wheat.

In ZT wheat, the average length of spike was 9.93 cm, plant height was 88.71 cm, spike per square meter was 176, thousand grain weight was 48.63 gm and grain yield was 4818 kg/ha. In farmers practice, the average length of spike was 10.05, plant height was 87.74, spike per square meter was 173, thousand grain weight was 43.60 and grain yield was 4629 kg/ha.

Figure 5: ZT wheat in farmer's field

Direct Seeded Rice (DSR)

DSR is being practiced in 17 farmers field of Parsa district during the rainy season and the total area was 16.23 ha. Zero-till seed drill was used for seeding. Seed rate used was 45 kg/ha and the rice variety used was Bahuguni-2. In case of fertilizer, DAP was used through zero-till seed drill while urea and potash was broadcasted manually. For control of weeds, Council active herbicide was used at the rate of 222 gm/ha. Now, crops are at maximum tillering stage.

Figure 6: DSR in farmer's field

Drip irrigation

Drip irrigation system of water smart CSA technology was practiced under plastic house of 11 and 20 farmers of Thakurichaap, Kavre district and Baradi, Tanahu, district, respectively. It is the cost- effective method for making the best use of limited available water. A water tank is installed on above the level of field and lateral pipes were laid out. Then planting holes were dug along

Figure 7: Drip irrigation under plastic house

the lateral pipes which were spaced to overlap with the drip holes. These holes are set at every 60 cm along the pipes. FYM and chemical fertilizers were placed in pits and mixed well with the soil and seedlings of tomato were planted in each hole. Irrigation was applied during morning or evening. At Thakurichap, the mean yield of tomato (11 farmers) was 40956 kg/ha and it ranged from 36456 to 45235 kg/ ha. At Baradi, different vegetable crops like tomato, cauliflower, cowpea, bitter gourd and okra was grown under drip irrigation system in 20 farmers field.

Intercropping of maize with soybean

Maize based intercropping is popular in mid hills of Nepal. Soybean is ideal crop for intercropping due to its comparative tolerance for shade and drought. Maize intercropping with soybean was practiced in 15 farmers field of Thakurichaap, Kavre district and the total area was 0.8 ha. The average yield of maize of 15 farmers was 3593 kg/ha and it was ranged from 3166 to 3922 kg/ha. Likewise, the average yield of soybean of 15 farmers was 492 kg/ha and it was ranged from 453 to 524 kg/ha.

Figure 8: Intercropping of maize with soybean

3.8.2 Generation and dissemination of weather forecast based Agro Advisory Bulletin (AAB)

The agro-met advisory bulletin (AAB) was prepared by an expert team in collaboration with the Department of Hydrology and Meteorology (DHM). The bulletin continued to encompass all 77 districts of Nepal. Seven days weather outlook for the seven provinces and special weather alert (if any) was obtained from the Meteorological Forecasting Division (MFD) of the DHM. Similarly, climate information of the past week and seasonal/sub seasonal outlook was obtained from the Climate Analysis Section of the DHM. Crop status was collected from NARC research stations, Agriculture Information and Training Center (AITC) of MoALD, and the MOLMAC/AKC/VHLEC of provincial governments. The problems faced by the farmers were collected from Kisaan Call Centre (KCC) service of the NARC as well as AITC and were provided to the expert team regularly. The expert team used crop and livestock status as well as weather forecast to prepare agro-met advisories which have been disseminated through Google group, television, mobile SMS, web service, email, etc.

3.8.3 Awareness program, stakeholder meeting and technology transfer training to participating farmers about CSA technologies

Awarness program, stakeholder meetings, and technology transfer training were given to stakeholders and participating farmers from the PR sites of Parsa, Chitwan, Tanahu and Kavrepalanchok on CSA technologies. The title of the meeting/training, total number of participants, date and place of are listed as following Table.

Table 6: Awareness program, stakeholder meeting and technology transfer training to farmers on CSA Technology

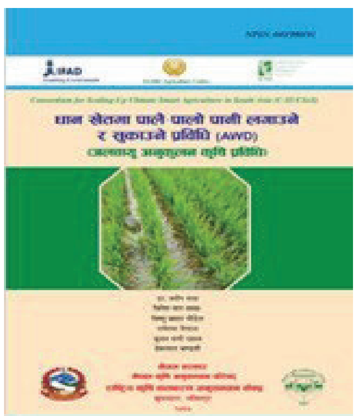
SN	Title of the meeting/ training	Total number of participants	Date and place of the meeting/ training
1	Farmers' Participatory Training on Climate Smart Agriculture Technologies	21	2023-07-10 (2080-03-22); Thakurichaap, Kavre
2	Farmers' participatory training on Climate Smart Agriculture Technologies	25	2023-07-13 (2080-03-25); Baradi, Tanahu
3	Stakeholder meeting on Problems faced by farmers in DSR and their solutions	34	2023-08-15 (2080-04-30); Bijbania, Parsa
4	Stakeholders meeting on Drip irrigation in vegetable crops	29	2023-09-02 (2080-05-16); Baradi, Tanahu
5	5 Training to farmers on Climate Smart Vegetable Production Technology	23	2023-11-29 (2080-08-13); Baradi, Tanahu
6	Training to farmers about Alternate Wetting and Drying (AWD) in spring rice	20	2023-11-30 (2080-08-14); Kathar, Chitwan
7	Technology transfer training to participating farmers about CSA technologies and scaling-up of zero- tillage wheat technology through capacity building of youth farmers	29	2023-12-1 (2080-08-15); Parsagadhi, Parsa
8	Training to farmers about Alternate Wetting and Drying (AWD) in spring rice	21	2023-12-1 (2080-08-15); Harnari, Chitwan
9	Training on Climate Smart Horticulture to Technicians working at Local Government	15	2024-04-03 (2080-12-21), NAERC, Khumaltar
10	Scientist-Journalist interaction program on Climate Smart Agriculture Technology	38	2024-06-04 (2081-02-22); NAERC, Khumaltar
11	Training on Climate Smart Agriculture Technology	22	2024-06-10 (2081-02-28), Harnari, Chitwan
12	Training on Climate Smart Agriculture Technology	21	2024-06-11 (2081-02-29), Kathar, Chitwan

Figure 9: Training on CSA at Harnari, Chitwan

Figure 10: Training on CSA at Kathar, Chitwan

Figure 11: Scientist-Journalist interaction program on Climate Smart Agriculture Technology

3.8.4 Preparation of case studies based on the selected most successful CSA innovations, to prepare study materials for relevant stakeholders



Preparation of case study on DSR is on progress. A booklet on AWD practices in rice (in Nepali language) was published which will be beneficial to farmers.

Monitoring from SAC, IFAD and IFPRI Field monitoring of Participatory Research sites of Parsa and Kavre was accomplished by the team of SAARC Agriculture Center (SAC), IFAD and

IFPRI. Similarly, discussions was made with ED and directors of NARC regarding the implementation of the project.

Figure 12: Field monitoring on PR sites by SAC team

Issues and challenges during the project implementation

The major challenges in scaling up of these CSA technologies through participatory research especially for women and smallholder farmers are lack of knowledge about climate change and CSA technologies. Other constraints are high cost of agricultural inputs and limited access to financial services. Furthermore, participation of rural women in agriculture is high but their participation in decision making process is less in community which also hinder the scaling up of CSA technologies. Similarly, conservation agriculture is a major part of CSA technology, in which use of farm machinery is necessary but due to their higher cost, smallholder farmers cannot purchase it which hinders the scaling up CSA technologies.

The way forward for scaling up of CSA technologies

- ❖ For effective scaling up of CSA technologies through participatroy research for women and smallholder farmers:
- ❖ Capacity building workshops and training programs on CSA technologies, deomonstration, and expousure visit should be initiated for women and smallholder farmers through farmers field school at community level
- ❖ Location specific CSA technology should be included which will increase the adoption percentage
- ❖ For scaling up of CSA technologies in large areas, information and communication technologies (ICTs) can be used to disseminate climate information from agro-advisories and weather forecast services by both public and private sectors.
- ❖ Financing and Insurance scheme can be a better option
- ❖ Support from government on agro inputs

Use of custom hiring services. Generally, in conservation agriculture, there is use of expensive farm machinary which cannot be purchased by smallholder farmers therefore custom hiring services can be promoted to hire farm machinary by smallholder farmers on rent.

3.9 The South Asia Agriculture Adaptation Atlas (ACASA)

Interconnections between Climate Risks, Practices, Technologies, and Policies

South Asian countries are vulnerable to climatic risks, which can have significant negative impacts on their food production systems. Extreme weather events, erratic rainfall patterns, rising temperatures, and changing climate dynamics threaten food production and security, affecting the livelihoods of millions of people. To address these challenges and ensure food security, concerted efforts are urgently needed to identify adaptation solutions and promote regional collaboration. The importance of addressing climate risks and its potential impacts on agriculture was underscored during the High-Level Meeting on “Strengthening AR4D in South Asia” held at the Borlaug Institute for South Asia (BISA) in New Delhi on September 1-2, 2022. The senior management of all countries in the region unanimously emphasized the urgency of taking action to mitigate climate risks and endorsed the need for collective efforts.

To address the urgent challenges posed by climate change on agriculture, the BISA proposed the development of the South Asia Climate Adaptation Atlas for Agriculture. This project is a collaborative endeavor with the National Agricultural Research Systems (NARS) of the region and BISA, supported by seed funding from the Bill and Melinda Gates Foundation, USA. The primary objective of the Atlas is to provide a comprehensive resource with tools for improved investment targeting, strategic priority setting, and informed decision-making in the face of climate risks. The Atlas will benefit various stakeholders including governments, industries, insurance companies, international and national donors, and adaptation-focused entities, who are actively working to address climate-related challenges effectively. This will improve investments in advanced agricultural technologies, climate information services, and effective policies to mitigate the negative impacts of climate change on agriculture.

The project involves collecting and standardizing diverse data pertaining to climate hazards, population exposure, vulnerability assessments, potential impacts on critical agricultural commodities, and evidence of effective climate adaptation practices. Capacity development of key stakeholders, such as researchers, policy planners, industry representatives, and non-governmental organizations (NGOs), is a critical part of the project. By enhancing their understanding and utilization of the Atlas's tools and insights, the project seeks to foster enthusiasm and dedication among stakeholders in proactively addressing and mitigating climate risks in the dynamic and interconnected South Asian region.

The South Asia Climate Adaptation Atlas for Agriculture represents a significant step toward enhancing the resilience of agricultural systems, fortifying food security, and promoting sustainable development across South Asian countries. By consolidating critical data, identifying adaptive pathways, and fostering collaboration among stakeholders, this project exemplifies evidence-based decision-making, ensuring strategic investments to safeguard agricultural systems. Ultimately, the initiative is dedicated to securing the well-being and prosperity of communities, navigating the multifaceted challenges of climate change with scientific acumen.

Project activities

The following activities are carried out to achieve the aforementioned objectives.

- ❖ Organize an inception meeting with NARS experts (partnership, key commodity identification, etc.).
- ❖ Manage database and conduct commodity-specific risk analysis.
- ❖ Conduct a systematic literature review to identify key climatic risks for important agricultural commodities.
- ❖ Identify commodity-specific prioritized adaptation solution.
- ❖ Calculate implementation feasibility and financial support required to implement a prioritized solution.
- ❖ Organize provincial and national-level stakeholder workshops to validate the prioritized adaptation solutions.
- ❖ Support South Asia Atlas and develop a Nepal version of the Atlas.
- ❖ Host the country version of the Atlas on the NARC/NATIC data center or Government data center and be responsible for its maintenance and update.
- ❖ Map climate change adaptation-related past and present projects in Nepal.
- ❖ Map climate change adaptation-related past and present projects in Nepal.
- ❖ Develop at least two use cases with the government, private sector, or others where the results of the Atlas are used to support the prioritization/ planning and implementation of climate adaptation investments.

Project team

In order to implement and achieve the project goal and run activities NARC headquarter assigned roles to scientists and technical officers with different expertise (Table-1). The project implementation team constitute of following scientists and technical officers from different research center of NARC.

Table 7: ACASA Nepal team member details and responsibility

High level coordination team				
Name	**Designation**	**Office**	**Expertise**	**Responsibility**
Dr. Dhruva Raj Bhattarai	Executive Director	NARC Head quarter	Horticulture	Overall management and direction
Dr. Luma Nidhi Panday	Director, Planning and Coordination	NARC Head quarter	Animal nutrition	Planning and monitoring
Dr. Tek Prasad Gotame	Chief, Planning and Coordination	NARC Head quarter	Horticulture	Planning/Action preparation
Dr. Amar Pun	Chief and senior scientist	NHRC-NARC, Khumaltar	Horticulture	Previous project leader and advisor
Project execution team				
Dr. Roshan Babu Ojha	Scientist	NSSRC-NARC	Soil Science	Focal person, overall coordination
Dr. Bibek Sapkota	Scientist	M&E, NARC HQ	Socioeco-nomics	Econometric and heuristic modelling
Dr. Rupa Bastola	Scientist	NANRC-NARC, Khumaltar	Livestock management	Livestock sector data collection and analysis
Dr. Sunita Sanjyal	Scientist	NPLRC-NARC, Khumaltar	Pasture and forage management	Blogs, newsletter, livestock sector analysis
Mr. Rameshwar Rimal	Technical officer	NAERC-NARC, Khumaltar	Agrometeo-rology	Planning activities and crop modelling
Mr. Pankaj Gyawaly	Senior Technical Officer	CHD, NARC HQA	Agronomy	Systematic Literature review
Mr. Pradip Karki	IT Officer	NATIS, NARC	Information technology	Vizualization
Supporting team				
Name	**Designation**	**Office**	**Expertise**	**Responsibility**
Mr. Pradip Shah	Scientist	NAERC-NARC	Agronomy	Supporting Crop modelling
Mr. Hemlal Bhandari	Technical officer	NAERC-NARC	Socioeco-nomics	Supporting heuristic modelling
Dr. Uddav Paneru	Scientist	NCRP-NARC	Animal breeding	Support Crop modelling
Mr. Prem Timilsina	Scientist	NFRP-NARC	Fisheries	Support fisheries related work

Deliverables details and progress

During the year 2023, we made significant progress on some of the deliverables and partially achieved others (Table 2). The reasons for the partial achievement were a revised plan and some technical and managerial challenges, such as a change in leadership role. However, we accomplished the critical deliverables within the deadlines. The details of the deliverables progress are presented in Annex 1.

Table 8: Summary of deliverables progress of Nepal ACASA project for 2023/24

Milestone	Means of verification	Progress	Achieve-ment
Project concept note developed in consultation with BISA.	Signed project document in PDF format	Project document was signed on 9 July 2023.	100%
Organize inception meeting with NARS experts.	National level workshop with experts	• National workshop conducted on 19-20 July 2023 • Workshop report prepared	100%
Partnerships developed with end users such as National Planning Commission and other stakeholders.	Narratives of support received either in email or letter in PDF format	• Three meetings were conducted with NPC. • Two meetings conducted with MoALD. • Agreement draft under revision with DHM.	80%
Conduct a systematic risk analysis following IPCC methodology for at least 10 commodities (crops, livestock and fisheries) of interest in the country using local, granular, measured data.	A report and database/ maps on commodity-specific climatic risk analysis in PDF format	• Two meetings were conducted. • Data was retrieved from national repository. • Data entry completed. • Data validation and visualization is going on. • Final clean data of 12 commodities of crop and livestock submitted to BISA.	100%
Contribute to the development of a regional database based on the above literature review and a meta-analysis identifyingthe key identify key climatic risks for important agricultural commodities (crops, livestock and fisheries), their relation with likely impacts of current and future climatic risks and possible adaptation solutions.	Database of published literature and analysis in a standardized, mutually agreed structure in PDF format	• One meeting conducted with BISA. • The reporting structure for systematic literature review and meta-analysis has not finalized yet for regional level. • BISA planned to conduct systematic literature review workshop • We are developing reporting structure for Nepal • 254 literatures from Nepal collected relating to adaptation solution	100%

Milestone	Means of verification	Progress	Achieve-ment
Publish at least 2 blogs, 2 newspaper items and digital mass media stories.	Blogs and news articles published in national and international media	• One blog published in NARC newsletter shared with BISA • One draft blog is prepared • News coverage of inception meeting, annual meeting broadcasted in national television. • National focal point gave a detailed interview about ACASA in a national radio broadcasting network	100%
Use district-level data etc. to identify statistical/ econometric relationships between specific climatic risks, impacts and adaptation solutions by commodity and agro-ecological region	A research report and paper linking climatic risks with gendered impacts and location specific adaptation solutions using statistical/ econometric models in PDF format	• SOP prepared for heuristic- model based decision tree analysis of adaptation options. • The framework for econometric analysis was prepared in the annual review meeting	100%
Organize region specific workshops of relevant and important stakeholders to validate the results and fine-tune prioritized adaptation solutions.		• Livestock workshop conducted and identified the Hazards, Exposure, and Vulnerability indicators for three Eco belts of Nepal. • Suitability, adoption barriers and feasibility related to adaptation options assessed • 35 Livestock experts of buffalo, cattle, goat and sheep participated. • Crop specific workshop planned for 2024. • Validation workshop conducted.	

The first year of project implementation (Year 2024) was satisfactory in achieving the project output. This year surpassed with lots of management leadership changes and uncertainty with the working modality. The ACASA annual review and planning meeting provided robust planning for year 2025. In collaboration with the BISA team and South Asian team, Nepal will achieve its target and meet the deadlines for 2025.

Project Glimpse

Figure 13: ACASA Inception meeting participation

Figure 14: Stakeholder engagement during inception meeting

Figure 15: Livestock workshop stakeholder engagement and group photo

Figure 16: Validation workshop stakeholder engagement

4. TECHNOLOGY TRANSFER AND SERVICES

Services

Information regarding climate change and climate smart agriculture technologies was provided to various concern stakeholders.

Publications

Annual report for the fiscal year 2079/80 was published and distributed to several institutions. (Annex 5).

Information through media

Various interviews related to climate change and its impact on Nepalese agriculture were broadcasted/published on various media. E-copies of the weekly agro- meteorological advisory bulletin were published and distributed to the concerned through mails and other media (Annex 7).

5. VISITS

The Center was visited by students from Tribhuvan University, Agriculture and Forestry University, Purbanchal university, Pokhara university, CTEVT and personnel from NGOs, INGOs, GOs regarding meteorological and climate change information.

6. OTHER ACTIVITIES

Participation in different training and workshops by different personals from the centre is given in Annex 6.

7. BUDGET AND EXPENDITURE

The total annual budget and expenditure of the centre for regular projects are provided in detail in Annex 8. The budget and expenditure of special projects (C-SUCSeS and ACASA) is given in Annex 9. Revenue generated from various activities and arrear (beruju) status of the centre is provided in Annex 10 and Annex 11, respectively.

8. KEY PROBLEMS

Insufficient technical human resources to represent different disciplines.

9. WAY FORWARD

Expansion of climate change related research activities to other researchstations.

Establishment of Environment Unit in each Agricultural Research Directorate and commodity program of NARC.

Strengthening human resources and laboratory facilities to conduct climate change related research work in NARC system.

Coordination with different organizations to provide agro-met advisory based on weather forecasting for agriculture use.

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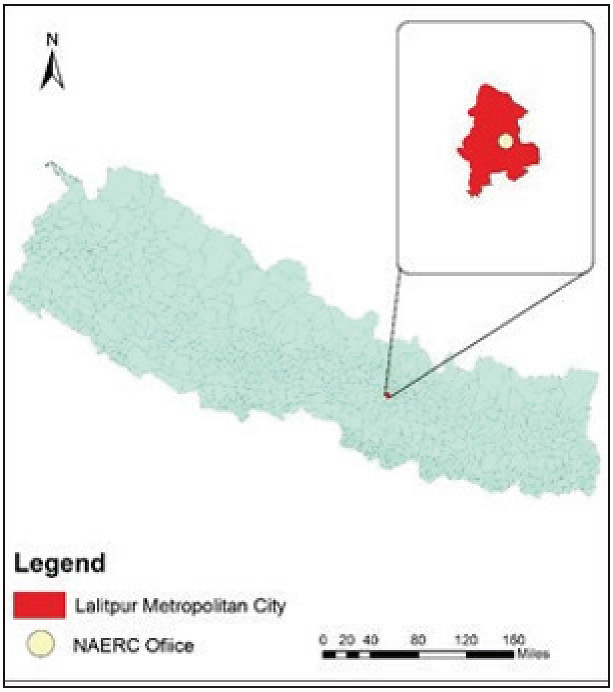
ANNEXES

Annex 1: Monthly meteorological data of Khumaltar, Lalitpur during 2080/81 (2023/24)

Month/Year	Mean Temperature (^oC)		Total rainfall (mm)	Rainy days
	Maximum	Minimum		
July 2022	28.72	21.19	221.1	25
August 2022	27.69	21.05	281.1	18
September 2022	29.57	20.42	77.4	14
October 2022	26.34	14.62	118.7	7
November 2022	23.86	9.39	0.0	0
December 2022	20.21	5.81	0.0	0
January 2023	18.68	3.10	0.0	0
February 2023	20.30	4.56	13.9	2
March 2023	23.45	9.78	44.3	10
April 2023	19.05	12.83	2.3	1
May 2023	29.32	17.22	0.0	15
June 2023	30.93	21.06	0.0	13
Mean/Total	24.84	13.42	758.8	105

Annex 2: Location of office in NAHRC facility, Khumaltar



Annex 3: Human Resources in NAERC during 2080/81

SN.	Name	Designation	Qualifi-cation	Specialization	Remarks
1	Mr. Amar Bahadur Pun Magar	Chief and Senior Scientist (S-4)	M.Sc. Ag	Horticulture	Till 2080/08/11
2	Mr. Binesh Man Sakha	Chief and Senior Scientist (S-4)	M.Sc. Ag	Horticulture	2080/08/04 to 2080/11/29
3	Dr. Dhruba Raj Bhattarai	Chief and Senior Scientist (S-4)	PhD	Horticulture	Since 2080/11/29
4	Mr. Bishnu Prasad Paudel	Senior Scientist (S-3)	M.Sc. Ag	Soil Science	Till 2081/02/06
5	Dr. Pradeep Shah	Scientist (S-2)	PhD	Agronomy	
6	Dr. Roshan Babu Ojha	Scientist (S-2)	PhD	Soil Science	Since 2080/11/09
7	Mr. Alok Sharma	Technical Officer (T-6)	M.Sc. Ag	Pasture and Agroforestry	Till 2080/06/06
8	Mr. Kumar Mani Dahal	Technical Officer (T-6)	M.Sc. Ag	Horticulture	Since 2080/08/25
9	Mr. Rameshwar Rimal	Technical Officer (T-6)	M.Sc. Meteo-rology	Agrometeorol-ogy	
10	Mr. Ram Kumar Rai	Admin. Officer (A-6)		Administration	Till 2081/01/13
11	Ms. Chandra Kala Silwal	Admin. Officer (A-6)		Administration	
12	Mr. Krishna Prasad Pokhrel	Account Officer (A-6)		Account	Till 2080/10/10
13	Ms. Sushma Ojha Aryal	Account Officer (A-6)		Account	Since 2080/10/10
14	Mr. Hem Lal Bhandari	Technician Officer (T-6)	M.Sc. Ag	Agri. economics	Since 2080/06/24
15	Mr. Raj Kumar Chalise	L. V. Driver (Level V)	Literate		
16	Mrs. Reena Maharjan	Technician (T-1, Level II)	Literate		

Annex 4: Summary of progress of NAERC research projects and activities in 2080/81 (2023/24)

Project code no.	Name of project/ activity	Project/ Activity Leader	End Year	Major progress/achievements
1	**Farm management and Research Support Project**	**Dhruba Raj Bhattarai**		
Activity 1	Admin support and management	Dhruba Raj Bhattarai		All research supports made available as per requirements
Activity 2	Office and farm security	Dhruba Raj Bhattarai		Office and farm security well maintained
Activity 3	Farm Beautification	Dhruba Raj Bhattarai		Farm beautification well maintained

Project code no.	Name of project/ activity	Project/ Activity Leader	End Year	Major progress/achievements
Activity 4	Office level proposal seminar			One day office level seminar conducted, and project proposals prepared
Activity 5	Participation in different training and workshop			Participated in different trainings and workshops
Activity 6	Sharing adaptation strategies on climate resilient technologies to the farmers of NARC technology village			Trainings on CSA technologies and adaptation strategies were conducted on NARC technology village
Activity 7	Annual Report and other publication			100 copies of the annual report was published
224	**Assessing vulnerability of Climate Variability/ Change in Agriculture**	**Dhruba Raj Bhattarai**		
Activity 1	Collection, Processing and dissemination of met data of various locations of Nepal	Rameshwar Rimal		Data collected and provided to the scientists and technical staffs of the NARC stations as per their request.
Activity 2	Monitor and estimate of carbon emission from DSR and transplanted rice NAgRC, Khumaltar			Data were taken and analyzed on CO2 -C emissions from rice fields with different planting methods; transplanting rice (TR) and direct seeded rice (DSR). Soil temperature, pH and moisture were recorded in the study.
Activity 3	Monitor estimate carbon sequestration by apple trees of Manang district	Bishnu Paudel, Hemlal Bhandari		Carbon sequestration of high-density apple trees was measured from the different farms of Manang district of Nepal. A total of 100 apple trees were sampled from different farms. The carbon sequestration by apple trees (ton/ tree) was found based on diameter and the age of the trees.
Activity 4	Generation of weather forecast based weekly Agro Advisory Bulletin (AAB)			52 issues of weekly AAB were prepared and disseminated through Google group, television, mobile SMS, web service, email, etc. The AABs were sent to the emails of MOALD, provincial MOLMACs, PMAMP- PIUs, provincial DOAD and DOLS, AKCs and VHLECs, MUAN, NARMIN, and 753 local levels and their staffs.

Project code no.	Name of project/ activity	Project/ Activity Leader	End Year	Major progress/achievements
Activity 5	Performance studyof promising wheat varieties under elevated temperature	Pradeep Shah, Hemlal Bhandari		Four tomato genotypes (HRDTOM, AVTO 1705, AVTO 0922, and AVTO 1422) were evaluated in open top chamber (OTC) and open field condition.
713	**Development of Forecasting Model for Potato Leaf Blight and Fruit Borer in Nepal**	**Dhruba Raj Bhattarai**	2082	
Activity 1	Verification of potato late blight forecasting model in mid-hill andTerai condition	Ram Bahadur Khadka/ Birendra Bahadur Rana		In Khumaltar, very few fruit borer adults were recorded. In summer season potatoes, no prevalence of late blight recorded. No late blight appeared in late season potato.
Activity 2	Collection of weather parameters	Rameshwar Rimal		Weather data collected from DHM stations installed at NARC stations and used to run model.
Activity 3	Training on application of late blight forecasting model	Ram Bahadur Khadka		Training on application of late blight forecasting model was organized for the 20 pathologists working at NARC stations

Annex 5: Publications in 2080/81 (2023/24)

S.N.	Title of publication	Type	Language	Author	No. of copies
1.	Annual Report 2079/80 (2022/23). National Agricultural Environment Research Centre, Khumaltar, Lalitpur, Nepal	Report	English	National Agricultural Environment Research Centre, Khumaltar	100
2.	Climate-Smart Agriculture Technologies and Practices in Nepal	Booklet	English	SAARC Agriculture Centre	

Annex 6: Training/workshop/seminar attended by staff in 2080/81 (2023/24)

S. N.	Name of staff	Position	Name of Training/ seminar/ workshop	Duration	Place/ Country	Organizer
1	Mr. Amar Bahadur Pun	Chief, Senior Scientist (S4)	Policy Roundtable Meeting	27-29 October, 2023	Kandy, Sri Lanka	SAARC Agriculture Centre (SAC)
2	Dr. Dhruba Raj Bhattarai	Chief	Training workshop on modules of climate smart agriculture technologies in South Asia	22-24 April, 2024	Gazipur, Bangladesh	IFPRI-SAR and Bangladesh Agricultural Research Institute
3	Dr. Dhruba Raj Bhattarai	Chief	International Conference on Polymertec 24	19-20 June, 2024	Merseburg, Germany	Institute of Polymer Materials
4	Pradeep Shah	Scientist (S2)	Climate Smart Agriculture in South Asia: Technologies, Policies, and Digital Tools	July 24-29, 2023 (Shrawan 8-13, 2080)	Varanasi, India	SAARC Agriculture Centre (SAC)
5	Pradeep Shah	Scientist (S2)	Training workshop on modules of climate smart agriculture technologies in South Asia	22-24 April, 2024	Gazipur, Bangladesh	IFPRI-SAR and Bangladesh Agricultural Research Institute
6	Dr. Roshan Babu Ojha	Scientist (S2)	ACASA Spatial Crop Modelling Workshop	(16-18 January 2024) 2-4 Magh 2080	Colombo, Sri Lanka	Borlaug Institute for South Asia (BISA)
7	Rameshwar Rimal	Technical officer (T6)	2nd Regional Workshop of CARE Componant 1	(28-30 November 2023) 12-14 Mangsir, 2080	Bangkok, Thailand	Regional Integrated Multi-Hazard Early Warning System (RIMES)
8	Rameshwar Rimal	Technical officer (T6)	ACASA Spatial Crop Modelling Workshop	(16-18 January 2024) 2-4 Magh, 2080	Colombo, Sri Lanka	Borlaug Institute for South Asia (BISA)

Annex 7: Agro-met advisory bulletin

कृषि-मौसम सल्लाह बुलेटिन

[Agro-met Advisory Bulletin (AAB)]

नेपाल कृषि अनुसन्धान परिषद्, राष्ट्रिय कृषि वातावरण अनुसन्धान केन्द्रद्वारा
जल तथा मौसम विज्ञान विभागसँगको सहकार्यमा जारी

वर्ष-१०, अंक-२७ अवधिः २-८ कात्तिक, २०८१ २ कात्तिक, २०८१

मौसमी सारांशः

- गत साता देशको थोरै केन्द्रहरुमा हल्का देखि भारी वर्षा मापन गरिएको छ भने सबैभन्दा बढी कोशी प्रदेशको सोलुखुम्बु जिल्लामा रहेको चैनपुर केन्द्रमा १००.१ मि.मि. साप्ताहिक कुल वर्षा मापन भएको छ। तराईका सबै स्थानहरुमा ३० डि.से. भन्दा बढी साप्ताहिक औसत अधिकतम तापक्रम मापन गरिएको छ भने मधेश प्रदेशको धनुषा जिल्लामा रहेको जनकपुर एयरपोर्ट केन्द्रमा सबैभन्दा बढी ३५ डि.से. साप्ताहिक औसत अधिकतम तापक्रम मापन गरिएको छ। कर्णाली प्रदेशको जुम्ला जिल्लामा रहेको जुम्ला एयरपोर्ट केन्द्रमा सबैभन्दा कम ३.७ डि.से. साप्ताहिक औसत न्यूनतम तापक्रम मापन भएको छ।
- देशभर पश्चिमी वायुको प्रभाव रहनुका साथै कोशी, बागमती र गण्डकी प्रदेशका पहाडी भू-भागमा स्थानीय वायुको पनि केही प्रभाव रहने सम्भावना छ।
- देशको पहाडी तथा हिमाली भू-भागमा साताको शुरु र मध्यमा आंशिक देखि साधारणतया बदली तथा अन्त्यमा आंशिक बदली देखि मुख्यतया सफा रहने सम्भावना छ।
- कोशी, बागमती र गण्डकी प्रदेशका पहाडी भू-भागमा साताको शुरू र मध्यमा थोरै स्थानहरूमा तथा साताको अन्त्यमा एक-दुई स्थानमा हल्का देखि मध्यम वर्षाको सम्भावना छ।
- मधेश, लुम्बिनी, कर्णाली र सुदूरपश्चिम प्रदेशमा साताको मध्यमा एक-दुई स्थानमा हल्का वर्षाको सम्भावना छ।
- देशभर अधिकतम तापक्रम साताको अन्त्यमा हल्का बढ्ने र न्यूनतम तापक्रममा उल्लेखनीय परिवर्तन नहुने सम्भावना छ।

कृषि सारांश

- कम्बाईन हार्भेष्टरले धान काट्दा खेतमा छोडेको पराल जलाउँदा खेत र वातावरणमा प्रतिकुल प्रभाव पार्ने तथा पशु आहारामा समेत असर पार्ने हुँदा बेलर मेसिन अथवा अन्य विधिहरु बाट पराल जम्मा गर्नुहोस्।
- धानको बीउ छनोटको लागि एकनासले पाकेका, रोग नलागेका पुष्ट बाला संकलन गरेर चुटानी गरी राम्रोसँग घाममा सुकाएर भण्डारण गर्नुहोस्।
- बीउ भण्डारणको लागि सुपर ब्यागको प्रयोग गर्नुहोस्। सुपर ब्याग उपलब्ध नभएको अवस्थामा हावा नछिर्ने भाँडो (मेटल बीन, घ्याम्पो, भकारी, आदी) मा राखी बीउ भण्डारण गर्नुहोस्।
- उच्चपहाडको लागि सिफारिस गरिएका गहुँका जातहरु- पासाङ्ल्हामु, डब्लु.के. १२०४, डाँफे, स्वर्गद्वारी, मुनाल, च्याखुरा, हिमगंगा र भेरीगंगा मध्ये उपलब्ध जातको गुणस्तरिय बीउ ६.० के.जी. प्रति रोपनीको दरले उपचार गरी छर्नुहोस्।
- मध्यपहाडका लागि गहुँबालीको सिन्दुरे रोग अवरोधी बीउहरु: स्वर्गद्वारी, मुनाल, च्याखुरा तथा तराईका लागि बाणगंगा, बि.एल. ४३४१, एन.एल. ९७१, आदित्य जातका बीउ उपचार गरी छर्नुहोस्।
- मध्य पहाड देखि उच्च पहाडको लागि सिफारिस गरीएका तोरीको जात; लुम्ले -१, मध्य पहाडको लागि प्रगति र सुर्खेत स्थानिय तोरी -३, बेंसीको लागि उन्नति र प्रिती, तराई र भित्री मधेशको लागि विकास, प्रगति, उन्नति, प्रिती, मोरङ् तोरी-२, सुर्खेत स्थानिय तोरी -३ तथा नवलपुर स्थानिय-४ मध्ये उपलब्ध जात ०.५ के. जी. प्रति रोपनी वा ०.३४ के.जी. प्रति कट्टा बीउका दरले बीउ उपचार गरी छर्नुहोस्।
- पहाडको लागि सिफारिस मुसुरोका जातहरु: शिशिर, सिमल, शिखर, शितल, महेश्वर भारती, सगुन, खजुरा मुसुरो ३ मध्ये उपलब्ध जातको गुणस्तरिय बीउ २ के.जी. प्रति रोपनीका दरले बीउ उपचार गरी छर्नुहोस्।
- तराई, भित्री-मधेश तथा बेंशीमा आलुको खुमल सेतो-३, खुमल उपहार, खुमल उज्वल, खुमल लक्ष्मी, खुमल रातो २, आईपिवाई ८, कुफ्रि सिन्दुरी, डेजिरे, कार्डिनल मध्ये उपलब्ध जातहरूको टुसाएको बीउ रोप्नुहोस्। जग्गा तयारीको बेलामा ७५० के.जी. कम्पोष्ट, ७.३ के.जी. डि.ए.पी., १.५ के.जी. युरिया र ३.३ के.जी. एम.ओ.पी. प्रति कठ्ठाका दरले माटोमा मिलाउनुहोस्।
- बाखामा मोओला लागेमा ५% पोभीडन आयोडिन वा १% कपर सल्फेट वा २% बोरिक एसिडको झोल वा १% पोटासको घोलले मुख सफा गर्नुहोस्।
- मध्यपहाड र तराईमा हिउँदे घाँसहरु- बर्सिम, जै, भेच, केराउ आदि लगाउन शुरु गर्नुहोस्।
- मौसम सम्वन्धी जिज्ञासाको लागी पैसा नलाग्ने चौविसै घण्टा उपलब्ध जल तथा मौसम विज्ञान विभागको फोन नम्बर-११५५ मा फोन गर्नुहोस्।
- कृषि र पशु सम्वन्धी जिज्ञासाको लागी पैसा नलाग्ने नार्कको फोन नम्बर-११३५ मा हरेक सोमबार साँझ ५ देखि ७ बजेसम्म फोन गर्नुहोस्।
- कृषि-मौसम सल्लाह बुलेटिन रेडियो नेपालबाट प्रत्येक शनिबार बेलुका ६:२५ देखि ६:३५ बजेसम्म साथै नेपाल टेलिभिजनको NTV NEWS Channel बाट प्रत्येक शनिबार बेलुका ८ बजेको समाचारपछि प्रसारण हुने गर्दछ।

Annex 8: Regular Annual Budget and Expenditure Record of F.Y. 2080/81 (2023/24)

Rs. in '000

Budget Code		Approved Annual Budget	Released Budget	Expenses	Balance
Budget Sub-Heading No.: 312411014 Capital Expenses					
31114	Land Development Work	500	500	498.33	1.67
31122	Machinery and Equipment	216	216	213	3.00
		716	**716**	**711.33**	**4.67**
Budget Sub-Heading No.: 312411013 Recurrent Expenses					
21111	Staff Salary	7574	7290.39	7290.39	283.61
21121	Uniform Expenses	100	100	100	0.00
21132	Dearness allowances	240	230.6	230.6	9.40
21124	Staff Meeting allowances	624	623.8	623.8	0.20
21213	Contribution-based Insurance Fund Expenses	48	46.4	46.4	1.60
22111	Electricity and Water Supply Expenses	196	194.63	194.63	1.37
22112	Communication Expenses	120	119.99	119.99	0.01
22212	Fuel (Office Uses)	691	687.68	687.68	3.32
22213	Vehicle Repair and Maintenance	334	333.20	333.20	0.80
22214	Insurance and Renewal Expenses	92	62.78	62.78	29.22
22221	Repair and Maintenance of Machinery and Equipment	184	183.86	183.86	0.14
22231	Repair and Maintenance Expenses of the Con- structed Public Assets	0.00	0.00	0.00	0.00
22291	Operation and Maintenance of Other Assets	544	64	64	480.00
22311	Stationery and Office Expenses	224	223.89	223.89	0.11
22313	Books and Materials Expenses	0.00	0.00	0.00	0.00
22314	Fuel for Other Use	17	17	17	0.00
22315	Newspaper, Printing and Notice Publication Expenses	38	38.00	38.00	0.00
22413	Contract Service	612	272.84	272.84	339.16
22512	Skill Development, Public Awareness Training and Workshop Expenses	390	193.59	193.59	196.41
22521	Farm Supplies and Service Cost	1644	1642.50	1642.50	1.50
22522	Program Expenses	0.00	0.00	0.00	0.00
22611	Monitoring Evaluation Expenses	163	162.81	162.81	0.19
22612	Travel Expenses	932	930.99	930.99	1.01
22711	Miscellaneous Expenses	276	275.98	275.98	0.02
28143	Vehicle and Machinery Equipment Rent	85	84.99	84.99	0.01
	Total	**15128**	**13779.93**	**13779.93**	**1348.07**
	Grand Total	**15844**	**14495.9**	**14491.27**	**1352.7**

Annex 9: Special Project Annual Budget and Expenditure Record of F.Y. 2080/81 (2023/24)
Rs. in '000

Project	Fund Source	Project Period	Annual Budget	Expenses	Bal-ance
C-SUCSeS	SAARC Agriculture Centre (SAC)	2021-2024	3627.00	3191.28	435.72
ACASA	Borlaug Institute for South Asia (BISA)	2023-2025	8011.08	5249.45	2761.30
	Total		**11638.08**	**8440.73**	**3197.35**

Annex 10: Revenue Status of F.Y. 2080/81 (2023/24) (In Nepalese Rupees)

Source	Total (Rs.)	Remarks
Crop and Horticulture Research	7360.00	7360.00
Administrative income Research Materials		
Total	7360.00	7360.00

Annex 11: Beruju status in 2080/81 (2023/24) (In Nepalese Rupees)

Beruju	Amount	Remarks
Beruju till last year	76800.00	Submitted to the office of Auditor General for the clearance and waiting for the response
Beruju cleared this FY	0.00	
Remaining Beruju	76800.00	

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