CLIMATE RESILIENT AGRICULTURE (CRA) ADVISORIES AND CLIMATE INFORMATION SYSTEM (CIS)

2024

ASIAN DEVELOPMENT BANK

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2024

Prepared by TRTA Consultant under

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Executive Summary

This report, provides a comprehensive analysis and strategic recommendations for enhancing the Climate Information System (CIS) to support climate-resilient agriculture in the Philippines. The report assesses the current dissemination and utilization of CIS across various regional offices, highlighting significant gaps in the timing, accuracy, and technical depth of the information provided. It offers tailored recommendations for managing priority crops and livestock based on prevailing weather conditions and identified climate hazards. A major proposal includes the development of a web-based, centralized CIS, aimed at streamlining and improving the delivery of climate information to make it more accessible and relevant to farmers' needs. The report underscores the need for upgrading technical capabilities, refining communication strategies, and ensuring that climate advisories are more directly aligned with regional climatic challenges to enhance decision-making at the farm level. The overall goal is to enhance the resilience of agricultural practices in the Philippines, thereby supporting both food security and economic stability in the face of climate change.

Overview of Report Content:

- Introduction: Contextualizes the significance of climate-resilient agriculture (CRA) in addressing climate variability and its impact on agricultural productivity.
- Output 1: Examines the current state of CIS dissemination and utilization, with observations and recommendations for enhancing its effectiveness.
- Output 2: Provides detailed CRA recommendations for various crops and livestock, supported by a summary of relevant technologies and adaptations for different climate hazards.
- Development of Web-Based CIS: Details the technical specifications, functional requirements, and the expected benefits of transitioning to a web-based CIS, aiming to improve the accessibility and relevance of climate information for the agricultural sector.

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Introduction

Climate change threatens agricultural production, and Greenhouse gas (GHG) emissions from agricultural activities exacerbates climate change. Solving food security has become a major challenge, hence, promotion and support to climate-resilient agriculture (CRA) is critical to address or slow climate change at the same time helpful to improve agricultural productivity and minimize losses.[1]

Climate-resilient agriculture (CRA) is an approach that includes sustainably using existing natural resources through crop and livestock production systems to achieve long-term higher productivity and farm incomes under climate variabilities.[2]

Experts on climate change, agriculture and other relevant fields in the Philippines came together to identify climate-resilient agriculture (CRA) technologies and practices that farmers can adopt into their fields. These CRA interventions were selected based on their relevance to the different agro-ecological systems in the Philippines. The technologies and practices were ranked to determine those that the country can prioritize for implementation. The key criterion for prioritization was the intervention's potential to improve agricultural productivity, increase climate resilience, and reduce greenhouse gas emissions.[4]

Output 1. Assessment on the current Climate Information System (CIS) dissemination and extent of utilization

The Climate Resilient Agriculture Office (CRAO) of the Department of Agriculture have developed climate information tools (CITs) that aims to help and guide farmers manage their crops, livestock and aquacultures better under different rainfall conditions. Giving information this way could help farmers increase their chances of boosting productivity and avoiding post-harvest losses.

At present, DA have the 10-day weather outlook and advisories. All DA regional offices provide climate information through their AMIA Regional Facebook pages. As climate is inherently variable and unpredictable, robust solutions that provide resilience across a range of climate scenarios are needed. Climate information in a decision-ready format can improve decision-making and thus achieve tangible development in the agriculture and fisheries sector.

Methodology

This study was done in consultation with selected DA Regional offices implementing the AMIA Program. Considerable desk work was initiated to gather information on the process of disseminating climate information in the regions as well as to determine the types of climate information service delivered to target communities. Similarly, coordination was done with Region 5, UPLBFI, and the Climate Resilient Agriculture Office (CRAO) for the ACAP report as a basis for the weather outlook. Review of documents on the communication plan of CRAO on CIS was initiated to come up with a proposed communication/advocacy strategy for CIS in the region. Meetings with CIS Team, UPLBFI was done through Zoom to strategize ways how to address challenges.

Climate Information Dissemination via Regional AMIA Facebook Pages

Based on the data gathered from the Regional AMIA Facebook pages for the period January to October 2023, it was found out that climate information is disseminated through Facebook posts at an average frequency of 4.5 times per month across regions. The types of climate information disseminated include 10-day farm weather outlook, regional/provincial seasonal outlook and advisories, tropical cyclone advisories, heavy rainfall warnings, and special farm weather outlook and advisories.

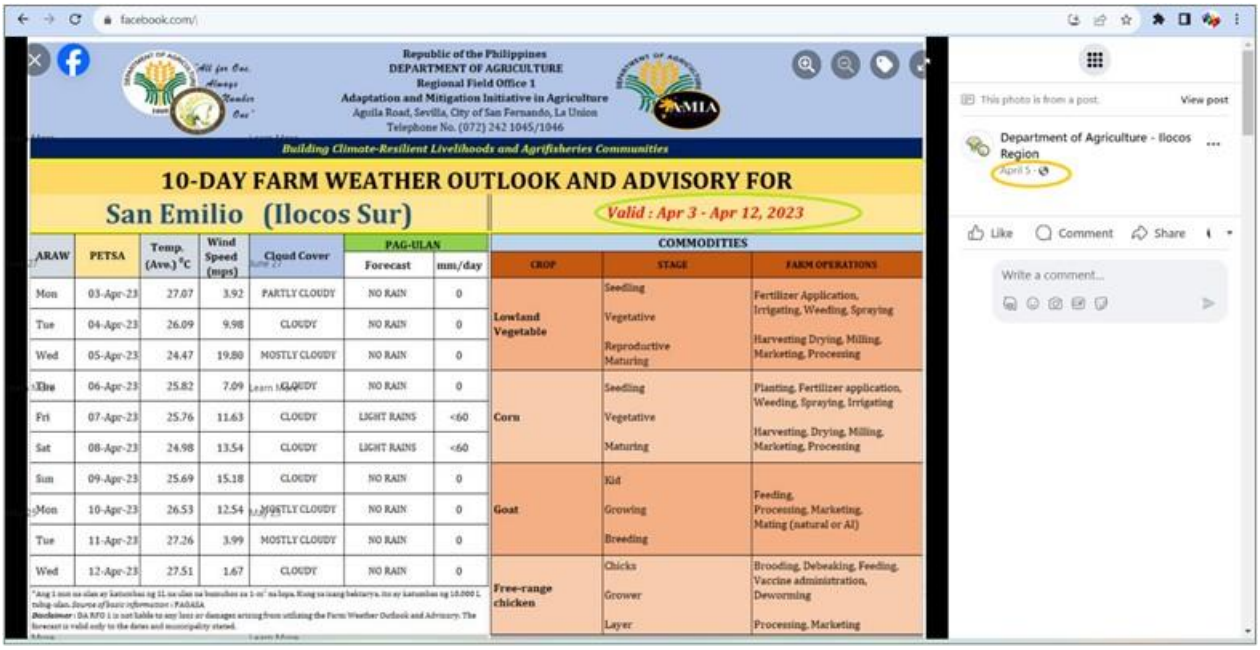
The farm weather outlook and advisory (FWOA), usually presented in English, Taglish and in the dialect, is composed of a location-specific 10-day weather data indicating temperature, wind speed, cloud cover and rain forecast. It also provides information as to what are the commodities in the specified AMIA sites, the different crop stages and corresponding farm operations, animal growth stages with corresponding health management, processing and marketing activities, as well as an impact outlook describing possible scenarios of the effect of the climate to various commodities. It also provides recommendations on climate-resilient agriculture (CRA) practices for various commodity groups to be employed to mitigate the impact of climate hazards in the specified AMIA sites.

Recommended CRA practices for rice include registration to crop insurance in Philippine Crop Insurance Corporation (PCIC), choosing of quality seeds that are resistant to pests and with tolerance to stresses, thorough land preparation, and practice of integrated pest management. For corn, it was recommended to use of postharvest machineries and storing the seeds in a clean, well-ventilated and dry area to prevent attack of insects and rats that can cause diminished quality of seeds. For lowland vegetables, CRA practices like Integrated Pest Management (IPM), use of plastic/organic mulching, drenching of fertilizers, use of Oriental Herb Nutrient (OHN), Herbal Extracts, and Natural Pesticides, and use of organic insect traps are recommended. Use of nylon/jute sacks and cans in storing seeds and use of dried neem tree leaves, labuyo chili and naphthalene balls are recommended for leguminous crops to prevent attack of destructive insects.

For livestock like cattle and goats, it is recommended to tether the animals in dry and clean pasture areas and providing them nutritious feeds like silage, grasses, legumes and concentrates with clean drinking water. For swine or native pig production, it is recommended to maintain cleanliness in the surroundings, provision of alternative feeds like camote and taro leaves, azolla, and trichantera, thorough disinfection and sanitation to prevent disease like hog cholera or African swine fever, while chickens are to be fed with alternative feeds like trichantera (madre de agua), azolla, duckweed and drinking of OHN and fermented oregano and using of incubator for artificial brooding and hatching of eggs.

It was observed that almost all CRA practices for each commodity groups are similar but are recommended to different AMIA sites experiencing varied climate hazards. This implies that the CRA practices have become generic recommendations and do not necessarily address the climate hazards based on the weather forecast in the AMIA sites.

It was also observed that there are several instances of literal translation leading to loss of correct thought or context, and also typographical errors in the posted climate information which may cause confusion among readers. Seemingly, inadequate proofreading happens before the final posting of the climate information. Also, posting of the FWOA comes later than the covered period of the advisory, say, advisory for April 03-12 is posted on 05 April 2023 (see Figure 1).



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Adaptation and Mitigation Initiative in Agriculture
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Building Climate-Resilient Livelihoods and Agrifisheries Communities

10-DAY FARM WEATHER OUTLOOK AND ADVISORY FOR

San Emilio (Ilocos Sur)

Valid : Apr 3 - Apr 12, 2023

ARAW	PETSA	Temp. (Ave.) °C	Wind Speed (mps)	Cloud Cover	PAG-ULAN	
					Forecast	mm/day
Mon	03-Apr-23	27.07	3.92	PARTLY CLOUDY	NO RAIN	0
Tue	04-Apr-23	26.09	9.98	CLOUDY	NO RAIN	0
Wed	05-Apr-23	24.47	19.80	MOSTLY CLOUDY	NO RAIN	0
Thu	06-Apr-23	25.82	7.09	CLOUDY	NO RAIN	0
Fri	07-Apr-23	25.76	11.63	CLOUDY	LIGHT RAINS	<60
Sat	08-Apr-23	24.98	13.54	CLOUDY	LIGHT RAINS	<60
Sun	09-Apr-23	25.69	15.18	CLOUDY	NO RAIN	0
Mon	10-Apr-23	26.53	12.54	MOSTLY CLOUDY	NO RAIN	0
Tue	11-Apr-23	27.26	3.99	MOSTLY CLOUDY	NO RAIN	0
Wed	12-Apr-23	27.51	1.67	CLOUDY	NO RAIN	0

COMMODITIES		
CROP	STAGE	FARM OPERATIONS
Lowland Vegetable	Seedling Vegetative Reproductive Maturing	Fertilizer Application, Irrigating, Weeding, Spraying Harvesting Drying, Milling, Marketing, Processing
Corn	Seedling Vegetative Maturing	Planting, Fertilizer application, Weeding, Spraying, Irrigating Harvesting, Drying, Milling, Marketing, Processing
Goat	Kid Growing Breeding	Feeding, Processing, Marketing, Mating (natural or AI)
Free-range chicken	Chicks Grower Layer	Brooding, Debeaking, Feeding, Vaccine administration, Deworming Processing, Marketing

Source:
https://www.facebook.com/photo?fbid=641140391360

Figure 1. Sample of late-posted farm weather advisory.

These observations could led to the assumption that there is an inadequate technical expertise in the preparation of climate advisories, technique to make the post more interesting and engaging, and there is limited element of responsiveness of the information disseminated in the FB page.

It was observed that AMIA Region 3 has stopped posting climate information in 2023 while having CI-related posts in Year 2022. Zamboanga Peninsula has the highest number of followers at 28,000 and Eastern Visayas ranked second with 22,000 followers. However, despite the large number of followers, there are only an average of 91 and 46 reactions, respectively, from FB users, and very low occurrence of post shares at 30.83 shares for ZamPen and 19.8 shares for Eastern Visayas. Inferentially, the low reactions to the climate information posts and few sharing of posts, may mean that the information is not interesting or insignificant to the followers. **Table 1** summarizes the client information disseminated via AMIA Facebook pages of DA Regional Offices.

Table 1: Summary of client information disseminated via AMIA Facebook pages of DA

REGION	No. of FB Page followers	FB Posted Climate Information	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total	Ave
Car	724	No. of Posts	-	6	4	3	7	2	3	1	7	-	33	4.13
		No. of Reactions	-	10	23	9	36	3	4	2	14	-	101	12.63
		No. of Post Shares	-	8	5	6	16	1	4	1	4	-	45	5.63
I Ilocos	1100	No. of Posts	1	2	-	3	11	-	6	5	1	4	33	4.13
		No. of Reactions	4	7	-	30	33	-	26	8	1	8	117	14.63
		No. of Post Shares	0	0	-	2	2	-	4	0	1	0	9	1.13
Ii Cagayan Valley	2300	No. of Posts	1	1	4	-	2	4	7	3	5	-	27	3.4
		No. of Reactions	6	6	9	-	14	8	25	4	7	-	79	9.9

		No. of Post Shares	0	1	3	-	5	6	9	1	2	-	27	3.4
Iii Amia Region 3 (Central Luzon)	577	No. of Posts	0	0	0	0	0	0	0	0	0	0	0	0
		No. of Reactions	0	0	0	0	0	0	0	0	0	0	0	0
		No. of Post Shares	0	0	0	0	0	0	0	0	0	0	0	0
Iv-A Calabarzon	1400	No. of Posts	9	13	10	6	9	7	12	6	3	2	77	7.7
		No. of Reactions	26	41	19	14	30	26	15	6	4	4	185	18.5
		No. of Post Shares	2	13	8	9	17	8	15	2	1	1	76	7.6
Iv-B Mimaropa	437	No. of Posts	4	3	3	1	5	3	3	3	2	-	27	3
		No. of Reactions	42	37	29	13	21	30	33	26	31	-	262	29.11
		No. of Post Shares	9	2	3	2	10	4	4	1	2	-	37	4.11
V Bicol	1200	No. of Posts	3	2	2	2	7	6	4	2	2	2	32	3.2
		No. of Reactions	15	7	34	15	76	29	22	6	10	4	218	21.8
		No. of Post Shares	5	5	11	10	55	17	23	17	12	6	161	16.1

Vi Western Visayas	962	No. of Posts	-	-	-	-	-	-	1	-	-	-	1	1
		No. of Reactions	-	-	-	-	-	-	3	-	-	-	3	3
		No. of Post Shares	-	-	-	-	-	-	0	-	-	-	0	0
Vii Central Visayas	564	No. of Posts	7	5	8	10	6	12	12	8	7	1	76	7.6
		No. of Reactions	42	25	22	23	44	17	20	15	7	2	217	21.7
		No. of Post Shares	20	4	4	8	17	3	5	6	7	0	74	7.4
Viii Eastern Visayas	22000	No. of Posts	5	-	-	-	2	-	1	2	1	-	11	2.2
		No. of Reactions	103	-	-	-	32	-	10	70	16	-	231	46.2
		No. of Post Shares	36	-	-	-	15	-	2	38	8	-	99	19.8
Ix Zamboanga Peninsula	28000	No. of Posts	-	-	-	-	7	7	11	6	7	5	43	7.17
		No. of Reactions	-	-	-	-	77	116	144	57	90	64	548	91.33
		No. of Post Shares	-	-	-	-	29	56	51	14	15	20	185	30.83
X Northern Mindanao	866	No. of Posts	7	7	14	6	16	22	14	12	12	5	115	11.5
		No. of Reactions	44	41	110	97	169	142	137	112	90	8	950	95

		No. of Post Shares	6	5	3	6	66	51	16	13	15	0	181	18.1
Xi Amia Onse (Davao Region)	992	No. of Posts	0	3	5	0	2	2	0	4	1	0	17	1.7
		No. of Reactions	0	15	17	0	9	4	0	10	0	0	55	5.5
		No. of Post Shares	0	6	5	0	9	2	0	2	0	0	24	2.4
Xii Soccsksargen	839	No. of Posts	6	5	6	2	2	4	5	3	6	4	43	4.3
		No. of Reactions	6	15	16	4	5	20	9	2	30	21	128	12.8
		No. of Post Shares	10	9	18	3	1	10	3	5	18	8	85	8.5
Xiii Amia-Caraga	1100	No. of Posts	5	2	4	0	4	2	1	0	1	1	20	2
		No. of Reactions	25	5	17	0	30	7	2	0	4	9	99	9.9
		No. of Post Shares	3	0	3	0	5	3	1	0	0	0	15	1.5

OBSERVATION

Dissemination of climate information primarily occurs through Facebook postings, averaging 4.5 posts per month. However, there are concerns regarding the competency of some Regional AMIA personnel in preparing climate outlooks and advisories. Additionally, there is a noted repetition in Climate Risk Assessment (CRA) recommendations within advisories, despite being intended for areas with varying climate hazards or rainfall patterns.

Furthermore, the current method of disseminating Climate Information Services (CIS) via Facebook lacks the ability to track the number of users accessing the information. The communication plan adopted by regions may also be insufficient for effectively disseminating climate information.

Moreover, there is no established system to measure the utilization of disseminated climate information or to gather feedback from users. These factors indicate potential areas for improvement in the dissemination and utilization of climate information.

RECOMMENDATION

- Regional AMIA Teams should explore more innovative ways to disseminate climate information to target communities and to reach a wider range of audiences for more possible users;
- Personnel in-charge in disseminating climate information should be trained on popularizing technical information as well as on lay-out and graphics design;
- Recommended CRA practices/guide must match the climate hazards/rainfall conditions in the AMIA sites in order to effectively help mitigate the possible impacts;
- Establish a mechanism that can track post hits, count post download, and gather user's profile and feedback to help determine the actual utilization of climate information, and
- Enhance CIS format and communication plan of CIS-related information;

Output 2. Key CRA recommendations for management of priority crops and livestock based on weather conditions/climate hazards

The output of this multi-sectoral participatory discussion was a book titled "Compendium of Climate-resilient Agriculture Technologies and Practices in the Philippines." Based on the technical discussions and recommendations in the compendium, below is the summary of CRA technologies and approaches recommended under different agro-ecosystems to address specific climate hazards that is very much useful for AMIA villages and farmers as a whole.

Table 2: Summary of CRA technologies and approaches recommended per ecosystem to address specific climate hazards

CRA Technology and Approaches with Description[5]	Climate Hazards Addressed	Commodity Application / Adaptation
IRRIGATED LOWLAND ECOSYSTEM		
Use of Stress-Tolerant Rice Varieties • Stress-tolerant rice varieties are developed to withstand environmental stresses that adversely affect rice production in the country. To mitigate losses due to abiotic stress, the International Rice Research Institute (IRRI) in partnership with the Philippine Rice Research Institute (PhilRice) developed submergence-, saline-, drought-, and heat-tolerant rice breeding lines.	• Flooding/ submergence • Drought • Saline intrusion • Extreme heat	**Rice** Stress-tolerant rice varieties give resilience to rice plants under any environmental stress. Production loss will be low, which can aid farmers to recover easily. Grain yield and quality will relatively improve because of gene improvements in these rice varieties.
Site-specific nutrient management • Site-specific nutrient management (SSNM) is a technology that aims to optimize soil nutrients supply that match crop requirements according to a specific timeframe and inherent spatial variability. It consists of the fundamental steps or 4Rs of nutrient stewardship: right product, right rate, right time, and right place, which encompass the economic, social, and environmental dimensions of SSNM	•Soil degradation	**Rice; Corn** Good nutrient management should primarily increase resilience of crops aside from increasing productivity and farmers' income. Improved resistance of crops to diseases is a result of balanced soil nutrients, particularly N, P, and K, which can be managed through SSNM
Controlled irrigation (alternate wetting and drying)		**Rice**

CRA Technology and Approaches with Description[5]	Climate Hazards Addressed	Commodity Application / Adaptation
• Alternate Wetting and Drying (AWD) is a water-saving technology that farmers operating irrigated rice lands can use to reduce irrigation cost and water input so that water can be used for other purposes	•Limited irrigation water • Drought	
System of Rice Intensification • System of Rice Intensification (SRI) is an innovation in rice production system developed to increase land and water productivity, labor, and capital with less external inputs	•Limited irrigation water • Drought	**Rice** SRI increases yield 20 percent to 100 percent with 90 percent reduction in required seed and up to 50 percent water saving
Ecological engineering for biological pest control • Ecological engineering in lowland rice agro-ecosystems is done by planting flower strips in rice fields. These strips serve as habitats for beneficial arthropods that control pests	•Soil degradation	**Rice; corn; vegetables** This technology increases biodiversity in bunds within irrigated rice fields. Aside from its aesthetic benefits, ecological engineering also increases resilience of crops to damages and yield through the regulation of pest species
Floating garden • Floating gardens are rafts of aquatic weeds on which vegetables and other edible crops can be grown	•Flooding/ submergence	**Vegetables** Floating gardens enable farmers to grow crops even when their fields are inundated. Vegetables are commonly planted, which will provide nutritious food to the households while the farms are not productive due to flooding.
Sorjan system • The Sorjan system is a land modification technique that constructs a series of alternating deep sinks and raised beds as an adaptation measure in both flood-prone and drought-prone areas	•Flooding/ submergence • Drought	**Vegetables** Through Sorjan system, there is an opportunity to grow crops even during the flood season, and a chance to increase irrigation water supply during the dry season
Rice-fish system • The rice-fish system is an integrated crop management where fish is raised	•Flooding/ submergence	**Rice; fish** Rice-fish system provides economic opportunities for farmers because of high harvest yields. The system

CRA Technology and Approaches with Description[5]	Climate Hazards Addressed	Commodity Application / Adaptation
concurrently or in rotation with rice crop in a symbiotic relationship	• Salt intrusion	supports the selection and utilization of suitable rice varieties for local climate and soil conditions
Rice-duck system. The rice-duck system is an integrated farming method wherein the symbiotic relationship between rice and duck benefits farmers the most. Ducks feed on fallen grains, snail, and succulent weeds, duck manure is used as organic fertilizer for rice crops.	•Flooding/ submergence	**Rice; duck** The rice-duck system provides resilience to farmers in terms of pest management, less production cost, and diversified livelihood Food security and climate change adaptation are achievable using the rice-duck system.
Laser-controlled land leveling. Land leveling is a precursor to good management practices in soil and crops. Laser-controlled land leveling is a proven technology, which is highly useful for conserving irrigation water. It is an advanced method for precisely leveling the field. It uses equipment, which is controlled in height with reference to a horizontal laser plane created by a rotating laser beam.	•Limited irrigation water	**Rice; corn; high value crops** Laser-controlled land leveling is considered a resource-conservation technology. It can change the way crops are produced through efficient use of critical inputs without harmful effects on the productivity and resilience of the ecosystem
Grain drying, grain storage, and grain cooling for postharvest. Grain drying is a method to remove moisture in the grain for safe storage. The shelf life of dry grain is longer, compared with that of wet grain. Grain storage is essential in postharvest rice production. It is recommended to store grains in rough rice form rather than in milled form that is used for human consumption. In rough rice form, the husks protect the grains from insects and molds while preserving quality. Grain cooling is usually done by forcing cold air through a grain bulk contained in a silo and, when the bulk is cooled to the desired temperature, the cooling is	• Flooding • Typhoon	**Rice** Grain drying and storage promotes higher income for farmers. Properly dried and stored seeds can increase seed germination and seed viability, which means that fewer seeds are used per hectare. By drying and properly storing, postharvest losses are reduced, and more grains are ready for human consumption and market distribution

CRA Technology and Approaches with Description[5]	Climate Hazards Addressed	Commodity Application / Adaptation
stopped. Safe storage time can be greatly extended by cooling the grain.		
RAINFED LOWLAND ECOSYSTEM		
Stress-tolerant varieties of corn in rainfed lowland Stress-tolerant corn varieties are those with increased tolerance to climate stresses. The erratic distribution pattern of monsoon rains has caused low yields of rainfed corn. Erratic rainfall patterns may cause severe drought or waterlog in a single crop season. The development of stress-tolerant corn varieties is timely and urgently needed to address the low productivity yield of corn in rainfed areas.	•Drought / limited irrigation water • Typhoons	**Corn** By providing stress-tolerant hybrid corn varieties, smallholder farmers will be able to cope with the erratic pattern of monsoon rains in rainfed areas. The developed varieties are expected to produce acceptable yields and will be useful for crop diversification and intensification.
Alternate wetting and drying (AWD) using pump irrigation. Controlled irrigation is used to increase efficiency of farm inputs and at the same time conserve water especially during the dry season. The field is alternately flooded and non-flooded when irrigation water is applied a few days after unavailability of ponded water.	•Drought / limited irrigation water	**Rice** AWD is a water-saving technology that offers a way of changing traditional practices to improve production and livelihood of rice farmers. It is an adaptation measure for water scarcity without affecting rice yield.
Site-specific nutrient management for corn after rice Corn cropping is totally dependent on rainfall because only a few farmers own pump irrigations. The concept of SSNM is to adjust fertilizer application (right time, right place, right rate, and right source of nutrients) to fill the deficiency between nutrient needs of a high-yielding crop and the nutrient supply from indigenous sources	•Soil degradation	**Corn** The SSNM approach in corn production is convenient, adaptable, and easy to use with the available materials. Corn farmers are taught to manage their farm inputs, with the goal of increasing yield and income despite changing weather conditions.
Water harvesting technique. Water harvesting is a technique of collection and storage of rainwater in natural reservoirs, tanks, or the	• Flooding • Drought	**Rice; corn; high value crops; fruit trees** Rainfed lowland and upland farms benefit the most from this technique

CRA Technology and Approaches with Description[5]	Climate Hazards Addressed	Commodity Application / Adaptation
infiltration of surface water into subsurface aquifers. There are different methods of water harvesting commonly practiced in the Philippines. These are small water impounding, small farm reservoir, and shallow tube well.		since it provides supplementary irrigation during the dry season. Water harvesting stabilizes water supply and improves food production in the country.
Drip irrigation systems. Drip irrigation allows the optimal utilization of water and fertilizer through their application close to the crop roots. This is achieved by delivering small water flows at low pressure through several emission points, called drippers	•Drought / limited irrigation water	Rice; corn; high value crops Gravity drip system is a climate change adaptation option for resource-poor farmers in water-scarce areas to improve crop yield and save water. It reduces demand for water and reduces water evaporation losses by providing the water requirement direct to the plant.
Bio-intensive gardening. Bio-intensive gardening (BIG) is a climate and nutrition-smart approach to gardening, which optimizes the use of natural resources available in the area without any application of chemical inputs. Deep-dug beds are functional and advantageous in times of flooding or drought because they store rainwater and soil moisture.	• Flooding • Drought •Soil degradation	Vegetables (indigenous) The use of indigenous crop varieties that can adapt to extreme weather conditions promotes sustainable food production and conservation of crop heritage. BIG also contributes to dietary diversity by increasing intraspecies and interspecies and reduces crop failure.
Basket composting as an organic fertilizer source Developed by the Mindanao Baptist Rural Life Center (MBRLC) in Bansalan, Davao del Sur, this is a gardening system named “Food Always in the Home (FAITH) Garden” that provides vegetable produce throughout the year. The FAITH Garden is made up of three sections: short-term vegetables (two to four months), medium-term vegetables (six to nine months), and long-term vegetables (all throughout the year). The central feature of FAITH garden is a series of raised garden beds in which bamboo baskets are set for production.	•Drought / scarce water source •Soil degradation	**Vegetables** These bamboo baskets are called “basket compost that serves as reservoirs and collector of moisture and nutrients for plants. This garden system is viable even in unproductive areas. Nutritious vegetables are produced at lesser cost and shorter time since plant nutrients derived from decomposed materials can be directly used without the three to four months waiting period.

CRA Technology and Approaches with Description[5]	Climate Hazards Addressed	Commodity Application / Adaptation
Hydroponics and aquaponics. Hydroponics is a method of growing plants in a water-based nutrient-rich solution. It utilizes specific culture and medium instead of soil, to support the root system of the plants. Nutrients are artificially introduced into the water-based solution. Aquaponics, on the other hand, is a combination of two cultures, which are aquaculture (fish raising) and hydroponics (crop production). Fish and vegetables are raised in one infrastructure and function to benefit one another. Fish gives off ammonia, which the bacteria convert to fertilizer, while the plants clean the water.	•Drought / scarce water source	**Vegetables and fish** Studies in the Central Luzon State University (CLSU) show that hydroponic technology can improve yield up to 300 t/ha/year–600 t/ha/year. Plants are observed to mature faster and have a longer shelf life, which can enhance productivity. With the efficient use of water and fertilizer, hydroponics can save production costs and space usage. Techniques under hydroponics and aquaponics are viable even in unproductive places in both rural and urban areas since they promote soilless agriculture.
Crop diversification Crop diversification refers to the incorporation of new crops or cropping systems to an established agricultural production area. New crops, particularly value-added crops, are incorporated to attain economic returns and marketing opportunities, and to withstand price fluctuations and to balance food demand	•Soil degradation • Typhoon • Drought • Flooding	**Various crops** Because crop diversification increases the availability of different crops throughout the year, the farmer's income is not dependent on a single crop. Farmers are not exposed to high risks in climate-induced events because they have other resources as backup. The introduction of a wide range of crops can strengthen the ability of farming systems to respond to environmental stresses, thus reducing the risk of crop failure and income instability.
Adjusting cropping pattern. Changes in the climate could also result in changes in the seasonal pattern. Efforts should be made to identify adjustments in cropping systems that will fit well with the new climate. The aim is to develop a cropping system that adjusts to the new climate or is resilient to climate change. Successful adaptation	• Typhoon • Flooding • Scarce source of water/ drought	**Various crops** Adjusting a cropping system to the new climatic pattern ensures the feasibility of crops used, increases resilience to climate change, and increases farm performance. A cropping pattern that involves the selection of crops and fitting of their growing period with the climatic

CRA Technology and Approaches with Description[5]	Climate Hazards Addressed	Commodity Application / Adaptation
will depend on how well the cropping pattern is planned.		pattern ensures high crop performance under the new climate.
Agroforestry in rainfed lowlands. Agroforestry, as part of diversification, is seen to increase resilience of farmers and their farmlands. Particularly, planting of perennial forest and fruit trees is beneficial for food production and risk mitigation.	•Soil degradation	**Rice; Forest and fruit trees** The adoption of agroforestry in rice-production landscapes increases resilience of the system and diversity of crops and by-products, which will bring high profits to farmers in the long run.
UPLAND ECOSYSTEM		
Multi-storey cropping Multi-storey cropping is a cultivation of inter-planted crops of different growth characteristics that use the soil, soil moisture, and space together at the optimal level. It consists of high storey and medium storey of trees and shrubs and low storey of crops or forages	•Soil degradation • Limited source of water	**High value crops; Fruit trees** This system optimizes use of resources for increased farm income. It can be modified to suit market demands. If one crop component in the system fails, it can be compensated with other crop components, which translates to food security. The system has been proven effective and remunerative for upland farmers especially if high-value crops are incorporated.
Improved village-type compact corn mill for white corn White corn is known to have low glycemic index but high dietary fiber, which makes it a potential alternative in the Filipino diet. The high demand for rice can be remedied by regular consumption of white corn to attain self-sufficiency. The improved village-type compact corn mill lessens productivity loss through high milling recovery and high-quality corn grits.	• Typhoon • Heavy rains	**Corn (white)** Consumption of white corn offsets the high demand for rice and can account for food sufficiency in the long run. In marginalized areas where access to rice is limited, milled white corn grits become the staple to meet their daily food requirements. Its mass commercialization can address the postharvest situation of white corn in the upland areas, where wet seasons are often intensive.
Agroforestry Agroforestry is a land management approach that intentionally combines	• Soil erosion	**Various crops; Livestock** Agroforestry increases farmers' resilience through high farm

CRA Technology and Approaches with Description[5]	Climate Hazards Addressed	Commodity Application / Adaptation
agriculture and forestry for improved productivity, profitability, and environmental stewardship (Figure 2.40). It is a key tool for upland farmers for a sustainable and diversified farming system.	•Soil degradation • Strong winds	profitability. Farmers are food-secure since the system is composed of perennial and annual crops. It is observed that crops and livestock protected from strong winds and extreme weather conditions are more productive. Thus, forest buffers and windbreaks are integral in agroforestry.
Livestock integration in upland farming system Livestock integration in upland farming system increases upland farmers' productivity and income through livestock raising while maximizing farm by-products. Crops and animals are two components that improve efficiency in mixed farming system. Crop biomass that has no economic or food value can be fed to livestock alternately with forage. Forages are used as "relay crop" after harvesting food crops to restore soil fertility. On the other hand, animal manure is collected and applied to crops as fertilizer.	•Soil degradation • Typhoon • Flooding	**Crops and livestock** The quest for alternative energy and feed source has been a long-term goal of climate change initiatives. Livestock production is considered a large contributor to the carbon footprint. Thus, biogas production and alternative feeding systems are important steps in reducing harmful emissions during production. The efficient use of available and viable resources combined with proper farm waste management can sustain livestock production in the long run.
• **Biogas production** Substrates that are more soluble and degradable require simpler fermentation design and biogas digester. Pig wastes, for example, are easier to process than straw bagasse because they easily produce impenetrable scum on the digester's surface.		**Livestock (Swine)**
• **Alternative feeding systems** are the key to this transformation since they play a significant role in raising livestock. FAO has developed innovative approaches that integrate the efficient use of natural resources, environment protection, and socioeconomic and cultural benefits.		**Poultry and livestock**

CRA Technology and Approaches with Description[5]	Climate Hazards Addressed	Commodity Application / Adaptation
• **Supplementation to offset nutrient deficiency** Animals with mineral and nitrogen deficiency are less productive. To supplement this deficiency, tree leaves, oilseed, brans, urea N, and mineral mixtures should be given to attain higher animal productivity such as increased milk production and efficient reproduction		**Poultry and livestock**
• **Utilization of farm waste** Ruminants in developing countries commonly feed on crop residues and farm byproducts. Proper crop residue management such as the utilization of straws and stubbles, can complement technologies that process complete feed for ruminants. Silage making is suitable for reducing crops and forage wastage during the rainy season.		**Poultry and livestock**
• **Technology for smart feeding options** To supply balanced feeds to dairy and livestock raisers on a wide scale, “densified total mixed ration blocks” or “densified mixed ration pellets” are developed by combining straw, oilseed meals, and nutrients. Smallholder farmers should be given technical assistance in preparing balanced rations to satisfy the nutrient requirements of productive livestock		**Poultry and livestock**
• **Alternative feed materials** The global demand for grains has exceeded the current yield capacity, which increases competition between food and feed production. There are alternative resources that can be utilized for feed production such as cassava residue, sweet sorghum residue, and algae residue. Black soldier fly, yellow mealworm,		**Poultry and livestock**

CRA Technology and Approaches with Description[5]	Climate Hazards Addressed	Commodity Application / Adaptation
silkworm, and grasshoppers, which are good sources of protein and macro-micro minerals, are promising feed resources. Leaf meal from moringa plants is also a good protein source. It yields higher protein per unit than soybean.		
HILLY LAND ECOSYSTEM		
Sloping agricultural land technology (SALT) Sloping agricultural land technology (SALT), also known as contour hedgerow intercropping (agroforestry) technology, is a system that involves planting of field crops and perennial crops in 3-to-5-meterwide bands between double rows (hedgerows) of nitrogen-fixing trees and shrubs along the contour lines in hilly areas	• Soil erosion •Soil degradation	**Various crops** The holistic approach in SALT does not only conserves the ecosystem but also provides extra income to farmers throughout the year. Improvements and continuous adoption of SALT, together with the implementation of best practices, can build resilience to erosion, soil degradation, income loss, and food insecurity
Natural vegetative strips (NVS) Natural vegetative strips (NVS) are narrow strips of naturally occurring herbs and grasses left unplowed to allow vegetation to flourish. These strips are used as barriers or buffers to prevent soil erosion caused by heavy rains and intensive cultivation	• Heavy rains • Soil erosion •Soil degradation	**Various crops; Livestock** NVS technology is easy to establish and maintain. Cut materials from NVS can be used as fodder for livestock and mulch for preserving soil moisture and weed suppressant. In terms of productivity, planting perennial crops and timber trees above the NVS can provide additional income for farmers and land users.
Stone bunds and small basins Stone bunds and small basins is a low-cost technology that primarily prevents soil erosion and excessive runoff. Rocks and stones are piled along the contour to control erosion and runoff	• Soil erosion •Flooding / heavy rains • Drought	**Various crops** As a climate change adaptation measure, stone bunds protect the hilly land during years of heavy rainfall. In drought years, increased water availability for plants can result from improved rainwater harvesting, retention, and infiltration into the soil through stone bunds and small basins.
Sustainable corn production in sloping areas (SCOPSA)		**Corn**

CRA Technology and Approaches with Description[5]	Climate Hazards Addressed	Commodity Application / Adaptation
This is a technology involving sustainable land-use management that integrates soil and water conservation practices needed to restore ecological balance in sloping areas and sustain productivity level of corn farmers. Technologies that focus on soil and water conservation and soil fertility improvement with mitigation strategies against soil erosion are used in techno-demo farms.	• Soil erosion • Soil degradation • Limited source of water	SCoPSA teaches farmers to sustain the land they have been using for corn production instead of abandoning it after harvest. Like SALT and NVS, SCoPSA promotes food production for both consumption and income generation for corn farmers. Crop rotation is practiced improving soil fertility by incorporating nutrients in the soil
Conservation farming village (CFV) Conservation farming village (CFV) is a system that promotes adoption of sloping land management technologies through science and technology (S&T)-based farming. CFV aims to capacitate farmers and stakeholders in efficiently managing fragile upland resources and to conduct interventions to sustain the development of upland communities. It seeks to catalyze transformation of traditional farming systems into resilient and sustainable production systems in the uplands.	• Soil erosion • Soil degradation	**Various crops** CFV develops, applies, and validates integrated farming systems (e.g., conservation farming, sloping land management, agroforestry, and organic farming or fertilizer. By establishing CFVs, the impact of soil erosion and land degradation in the uplands will be mitigated.
Soil conservation guided farming system Soil conservation guided farming system (SCGFS) is an approach to land-use management that uses technologies such as terracing, multi-storey, contouring, and agro-pastoral technology to optimize the development of soil and water resources	• Soil erosion •Soil degradation	**Various crops** With SCGFS, enhanced productivity is sustained through time while conserving resources. Eventually, the stability in production ensures self-sufficiency in food and other necessities. These practices mitigate soil erosion and water runoff and protect the fertility of the land and the hilly land ecosystem
HIGHLAND ECOSYSTEM		
Firebreak and green break technology Firebreaks and green breaks are established barriers to prevent and control the spread of forest fires to other areas. They protect forest trees from wildfires and simultaneously protect wildlings from disturbances. The firebreak and green break technology	• Drought • Extreme heat • Soil erosion	**Fruit trees; Forest trees; Cash crops** Cash crops planted on green breaks are beneficial to farmers as immediate food source and income generator even in off-seasons. Firebreaks are effective mitigation

CRA Technology and Approaches with Description[5]	Climate Hazards Addressed	Commodity Application / Adaptation
aids in the conservation of biodiversity in mountains and forest reserves.		strategy for forest fires. Kakawate, which is fire-resistant and drought-resistant, planted between firebreaks also serve as soil erosion control during the wet seasons.
Rainfed rice terraces Rice planted in terraces on steep mountain slopes is an ancient method of rice cultivation. Rainfed water, which is the primary water source for the crops, is impounded in the terraces, preventing soil erosion. Organic matter that enriches soil fertility is preserved by the impounded water and prevents erosion. Thus, the terraces are beneficial to farmers because of their agricultural use and assistance in protecting the environment through flood mitigation.	• Soil erosion • Flooding	**Rice** Proper land use to increase productivity and conserve biodiversity is observed in rainfed paddy rice terraces. The water impounding abilities of the terraces have contributed to soil erosion control in the mountain slopes.
Community-based Forest management Community-based Forest management (CBFM) is an integrated approach that is based on organized efforts to work with communities in forestlands to protect, manage, rehabilitate, conserve, and sustain resources in partnership with various stakeholders. CBFM aims to develop and protect forestlands through sustainable forest management practices such as agroforestry. It also aims to provide forest communities with additional income sources to slowly alleviate poverty and hunger in the uplands.	• Soil erosion •Soil degradation	**Various crops; Forest and fruit trees** Forest communities are given opportunities to protect and sustain the forestlands while still earning some income. Through CBFM efforts, increasing forest cover, species diversity, and proliferation of forest and fruit trees mitigate impact of climate change on forest communities and forestlands. Trees grown along crops are proven to further decrease carbon development. They increase carbon storage in biomass vegetation and in soil
COASTAL ECOSYSTEM		
Artificial reef The concept of artificial reefs has been around for decades. It started when submerged shipwrecks were naturally converted to nesting grounds and shelters of marine species. New	• Coral bleaching	**Fisheries and other marine species** Artificial reefs provide habitat and protection for biodiversity. It is an innovative management solution for coral reef recovery and resilience. Although artificial reefs do not directly

CRA Technology and Approaches with Description[5]	Climate Hazards Addressed	Commodity Application / Adaptation
techniques began to focus on smart and sustainable restoration of coral reef ecosystems		mitigate ocean acidification, they can provide additional protection and resilience to marine animals
Postharvest facilities and technologies (the solar tunnel fish dryer) This type of dryer is a semi-cylindrical walk-in type natural convection solar-powered dryer that has been developed for drying of products. Drying with a solar tunnel dryer not only maintains the quality of fish products and other commodities, but also contributes to energy conservation		**Fishery products** The solar tunnel fish dryer allows for quality, fast, and even drying. This method is efficient and reliable even during the wet season because the dryer uses saved solar energy to function. It also improves fish products to enhance fisherfolks' productivity and income. The use of solar energy for this drying equipment reduces fuel consumption and food waste by preventing fish spoilage
Ridge-river-to-reef approach: Reforestation, enhancement, and protection of wetlands and critical coastal ecosystems Mangroves, locally known as bakawan, are planted along coastlines to form barriers against storm surge, tsunamis, and coastal erosion. Mangroves mitigate the impact of typhoons that bring strong winds and high tidal waves obstruct the strong entry of waves and winds. Mangroves are also used for household consumption such as building materials and charcoals. The dense roots of mangroves serve as binder of soil, which prevents soil erosion.	• Sea-level rise • Flooding • Coastal erosion • Soil erosion •Soil degradation	**Fisheries and other marine species** Mangroves protects communities from storm surge, reduces land degradation, improves production, preserves biodiversity, and protects watershed areas. Mangrove plantations have the potential to establish and develop the ecotourism of an area. Most importantly, they provide livelihood to fishermen because mangroves can be utilized for aquaculture and aquasilviculture.
Community-based fish stock enhancement Community-based fish stock enhancement is a method of releasing cultured juveniles into wild populations to increase natural supply and optimize harvest of fish stocks Restocking is a method of releasing cultured juveniles into wild populations to aid in restoring heavily depleted spawning biomass to self-sustaining levels. Sea ranching method allows for the recurring release of cultured juveniles		**Fish species and other aquatic resources** Community-based fish stock enhancement improves the management of coastal fishery and aquaculture ecosystems. It increases efficiency in sustaining and intensifying production through better integrated systems, improved fish stocks, and control over losses from diseases and abiotic stresses.

CRA Technology and Approaches with Description[5]	Climate Hazards Addressed	Commodity Application / Adaptation
into unenclosed marine and estuaries environment (a put-grow-take operation)		
Aquasilviculture Aquasilviculture can be defined as the integration of two systems, mainly aquaculture with mangrove forestry, otherwise known as silviculture. It is a management system of rearing fish, crabs, shrimps, and other crustaceans along with mangrove development.	• **Storm surge** • **Flooding**	**Fish species and other aquatic resources** The integration of mangrove forestry, with aquaculture as a management system, addresses the goals of food security and climate change adaptation, namely, better productivity yield, additional income for marginalized communities, and conservation of natural resources such as mangroves.

The matrix was used by the UPLBFI in preparing farm advisories in the ACAP system has been integrated by the CIS Team for easy encoding of information of farm advisories of other or new priority commodities not yet included in the ACAP system of UPLBFI the in New Cetralized CIS System.

In view of this, and in addition to the CRA farm advisories for different agro-ecosystem as affected by different climate hazards presented in Table 2, the succeeding tables below are the farm advisories of priority livestock, poultry, crops, and fisheries using the UPLBFI matrix, and from other sources.

COMMODITY: MANGO

Table 3: FARM ADVISORY ON MANGO PRODUCTION AS AFFECTED BY RAINFALL CONDITION

Phenology Stage		RAINFALL CONDITION						REMARKS
		Heavy Rain		Moderate Rain		No Rain		
	DAFI	Potential Impact	Technology to be employed	Potential Impact	Technology to be employed	Potential Impact	Technology to be employed	
Flowering (Bud emergence to Full bloom)	10-28	Delayed flowering due to excess moisture	Apply appropriate preventive fungicide to prevent the development of fungal diseases	Normal flowering	Monitor the amount of rainfall and adjust the irrigation practices accordingly to prevent over watering.	Normal flowering	Irrigate the trees. The trees 600-1500 liter/week.	
Fruit Setting (Mungbean size to marble size)	33-46	Poor fruit set due to waterlogged conditions and low pollination rate	Maintain proper drainage in the orchard to prevent waterlogging, which can lead to poor fruit setting. Hanging of pollinator attractant using decomposed	Normal fruit set	Spray preventive fungicide as “hugas” to avoid occurrence of Sooty mold. Use of dried leaves as mulch may regulate soil temperature and prevent soil erosion.	Normal fruit set	Irrigate the trees to prevent fruit drops. The trees 800-2000 liter/week.	

			fish scraps or snails or frogs		Regularly monitor fruit clusters for signs of pests like mango leaf hoppers and diseases infestation like anthracnose. Then, take necessary action.			
Fruit Enlargement (egg-size to full size)	50-90	Risk of fruit rot due to prolonged wet conditions	Watch out for signs of fruit rot or fungal diseases and apply systemic fungicide Pick fallen fruits and dispose it properly to avoid continuous life cycle of the pests and possible spread of diseases or contamination of pathogens	Normal fruit development	Continue monitoring rainfall and adjust irrigation and drainage practices accordingly. Implement Integrated pest Management (IPM) strategies to prevent pests and diseases using Biological Control Agents produced in the Regional Crop Protection Center laboratory	Normal fruit development	Irrigate the trees to increase fruit size. The trees need 400-1000 liter/ week	

			Bag fruits using waxy or glossy paper at 45-55 DAP to avoid insect pest attack especially cecidfly, fruitfly and disease infection like anthracnose and stem end rot		that may thrive in moist conditions. Bag fruits using waxy or glossy paper at 45-55 DAP to avoid insect pest attack especially cecidfly, fruitfly and disease infection like anthracnose and stem end rot			
Maturity/ Harvest	100-120	Risk of fruit rot due to high humidity	Provide adequate tree support to prevent branch breakage due to strong wind Harvest ripe fruits promptly to avoid fruit rot caused by prolonged exposure to high humidity. As much as possible, harvest	Normal maturity/ ripening	Monitor fruit quality closely and take necessary steps to prevent fruit splitting or damage Harvest ripe fruits promptly to avoid fruit rot caused by prolonged exposure to moisture. As much as possible, harvest the fruits at least 110 DAFI	Normal maturity/ ripening	Withheld water to increase dry matter content	

			the fruits at least 110 DAFI Store harvested fruits in dry place and well-ventilated area to minimize the risks of post-harvest diseases.		Implement post-harvest practices such as proper washing and drying to prevent post-harvest diseases. Apply biological fungicides such as Bacillus subtillis or Bacillus amyloliquifaciens			

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Table 4: Potential impacts of different rainfall conditions on Mango

	RAINFALL CONDITIONS			
Crop Stages	**Normal**	**Way Below Normal**	**Below Normal**	**Above Normal**
Seedling Stage	Adequate moisture supports early root development	Reduced root growth may hinder establishment	Moderately reduced root growth	Enhanced root development
Transplanting stage	Optimal conditions for successful transplantation	Increased transplant shock due to dry conditions	Sub-optimal transplanting conditions	Reduced transplant shock due to better moisture
Flowering	Regular flowering patterns with sufficient water supply	Delayed or irregular flowering due to water stress	Reduced flowering intensity	Increased flowering due to favorable conditions
Fruit setting	Adequate water crucial for fruit setting and retention	Poor fruit setting due to water scarcity	Sub-optimal fruit setting conditions	Enhanced fruit setting with improved water availability
Fruit enlargement	Normal fruit enlargement supported by consistent moisture	Stunted fruit growth and smaller fruit size	Reduced fruit enlargement under water stress	Enhanced fruit size and development
Maturity/ harvest	Regular maturation process with sufficient water supply	Early maturation and smaller fruit size	Delayed maturation under sub-optimal condition	Improved fruit quality with optimal water availability

Table 5: Suitable technical management guidelines for Mango under different season

Activities	RAINFALL CONDITIONS			
	Normal	Way Below Normal	Below Normal	Above Normal
Varietal selection	Use quality planting material of carabao mango such as GES, Lamao, etc certified varieties			
Sanitation (Cleaning and Clearing the Area)	All tall weeds will be removed. Cleanliness and sanitation should be observed to avoid alternate host of the pests.			
Pruning dead and infected branches	Remove dead branches and infected branches. Use chainsaw or bolo. Apply paint on the open cut with fungicide.			
Nutrient Management or Fertilization *(How manage fe and other necessary growth of*	Fertilizer to be applied is based on soil analysis. In the absence of soil analysis, the trees may be fertilized using organic at 8 kg per tree and complete fertilizer at 4 kg and 1 kg urea per tree. Fertilizer may be applied in 8 holes about 30cm deep, 2.5 to 3 meters away from the base of the trees. Use water pump to irrigate the soil in order to dissolve the fertilizers applied.	Controlled release of fertilizers or other chelated micronutrients available in the market	Apply foliar fertilizers enrich with micronutrients. Use spreader/ sticker to allow the nutrients stick onto the leaves for a longer period of time	It is best recommended to apply fertilizer at the onset of rainy season. After application of fertilizer best on soil analysis or based on the age of the tree. Drain water properly. You may plant cover crops to avoid leaching of nutrients whenever there's soil erosion due to heavy downpour

Water Management or Irrigation *(Wh are recommende practices management are sustai climate-resilie*	At flowering stage, irrigate the trees with 600-1500 liter/week. During fruit setting, irrigate the trees with 800-2000 liter/week to prevent fruit drops. At fruit enlargement, irrigate the trees to increase fruit size. The trees need 400-1000 liter/ week. During maturity stage, withheld water to increase dry matter content	Use blue drums filled with water as a supplementary irrigation. Set-up shallow tube wells near the source of clean water	Use sub-surface drip irrigation if any.	Construct a canal so that water flows away from the orchard farm
Flower Induction	The trees will be induced to flower using calcium nitrate at a rate of 2kg per 100 liters of water (2%). Power spraying will be done so that all the branches and leaves will be sprayed uniformly. A follow-up spraying at a rate of 1.5 kg per 100 liters of water (1.5%) may be done if flower response is low.	Use 3kg of calcium nitrate of potassium nitrate per 100 Li of water. Follow-up spraying 5 days after first spraying at 1.5 kg per drum	Use ethephon plant growth regulator to induce flowering	Gibberellic acid may be used to regulate flowering or use paclobutrazol to induce flowering

Pest and Disease Management *(What are the pests and may proli f how to r them?)*	*During fruit se enlarg* regularly monitor fruit clusters for signs of pests like mango leaf hoppers, cecidfly, seedborer, fruitfly and diseases infestation like anthracnose, stem end rot, and scab. Then, take necessary action. You may opt to use BCAs to spray. Bag fruits using waxy or glossy paper at 45-55 DAP to avoid insect pest attack especially cecidfly, fruitfly and disease infection like anthracnose and stem end rot Pick fallen fruits and dispose it properly to avoid continuous life cycle of the pests and possible spread of diseases or contamination of pathogens,	Apply neem oil-based products to manage the population of hoppers and whiteflies, and thrips as pest control	Employ the Integrated Pest Management Strategies with proper monitoring of its agro ecosystem. Use BCAs, sanitation and bag the fruits with waxy paper at 45-55 DAFI	As prevention and suppression, spray biopesticides and other biological fungicides with spreader/ sticker

Harvesting *(What are recommended practices harvesting*	Harvest mature fruits using bamboo picker and plastic crates or bamboo basket (kaing) As much as possible, harvest the fruits at 115-120 DAFI	Manual harvesting using bamboo picker and bamboo basket at 110 to 115	Mechanical harvesting using boom truck	Check maturity of the fruits using floatation method. Harvest at the right time. Not too early or not too late to avoid high moisture of fruits to avoid occurrence of fungal diseases of fruits.
Post-harvest *(What are recommended practices harvesting*	Store harvested fruits in dry place and well- ventilated area to minimize the risks of post-harvest diseases	Ethylene application for uniform fruit ripening	Ethylene application for uniform fruit ripening	Use hot water treatment to avoid post harvest diseases and storing it in cold storage

Table 6: Potential impacts of different daily rainfall conditions on MANGO

	RAINFALL CONDITIONS			
Crop Phenology	**No rain**	**Light Rains**	**Moderate Rains**	**Heavy Rains**
Flowering (Bud emergence to Full bloom) 10-28 Days After Flower Induction (DAFI)	Normal flowering	Normal flowering	Normal flowering	Delayed flowering due to excess moisture
Fruit Setting (Mungbean size to marble size) 33-46 DAFI	Normal fruit set High incidence of mango leaf hoppers	Normal fruit set Favorable occurrence of fungal diseases	Normal fruit set Favorable occurrence of fungal diseases	Poor fruit set due to waterlogged conditions and low pollination rate
Fruit Enlargement (chicken egg-size to full size) 50-90	Normal fruit development	Normal fruit development High incidence of pests and diseases	Normal fruit development High incidence of pests and diseases	Risk of fruit rot due to prolonged wet conditions
Maturity/ Harvest	Normal maturity/ ripening	Normal maturity/ ripening	Normal maturity/ ripening	Risk of fruit rot due to high humidity

Table 7: Suitable technical management guidelines for MANGO in response to differe

Activities	No Rain	Light Rains	Moderate Rains	Heavy Rains
Sanitation (Cleaning and Clearing the Area)	All tall weeds will be removed. Cleanliness and sanitation should be observed to avoid alternate host of the pests.			
Pruning dead and infected branches	Remove dead branches and infected branches. Use chainsaw or bolo. Apply paint on the open cut with fungicide.			
Nutrient Management or Fertilization *(How to fertilizer s nutrients necessary for t crop)*	Fertilizer to be applied is based on soil analysis. In the absence of soil analysis, the trees may be fertilized using organic at 8 kg per tree and complete fertilizer at 4 kg and 1 kg urea per tree. Fertilizer may be applied in 8 holes about 30cm deep, 2.5 to 3 meters away from the base of the trees. Use water pump to irrigate the soil in order to dissolve the fertilizers applied.	Fertilizer to be applied is based on soil analysis. In the absence of soil analysis, the trees may be fertilized using organic at 8 kg per tree and complete fertilizer at 4 kg and 1 kg urea per tree. Fertilizer may be applied in 8 holes about 30cm deep, 2.5 to 3 meters away from the base of the trees. Do supplementary irrigation.	Fertilizer to be applied is based on soil analysis. In the absence of soil analysis, the trees may be fertilized using organic at 8 kg per tree and complete fertilizer at 4 kg and 1 kg urea per tree. Fertilizer may be applied in 8 holes about 30cm deep, 2.5 to 3 meters away from the base of the trees	Fertilizer to be applied is based on soil analysis. In the absence of soil analysis, the trees may be fertilized using organic at 8 kg per tree and complete fertilizer at 4 kg and 1 kg urea per tree. Fertilizer may be applied in 8 holes about 30cm deep, 2.5 to 3 meters away from the base of the trees. Use of dried leaves as mulch. It may regulate

				soil temperature and prevent soil erosion.
Water Management or Irrigation *(What are recommended practices for water management that are sustainable and resilient?)*	At flowering stage, irrigate the trees with 600-1500 liter/week. During fruit setting, irrigate the trees with 800-2000 liter/week to prevent fruit drops. At fruit enlargement, irrigate the trees to increase fruit size. The trees need 400-1000 liter/ week. During maturity stage, withheld water to increase dry matter content	Monitor the amount of rainfall and adjust the irrigation practices accordingly to augment the water requirement of the trees.	Monitor the amount of rainfall and adjust the irrigation practices accordingly to prevent over watering.	Drain the water to remove excessive moisture of the soil
Flower Induction	The trees will be induced to flower using calcium nitrate at a rate of 2kg per 100 liters of water (2%). Power spraying will be done so that all the branches and leaves will be sprayed uniformly. A follow-up spraying at a rate of 1.5 kg per 100 liters of water (1.5%) may be done if flower response is low.	The trees will be induced to flower using calcium nitrate at a rate of 2kg per 100 liters of water (2%). Power spraying will be done so that all the branches and leaves will be sprayed uniformly. A follow-up spraying at a rate of 1.5 kg per 100 liters of water (1.5%) may be done if	The trees will be induced to flower using potassium nitrate at a rate of 3kg per 100 liters of water (3%). Power spraying will be done so that all the branches and leaves will be sprayed uniformly. A follow-up spraying at a rate of 1.5 kg per 100 liters of	The trees will be induced to flower using potassium nitrate at a rate of 3kg per 100 liters of water (3%). Power spraying will be done so that all the branches and leaves will be sprayed uniformly. A follow-up spraying at a rate of 1.5 kg per 100 liters of

		flower response is low. Never induce while it is raining.	water (1.5%) may be done if flower response is low. Never induce while it is raining.	water (1.5%) may be done if flower response is low. Never induce while it is raining.
Pest and Disease Management *(What a potential pests may proliferat manage them?)*	During fruit setting and fruit enlargement, regularly monitor fruit clusters for signs of pests like mango leaf hoppers, cecidfly, seedborer, fruitfly and diseases infestation like anthracnose, stem end rot, and scab. Then, take necessary action. You may opt to use BCAs to spray. Bag fruits using waxy or glossy paper at 45-55 DAP to avoid insect pest attack especially cecidfly, fruitfly and disease infection like anthracnose and stem end rot Pick fallen fruits and dispose it properly to avoid continuous life cycle of the pests and	At fruit setting, spray preventive fungicide as “hugas” the next day after the rain to avoid occurrence of Sooty mold. Regularly monitor fruit clusters for signs of pests like mango leaf hoppers and diseases infestation like anthracnose. Then, take necessary action. During fruit enlargement, implement Integrated pest Management (IPM) strategies to prevent pests and diseases using Biological Control Agents produced in the Regional Crop Protection Center	At fruit setting, spray preventive fungicide as “hugas” the next day after the rain to avoid occurrence of Sooty mold. Regularly monitor fruit clusters for signs of pests like mango leaf hoppers and diseases infestation like anthracnose. Then, take necessary action. Pick fallen fruits and dispose it properly to avoid continuous life cycle of the pests and possible spread of diseases or contamination of pathogens.	Apply appropriate preventive fungicide after the rain on the next day to prevent the development of fungal diseases *During fru* hang pollinator attractant using decomposed fish scraps or snails or frogs At fruit development, watch out for signs of fruit rot or fungal diseases and apply systemic fungicide, Pick fallen fruits and dispose it properly to avoid continuous life cycle of the pests and possible spread of

	possible spread of diseases or contamination of pathogens,	laboratory that may thrive in moist conditions. Bag fruits using waxy or glossy paper at 45-55 DAP to avoid insect pest attack especially cecidfly, fruitfly and disease infection like anthracnose and stem end rot Pick fallen fruits and dispose it properly to avoid continuous life cycle of the pests and possible spread of diseases or contamination of pathogens,	During fruit enlargement, implement Integrated pest Management (IPM) strategies to prevent pests and diseases using Biological Control Agents produced in the Regional Crop Protection Center laboratory that may thrive in moist conditions. Bag fruits using waxy or glossy paper at 45-55 DAP to avoid insect pest attack especially cecidfly, fruitfly and disease infection like anthracnose and stem end rot	diseases or contamination of pathogens, Bag fruits using waxy or glossy paper at 45-55 DAP to avoid insect pest attack especially cecidfly, fruitfly and disease infection like anthracnose and stem end rot
Harvesting *(What are recommended practices in harvesting?)*	Harvest mature fruits using bamboo picker and plastic crates.	Monitor fruit quality closely and take necessary steps to prevent fruit splitting or damage	Monitor fruit quality closely and take necessary steps to prevent fruit splitting or damage	Provide adequate tree support to prevent branch breakage due to strong wind

	As much as possible, harvest the fruits at least 110 DAFI	Harvest mature fruits promptly to avoid fruit rot caused by prolonged exposure to moisture. As much as possible, harvest the fruits at least 110 DAFI Apply biological fungicides such as Bacillus subtillis or Bacillus amyloliquifaciens	Harvest mature fruits promptly to avoid fruit rot caused by prolonged exposure to moisture. As much as possible, harvest the fruits at least 110 DAFI Apply biological fungicides such as Bacillus subtillis or Bacillus amyloliquifaciens	Harvest mature fruits promptly to avoid fruit rot caused by prolonged exposure to high humidity. As much as possible, harvest the fruits reaching 120 DAFI Apply biological fungicides such as Bacillus subtillis or Bacillus amyloliquifaciens
Post-harvest *(What are recommended practices post-harvesting?)*			Implement post-harvest practices such as proper washing and drying to prevent post-harvest diseases.	Store harvested fruits in dry place and well-ventilated area to minimize the risks of post-harvest diseases

COMMODITY: CACAO

Table 8: Potential impacts of different rainfall conditions on Cacao

Crop Stages	RAINFALL CONDITIONS			
	Normal	Way Below Normal	Below Normal	Above Normal
Newly Planted (Seedling Stage)	Favorable for normal growth and development,	Favorable for normal growth and development, provided sufficient irrigation is provided	Favorable for normal growth and development, provided sufficient irrigation is provided	High Risk on the development of diseases such as dumping off.
Vegetative	Favorable for normal growth and development,	Favorable for normal growth and development, provided sufficient irrigation is provided	Favorable for normal growth and development, provided sufficient irrigation is provided	High Risk on the development of diseases such as dumping off.
Reproductive	Favorable for normal growth and development, .	Favorable for normal growth and development, provided sufficient irrigation is provided. High infestation of insect pest.	Favorable for normal growth and development, provided sufficient irrigation is provided. High infestation of insect pest.	High Risk on the development of diseases such as dumping off.

Maturing	Favorable for normal growth and development,	Favorable for normal growth and development, provided sufficient irrigation is provided. High infestation of insect pest.	Favorable for normal growth and development, provided sufficient irrigation is provided. High infestation of insect pest.	High Risk on the development of diseases such as dumping off, fruit rot, blossom end rot

Table 4.1. Suitable technical management guidelines for Cacao under different seasonal conditions

Activities	RAINFALL CONDITIONS			
	Normal	Way Below Normal	Below Normal	Above Normal
Selection of varieties (What local varieties are most suitable?)	Recommended varieties listed for the regions area: NSIC Rc 216, 402, 480 recommended by the National Rice Competitive Enhancement Fund (RCEF)	All varieties are suitable as long as you can maintain/ provide the water and nutrient requirement	All varieties are suitable as long as you can maintain/ provide the water and nutrient requirement	All varieties are suitable as long as you can maintain/ provide the water and nutrient requirement
Land Preparation (How to prepare the land given the following rainfall conditions?)	Prepare land after harvesting rice. Plow and leave field for 2-3 weeks to decompose rice straws and limit weed growth. Prep land again before planting or when seedling age is around 25-30 days.	Prepare land after harvesting rice. Plow and leave field for 2-3 weeks to decompose rice straws and limit weed growth. Prep land again before planting or when seedling age is around 25-30 days. Provide irrigation.	Prepare land after harvesting rice. Plow and leave field for 2-3 weeks to decompose rice straws and limit weed growth. Prep land again before planting or when seedling age is around 25-30 days. Provide irrigation.	Prepare land after harvesting rice. Plow and leave field for 2-3 weeks to decompose rice straws and limit weed growth. Prep land again before planting or when seedling age is around 25-30 days. Provide good drainage system to maintain proper amount of moisture.

Method of cultivation (What are the most suitable methods of planting/transplanting?)	If transplanting, prepare seedlings with seed bed size of 10 x 20 cm, with 2 m gap between plots. Apply manure or compost during soil prep. DO NOT add Urea 46-00-00. Soak seeds in water for 36-48 hours due to low temperature, especially during dry season. Broadcast seeds and keep water level. Remove and transplant seedlings immediately at 2-3 seedlings per hill, with 20 x 20-25 cm spacing. If using wet direct seeded or wet broadcasting method, incubate for another 24 hours after soaking. Sow or use drum seeder for planting. If using dry direct seeded method with a drill seeder, sow immediately after second land prep in dry field condition, with a seed rate of 40-50 kg/ha.	Rainy season requires lesser nitrogen fertilizer requirement.	Direct seeding can save time and labor but weeds must be manage properly. Transplanting may required higher cost but in terms of productivity and uniformity is more assured.	Direct seedling during this stage is not recommended. Transplanting will give more advantage.
Nutrient Management (How to manage fertilizers and other nutrients necessary for the growth of the crop?)	If using transplanting method, apply basal fertilizer at 200kg/ha of 15-15-15 for sandy soils, and 150 kg/ha of 16-20-00 for clay soils before planting. Apply Urea (46-00-00) 65 kg/ha twice at 20 DAT and again at 40 DAT for early maturity varities, or at 40 DAT and again at 45 DAT for medium and late maturity varieites.	Follow recommended rate always see to it that every application of fertilizers, water is sufficient.	Follow recommended rate always see to it that every application of fertilizers, water is sufficient.	Follow recommended rate always see to it that every application of fertilizers, water is sufficient. Rainy days required lesser nitrogen.

	If direct-seed sowing or broadcasting, use same rate of basal fertilizer, followed by 2 split of Urea (46-00-00) at 65 kg/ha at 30-35 DAS, and 65 kg/ha at 60-65 DAS.			
Water Management (What are the recommended practices for water management that are sustainable and climate-resilient?)	Soil level helps in controlling weeds	Water level helps in controlling weeds. Maintain soil moisture. Additional irrigation every application of fertilizers	Maintain soil moisture. Additional irrigation every application of fertilizers	Establish good drainage system
Pest and Weed Management (What are the potential pests and weeds that may proliferate and how to manage them?)	Monitor regularly and use pesticides only when necessary. Maintain water level regularly. If no standing water in field, control weeds until 45 days after transplanting or until soil is covered with leaves. Eliminate weeds at least 1/3 to ½ of growing season.	Appy IPM	Apply IPM	Apply IPM
Harvesting (What are the recommended practices for harvesting?)	The best way to harvest rice is the by the use of combine harvester.	The best way to harvest rice is the by the use of combine harvester.	The best way to harvest rice is the by the use of combine harvester.	The best way to harvest rice is the by the use of combine harvester.

Post-harvest/Storage (How to properly store the harvested crops? What are other recommended practices for post-harvesting and storage?)	Maintain the recommended MC, crops should be placed in pallets and keeps away from walls. Traps for rats should in placed.	Maintain the recommended MC, crops should be placed in pallets and keeps away from walls. Traps for rats should in placed.	Maintain the recommended MC, crops should be placed in pallets and keeps away from walls. Traps for rats should in placed.	Maintain the recommended MC, crops should be placed in pallets and keeps away from walls. Traps for rats should in placed.

COMMODITY: CORN

Table 5. FARM ADVISORY ON CORN PRODUCTION AS AFFECTED BY RAINFALL CONDITION

Phenology Stage		RAINFALL CONDITION						REMARKS
		Heavy Rain		Moderate Rain		No Rain		
	DAS	Potential Impact	Technology to be employed	Potential Impact	Technology to be employed	Potential Impact	Technology to be employed	
Germination	0-9	High mortality rate due to excessive water during emergence	Plant corn only when soils will be warmer than 50 degrees during the first 24 hours after planting to reduce the risk.	Normal germination of seed	Plant where the crown of the corn plant usually establishes at about ¾ inch from the soil's surface.	Can cause seed death and damaged radicle due to low moisture content of the soil	Apply atleast 30% moisture on the soil	
Leaf Development	10-19	Increased time between leaf stages and delayed tassel formation Can kill plants due to flooding	Make a furrow for good drainage system	Normal leaf and tassel formation	Apply the necessary fertilizer material needed during this stage	Leaf rolling	Water the soil to lower the temperature	

		Reduce nutrient uptake and increase in fertilizer lost due to denitrification	Nitrogen fertilizer applications in corn are often split into different timings (e.g., pre-planting, at planting, after planting) to gain N use efficiencies. Additionally, split applications can avoid losing the season's N budget due to excess rain events.	Normal nutrient uptake	Evenly apply in band organic and inorganic fertilizer along the furrows at planting time. Then cover the fertilizer with a 2 cm layer of soil prior to planting.	May limit the availability of nutrients that were applied to the surface zone and that are not mobile Plants are susceptible to green-snap	Irrigate the crop with sufficient water	
Stem Elongation	30-39	Fungal Infection	Apply suitable fungicide when pathogens are detected at this growth stage	Proper stem elongation	Corn needs the most nitrogen, along with plenty of water and other nutrients. To prevent cob weight loss, avoid spraying fungicides	Delay plant growth due to hindered photosynthesis because the stomata of the plant are closed	Apply nitrogen-rich organic or inorganic fertilizer	

					during the stem elongation stage.			
Tillering	40-49	Can cause large grain yield reduction	Proper drainage system to reduce excess water and moisture	Normal tillering	There is a great need for both fertilizers and water at this corn growth stage. Giving the plant trace elements that improve its fertility, such as boron (B), water intake, such as zinc (Zn), and photosynthetic productivity, such as manganese (Mn) and magnesium (Mg), raises the odds of successful growth,	Can develop drought stress	Maintain water supply for irrigation purposes	
Inflorescence Emergence, Heading	50-59	Fertilizer lost due to leaching		Good heading		Plant development delay	Irrigate the crop if necessary	

					flowering, and fertilization.			
Flowering, Anthesis	60-69	Foliar infections resulting to insufficient seed formation	Fertilizer application should be done before this stage	Normal flower formation	Avoid human activities during this stage to avoid disturbance during the flower development	Poor grain setting and may reduce yield because of kernel abortion due to decreased photosynthesis and lack of carbs after pollination	Consider precision irrigation program for healthy crop growth.	
Development of fruit	70-79	Can cause damage and even partial mortality	An effective drainage system to alleviate excess water and moisture.	Good quality of kernel development	Proper monitoring of crop	Higher number of undeveloped fruits	Irrigate the soil to maintain the moisture content	
Ripening	80-89	Can cause premature black layer formation	Drainage systems to help release the excess water present in a field. Different options exist; some are subsurface tile drainage and	Simultaneous ripening	Ocular inspection should be done to ensure the simultaneous ripening of corn kernel	Simultaneous ripening	Ocular inspection should be done to ensure the simultaneous ripening of corn kernel	

			raised bed cultivation.					
Harvesting	90	Possible spoilage due to the rapid growth of pests and pathogens	Choose a hybrid that matures about three weeks before the average first killing frost date.	Normal yield	Corn requires from 60 to 100 days to reach harvest depending on the variety and warm weather. Ears will be ready to pick when the silks turn brown, but the husk remains green. Stalks should have at least one ear near the top before harvesting occurs.	Normal yield	Corn requires from 60 to 100 days to reach harvest depending on the variety and warm weather. Ears will be ready to pick when the silks turn brown, but the husk remains green. Stalks should have at least one ear near the top before harvesting occurs.	

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COMMODITY: AMPALAYA

Table 6. FARM ADVISORY ON AMPALAYA PRODUCTION AS AFFECTED BY RAINFALL CONDITION

Growth Stage		RAINFALL CONDITION						REMARKS
		Heavy Rain		Moderate Rain		No Rain		
	DAS	Potential Impact	Technology to be employed	Potential Impact	Technology to be employed	Potential Impact	Technology to be employed	
Germination	5-10 days after germinating the seeds	Poor germination	Germinate seed in areas that will not be affected by heavy rainfall.	Normal germination	Break the seed coat by cutting the pointed tip of the seed with a nail-cutter. Soak the seeds in clean water for 24 hours. Cover seeds with some soil at least 2-3 mm deep or just cover the seeds with the thickness not exceeding its diameter.	Poor germination	Soak the seeds overnight in clean water. Remove/ drain water and wrap the seeds in damp cloth for 3-4 days or until the seed coat breaks to facilitate germination.	

Seedling Stage to Vegetative Stage	1-28 days	Water logging	Ampalaya is sensitive to water logging or excessive moisture. The best type and texture of soil for this crop is sandy loam or clay loam with good drainage, high organic matter and with pH ranging from 6 to 6.7. To boost plant vigor, apply weekly (spray or drench)	Normal plant growth	Before transplanting, add a handful of compost/vermicast/manure to the hole as basal fertilizer. To boost plant vigor, apply weekly (spray or drench) organic probiotics preparations like IMO, Vermitea, FAA, OHN and FPJ during vegetative stage. During reproductive stage, apply FFJ, CalPhos or OHN to support flower & fruit development For non-organic production, add 2 tbsp. of complete fertilizer (14-14-14) in the hole then cover it with a handful compost prior to planting.	Drought leads to poor crop growth	Install drip system with main and sub-main pipes and place the inline lateral tubes at an interval of 1.5m. Place the drippers in lateral tubes at an interval of 60 cm and 50 cm spacing with 4LPH and 3.5 LPH capacities respectively.	

			organic probiotics preparations like IMO, Vermitea, FAA, OHN and FPJ. For non-organic application. Three to four (3-4) weeks after planting, apply 1 tbsp. of urea by burying it in a 1-inch-deep hole 3-4 inches away from the stem. Repeat application of urea (46-0-0)					

			every two for 2-3 times more depending on the crop stand					
Flowering Stage	28-42 days	Abnormal flowering	Trellis for better fruit Development. All leaves and lateral vines within 1 meter from the ground should be removed. Maintain at least 2 main fruiting vine. Prune unproductive lateral vines	Normal Flowering	Apply FFJ, CalPhos or OHN to support flower & fruit development. Adopt row and plant spacing from 1.5-3 m and 0.5-0.9 m, respectively for optimum crop growth.	Abnormal flowering	For furrow irrigation. Form 20 cm-high beds during the dry season and 30 cm or higher during the wet season using a plow or mechanical bed shaper. Furrow irrigate every 10	

			and sell it in the market or use it for family consumption.				days during the cool-dry season, and weekly during the hot-dry season.	
Fruit Development	42-56 days	Spread of diseases	Remove damaged and deformed fruits while still young to prevent nutrient competition.	Normal fruit development	Fruitfly is the most destructive insect pest of Ampalaya. Use attractants or immediately wrap the developing fruit to protect it from the insect.	Poor fruit setting	Bitter gourd will not tolerate drought. Maintain good soil moisture in the upper 50 cm of soil where the majority of roots are located.	
Maturity and Harvest	56-84 days	Poor quality of fruits	If cultivated in too wet conditions, bacterial and fungal wilt	Good yield	Harvest fruits 18-20 days after blooming or when the fruits attain full size, with seeds still immature.	Insufficiency of ripening	Bitter gourd requires close attention at	

			and fruit cracking can become major problems, resulting in a lower percentage of high-quality fruits and a shortened shelf life of the fruits. October-February is the ideal planting season because cool months favor more fertilized flowers thus better production.		This occurs three (3) weeks after petals fall. To harvest, hold the fruits with one hand then cut from its peduncle using a sharp knife		harvest time. The fruits develop rapidly and must be harvested frequently to keep them from becoming too large or too bitter.	

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COMMODITY: CASSAVA

Table 7. FARM ADVISORY ON CASSAVA PRODUCTION AS AFFECTED BY RAINFALL CONDITION

Phenology Stage		RAINFALL CONDITION						REMARKS
		Heavy Rain		Moderate Rain		No Rain		
	DAP	Potential Impact	Technology to be employed	Potential Impact	Technology to be employed	Potential Impact	Technology to be employed	
Seedling stage	30-60	Intense rainfall can lead to soil compaction, reducing the pore spaces in the soil. Hinder root development and limit the movement of air and water in the soil.	Measures may include proper drainage systems, soil conservation practices, and the selection of cassava varieties that are more tolerant to waterlogging.	Moderate rainfall provides a consistent and adequate supply of water, which is beneficial for the germination and early growth of cassava seedlings.	Monitor weather patterns closely and implement proper water management practices. This may include optimizing irrigation schedules, improving drainage systems, and selecting appropriate planting times.	Lack of rainfall leads to water stress for cassava seedlings, hindering their ability to absorb water and essential nutrients from the soil. Water stress can stunt growth, reduce leaf expansion, and compromise	It's important for farmers to monitor weather conditions closely and implement appropriate water management practices to ensure the healthy growth of cassava seedlings during periods of low rainfall.	

						overall plant health.		
Vegetative stage	75-90	cassava plants have sufficient moisture for optimal growth during the vegetative stage.	Maintain proper drainage in the orchard to prevent waterlogging, which can lead to poor fruit setting. Hanging of pollinator attractant using decomposed fish scraps or snails or frogs	Normal fruit set	Spray preventive fungicide as “hugas” to avoid occurrence of Sooty mold. Use of dried leaves as mulch may regulate soil temperature and prevent soil erosion. Regularly monitor fruit clusters for signs of pests like mango leaf hoppers and diseases infestation like anthracnose. Then, take	The vegetative stage is crucial for the development of leaves, stems, and branches. Without adequate water, cassava plants may experience stunted growth and a reduction in overall biomass accumulation.	Implement drip irrigation systems to provide targeted and efficient water delivery directly to the root zone of cassava plants. Drip irrigation minimizes water wastage and helps conserve water during periods of no rain	

					necessary action.			
Reproductive stage	140-180	Wet conditions can promote the development of fungal diseases on cassava plants, affecting both the foliage and tubers.	Consider applying fungicides preventively to protect cassava plants from fungal diseases associated with heavy rainfall.	Moderate rain can contribute to the development of root diseases, particularly if the soil drainage is poor. This can affect the overall health of the cassava plants and impact tuber quality.	Regularly monitor field conditions, plant health, and tuber development during the reproductive stage. Promptly address any signs of disease or stress. Implement or enhance drainage systems to prevent waterlogging, which can reduce the risk of root and tuber diseases.	Water scarcity during tuberization can lead to smaller tuber sizes. Insufficient water availability limits the plant's ability to allocate resources to tuber growth, resulting in smaller and potentially less valuable tubers.	Implement water conservation techniques, such as mulching, to retain soil moisture. Mulch helps reduce evaporation, maintain soil temperature, and conserve water.	

Maturity/ Harvest	210-280	Muddy and waterlogged field conditions can make harvesting challenging. Harvesting under these conditions may result in soil sticking to the tubers, making cleaning and processing more difficult.	Plan cassava harvests during drier periods to avoid muddy field conditions and minimize potential damage to tubers. Implement or enhance drainage systems to prevent waterlogging and improve field drainage. Well-drained soils are crucial to avoid root and tuber diseases..	Moderate rainfall can promote weed growth, which may compete with cassava plants for nutrients and water. Weeds can also make harvesting more challenging. Adequate moisture in the soil can soften the ground, making it easier to harvest cassava tubers. This can reduce the risk of damage to	Implement weed management practices to control weed growth and reduce competition with cassava plants for nutrients and water.	Dry and compacted soil conditions, resulting from the absence of rain, can make harvesting more challenging. Cassava tubers may be firmly anchored in the ground, requiring more effort and potentially causing damage during extraction. Without adequate rain, cassava	Plan cassava harvests during periods when the soil is not excessively dry to minimize the risk of damage to tubers during extraction. Invest in proper storage facilities to ensure the quality of harvested cassava tubers, especially if the harvesting period is extended due to the absence of rain.	

				tubers during the harvesting process.		tubers might face increased vulnerability to post-harvest deterioration. Rapid drying of the soil and exposure to sun and air can contribute to deterioration.		

References:

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COMMODITY: POLE SITAO

Table 8. FARM ADVISORY ON POLE SITAO PRODUCTION AS AFFECTED BY RAINFALL CONDITION

Growth Stage		RAINFALL CONDITION						REMARKS
		Heavy Rain		Moderate Rain		No Rain		
	DAS	Potential Impact	Technology to be employed	Potential Impact	Technology to be employed	Potential Impact	Technology to be employed	
Germination	7-14 days	Poor germination	Germinate seed in areas that will not be affected by heavy rainfall	Normal germination	Pole sitao is well suited in warm climate at a temperature range of 20-35oC. It can thrive well under full sunlight although it can tolerate partial shading. Higher percentage of pod set can be achieved when planted in May for wet season and in October-November for dry season. Any type of soil is suited to pole sitao production. However, a friable	Poor germination	Speed up germination by soaking the seeds at room temperature overnight. Put the seeds in a moist paper towel, roll up the towel along with the seeds, place the bundle inside a plastic bag over the next few days for better germination.	

					fertile soil is preferred to obtain healthy growth and high quality pods. The soil must have a pH value of 5.5-6.8.			
Seedling Stage to Vegetative Stage	14-49 days	Water logging	During rainy season, there should be enough irrigation canal to control water-logging.	Normal plant growth	There should be enough irrigation canal to control water-logging.	Drought leads to poor crop growth and development	Though pole sitao has a relatively deep root system which enables it to tolerate drought, it also needs enough water for their growth and development. So water the crop and use mulching to preserve moisture in the soil especially during dry season. Use rice straw or cogon grass.	

Flowering Stage	50-60 days	Can cause flower drop	In hill and drill methods of planting, provide poles after 14 days from emergence. Vertical trellis is used for single row plot with a distance between rows of one (1) meter. Ipil-ipil, bamboo and kakawate poles are used 3-4 m apart with in the rows and are secured on top with GI wire #16. Tie the top wire to the stakes at the end of the rows to make the poles stable. Plastic straw is used at the bottom portions in every row.	Normal Flowering	Muriate of potash (0-0- 60) should be applied at the rate of 1-2 bags during flowering stage. Foliar fertilizers should also be applied weekly starting at flowering stage.	Less number of flower developed	Irrigate the plant with sufficient water for better flower development.	

			Straw lines are tied vertically from top to bottom in every hill. For double row plots, A-type trellis is spaced apart at 0.75 m. Synthetic straw is also used for the pole sitao to cling on for the trellis.					
Pod Development	55-60days	Spread of diseases due to pod rot	Eliminate any damaged or deformed fruits in their early stages through rouging and pruning to avoid spreading and nutrient competition.	Normal pod development	Supplementary application of Fermented Plant Juice (FPJ) or Fermented Fruit Juice (FFJ) should also be applied twice a week up to fruiting stage. Doing crop rotation every end of the harvest is a good idea. A local systemic control of hot pepper extract to	Less pod development	Water the plants during the onset of dry weather regularly or anytime if urgently needed.	

					be sprayed to the plants is also helpful to keep beanfly away from the plants one week after planting and next week depending on the degree of damaged. Aphids can be controlled by the use of soap spray or green-labeled pesticides. Do not use yellow and red label pesticides during the onset of pod bearing. It is not safe for consumers' consumption. Practice botanical pesticides using hot pepper.			

Maturity and Harvest	60-70 days	Less number of harvested pods due to root rot	Harvesting is done manually to choose the good quality pods. Harvest the pod by holding the stem end before twisting it free. To avoid weight loss, harvesting should be done early in the morning or during the cooler times of the day. The pods should be kept in a shaded area after harvest.	Good yield	Pole sitaw is harvested 60-70 days from planting, depending on the pod diameter and toughness. It is harvested by hand every 3-4 days for up to 30 times during the growing season.	Less number of harvested pods	Harvest green pods immediately. If it exceeds the ideal harvesting period, the pods become fibrous and not palatable for consumption.	

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COMMODITY: CATTLE

Table 9. Potential impacts of different daily rainfall conditions on CATTLE by Different Age Group

Age Group	RAINFALL CONDITIONS No rain	Light Rains	Moderate Rains	Heavy Rains
Calf Unsexed, unweaned cattle under 11 months old.	Large quantity of ammonia is released in the excreta of goats which are further increased during the summer season. Breathing of this gas is harmful to the calf's health; High incidence of skin sores, respiratory ailments, digestive and foot problem; Limited water supply and feed due to no rain/drought can affect the health, growth, and well-being of calf.	Prolonged light rain brings about damp condition that creates a favorable environment for the proliferation of parasites, including gastrointestinal worms that pose significant threat to the health of the calf.	Prolonged moderate rain brings about damp condition that creates a favorable environment for the proliferation of parasites, including gastrointestinal worms that pose significant threat to the health of the calf.	Rainy season influences outbreak of respiratory diseases caused by microorganisms like bacteria and fungi and nematodes that can cause pneumonia. Favorable environment for the proliferation of parasites. Muddy and waterlogged conditions can cause foot problems, resulting in lameness and reduced mobility
Yearling Unsexed cattle, > 12 months old.	Large quantity of ammonia is released in the excreta of goats which are further increased during the summer season. Breathing of this gas is harmful to the	Prolonged light rain brings about damp condition that create a favorable environment for the proliferation of parasites, including gastrointestinal	Prolonged moderate rain brings about damp condition that create a favorable environment for the proliferation of	Rainy season influences outbreak of respiratory diseases caused by microorganisms like bacteria and fungi and nematodes that can cause

Age Group	RAINFALL CONDITIONS			
	No rain	Light Rains	Moderate Rains	Heavy Rains
	cattle's health; High incidence of skin sores, respiratory ailments, digestive and foot problem; Limited water supply and feed due to no rain / drought can affect the health, growth, and well-being of cattle; Heat stress decreased productivity and energetic efficiency since there is suppression of feed intake cuased by the stimulation of evaporative heat loss mechanism in cattle.	worms that pose significant threat to the health of the cattle. Heat stress decreased productivity and energetic efficiency since there is suppression of feed intake	parasites, including gastrointestinal worms that pose significant threat to the health of the cattle.	pneumonia. Favorable environment for the proliferation of parasites. Muddy and waterlogged conditions can cause foot problems, resulting in lameness and reduced mobility
Breeder (sexually mature female adult cattle that has produced at least 1 calf (cow), and Bull- male adult cattle)	Large quantity of ammonia is released in the excreta of goats which are further increased during the summer season. Breathing of this gas is harmful to the cattle's health; High incidence of skin sores, respiratory ailments,	Prolonged light rain brings about damp condition that create a favorable environment for the proliferation of parasites, including gastrointestinal worms that pose significant threat to the health of the cattle. Heat stress decreased	Prolonged moderate rain brings about damp condition that create a favorable environment for the proliferation of parasites, including gastrointestinal worms that pose significant	Rainy season influences outbreak of respiratory diseases caused by microorganisms like bacteria and fungi and nematodes that can cause pneumonia. Favorable environment for the proliferation of parasites

Age Group	RAINFALL CONDITIONS No rain	Light Rains	Moderate Rains	Heavy Rains
	digestive and foot problem; Limited water supply and feed due to no rain / drought can affect the health, growth, and well-being of cattle. Heat stress in cattle is caused by a moderate to high temperature in combination with high humidity. At temperatures above 22ºC cows are unable to dissipate their body heat effectively. This results in reduced feed intake, reduced milk production, decreased immunity and poor fertility2	productivity and energetic efficiency since there is suppression of feed intake. On the other hand, rain enables grasses and legumes to thrive/grow, hence, source of feed is available.	threat to the health of the cattle. On the other hand, rain enables grasses and legumes to thrive/grow, hence, source of feed is available.	such as fluke and round worms. On the other hand, rain enables grasses and legumes to thrive/grow, hence, source of feed is available. Muddy and waterlogged conditions can cause foot problems, resulting in lameness and reduced mobility

Table 9.1. Suitable technical management guidelines for CATTLE in response to different rainfall conditions

Activities	No Rain	Light Rains	Moderate Rains	Heavy Rains
Health Care and Management	Thorough cleaning of the sheds is necessary. Provide with shady areas along with ad libitum clean drinking water with electrolytes to offset nutrient deficiencies. Provide slat leaks/UMMB. Premises should be kept clean at all times to prevent disease occurrence. Deworm animals prior to onset of rainy season. Inspect their hooves and trim them if necessary to prevent overgrowth and lameness.	House cattle under complete confinement in a secure pen with good ventilation. Deworming must be done in the beginning of the rainy season and throughout the season because worms multiply at a greater rate during rainy period. Provide water with molasses, salt leaks UMMB. The premises should be kept clean at all times to minimize proliferation of bacteria and prevent disease occurrence. Inspect their hooves and trim them if necessary to prevent overgrowth and lameness. Consider having small water reservoir to collect water in preparation for	House cattle under complete confinement in a secure pen with good ventilation throughout the rainy season. Provide water with molasses, salt leaks UMMB. The premises should be kept clean at all times to minimize proliferation of bacteria and prevent disease occurrence. Inspect their hooves and trim them if necessary to prevent overgrowth and lameness. Consider having small water reservoir to collect water in preparation of drought, and crop-	House cattle under complete confinement in a good and secure pen if not throughout the year, at least throughout the rainy season. Provide water with molasses, salt leaks or UMMB. The premises should be kept clean at all times to minimize proliferation of bacteria and prevent disease occurrence. Keep animals away from flood waters which may contain harmful bacteria or chemicals. Monitor animals daily for signs of illness.

Activities	No Rain	Light Rains	Moderate Rains	Heavy Rains
		drought, and crop-livestock integration system for higher ROI	livestock integration system for higher ROI	
Breeding Management	Vaccinate, deworm and administer vitamin supplementation for animals in preparation for breeding. Breed cows during summer that calving will happen after the rainy season.	Vaccinate, deworm and administer vitamin supplementation for animals in preparation for breeding.	Vaccinate, deworm and administer vitamin supplementation for animals in preparation for breeding.	Vaccinate, deworm and administer vitamin supplementation for animals in preparation for breeding.
Feeding Management	Supplement their diet with alternative feed sources can help ensure that cattle receive the necessary nutrients to maintain optimal health and productivity. Include alternative feed such as hay, silage, leaf meal, waste products from corn, peanut, soybean, and sorghum, and provide concentrated feeds.	Adopt cut-and-carry feeding system can be an effective alternative to grazing for cattle raisers during the rainy season. Before feeding freshly cut forage, leave it for a while to dry and for the possible worms to fall down. Utilize farm wastes as feed such wastes from corn, peanut, sorghum, soybean. Store feedstuffs (grain and	Adopt cut-and-carry feeding system can be an effective alternative to grazing for cattle raisers during the rainy season. Before feeding freshly cut forage, leave it for a while to dry and for the possible worms to fall down. Provide salt leaks or UMMB. Utilize farm wastes as feed such wastes	Adopt cut-and-carry feeding system can be an effective alternative to grazing for cattle raisers during the rainy season. Before feeding freshly cut forage, leave it for a while to dry and for the possible worms to fall down. Provide salt leaks/UMMB. Utilize farm wastes as feed such wastes from corn, peanut, sorghum,

Activities	No Rain	Light Rains	Moderate Rains	Heavy Rains
	Safe, clean, and adequate rations or feeding materials (silage, grasses, legumes and concentrates) suited for cattle and buffaloes should be provided.	hay) at higher locations to ensure accessibility when needed. Provide alternative feed options (such as hay, silage, UTRS, and concentrated feeds) to promote overall health.	from corn, peanut, sorghum, soybean. Store feedstuffs (grain and hay) at higher locations to ensure accessibility when needed. Provide alternative feed options (such as hay, silage, UTRS, and concentrated feeds) to promote overall health.	soybean. Store feedstuffs (grain and hay) at higher locations to ensure accessibility when needed. Provide alternative feed options (such as hay, silage, and concentrated feeds) to promote overall health.

Table 9.2. Suitable technical management guidelines for CATTLE in response to different climate risks

Activities	Drought / High Temperature	Flooding	Heavy Rainfall	Low Temperature	Strong Wind
Health Care and Management	Provide quality water sources - Ensure animals have a supply of cool, clean water; Make sure cows have free access to plenty of fresh, clean drinking water. Ensure cattle sheds are well-ventilated. Ensure grazing cows have access to shade. Keep the housing clean and dry to prevent proliferation of microorganisms that can cause desease to the animal. Monitor animals for illness -	House cattle under complete confinement in a secure pen with good ventilation. Deworming must be done in the beginning of the rainy season and throughout the season because worms multiply at a greater rate during rainy period. Provide water with molasses, salt leaks UMMB. The premises should be kept clean at all times to minimize proliferation of bacteria and prevent disease occurrence. Inspect their hooves and trim them if necessary to prevent	House cattle under complete confinement in a secure pen with good ventilation. Deworming must be done in the beginning of the rainy season and throughout the season because worms multiply at a greater rate during rainy period. Provide water with molasses, salt leaks UMMB. The premises should be kept clean at all times to minimize proliferation of bacteria and prevent disease occurrence. Inspect their hooves and trim them if necessary to prevent	If possible, move animals to an indoor shelter or building, especially the young. Provide additional bedding to keep animals insulated from the ground and keep them dry.6 Never leave animals tied up or restrained outside	House cattle under complete confinement wherein cattle are fully confined in a good and secure pen. For grazing cattle, house them well in advance of a storm. Keep them away from areas with windows. Never leave animals tied up or restrained outside.7

Activities	Drought / High Temperature	Flooding	Heavy Rainfall	Low Temperature	Strong Wind
	If animals show signs of illness, contact your local veterinarian immediately. Signs of dehydration: rapid, shallow breathing; reluctance to move; weight loss; drying of mucous membranes (e.g., eyes, nose, mouth); decreased skin flexibility; Signs of heat stress: increased respiration rate or panting; excessive salivation; elevation of the head to make it easier to breathe; open mouth breathing.	overgrowth and lameness. Evacuate the cattle to higher or elevated pasture ground/ shed if necessary. Keep animals away from flood waters which may contain harmful bacteria or chemicals. Monitor animals daily for signs of illness.5	overgrowth and lameness. Evacuate the cattle to , higher or elevated pasture ground/ shed if necessary. Keep animals away from flood waters which may contain harmful bacteria or chemicals. Monitor animals daily for signs of illness.5 Never leave animals tied up or restrained outside		
Breeding Management	Only sexually mature animals of appropriate age and weight and free from	Only sexually mature animals of appropriate age and weight and free from	Only sexually mature animals of appropriate age and weight and free from	Only sexually mature animals of appropriate age and weight and free from	Only sexually mature animals of appropriate age and weight and free from

Activities	Drought / High Temperature	Flooding	Heavy Rainfall	Low Temperature	Strong Wind
	any disease or probable inherited abnormality should be bred. Administer vitamin supplementation for animals in preparation for breeding	any disease or probable inherited abnormality should be bred. Administer vitamin supplementation for animals in preparation for breeding	any disease or probable inherited abnormality should be bred. Administer vitamin supplementation for animals in preparation for breeding	any disease or probable inherited abnormality should be bred. Administer vitamin supplementation for animals in preparation for breeding	any disease or probable inherited abnormality should be bred. Administer vitamin supplementation for animals in preparation for breeding
Feeding Management	Safe, clean, and adequate rations or feeding materials (silage, grasses, legumes and concentrates) suited for cattle should be provided. Make sure they have plenty of food and water. Provide water with molasses or probiotics	Safe, clean, and adequate rations or feeding materials (silage, grasses, legumes and concentrates) suited for cattle should be provided. Make sure they have plenty of food and water. Do not feed flood damaged or moldy feed or hay	Safe, clean, and adequate rations or feeding materials (silage, grasses, legumes and concentrates) suited for cattle should be provided. Make sure they have plenty of food and water. Do not feed flood damaged or moldy feed or hay	Safe, clean, and adequate rations or feeding materials (silage, grasses, legumes and concentrates) suited for cattle should be provided. Make sure they have plenty of food and water.	Safe, clean, and adequate rations or feeding materials (silage, grasses, legumes and concentrates) suited for cattle should be provided. Make sure they have plenty of food and water.

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COMMODITY: GOAT

Table 10. Potential impacts of different daily rainfall conditions on GOAT

	RAINFALL CONDITIONS			
Age Group	No rain	Light Rains	Moderate Rains	Heavy Rains
BUCK sexually mature uncastrated male goat usually kept for breeding	Limited water supply and feed due to no rain can affect the health, growth, and well-being of goat; Plants can concentrate toxins making them unsafe for animal consumption. Large quantity of ammonia is released in the excreta of goats which are further increased during the summer season. Breathing of this gas is harmful for goats1. High incidence of skin sores, respiratory ailments, digestive problems, foot problems1 Heat stress decreased productivity and energetic efficiency since there is suppression of feed intake caused by the stimulation	The rainy season brings about damp conditions that create a favorable environment for the proliferation of parasites, including gastrointestinal worms and liver flukes. These parasites can pose a significant threat to the health and productivity of goats Heat stress decreased productivity and energetic efficiency since there is suppression of feed intake cuased by the stimulation of evaporative heat loss mechanism. On the other hand, rain enables grasses and legumes to thrive/grow, hence, source	The rainy season brings about damp conditions that create a favorable environment for the proliferation of parasites, including gastrointestinal worms and liver flukes. These parasites can pose a significant threat to the health and productivity of goats On the other hand, rain enables grasses and legumes to thrive/grow, hence, source of feed will be available for goats	Rainy season influences outbreak of respiratory diseases caused by microorganisms like bacteria and fungi and nematodes that can cause pneumonia. Favorable environment for the proliferation of parasites including gastrointestinal worms and liver flukes. These parasites can pose a significant threat to the health and productivity of goats. On the other hand, rain enables grasses and legumes to thrive/grow, hence, source of feed for goat will be available.

	of evaporative heat loss mechanism	of feed will be available for goats		
DOE sexually mature female goat that has given birth	Large quantity of ammonia is released in the excreta of goats which are further increased during the summer season. Breathing of this gas is harmful to the goat's health; High incidence of skin sores, respiratory ailments, digestive and foot problem; Limited water supply and feed due to no rain/drought can affect the health, growth, and well-being of goat. Heat stress leads to reduction in milk yield Heat stress decreased productivity and energetic efficiency since there is suppression of feed intake cuased by the stimulation of evaporative heat loss mechanism	Prolonged light rain brings about damp condition that create a favorable environment for the proliferation of parasites, including gastrointestinal worms that pose significant threat to the health of the goat. Heat stress decreased productivity and energetic efficiency since there is suppression of feed intake cuased by the stimulation of evaporative heat loss mechanism. On the other hand, rain enables grasses and legumes to thrive/grow, hence, source of feed for goat will be available.	Prolonged moderate rain brings about damp conditions that create a favorable environment for the proliferation of parasites, including gastrointestinal worms and liver flukes. These parasites can pose a significant threat to the health and productivity of goats On the other hand, rain enables grasses and legumes to thrive/grow, hence, source of feed will be available for goats	Rainy season influences outbreak of respiratory diseases caused by microorganisms like bacteria and fungi and nematodes that can cause pneumonia. Favorable environment for the proliferation of parasites including gastrointestinal worms and liver flukes. These parasites can pose a significant threat to the health and productivity of goats. On the other hand, rain enables grasses and legumes to thrive/grow, hence, source of feed for goat will be available.

GROWER a young male (Buckling) or female goat (Doeling) that has attained puberty and kept for breeding	Large quantity of ammonia is released in the excreta of goats which are further increased during the summer season. Breathing of this gas is harmful to the goat's health; High incidence of skin sores, respiratory ailments, digestive and foot problem; Limited water supply and feed due to no rain / drought can affect the health, growth, and well-being of goat.Heat stress decreased productivity and energetic efficiency since there is suppression of feed intake cuased by the stimulation of evaporative heat loss mechanism	Prolonged light rain brings about damp condition that create a favorable environment for the proliferation of parasites, including gastrointestinal worms that pose significant threat to the health of the goat. Heat stress decreased productivity and energetic efficiency since there is suppression of feed intake cuased by the stimulation of evaporative heat loss mechanism. On the other hand, favorable for growth as long as shades, good housing, feeds and water are provided; rain enables grasses and legumes to thrive/grow, hence, source of feed for goat will be available	Prolonged light rain brings about damp condition that create a favorable environment for the proliferation of parasites, including gastrointestinal worms that pose significant threat to the health of the goat. On the other hand, favorable for growth as long as shades, good housing, feeds and water are provided; rain enables grasses and legumes to thrive/grow, hence, source of feed for goat will be available	Rainy season influences outbreak of respiratory diseases caused by microorganisms like bacteria and fungi and nematodes that can cause pneumonia. Favorable environment for the proliferation of parasites including gastrointestinal worms and liver flukes. These parasites can pose a significant threat to the health and productivity of goats. On the other hand, rain enables grasses and legumes to thrive/grow, hence, source of feed for goat will be available.
Kids-	Large quantity of ammonia is released in the excreta of goats which are further	Prolonged light rain brings about damp condition that create a favorable	Prolonged moderate rain brings about damp condition that	Rainy season influences outbreak of respiratory diseases caused by

young goat of either sex below three months of age	increased during the summer season. Breathing of this gas is harmful to the kid's health; High incidence of skin sores, respiratory ailments, digestive and foot problem; Limited water supply and feed due to no rain/drought can affect the health, growth, and well-being of the kid.	environment for the proliferation of parasites, including gastrointestinal worms that pose significant threat to the health of the kids. On the other hand, favorable for growth as long as shades, good housing, feeds and water are provided; rain enables grasses and legumes to thrive/grow, hence, source of feed for goat will be available	create a favorable environment for the proliferation of parasites, including gastrointestinal worms that pose significant threat to the health of the kids. On the other hand, favorable for growth as long as shades, good housing, feeds and water are provided; rain enables grasses and legumes to thrive/grow, hence, source of feed for goat will be available	microorganisms like bacteria and fungi and nematodes that can cause pneumonia. Favorable environment for the proliferation of parasites including gastrointestinal worms like liver flukes. These parasites can pose a significant threat to the health and productivity of goats. On the other hand, rain enables grasses and legumes to thrive/grow, hence, source of feed for goat will be available.

Table 10.1. Suitable technical management guidelines for GOAT in response to different rainfall conditions

Activities	No Rain	Light Rains	Moderate Rains	Heavy Rains
Health Care and Management	Thorough cleaning of shed is necessary; provide shady areas along with ad libitum clean drinking water combined with probiotics or	Confine goats to protect them from rain. The pen must be dry and have good ventilation.	House goats under complete confinement with good ventilation and complete water and	House goats under complete confinement wherein goats are fully confined in a good and

	electrolytes; monitor the health. Premises should be kept clean at all times to prevent disease occurrence. Deworm animals prior to onset of rainy season. Vaccinate to protect the goat from major diseases. Separate unhealthy animals.	Make sure that soil and plants are dry before grazing the animals to avoid ingestion of parasites/worm. Keep premises clean at all times to prevent disease occurrence. Vaccinate to protect the goat from major diseases. Separate unhealthy animals.	feeding through at least throughout the rainy season. Keep premises clean at all times to prevent disease occurrence. Vaccinate to protect the goat from major diseases. Separate unhealthy animals.	secure pen if not throughout the year, at least throughout the rainy season. The premises should be kept clean at all times to prevent disease occurrence. Deworm after the rain. Separate unhealthy animals.
Breeding Management	Administer vitamin and concentrate supplementation for animals in preparation for breeding	Administer vitamin supplementation for animals in preparation for breeding	Administer vitamin supplementation for animals in preparation for breeding	Administer vitamin supplementation for animals in preparation for breeding
Feeding Management	Supplement their diet with alternative feed sources can help ensure that cattle receive the necessary nutrients to maintain optimal health and productivity. Include alternative feed such as hay, silage, leaf meal, waste products from corn, peanut, soybean, and	Adopt cut-and-carry feeding system can be an effective alternative to grazing for cattle raisers during the rainy season. Before feeding freshly cut forage, leave it for a while to dry and for the possible worms to fall down. Utilize farm wastes as feed such wastes from corn, peanut, sorghum, soybean. Store	Adopt cut-and-carry feeding system can be an effective alternative to grazing for cattle raisers during the rainy season. Before feeding freshly cut forage, leave it for a while to dry and for the possible worms to fall down. Utilize farm	Adopt cut-and-carry feeding system can be an effective alternative to grazing for goat raisers during the rainy season. Provide alternative feed options (such as hay, silage, and concentrated feeds) to promote overall health. Consider water

	sorghum, and provide concentrated feeds. Safe, clean, and adequate rations or feeding materials (silage, grasses, legumes and concentrates) suited for cattle and buffaloes should be provided.	feedstuffs (grain and hay) at higher locations to ensure accessibility when needed. Provide alternative feed options (such as hay, silage, UTRS, and concentrated feeds) to promote overall health. Consider fruit bearing tree or crop-livestock integration for higher ROI. Plant quality grasses and legumes as feed for the goat	wastes as feed such wastes from corn, peanut, sorghum, soybean. Store feedstuffs (grain and hay) at higher locations to ensure accessibility when needed. Provide alternative feed options (such as hay, silage, UTRS, and concentrated feeds) to promote overall health. Consider fruit bearing tree or crop-livestock integration for higher ROI. Plant quality grasses and legumes as feed for the goat	harvesting to preserve rain water in preparation for drought.

Table 10.2. Suitable technical management guidelines for GOAT in response to different climate risks

Activities	Drought / High Temperature	Flooding	Heavy Rainfall	Low Temperature	Strong Wind
Health Care and Management	Provide quality water sources - Ensure animals have a supply of cool, clean water; Monitor the water temperature and keep it cool. Monitor animals for illness - Signs of dehydration: rapid, shallow breathing; reluctance to move; weight loss; drying of mucous membranes (e.g., eyes, nose, mouth); decreased skin flexibility; Signs of heat stress: increased respiration rate or panting; excessive salivation; elevation of the head to make it easier to	Confine goats in an elevated housing under complete confinement in a good and secure pen throughout the rainy season. Monitor health. Separate the healthy goat/ to unhealthy goat, and trim the hooves	House goats under complete confinement in a good and secure pen throughout the rainy season. Make sure that goats are not directly in contact with wet feces. Monitor the health. Deworm after the rain. Separate the healthy goat/ to unhealthy goat, and trim the hooves	Protected goats from exposure to adverse environmental condition, which indirectly affects the health of the animal. Provide a hay in the barn/housing to make the goats warm. Elevated slatted flooring will keep them away from their feces. Monitor the health. Separate the healthy goat/ to unhealthy goat, and trim the hooves	Provide wind brakers at the sides of pen to protect them strong wind or splash of rain. Confine animals in housing with elevated slatted floors made from locally available materials such as bamboo, coco lumber, cogon, and nipa shingles. Separate the healthy goat/ to unhealthy goat, and trim the hooves

	breathe; open mouth breathing. Provide shaded area for the goats Separate the healthy goat/ to unhealthy goat. Trim the hooves				
Breeding Management	Only sexually mature animals of appropriate age and weight and free from any disease or probable inherited abnormality should be bred. Administer vitamin and feed supplementation for animals in preparation for breeding11	Only sexually mature animals of appropriate age and weight and free from any disease or probable inherited abnormality should be bred. Administer vitamin and feed supplementation for animals in preparation for breeding	Only sexually mature animals of appropriate age and weight and free from any disease or probable inherited abnormality should be bred. Administer vitamin and feed supplementation for animals in preparation for breeding	Only sexually mature animals of appropriate age and weight and free from any disease or probable inherited abnormality should be bred. Administer vitamin and feed supplementation for animals in preparation for breeding	Only sexually mature animals of appropriate age and weight and free from any disease or probable inherited abnormality should be bred. Administer vitamin and feed supplementation for animals in preparation for breeding
Feeding Management	You may need to limit the number of animals to conserve water and reduce feed demand. Sell unproductive	Safe, clean, and adequate rations or feeding materials (silage, grasses, legumes and concentrates) suited	Adopt stall feeding and practice cut and carry with available herbaceous forages supplemented with leguminous tree	Goats need more energy to help maintain body temperature. They will also need roughage	Goats need more energy to help maintain body temperature. They will also need roughage

	animals. Supplementing their diet with alternative feed sources can help ensure that goats receive the necessary nutrients to maintain optimal health and productivity. Include alternative feed options for goats12	for cattle should be provided. Make sure they have plenty of food and water. Do not feed flood damaged or moldy feed or hay. Consider to rest pastures or postpone grazing in all pastures	leaves and concentrate. Provide salt leak or UMMB/red rockies	which can be supplied in grass, alfalfa, or mixed hay. Alfalfa hay can be a great source of both energy and protein, Safe, clean, and adequate rations or feeding materials (silage, UTRS, grasses, legumes and concentrates) suited for cattle should be provided. Make sure they have plenty of food and water.	which can be supplied in grass, alfalfa, or mixed hay. Alfalfa hay can be a great source of both energy and protein. Safe, clean, and adequate rations or feeding materials (silage, grasses, legumes and concentrates) suited for cattle should be provided. Make sure they have plenty of food and water.

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Growth stages	No. of Weeks	• Farm activities	Environmental Requirements			• Feeding	Feeding Frequency
			Temperature Range	Space Requirement (m^2)	Linear Feeding Space requirement(cm)		
Kid Stage (New born kids)	0-3mos	• Record the date of birth • Tagging kids for identification • Keep the bedding clean by renewing it regularly Keep the kid warm, clean and dry and the area free from draughts	101°C - 103°C	0.20-0.50	7.62-12.70	• New born kids should get colostrum within 3 hours after birth • Feed in small amounts and often for the first few days • approximately 6 weeks of age slowly introduce the kid to pellets	4-6times daily requires at least 4 feeds daily Feed 3 times daily Only 2 feeds per day At least once a day
Doeling/buckling Stage	4-12months	• Feed adequate and quality feeds along with clean water • Know major disease and vaccinated against those disease • Control of internal and external parasites • Keep ailing goats/separately and	25-32°C	0.50-0.75	10.16-15.24	Forages, Minimum of 1-3% of their body weight everyday Supplemental feeds	2-3 times daily At least once a day

		do not mix with healthy goats • Trimming the hooves					
Doe/Buck **(Adult stage)**	Up to 1 year	• Feed adequate and quality feeds along with clean water • Monitor Health and Nutrition. • Know major disease and vaccinated against those disease • Trimming the hooves • Introducing breeding/ cross-breeding • Separate the healthy goat/ to unhealthy goat	25-32°C	0.75-1.50	15.24-25.40	Forages, Minimum of 1-3% of their body weight everyday Supplemental feeds	2-3 times daily At least once a day

Table 11. Potential impacts of different daily rainfall conditions ON CHICKEN

Rainfall Conditions				
Age Group	**No Rain**	**Light Rains**	**Moderate Rains**	**Heavy Rains**
Chicks	High temperatures due to no rain for extended periods of time increases mortality, and have negative impact on growth performance. Exposure to high temperatures during the first 2 days of life causes body weight losses of about 12% in chicks, and stagnant growth.	The rainy season is usually synonymous with an increase in relative humidity and a reduction in temperature; rainfall affects both the quality and quantity of feeding, while wind speed has an impact on the outbreak of diseases. In addition, increased humidity and wet conditions create an ideal environment for various poultry pathogens and parasites to proliferate.	The rainy season is usually synonymous with an increase in relative humidity and a reduction in temperature; rainfall affects both the quality and quantity of feeding, while wind speed has an impact on the outbreak of diseases. In addition, increased humidity and wet conditions create an ideal environment for various poultry pathogens and parasites to proliferate. Wet and caked litter becomes a breeding ground for all sorts of germs,	The rainy season is usually synonymous with an increase in relative humidity and a reduction in temperature; rainfall affects both the quality and quantity of feeding, while wind speed has an impact on the outbreak of diseases. Cold nights may affect their metabolic rate of chicks. They are much more sensitive to the cold than adult chickens due to their small size and immature feathers. Chicks are particularly susceptible to the cold in their first few days of life, and being exposed to cooler

			predisposes the chicken to infections	temperatures during this time can lead to illness nd death. They eat more feed during cold weather.
Pullet	High temperatures due to no rain for extended periods of time causes heat stress, have negative impact on growth performance, and may lead to high mortality rate.	The rainy season is usually synonymous with an increase in relative humidity and a reduction in temperature; rainfall affects both the quality and quantity of feeding, while wind speed has an impact on the outbreak of diseases. In addition, increased humidity and wet conditions create an ideal environment for various poultry pathogens and parasites to proliferate. There is high likelihood that birds will contract numerous pathogenic and parasitic illnesses such coccidiosis in rainy season. The risk of mycotoxin poisoning and respiratory disease infection increases due to wet or moist feeds .	The rainy season is usually synonymous with an increase in relative humidity and a reduction in temperature; rainfall affects both the quality and quantity of feeding, while wind speed has an impact on the outbreak of diseases. In addition, increased humidity and wet conditions create an ideal environment for various poultry pathogens and parasites to proliferate. Wet and caked litter becomes a breeding ground for all sorts of germs, predisposes the chicken to infections. The risk of mycotoxin poisoning and respiratory disease	The rainy season is usually synonymous with an increase in relative humidity and a reduction in temperature; rainfall affects both the quality and quantity of feeding, while wind speed has an impact on the outbreak of diseases. In addition, increased humidity and wet conditions create an ideal environment for various poultry pathogens and parasites to proliferate. There is high likelihood that birds will contract numerous pathogenic and parasitic illnesses such coccidiosis in rainy season. Wet and caked litter becomes a breeding ground for all sorts of germs,

			infection increases due to wet or moist feeds	predisposes the chicken to infections
Breeder	Egg production is reduced in extremely cold or hot weather. High temperatures due to no rain for extended periods of time causes heat stress, have negative impact on growth performance, and may lead to high mortality rate.	Egg production is reduced in extremely cold or hot weather. There is high likelihood that birds will contract numerous pathogenic and parasitic illnesses such coccidiosis in rainy season. Wet and caked litter becomes a breeding ground for all sorts of germs, predisposes the chicken to infections that affects the health, production and performance of breeder chicken	Egg production is reduced in extremely cold or hot weather. There is high likelihood that birds will contract numerous pathogenic and parasitic illnesses such coccidiosis in rainy season. Wet and caked litter becomes a breeding ground for all sorts of germs, predisposes the chicken to infections that affects the health, production and performance of breeder chicken	Egg production is reduced in extremely cold or hot weather. There is high likelihood that birds will contract numerous pathogenic and parasitic illnesses such coccidiosis in rainy season. Wet and caked litter becomes a breeding ground for all sorts of germs, predisposes the chicken to infections. that affects the health, production and performance of breeder chicken
Broiler-fryers Young, tender chicken about 7 weeks old	In poultry breeding the issue of maintenance of the proper temperature is of key importance to preserve proper conditions of bred broilers. They are affected with thermal stress that results in lower weight gains, worse health	Chicks are much more sensitive to the cold than adult chickens due to their small size and immature feathers. Chicks are particularly susceptible to the cold in their first few days of life, and being exposed to	The rainy season is usually synonymous with an increase in relative humidity and a reduction in temperature; rainfall affects both the quality and quantity of feeding, while wind speed has an	If chicks are chilled before day 6, it may affect their metabolic rate for several weeks and increase the ascites. However, Malan et al. (2003) found that ascites can relate to a low metabolic rate. Cold temperature is closely associated with the ability

	condition and higher death rate.	cooler temperatures during this time can lead to illness.	impact on the outbreak of diseases.	of the broiler to produce heat.[1]
Roasters Older chicken, about 3-5 months old	Heat stress can result in panting, increased water intake and eventually death. Access to cool, fresh water, ventilation, and adjusted feed schedules can help provide relief to birds.[2]	on cold nights, they will huddle together in a tight group to share body heat. Chickens can even slightly lower their internal metabolism to better resist cold snaps.	Chicken feathers are somewhat waterproof, so letting them out is fine. Letting your birds out prevents overcrowding, boredom and the diseases that go along with a wet chicken coop. Not all birds appreciate going out, but almost all will seek shelter and dry off before they get dangerously soaked.	The rain will eventually get through, but your chickens' water repellent feathers do give them a bit of a grace period. Their plumage protects them for a time from actually getting wet to the skin in the rain, like an oilcloth slicker, but for chickens.
Capons Male chickens about 16 weeks to 8 months old	In general, low temperature, as a physical environmental stressor, is known to in-crease feed intake to meet energy requirements.	It is always better to repair the house before the arrival of the rainy season and to clear the drainage ditch around the chicken house. When it rains, close the doors and windows or let the curtains open to prevent rain from entering the house and prevent the chickens from	Shelter from the weather is one of the most important things to provide for your chickens in winter. A combination of natural shelter (e.g. vegetation) and artificial shelter (e.g. the coop) will help to ensure your chickens feel safe and give them somewhere to	A chicken's body temperature lowers when it loses more heat than it can produce. Huddling together, holding a foot up to their breast, or puffing their feathers are all signs that your chickens may be cold. Prolonged cold stress can reduce

		getting cold or other problems	stay warm during windy or rainy weather.	performance and lead to death.
Stewing or Baking Hens Mature laying hens 10 months to 1 ½ years old	Chickens and other livestock birds consume less feed and drink more water in the hot season or weather in order to cool their body.	Poultry production is generally affected by seasonal climatic or weather changes. For instance, in the wet or cold season, chickens eat more feed, drink less water and huddle together to generate heat and keep them warm.	Rain isn't necessarily dangerous for your hens so long as the temperatures are moderate. The most dangerous time for a chicken to become wet is during cold weather, as hens need to be able to fluff their feathers up to trap air around their bodies as insulation.	Under the influence of the rainy season of battery cage for layers, the humidity in the chicken house is increased, the litter is moist, the feed is mildewed, some production units cannot obtain clean drinking water, which may lead to coccidiosis, E. coli outbreak, and elevated ammonia concentration. The risk of mycotoxin poisoning and respiratory disease infection increases.

Table 11.1. Suitable technical management guidelines for CHICKEN in response to different rainfall conditions

Activities	No Rain	Light Rains	Moderate Rains	Heavy Rains
Health Care and Management	Provision of shades, feeds, and clean drinking water at all times with probiotics. High-level farm/pen hygiene and sanitation must be maintained. Biosecurity measures should be in place. Housing must have a good ventilation. If necessary, keep the environment fumigated against bacteria and germs to keep outbreak of diseases. Dewormers should be given every three months, with strict adherence to label directions	Pen's roofing must be free from leaks and have a good ventilation. This involves regular maintenance and repairs to prevent water ingress. Provide water and proper nutrition at all times. High-level farm/pen hygiene and sanitation must be maintained. Biosecurity measures should be in place. Stagnant water should not be left in the chicken coops, as they serve as breeding ground for disease agents. The litter should also be kept dry and changed once it gets wet, as wet litter boosts microbial growth. Dewormers should be given every three months, with strict adherence to label directions	Pen's roofing must be free from leaks and is well ventilated. This involves regular maintenance and repairs to prevent water ingress. Provide water and proper nutrition. High-level farm/pen hygiene and sanitation must be maintained. Biosecurity measures should be in place. Stagnant water should not be left in the chicken coops, as they serve as breeding ground for disease agents. The litter should also be kept dry and changed once it gets wet, as wet litter boosts microbial growth. Dewormers should be given, with strict adherence to label directions. Provide light to chicks to provide them with warmth.	Pen's roofing must be free from leaks and is well ventilated. This involves regular maintenance and repairs to prevent water ingress. Provide water and proper nutrition. High-level farm/pen hygiene and sanitation must be maintained. Biosecurity measures should be in place. Stagnant water should not be left in the chicken coops, as they serve as breeding ground for disease agents. The litter should also be kept dry and changed once it gets wet, as

				wet litter boosts microbial growth. Provide light to chicks to provide them with warmth.
Breeding Management	Provision of clean drinking water at all times with probiotics. High-level farm/pen hygiene and sanitation must be maintained. Biosecurity measures should be in place. Housing must have a good ventilation. If necessary, keep the environment fumigated against bacteria and germs to keep outbreak of diseases	Providing florescent light when environment is gloomy for egg production	Providing florescent light when environment is gloomy for egg production	Providing florescent light when environment is gloomy for egg production
Feeding Management	Proper nutrition is vital for good immune system and health. Provide forages as supplemental feed and clean drinking water with probiotics at all times.	Proper nutrition is vital for good immune system and health. Provide forages as supplemental feed and clean drinking water with probiotics at all times.[4]	Proper nutrition is vital for good immune system and health. Provide forages as supplemental feed and clean drinking water with probiotics at all times.	Proper nutrition is vital for good immune system. Provide forages as supplemental feed and clean drinking water with probiotics at all times.

Table 11.2. Suitable technical management guidelines for CHICKEN in response to different climate risks

Activities	Drought/High Temperature	Flooding	Heavy Rainfall	Low Temperature	Strong Wind
Health Care and Management	Provide proper nutrition and clean drinking water with probiotics at all times. Provide shades/ housing with good ventilation. Provide forages, alfalfa as supplemental feed.	Be sure animals are evacuated before floodwaters enter barns and other enclosed livestock areas. Animals sometimes refuse to leave during a rapid rise of water.[11]	Install proper eave troughs and down-spouts on poultry houses to carry rainwater far from the buildings. Provide proper drainage in the poultry yards.[9]	Provide supplemental heat when coop temperatures fall below 35 degrees F. Collect eggs as soon as you can and throw away any with cracked shells. Make sure your chickens have free access to fresh, clean water. Manage manure and provide ventilation to control moisture in your coop.[12]	Poultry housing should be weather-proof to provide protection from the elements (cold, rain, wind, and hot sun) and provide warmth, especially during brooding.[13]
Breeding Management	Breeding programs can focus on developing more heat-tolerant chicken breeds that exhibit improved performance.[14]	Assess the reproductive status of breeding animals affected by the floods.[15]	Continuous rainfall leads to wet and muddy conditions. Puddles of water can form in and around the chicken coop, providing breeding	It is better to stay within the range 'of feed suggested by the breeder. During rearing if more feed is required to stop bodyweights stalling.[16]	Higher windspeed dissipates more heat from these birds, resulting in better feed conversion, faster growth rate, lower mortality and increased yields.[17]

			grounds for pathogens.		
Feeding Management	Because of high temperature and relative humidity, birds may decrease their feed intake.	Feeding management during disaster has to be given utmost care to prevent starvation.[18]	Adding overhead coverage to your chicken feeding stations can make a big difference when it comes to facing the rainy weather.[8]	Using lower calcium and phosphorus levels in cold weather will decrease fecal and litter moisture.[19]	Discarded feed sacks when availa ble, can be utilized as wind and sun breakers. Planting trees will also serve as windbreaks.[20]

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Table 11.3. FARM ADVISORY ON CHICKEN PRODUCTION AS AFFECTED BY TEMPERATURE

GROWTH STAGE		TEMPERATURE						REMARKS
		BELOW NORMAL		NORMAL		ABOVE NORMAL		
	DAFI	Potential Impact	Technology to be employed	Potential Impact	Technology to be employed	Potential Impact	Technology to be employed	
1. Egg Fertilization	10-14 day	<10-15.56°C, Unfertile eggs	Incubator must be used to regulates the temperature index	Normal temperature of 10-15.56°C	store the eggs in a cool and dry place with a temperature between 50-60°F (10-15.56°C) and a humidity level of 70-75%.	>10-15.56°C, Unfertile eggs	The optimal temperature for incubating chicken eggs is between 99-101°F (37.22-38.33°C), with a humidity level of 50-55% for the first 18 days, and 65-75% for the last 3 days.	
2. Egg Embryo	1-21 days	<37.22-38.89°C, causing potentially fatal damage	Eggs must be physically turned to prevent the developing chick from sticking to the shell. More	Normal temperature of 37.22-38.89°C	By turning the eggs, the yolk turns within the albumin, once again moving the yolk away from the	>37.22-38.89°C, Unfertile eggs	Raising temperature initially accelerates embryonic growth and	

			scientifically, the embryo should be resting on top of the yolk. The yolk tends to float upward, on top of the albumen (egg white) towards the shell if the egg is not turned. As a result, the developing embryo can be squeezed between the yolk and the shell, causing potentially fatal damage.		shell and making it safe for the embryo on top until it is time to turn again.		utilization of nutrients and energy from yolk and albumen, but as incubation progresses, exposure to constant high temperatures decreases embryonic growth	
3. Baby chicks	Weeks 3-8	<32-35°C Low environmental temperature increases feed intake and decreases body weight gain and feed efficiency, thus negatively influencing the performance of	Thermometers shall be placed in strategic locations inside the poultry house in order to monitor the temperature.	Normal temperature of 32-35°C	Proper temperature inside the brooding area shall be maintained to make the chicks feel comfortable. The range of temperature ideal	>32-35°C stagnant growth	Temperature in the poultry house shall not be permitted to become higher than the outside temperature during summertime. Temperature	

		broiler chickens.			at various ages of broiler chicks		should be lowered by providing additional water troughs, roof sprinklers, foggers and fans.	
4. Pullet (Teenager)	Weeks 9-12	<21.11-23.89°C, Causes stress	A general rule of thumb for linear feeder and waterer space is 1 inch per chick, and increase to 2 inches per bird by week 2. After week 8, give 3-4 inches per growing pullet. Also, extra feed space is needed for the first week. Adding 1 feeder tray per 50 chicks in addition to their normal feeders.	Normal Temperature of 21.11-23.89°C	To maintain the proper temperature, install the best heating accessories for chicks in your brooders	>21.11-23.89°C, increased water and food intakes	Providing enough feeder and waterer space allows for pullets to eat and drink with enough space and will help flock uniformity.	

5. Hen (Adult)	Week 16-20	<7.22-23.89°C, causes stress	Floor space is also important for development. Having adequate living space will help social development, decrease pecking, and increase comfort and performance. Giving 0.5 sq. ft.per chick and increasing to 1 sq ft per chick at 3 weeks is required. From week 4 to week 17, 1.5 sq ft per pullet is needed. This helps to spread out manure load and helps improve air quality.	7.22-23.89°C	Proper housing is a cornerstone in maintaining the ideal temperature for chickens. It provides shelter from the elements, protects against predators, and offers a controlled environment where temperature, humidity, and ventilation can be managed effectively. A well-designed coop should be insulated to maintain a consistent temperature and equipped with adequate ventilation to prevent moisture buildup and allow	>7.22-23.89°C, increased water and food intakes	Extreme temperatures, however, result in cold stress or heat stress, because they require a chicken to use energy that would otherwise go to maintaining health and productivity. A cold-stressed chicken covers its legs and shivers. Hens stop laying.	

					fresh air circulation.			

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Table 12. Potential impacts of different daily rainfall conditions ON SWINE PRODUCTION

	RAINFALL CONDITIONS			
Age Group	**No rain**	**Light Rains**	**Moderate Rains**	**Heavy Rains**
Piglets to weaners	High temperature due to no rain reduces feed intake, growth rate and weakens the immune system of swine. Higher incidence and severity of scours, increased respiration rate, increased water consumption. No rain is likely to decrease water quality for animal consumption. Increase in temperature and precipitation levels favors the growth and distribution of most pest species by providing a warm and humid environment and providing necessary moisture for their growth	Conducive for growth for as long as animals are confined in a dry and well ventilated housing. Light rain may reduce environment temperature favorable to the growth of swine. Increase in temperature and precipitation levels favors the growth and distribution of most pest species by providing a warm and humid environment and providing necessary moisture for their growth	Conducive for growth for as long as animals are confined in a dry and well ventilated housing. Moderate rain may reduce environment temperature favorable to the growth of swine. Increase in temperature and precipitation levels favors the growth and distribution of most pest species by providing a warm and humid environment and providing necessary moisture for their growth	The rainy season brings about damp/went environment that create a favorable environment for the proliferation of parasites, microorganism that has a significant threat to the health and productivity of swine. Cold environment and wet flooring can cause pneumonia.
Grower and Finisher	Higher temperatures result in lower fertility rate, decreased feed	Conducive for growth for as long as animals are confined	Conducive for growth for as long as animals	The rainy season brings about damp/went

	intake and reduced growth rate in pig. Higher incidence and severity of scours, increased respiration rate, increased water consumption. No rain is likely to decrease water quality for animal consumption. Increase in temperature and precipitation levels favors the growth and distribution of most pest species by providing a warm and humid environment and providing necessary moisture for their growth	in a dry and well ventilated housing and quality nutrition. Light rain may reduce environment temperature favorable to the growth of swine. Increase in temperature and precipitation levels favors the growth and distribution of most pest species by providing a warm and humid environment and providing necessary moisture for their growth	are confined in a dry and well ventilated housing and quality nutrition. Light rain may reduce environment temperature favorable to the growth of swine. Increase in temperature and precipitation levels favors the growth and distribution of most pest species by providing a warm and humid environment and providing necessary moisture for their growth	environment that create a favorable environment for the proliferation of parasites, microorganism that has a significant threat to the health and productivity of swine. Cold environment and wet flooring can cause pneumonia.
Sows and boars (breeders)	Higher temperatures result in lower fertility rate, decreased feed intake and reduced growth rate in pig. Higher incidence and severity of scours, increased respiration rate, increased water consumption.	Conducive for growth for as long as animals are confined in a dry and well ventilated housing and quality nutrition. Light rain may reduce environment temperature favorable to the growth of swine.	Conducive for growth for as long as animals are confined in a dry and well ventilated housing and quality nutrition. Light rain may reduce environment	The rainy season brings about damp/went environment that create a favorable environment for the proliferation of parasites, microorganism that has a significant threat to the health and productivity of swine. Cold environment

	No rain is likely to decrease water quality for animal consumption. Increase in temperature and precipitation levels favors the growth and distribution of most pest species by providing a warm and humid environment and providing necessary moisture for their growth	Increase in temperature and precipitation levels favors the growth and distribution of most pest species by providing a warm and humid environment and providing necessary moisture for their growth	temperature favorable to the growth of swine. Increase in temperature and precipitation levels favors the growth and distribution of most pest species by providing a warm and humid environment and providing necessary moisture for their growth	and wet flooring can cause pneumonia.

Table 12.1. Suitable technical management guidelines for SWINE in response to different rainfall conditions

Activities	No Rain	Light Rains	Moderate Rains	Heavy Rains
Health Care and Management	Thorough cleaning of the housing is necessary. Provide adlibitum clean drinking water fortified with electrolytes. Provision of cooling system or water sprinkler. The premises should be kept clean at all times to prevent disease occurrence. Deworm animals prior to onset of rainy season. Provide proper nutrition and vitamins for better immune system against pest and diseases. Separate pigs showing symptoms of disease	The premises should be kept clean at all times to prevent disease occurrence. Provide adlibitum clean drinking water fortified with electrolytes. Provision of cooling system or water sprinkler if necessary. Provide proper nutrition and vitamins for better immune system against pest and diseases; Separate pigs showing symptoms of disease.	House goats under complete confinement wherein goats are fully confined in a good and secure pen if not throughout the day, at least throughout the rainy season. The premises should be kept clean at all times to prevent disease occurrence; Separate pigs showing symptoms of disease.	House goats under complete confinement wherein goats are fully confined in a good and secure pen if not throughout the year, at least throughout the rainy season The premises should be kept clean at all times to prevent disease occurrence; Separate pigs showing symptoms of disease.
Breeding Management	Administer vitamin supplementation for	Administer vitamin supplementation for	Administer vitamin supplementation for	Administer vitamin supplementation for

	breeders in preparation for breeding. Keep pregnant sow in a dry and well ventilated housing. Sprinkle water on sow when weather is too hot. Provide healthy ration such as fresh camote vines, kangkong, paragrass. Provide plenty of clean drinking water. Deworm breeders against internal parasites 14days before farrowing. Feed them with high energy ration. Separate breeders showing symptoms of disease.	breeders in preparation for breeding. Keep pregnant sow in a dry and well ventilated housing. Sprinkle water on sow when weather is too hot. Provide healthy ration such as fresh camote vines, kangkong, paragrass. Provide plenty of clean drinking water. Deworm breeders against internal parasites 14days before farrowing. Feed them with high energy ration. Separate breeders showing symptoms of disease.	breeders in preparation for breeding. Keep pregnant sow in a dry and well ventilated housing. Sprinkle water on sow when weather is too hot. Provide healthy ration such as fresh camote vines, kangkong, paragrass. Provide plenty of clean drinking water. Deworm breeders against internal parasites 14days before farrowing. Feed them with high energy ration. Separate breeders showing symptoms of disease.	breeders in preparation for breeding. Keep pregnant sow in a dry and well ventilated housing. Sprinkle water on sow when weather is too hot. Provide healthy ration such as fresh camote vines, kangkong, paragrass. Provide plenty of clean drinking water. Deworm breeders against internal parasites 14days before farrowing. Feed them with high energy ration. Separate breeders showing symptoms of disease.
Feeding Management	Provide pigs with ample supply of clean drinking water, and quality feeds. Supplementing their diet with alternative feed	Provide pigs with ample supply of clean drinking water, and quality feeds. Supplementing their diet with alternative feed	Provide pigs with ample supply of clean drinking water, and quality feeds. Supplementing their	Provide pigs with ample supply of clean drinking water, and quality feeds. Supplementing their

	sources such as camote, corn by-products, cassava and other farm wastes provided properly cooked can help ensure that the animals receive the necessary feeds and nutrients to maintain optimal health and productivity. Consider crop-livestock integration for higher farm ROI	sources such as camote, corn by-products, cassava and other farm wastes provided properly cooked can help ensure that the animals receive the necessary feeds and nutrients to maintain optimal health and productivity. Consider crop-livestock integration for higher farm ROI	diet with alternative feed sources such as camote, corn by-products, cassava and other farm wastes provided properly cooked can help ensure that the animals receive the necessary feeds and nutrients to maintain optimal health and productivity. Consider crop-livestock integration for higher farm ROI	diet with alternative feed sources such as camote, corn by-products, cassava and other farm wastes provided properly cooked can help ensure that the animals receive the necessary feeds and nutrients to maintain optimal health and productivity.

Table 12.2. Suitable technical management guidelines for SWINE in response to different climate risks

Activities	Drought / High Temperature	Flooding	Heavy Rainfall	Low Temperature	Strong Wind
Health Care and Management	The premises should be kept clean at all times to prevent disease occurrence. Provide clean drinking water - Ensure animals have a supply of cool, clean water; Monitor the water temperature and keep it cool. Monitor animals for illness - If animals show signs of illness, contact your local veterinarian immediately. Check ***signs dehydration***: rapid, shallow breathing; reluctance to move; weight loss; drying of mucous membranes	Transfer the animals in elevated place if current housing is not elevated or is located in a flooded prone area. Cold and wet flooring causes the proliferation of bacteria, viruses and fungi to grow. Provide proper nutrition and vitamins for better immune system against pest and diseases. Separate pigs showing symptoms of disease.	Repair the roofing and sides of housing. Ensure that splashes of rain will not enter the housing. Cold and wet flooring causes the proliferation of bacteria, viruses and fungi to grow.	The premises should be kept clean at all times to prevent disease occurrence. provide probiotics to strengthen immune system.	Make sure that housing is sturdy, provide wind brakers.

	(e.g., eyes, nose, mouth); decreased skin flexibility; ***and signs of h*** increased respiration rate or panting; excessive salivation; elevation of the head to make it easier to breathe; open mouth breathing.				
Breeding Management	Only sexually mature animals of appropriate age and weight and free from any disease or probable inherited abnormality should be bred. Administer vitamin supplementation for animals in preparation for breeding Deworm animals twice a year and 2weeks prior to farrowing to avoid	Only sexually mature animals of appropriate age and weight and free from any disease or probable inherited abnormality should be bred. Administer vitamin supplementation for animals in preparation for breeding. Deworm animals twice a year and 2weeks prior to farrowing to avoid	Only sexually mature animals of appropriate age and weight and free from any disease or probable inherited abnormality should be bred. Administer vitamin supplementation for animals in preparation for breeding. Deworm animals twice a year and 2weeks prior to farrowing to avoid	Only sexually mature animals of appropriate age and weight and free from any disease or probable inherited abnormality should be bred. Administer vitamin supplementation for animals in preparation for breeding. Deworm animals twice a year and 2weeks prior to farrowing to avoid	Only sexually mature animals of appropriate age and weight and free from any disease or probable inherited abnormality should be bred. Administer vitamin supplementation for animals in preparation for breeding. Deworm animals twice a year and 2weeks prior to farrowing to avoid

	newborn piglets from becoming infected.	newborn piglets from becoming infected.	newborn piglets from becoming infected.	newborn piglets from becoming infected.	newborn piglets from becoming infected.
Feeding Management	Provide pigs with ample supply of clean drinking water, and quality feeds. Supplementing their diet with alternative feed sources such as camote, corn by-products, cassava and other farm wastes provided properly cooked can help ensure that the animals receive the necessary feeds and nutrients to maintain optimal health and productivity.	Provide pigs with ample supply of clean drinking water, and quality feeds. Supplementing their diet with alternative feed sources such as camote, corn by-products, cassava and other farm wastes provided properly cooked can help ensure that the animals receive the necessary feeds and nutrients to maintain optimal health and productivity.	Provide pigs with ample supply of clean drinking water, and quality feeds. Supplementing their diet with alternative feed sources such as camote, corn by-products, cassava and other farm wastes provided properly cooked can help ensure that the animals receive the necessary feeds and nutrients to maintain optimal health and productivity.	Provide pigs with ample supply of clean drinking water, and quality feeds. Supplementing their diet with alternative feed sources such as camote, corn by-products, cassava and other farm wastes provided properly cooked can help ensure that the animals receive the necessary feeds and nutrients to maintain optimal health and productivity.	Provide pigs with ample supply of clean drinking water, and quality feeds. Supplementing their diet with alternative feed sources such as camote, corn by-products, cassava and other farm wastes provided properly cooked can help ensure that the animals receive the necessary feeds and nutrients to maintain optimal health and productivity.

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Table 12.3. Suitable technical management guidelines for SWINE in response to Temperature

Growth Stage	TEMPERATURE RISK				REMARKS
	Below Normal		Above Normal		
	Potential Impact	Technology to be employed	Potential Impact	Technology to be employed	
Piglets(new born)	<27°C, death	Provision of heaters (infrared heating lamp, electric heating pad,hot blast heater, heating floor, solar heating system)	>35°C, death	Provision of cooling system(evaporative pad cooling system,high pressure fogging,floor coolings,sprinkling as well as elevating of air velocity, ventilation fans)	
Weaners	<20°C, poor feed conversion rates, increased feed intake, struggle to grow		>30°C, Reduced feed intake,growth rate, increased feed conversion ratio, higher incidence and severity of scours, increased respiration rate, increased water consumption		
Growers and Finishers	<15°C, poor feed conversion rates, increased feed intake, struggle to grow, weight loss		>30°C, Reduced feed intake,growth rate, increased feed conversion ratio, higher incidence and severity of scours, increased respiration rate, increased water consumption		
Sows and boars	<15°C, poor feed conversion rates, increased feed intake, struggle to		>30°C, Reduced feed intake,growth rate, increased feed conversion ratio, higher incidence and severity of scours,		

	grow, weight loss,effect in fertility, and milk production		increased respiration rate, increased water consumption, decreased in reproduction and performance efficiency		

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Table 13. TILAPIA - CLIMATE SCENARIO FARMING RECOMMENDATIONS

Growth stages	No. of Weeks	Farm activities	Environmental Requirements				Feeding	Feeding Frequency
			Temperature Range	Dissolved Oxygen	Potential of Hydrogen (pH)	Ammonia (NH3) and Nitrite (NO2-)		
Fry Stage	2-4 weeks	Prepare fry ponds with fine-mesh nets to protect from predators Stock fry at low densities to avoid overcrowding Monitor water temperature, dissolved oxygen, and pH	25-32°C	3-5 mg/L	6.5-9.0	<0.5 mg/L	Start with live feed (zooplankton, rotifers) Gradually introduce formulated feed Ensure proper aeration	4-8 times a day
Fingerling	6-8 weeks	Transfer to fingerling ponds Implement biosecurity measures Monitor water quality (ammonia, nitrite) and oxygen levels	25-32°C	3-5 mg/L	6.5-9.0	<0.5 mg/L	Provide high-protein formulated feed Monitor water quality parameters Ensure adequate aeration	2-4 times a day
Juvenile	8-12 weeks	Transfer to grow-out ponds or tanks Monitor and control diseases Adjust feeding rates based on environmental conditions	25-32°C	3-5 mg/L	6.5-9.0	<0.5 mg/L	Adjust feeding based on growth and nutritional needs Provide balanced nutrition with appropriate protein levels	2-4 times a day

							Monitor water quality regularly	
Adult	12+ weeks	Continue growth in grow-out ponds or tanks Adjust feeding rates based on seasonal changes Harvest at the desired market size Monitor water quality parameters	25-32°C	3-5 mg/L	6.5-9.0	<0.5 mg/L	Adjust feeding based on seasonal changes and size Harvest at the right time to maximize growth and minimize stress Monitor water quality parameters Implement disease prevention measures	2-4 times a day

Growth stages	Climate Risks	Farming advisories (recommendation)
Fry Stage	• Typhoons, Heavy Rain, Flooding	• Provide shelters to protect fry ponds during typhoons and heavy rain • Monitor water quality regularly • Be cautious with water exchange during heavy rain
Fingerling	• High Temperatures, Disease Outbreaks • Low Oxygen Levels, Predators	• Monitor and adjust feeding rates based on growth and water quality • Use shading or floating covers to mitigate high temperatures • Avoid sudden changes in water quality
Juvenile	• Disease Outbreaks, Low Oxygen Levels • High Temperatures, Water Quality Fluctuations	• Implement strict biosecurity measures to prevent disease outbreaks • Use aeration to maintain optimal oxygen levels • Monitor water temperature and adjust feeding rates accordingly
Adult	• Seasonal Changes, Water Quality Variations • Disease Outbreaks, High Temperatures	• Harvest at the desired market size • Monitor water quality, especially during seasonal changes • Adjust feeding rates based on seasonal variations • Maintain proper aeration during periods of low dissolved oxygen

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Table 14. Potential Impacts of different daily rainfall conditions on ONIONS

Rainfall Conditions				
Age Group	No Rain	Light Rains	Moderate Rains	Heavy Rains
Germination to Seedling Adult leaves with developed roots 1 to 2 over weeks	The depletion of the soil water content influences seed inhibition. Slow water absorption by a germinating seed might threaten its emergence and the subsequent crop stand	Beneficial to the growth of onion for as long as not prolonged light rain.	Beneficial but prolonged moderate rain can damage the delicate foliage of the germinating onion	Wash seeds right out of the soil and damage the delicate foliage of the germinating onion
Vegetative Growth 8 to 10 flourishing leaves 2 weeks	Onions at the bulbing stage need a substantial amount of water, but excessive moisture must be avoided during the growing season. Deficit irrigation of onions leads to water stress, which results in less leaf growth, a lower bulbing ration, reduced fresh weight, smaller bulb size, and decreased marketable yields. Thrips pest is abundant during dry season. Adult and nymphs rasp the leaf	Beneficial to the growth of onion for as long as not prolonged light rain. Onions are best planted during the dry season. It does not grow well during rainy days	Excessive rainfall during active growing stages hinder root growth, nutrient uptake, nutrient translocation and photosynthesis, thereby reducing crop growth Heavy dew and foggy weather favor rapid spread of blight and purple blotch, and when prolonged rainy spells occur in warm weather, these diseases can be very destructive. Should the leaves turn pale-green, then yellow, blight has probably affected the plant.	Onion is prone to excess moisture stress due to its shallow root system. Heavy rainfall periods during the bulb-development stage reduces bulb yield by 50-70%. Heavy dew and foggy weather favor rapid spread of blight and purple blotch, and when prolonged rainy spells occur in warm weather, these diseases can be very destructive. Should the leaves turn pale-green, then yellow, blight has probably affected the plant. Purple blotch causes purple lesions on the leaves

	surface and suck juice from the leaf. Drought condition is favorable for the proliferation of fall armyworm		Purple blotch causes purple lesions on the leaves Onions are best planted during the dry season. Production is affected when prolonged rainy days	
Maturation Bulbs pops out of the ground Weeks to months	Onions at the bulbing stage need a substantial amount of water, but excessive moisture must be avoided during the growing season. Deficit irrigation of oinions leads to water stress, which results in less leaf growth, a lower bulbing ration, reduced fresh weight, smaller bulb size, and decreased marketable yields. Thrips pest is abundant during dry season. Adult and nymphs rasp the leaf surface and suck juice from the leaf. Drought condition is favorable for the proliferation of fall armyworm	Beneficial to the growth of onion for as long as not prolonged light rain. Onions are best planted during the dry season. It does not grow well during rainy days	Proliferation of the two major diseases of onions which are blight and purple blotch. Heavy dew and foggy weather favor their rapid spread, and when prolonged rainy spells occur in warm weather, these diseases can be very destructive. Should the leaves turn pale-green, then yellow, blight has probably affected the plant. Purple blotch causes purple lesions on the leaves. Rain on mature onions encourages the development of rot-causing fungi and bacteria while complicating manual and mechanical harvesting practices. Rain during the growing season	The two major diseases that will affect onions are blight and purple blotch. Should the leaves turn pale-green, then yellow, blight has probably affected the plant. Purple blotch causes purple lesions on the leaves. Heavy dew and foggy weather favor their rapid spread, and when prolonged rainy spells occur in warm weather, these diseases can be very destructive. Rain on mature onions encourages the development of rot-causing fungi and bacteria while complicating manual and mechanical harvesting practices.

			favor weed growth and insects.	
Harvest Gradually stop growing Months	Thrips pest is abundant during dry season. Adult and nymphs rasp the leaf surface and suck juice from the leaf No rain is beneficial 3-5 days before harvesting. Drought condition is favorable for the proliferation of fall armyworm	Beneficial to the growth of onion for as long as not prolonged light rain. Onions are best planted during the dry season. It does not grow well during rainy days	Rain on mature and almost ready for harvest encourages the development of rot-causing fungi and bacteria while complicating manual and mechanical harvesting practices.	Rain on mature onions encourages the development of rot-causing fungi and bacteria while complicating manual and mechanical harvesting practices.

Table 14.1.Suitable technical management guidelines for ONION in response to different rainfall conditions

Activities	No Rain	Light Rains	Moderate Rains	Heavy Rains
Plant Care and Management				
Germination to Seedling Adult leaves with developed roots 1 to 2 over weeks	Irrigate after transplanting. Weekly irrigation is done or whenever necessary. Surface drip irrigation was found to be better Apply high organic matter or fertilizer in the soil 2-3 weeks after germination	Create drainage channel to prevent water stagnation Apply high organic matter or fertilizer in the soil 2-3 weeks after germination	Create drainage channel to prevent water stagnation Apply high organic matter or fertilizer in the soil 2-3 weeks after germination	Create drainage channel to prevent water stagnation. Onion should be planted in beds so that it will minimized soaking during rainy season
Vegetative Growth 8 to 10 flourishing leaves 2 weeks	Frequent watering is needed when the bulbs are developing. Surface drip irrigation was found to be better. Apply pesticides (organic or inorganic if necessary), introduce natural enemies, practice IPM.	Create drainage channel to prevent water stagnation. Onion should be planted in beds so that it will minimized soaking during rainy season. Weeding is necessary for this allow free air circulation and avoid overcrowding. Spray with	Create drainage channel to prevent water stagnation. Onion should be planted in beds so that it will minimized soaking during rainy season. Weeding is necessary for this allow free air circulation and avoid overcrowding. Spray with	Create drainage channel to prevent water stagnation. Onion should be planted in beds so that it will minimized soaking during rainy season Weeding is necessary for this allow free air circulation and avoid

Activities	No Rain	Light Rains	Moderate Rains	Heavy Rains
	Avoid overhead watering when condition is humid since this ncreases leaf wetness, and disease infestation. Spray foliar fertilizer	fungicide when affected with downey mildew. Spray foliar fertilizer after rain. Integrated pest management (IPM) for prevention and control of pests. Proper fertilization, irrigation, cultivation to make the plant healthy	fungicide when affected with downey mildew. Spray foliar fertilizer after rain. Integrated pest management (IPM) for prevention and control of pests. Proper fertilization, irrigation, cultivation to make the plant healthy	overcrowding. Spray with fungicide when affected with downey mildew. Spray foliar fertilizer after rain. Integrated pest management (IPM) for prevention and control of pests.Proper fertilization, irrigation, cultivation to make the plant healthy
Harvest Gradually stop growing Months	No rain is beneficial 3-5 days before harvesting. Weeding is necessary for this allow free air circulation and avoid overcrowding. Spray with fungicide when affected with downey mildew. Spray foliar fertilizer If the onions are ready, harvest it the soonest	Weeding is necessary for this allow free air circulation and avoid overcrowding. Spray with fungicide when affected with downey mildew. Spray foliar fertilizer after rain. Affected bulb with disease should be removed and properly disposed as fungus remain in the soil for long period. Properly	Create drainage channel to prevent water stagnation. Weeding is necessary for this allow free air circulation and avoid overcrowding. Spray with fungicide when affected with downey mildew. Spray foliar fertilizer after rain. Affected bulb with disease should be removed and properly	Create drainage channel to prevent water stagnation. Weeding is necessary for this allow free air circulation and avoid overcrowding. Spray with fungicide when affected with downey mildew. Spray foliar fertilizer after rain. Affected bulb with

Activities	No Rain	Light Rains	Moderate Rains	Heavy Rains
	because staying longer in the soil will enable them to absorb more water decreasing the shelf-life.	dry onions prior to storage to preserve and prevent the development of bacteria, mold in onion. Drying is important in wet climates.	disposed as fungus remain in the soil for long period. Properly dry onions prior to storage to preserve and prevent the development of bacteria, mold in onion. Drying is important in wet climates.	disease should be removed and properly disposed as fungus remain in the soil for long period. Properly dry onions prior to storage to preserve and prevent the development of bacteria, mold in onion. Drying is important in wet climates.

Table 14.2. Suitable technical management guidelines for ONION in response to different climate risks

Activities	Drought/High Temperature	Flooding	Heavy Rainfall	Low Temperature	Strong Wind
Germination to Seedling Adult leaves with developed roots 1 to 2 over weeks	Irrigate after transplanting. Weekly irrigation is done or whenever necessary. Surface drip irrigation was found to be better Apply high organic matter or fertilizer in the soil 2-3 weeks after germination	Create drainage channel to prevent water stagnation. Onion should be planted in beds so that it will minimized soaking during rainy season.	Create drainage channel to prevent water stagnation. Weeding is necessary for this allow free air circulation and avoid overcrowding	Weeding is necessary for this allow free air circulation and avoid overcrowding	

Vegetative Growth 8 to 10 flourishing leaves 2 weeks	Frequent watering is needed when the bulbs are developing. Surface drip irrigation was found to be better. Apply pesticides (organic or inorganic if necessary), introduce natural enemies, practice IPM. Avoid overhead watering when condition is humid since this ncreases leaf wetness, and disease infestation. Spray foliar fertilizer	Create drainage channel to prevent water stagnation. Onion should be planted in beds so that it will minimized soaking during rainy season.	Weeding is necessary for this allow free air circulation and avoid overcrowding. Spray with fungicide when affected with downey mildew after heavy rain. Spray foliar fertilizer after rain. Affected bulb with disease should be removed and properly disposed as fungus remain in the soil for long period	Weeding is necessary for this allow free air circulation and avoid overcrowding	
Plant Care and Management	Using groundwater through shallow tube well during the peak growing season, when there is no water from the irrigation canals. Use improved crop varieties, agroforestry practices, soil conservation practices, irrigation practices, and adjusting planting	Avoid planting successive onion or garlic crops. Flood irrigation or heavy rains may reduce mite levels in the soil. Best cure for blight and purple blotch is prevention: use only well-drained soil, run the rows	Avoid planting successive onion or garlic crops. Flood irrigation or heavy rains may reduce mite levels in the soil. Purple blotch causes purple	Cool-weather is needed by the crop during its early stage of growth. During ripening stage, a comparative dry soil, dry atmosphere and moderately high temperature are important. Areas with an elevation of 8,000	Purple blotch causes purple lesions on the leaves. Heavy dew and foggy weather favor their rapid spread, and when prolonged rainy spells occur in warm weather, these diseases can

	dates are the most important adaptation strategies	in the same direction as prevailing wind and avoid windbreaks or other protection. Should conditions persist, a spray with a multipurpose fungicide such as daconil can be applied on a 7 to 10 day schedule.	lesions on the leaves. Heavy dew and foggy weather favor their rapid spread, and when prolonged rainy spells occur in warm weather, these diseases can be very destructive. The best cure is prevention: use only well-drained soil, run the rows in the same direction as prevailing wind and avoid windbreaks or other protection. Should conditions persist, a spray with a multipurpose fungicide such as daconil can be applied on a 7 to 10 day schedule.	to 1,500 meters above the sea level are good places for cultivation. Purple blotch causes purple lesions on the leaves. Heavy dew and foggy weather favor their rapid spread, and when prolonged rainy spells occur in warm weather, these diseases can be very destructive. The best cure is prevention: use only well-drained soil, run the rows in the same direction as prevailing wind and avoid windbreaks or other protection. Should conditions persist, a spray with a multipurpose fungicide such as daconil can be applied on a 7 to 10 day schedule.	be very destructive. The best cure is prevention: use only well-drained soil, run the rows in the same direction as prevailing wind and avoid windbreaks or other protection. Should conditions persist, a spray with a multipurpose fungicide such as daconil can be applied on a 7 to 10 day schedule.

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Table 15. Potential Impacts of different daily rainfall conditions on GARLIC

Rainfall Conditions				
Age Group	No Rain	Light Rains	Moderate Rains	Heavy Rains
Germination 1-2 months after sowing the seeds.	Garlic is tolerant of dry soil; While too much water can cause garlic bulbs to rot, too little water will stress garlic plants and reduce garlic production.	Higher incidences of infection. This includes the presence of different fungal pathogens such as Colletotrichum sp. causing anthracnose, Fusarium sp. causing basal rot, and Cercospora sp. causing leaf spots. These pathogens thrive in a moist environment that affects over-all garlic production Garlic plants perform well in areas with low rainfall since excess rain and humidity are bad for their growth.	Higher incidences of infection. This includes the presence of different fungal pathogens such as Colletotrichum sp. causing anthracnose, Fusarium sp. causing basal rot, and Cercospora sp. causing leaf spots. These pathogens thrive in a moist environment that affects over-all garlic production Extended wet periods can make the soil too wet to work on. Garlic plants perform well in areas with low rainfall since excess rain	Higher incidences of infection. This includes the presence of different fungal pathogens such as Colletotrichum sp. causing anthracnose, Fusarium sp. causing basal rot, and Cercospora sp. causing leaf spots. These pathogens thrive in a moist environment that affects over-all garlic production Extended wet periods can make the soil too wet to work on. Garlic plants perform well in areas with low rainfall since excess

			and humidity are bad for their growth.	rain and humidity are bad for their growth.
Green Garlic/Spring Garlic 7 months after planting	Garlic is tolerant of dry soil; While too much water can cause garlic bulbs to rot, too little water will stress garlic plants and reduce garlic production/ leads to smaller bulb.	Higher incidences of infection. This includes the presence of different fungal pathogens such as Colletotrichum sp. causing anthracnose, Fusarium sp. causing basal rot, and Cercospora sp. causing leaf spots. These pathogens thrive in a moist environment. Garlic plants perform well in areas with low rainfall since excess rain and humidity are bad for their growth.	Higher incidences of infection. This includes the presence of different fungal pathogens such as Colletotrichum sp. causing anthracnose, Fusarium sp. causing basal rot, and Cercospora sp. causing leaf spots. These pathogens thrive in a moist environment. Extended wet periods can make the soil too wet to work on. Garlic plants perform well in areas with low rainfall since excess rain and humidity are bad for their growth.	Higher incidences of infection. This includes the presence of different fungal pathogens such as Colletotrichum sp. causing anthracnose, Fusarium sp. causing basal rot, and Cercospora sp. causing leaf spots. These pathogens thrive in a moist environment. Extended wet periods can make the soil too wet to work on. Garlic plants perform well in areas with low rainfall since excess rain and humidity invites mold and decay.

Scapes 3 to 4 weeks after the green or spring garlic stage	Garlic is tolerant of dry soil; While too much water can cause garlic bulbs to rot, too little water will stress garlic plants and reduce garlic production.	Higher incidences of infection. This includes the presence of different fungal pathogens such as Colletotrichum sp. causing anthracnose, Fusarium sp. causing basal rot, and Cercospora sp. causing leaf spots. These pathogens thrive in a moist environment that affects production Garlic plants perform well in areas with low rainfall since excess rain and humidity are bad for their growth.	Higher incidences of infection. This includes the presence of different fungal pathogens such as Colletotrichum sp. causing anthracnose, Fusarium sp. causing basal rot, and Cercospora sp. causing leaf spots. These pathogens thrive in a moist environment. Extended wet periods can make the soil too wet to work on. Garlic plants perform well in areas with low rainfall since excess rain and humidity are bad for their growth.	Higher incidences of infection. This includes the presence of different fungal pathogens such as Colletotrichum sp. causing anthracnose, Fusarium sp. causing basal rot, and Cercospora sp. causing leaf spots. These pathogens thrive in a moist environment. Extended wet periods can make the soil too wet to work on. Garlic plants perform well in areas with low rainfall since excess rain and humidity are bad for their growth.
Young Bulbs 8 months	Garlic is tolerant of dry soil; however, too little water will stress garlic plants and reduce garlic production	Garlic plants perform well in areas with low rainfall since excess rain and humidity	Garlic plants perform well in areas with low rainfall since excess rain and humidity are bad for their growth.	Garlic plants perform well in areas with low rainfall since excess rain and humidity are bad for their growth.

		are bad for their growth – it causes the bulb to decay Too much water during this period will cause a watery bulb, high rotting ratio and reduced quality of the bulbs.	Too much water during this period will cause a watery bulb, high rotting ratio and reduced quality of the bulbs.	Too much water during this period will cause a watery bulb, high rotting ratio and reduced quality of the bulbs.
Mature Bulbs 9 months	Garlic is tolerant of dry soil; large bulb grows when not passing through dry periods. While too much water can cause Garlic bulbs to rot, too little water will stress Garlic plants and reduce Garlic production.	Garlic plants perform well in areas with low rainfall since excess rain and humidity are bad for their growth Too much water during this period will cause a watery bulb, high rotting ratio and reduced quality of the bulbs.	Garlic plants perform well in areas with low rainfall since excess rain and humidity are bad for their growth. Too much water during this period will cause a watery bulb, high rotting ratio and reduced quality of the bulbs.	Garlic plants perform well in areas with low rainfall since excess rain and humidity are bad for their growth. Too much water during this period will cause a watery bulb, high rotting ratio and reduced quality of the bulbs.
Flowering Stage 10-month mark, indicating the completion of the growing cycle	Garlic is tolerant of dry soil; large bulb grows when not passing through dry periods. While too much water can cause Garlic bulbs to rot, too little water will stress Garlic plants and reduce Garlic production.	Garlic plants perform well in areas with low rainfall since excess rain and humidity are bad for their growth.	Garlic plants perform well in areas with low rainfall since excess rain and humidity are bad for their growth.	Garlic plants perform well in areas with low rainfall since excess rain and humidity are bad for their growth.

Table 15.1. Suitable technical management guidelines for GARLIC in response to different rainfall conditions and climate risks

Activities	No Rain	Light Rains	Moderate Rains	Heavy Rains
Health Care and Management	Regular irrigation during dry seasons is advised, where moisture in the top 30 cm of the soil should be maintained during the entire growth period to attain maximum yields. However, in some areas, stopping irrigation three weeks before harvest is recommended to prevent rotting and skin color loss. Apply mulch after planting. Rice straw and cogon is commonly used as mulching. Other mulching materials that can also be used are hulls, saw dust, grasses, and polyethylene or plastic sheet. Mulch controls soil moisture as well as the growth of weeds. Applying organic fertilizer is found to be more effective in garlic production. Organic fertilizer does not	To control the field for water overflow during rainy season, there should be a canal around the paddies. Apply mulch after planting. Rice straw and cogon is commonly used as mulching. Other mulching materials that can also be used are hulls, saw dust, grasses, and polyethylene or plastic sheet. Mulch controls soil moisture as well as the growth of weeds Application of organic fertilizer is found to be more effective in garlic production. Organic fertilizer does not only provide macro and micro nutrients but also some beneficial microorganisms. It also improves the physical, chemical, and biological conditions of the soil	To control the field for water overflow during rainy season, there should be a canal around the paddies. Remove weeds, it competes on soil nutrients. Practice Integrated Pest Management when observed occurrence of pest	To control the field for water overflow during rainy season, there should be a canal around the paddies. Remove weeds, it competes on soil nutrients. Practice Integrated Pest Management when observed occurrence of pest

Activities	No Rain	Light Rains	Moderate Rains	Heavy Rains
	only provide macro and micro nutrients but also some beneficial microorganisms. It also improves the physical, chemical, and biological conditions of the soil. Practice Integrated Pest Management when observed occurrence of pests.	Remove weeds, it competes on soil nutrients. Practice Integrated Pest Management when observed occurrence of pest		

Activities	Drought/High Temperature	Flooding	Heavy Rainfall	Low Temperature	Strong Wind
Health Care and Management	Using groundwater through shallow tube well during the peak growing season, when there is no water from the irrigation canals. Remove weeds, it competes on soil nutrients. Practice Integrated Pest Management when observed occurrence of pest	To control the field of water overflow during rainy season, there should be a canal around the paddies.	To control the field of water overflow during rainy season, there should be a canal around the paddies.		

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OUTPUT # 3. Prepare a proposed advocacy and communication plan of CIS for AMIA villages and farmers

Climate information services may be defined as services that provide climate information in a way that assists decision-making by individuals and organizations. Climate information services, therefore, involve the timely production, translation and delivery of useful climate data, information and knowledge for societal decision-making and climate-smart policy and planning. Climate information services are meant to provide the science-based and user-specific information for managing risks and exploiting opportunities created by climate variability and change, thereby helping society to become more resilient in coping with the increasing impacts of climate change.[1]

Providing climate information services to the right people at the right time reduces climate risk and helps individuals, households and communities adapt to climate change. Relevant, reliable and timely climate information should be accessible to people across sectors, such as finance, health and agriculture. Some climate information services include early warning systems, which help individuals, institutions and governments take early and effective action.[2]

Hence, the Department of Agriculture through its Adaptation and Mitigation Initiatives in Agriculture (AMIA) Program provides climate information services for agriculture spearheaded by DA-Climate Resilient Agriculture Office (CRAO). Climate Information Services for agriculture play a crucial role in reducing climate-related damage and losses in agriculture.

As to functions, CRAO shall set the weekly theme/category for regular postings related to AMIA initiatives such as trainings, provision of CRA materials, CIS, and inauguration of facilities. It shall relay to regional focal and alternate focal the postings of AMIA-focused activities such as webinars, e-trainings, short courses among others. CRAO shall also repost/reshare the postings of DA RFOs related to AMIA initiatives such as success stories and highlights of accomplishments as well as schedule the “boosting” of a post to reach more target audience, monitor the postings of the Regional AMIA pages, and conduct a weekly assessment meeting on the deliverables.

On the other hand, DA-RFOs are tasked to come up with an outline of what to be posted based on the category set by DA-AMIA. They shall designate representatives from Provincial Agricultural Offices (PAO) who will provide inputs for postings and names will be submitted to DA AMIA. They shall consult the DA AMIA in the content of the posting especially the regular posts and provide weekly update to DA AMIA about the posting.

The RAFIS representative shall assist the Regional AMIA Focal Person in posting and creating content. He/she shall coordinate with PAO about the content and monitor and share the AMIA-focused activities posts and the post which was boosted or sponsored by DA AMIA including promotion of FB pages of other DA RFOs and DA AMIA.

In the analysis of climate information posting in Regional AMIA Facebook pages, it was found out that the services have relatively low access rates when based to the number of reactions and number of shares. CIS-related posts are done regularly at an average of 4.5 posts per month across regions, and the types of climate information disseminated include 10-day farm weather outlook, regional/provincial seasonal outlook and advisories, tropical cyclone advisories, heavy rainfall warnings, and special farm weather outlook and advisories.

To make terminologies easier to understand, the farm weather outlook and advisory (FWOA) that was usually presented in English has been posted in Taglish and in regional dialects, composed of a location-specific 10-day weather data indicating temperature, wind speed, cloud cover and rain forecast. It also provided information as to what are the commodities produced in the specified AMIA sites, the different crop stages with corresponding farm operations, animal growth stages with corresponding health management practices, processing, and marketing activities, as well as an impact outlook describing possible scenarios of the effect of the climate to these various commodities. It also provides recommendations on climate-resilient agriculture (CRA) practices for various commodity groups to be employed to mitigate the impact of climate hazards in the specified AMIA sites.

However, despite efforts of localizing climate information, it is sad to note that there was a relatively low access to CIS based on the number of reactions and sharing of regional FB posts. In Zamboanga Peninsula alone, with 28,000 followers of its FB page, only gained an average of 91 reactions per post and average of 30.8 post sharers per month. In Eastern Visayas having 22,000 followers only gained 46 reactions and average of 19.8 post sharers per month. Also, it was observed that almost all CRA practices for each commodity group are similar but are recommended to different AMIA sites experiencing varied climate hazards. This implies that the CRA practices have become generic recommendations and do not necessarily address the climate hazards existing in the specified AMIA sites.

Another finding is that there are several instances of literal translation from English to the Tagalog or to regional dialects leading to loss of correct thought or context, as well as instances if typographical errors in the posted climate information which may cause confusion among readers. Seemingly, inadequate proofreading happens before the final posting of the climate information. Also, posting of the FWOA comes later than the covered period of the advisory, say, advisory for April 03-12 was posted on 05 April 2023 and the recommended CRA practices are almost similar throughout the observed posting period of January to October 2023.

Table 1. Recommended advocacy and communication plan to improve dissemination of climate information in support to AMIA program implementation

ISSUE	COMMUNICATION GOALS	COMMUNICATION OBJECTIVES	PROSPECTIVE MATERIALS	TARGET AUDIENCE	CHANNELS	INDICATORS
Low technical capacities of RFOS in coming up with CIS outline	To develop outcome-based trainings on enhancing technical knowledge of AMIA implementers	At the end of the training, participants have gained more knowledge in formulating CIS outline and content	PowerPoint presentations; Handouts; Training materials	AMIA implementers (particularly those designated as CIS focal person); program partners	Face-to-face discussions; hands-on activities	# of CIS-related contents produced (after the training)
Design and layout of CIS-related materials and/or collaterals needs to be improved	To develop outcome-based trainings on facilitating and improving the production of contextualized materials and collaterals	At the end of the training, participants have been equipped with skills on operating and processing software and equipment used for graphics and design	PowerPoint presentations; Handouts; Training materials	AMIA implementers (designated as CIS focal person); program partners	Face-to-face discussions; hands-on activities	# of CIS-related contents printed and distributed; # of post likers/ reactions / shares
Limited platforms used by RFOs to disseminate climate information	To develop capacity-building activity promote diversified strategies to disseminate CIS-related content	Participants have explored or devised varied means of disseminating CIS-related contents	PowerPoint presentations; Handouts; Training materials;	AMIA implementers (designated as CIS focal person); LGU program partners	Face-to-face discussions; sharing of experiences, Benchmarking or techno exchange package;	% increase in number of CIS users and/or adopters; Increase in # of content formats

ISSUE	COMMUNICATION GOALS	COMMUNICATION OBJECTIVES	PROSPECTIVE MATERIALS	TARGET AUDIENCE	CHANNELS	INDICATORS
					Exploration of other info channels such as info caravan; media; text blasting; climate forums	
Repetitive CRA recommendations integrated in CIS advisories	To promote appropriate CRA practices and advisories in the AMIA villages	To integrate appropriate and accurate CRA practices	Compendium of Climate-Resilient Agriculture technologies; IEC materials on weekly CIS advisories	AMIA Program Management Team; DA-LGUs; Farmer-partners; program partners	Regional Websites; LGU websites; Social media channels; Billboards	# of CIS advisories
No hit/access counter for posted CIS-related contents	To develop a digital system that provides information on number of access or hits including downloading of posted CIS-related contents	To create a mechanism that could monitor access and utilization of CIS-related contents	Website creation of integration in regional DA-portals, LGU pages	Farmers and fisherfolk; AMIA Regional and LGU implementers; Livestock and poultry raisers;	Webpages, (Facebook, Twitter, Tiktok and other social media platforms);	# of hits monitored; # of downloads documented

ISSUE	COMMUNICATION GOALS	COMMUNICATION OBJECTIVES	PROSPECTIVE MATERIALS	TARGET AUDIENCE	CHANNELS	INDICATORS
Inadequate support and/or collaboration with other stakeholders	To build stable and constant collaboration and partnership with various stakeholders	To gain commitment and foster linkage with stakeholders	Memorandum of Agreement or Understanding; Pledge of Commitment	Local government units; FCAs; NGOs;	Technical briefings; info caravan; Stakeholders' consultation or dialogues	# of MOAs or MOUs forged # of collaborative projects conducted

Table 2. Roles of various stakeholders in the proposed communication and advocacy plan.

ISSUE	DA-CRAO	REGIONAL AMIA IMPLEMENTERS	PLGU/MLGU	FARMERS AND FISHERFOLK	TRAINING INSTITUTIONS/ TECHNICAL EXPERTS	NGOs
Low technical capacities of RFOS in coming up with CIS outline	Provide funding and spearhead capacity-building activities (CBA) and knowledge enhancement in formulating CIS outline and content	Participation to capacity-building activities; Re-echo learnings to DA-LGU counterparts	Authorize designated staff to undergo capacity building and provide counterpart funding for re-echo activities at the LGU level	-	Serve as learning service providers (LSP) during CBA	Share available best practices (i.e. IIRR) Maybe tapped as LSP
Design and layout of CIS-related materials and/or collaterals needs improvement	Provide funding and spearhead capacity-building activities (CBA) and knowledge enhancement in formulating CIS outline	Participation to capacity-building activities; Conduct pre-testing of produced IEC material; Re-echo learnings to DA-LGU counterparts	Authorize designated staff to undergo capacity building and provide counterpart funding for re-echo activities at the	Provide feedback to produced CIS materials/info collaterals	Serve as learning service providers (LSP) during CBA	Share available best practices (i.e. IIRR)

ISSUE	DA-CRAO	REGIONAL AMIA IMPLEMENTERS	PLGU/MLGU	FARMERS AND FISHERFOLK	TRAINING INSTITUTIONS/ TECHNICAL EXPERTS	NGOs
	and content		LGU level			
Limited platforms used by RFOs to disseminate climate information	Spearhead lecture sessions on introducing program implementers to varied platforms of CIS dissemination Spearhead a centralized platform used in disseminating climate information	Participation to capacity-building activities; Re-echo learnings to DA-LGU counterparts Identify appropriate channels (aside from the established media by CRAO) for info dissemination based on the preference of the audience.	Authorize designated staff to undergo capacity building and provide counterpart funding for re-echo activities at the LGU level	Provide feedback to CIS dissemination strategy	Serve as learning service providers during CBA	Share available best practices (i.e. IIRR)
Repetitive CRA recommendations integrated in CIS advisories	Spearhead technical briefings for regional implementers on various CRA	Participation to capacity-building activities; Regularly update recommendations by	Authorize designated staff to undergo capacity building and provide	Explore and adopt CRA technology appropriate to existing hazards in the farm/ fishing areas or	Serve as learning service providers for AEWs and farmers in the accurate application	Serve as learning service providers for AEWs and farmers in the accurate

ISSUE	DA-CRAO	REGIONAL AMIA IMPLEMENTERS	PLGU/MLGU	FARMERS AND FISHERFOLK	TRAINING INSTITUTIONS/ TECHNICAL EXPERTS	NGOs
	technologies appropriate for different climate hazards and/or agro-ecosystems	doing local research in the AMIA villages; Re-echo learnings to DA-LGU counterparts	counterpart funding for re-echo activities at the LGU level	communities; Provide feedback to recommendations identified in CIS advisories	of CRA technologies	application of CRA technologies
No hit/access counter for posted CIS-related contents	Provide funding and establish the creation of portal with hit/access and download counters	Populate the portal with CIS contents; Promote the portal via social media and other information channels Provide feedback during program / portal test run	Provide feedback during program / portal test run	Provide feedback during program / portal test run	Provide feedback during program / portal test run	Provide feedback during program / portal test run
Inadequate support and/or collaboration with other stakeholders	Lead / spearhead in making national and international collabora	Lead / spearhead in making regional collaboration and linkages	Lead / spearhead in making provincial and local collaboration and linkages	Serve as active partners and collaborators in project implementation, adoption and	Serve as active partners and collaborators in terms of capacitation and human	Serve as active partners and collaborators

ISSUE	DA-CRAO	REGIONAL AMIA IMPLEMENTERS	PLGU/MLGU	FARMERS AND FISHERFOLK	TRAINING INSTITUTIONS/ TECHNICAL EXPERTS	NGOs
	tion and linkages			commercialization	development	

Figure 1 shows the CIS communication framework. The structure comprises just three components: information needs, information channels, and information use. Identifying information needs is a key aspect of effective communication because it directly affects whether users intend to utilize the shared information. If individuals find the information relevant to their needs, they pay attention as it addresses some of their issues and concerns. Conversely, if information is not delivered using the right channel, it may never reach its intended audience. Hence, having the right information delivered through the right channel is essential. However, this still doesn't guarantee information use. In cases where the audience does not utilize the information, reasons must be examined, as this may indicate other factors that need to be considered.

Figure 2 on the other hand shows the process mapping for the CIS communication strategy. This includes the Input, Process, Output, and Outcome. Proposed activities has been identified per process in order to be able to achieve a wider reach of CIS to endusers.

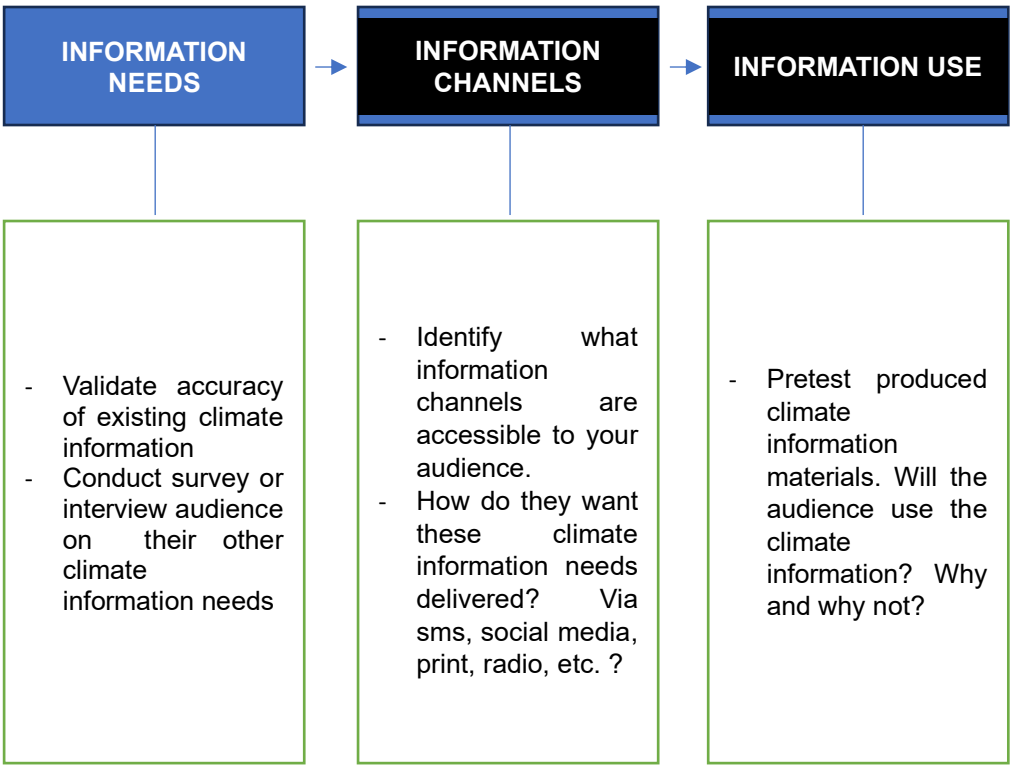


Figure 1. CIS communication framework

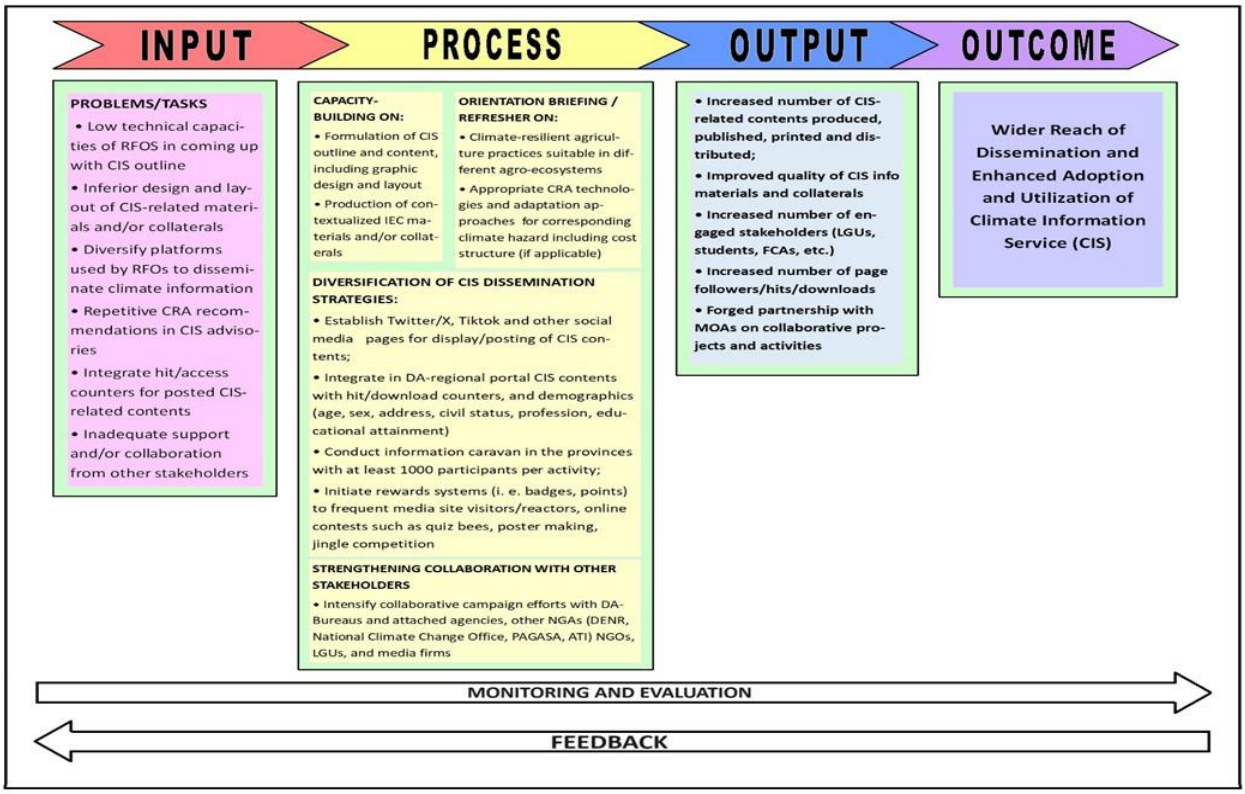


Figure 2. Process mapping for the CIS communication strategy

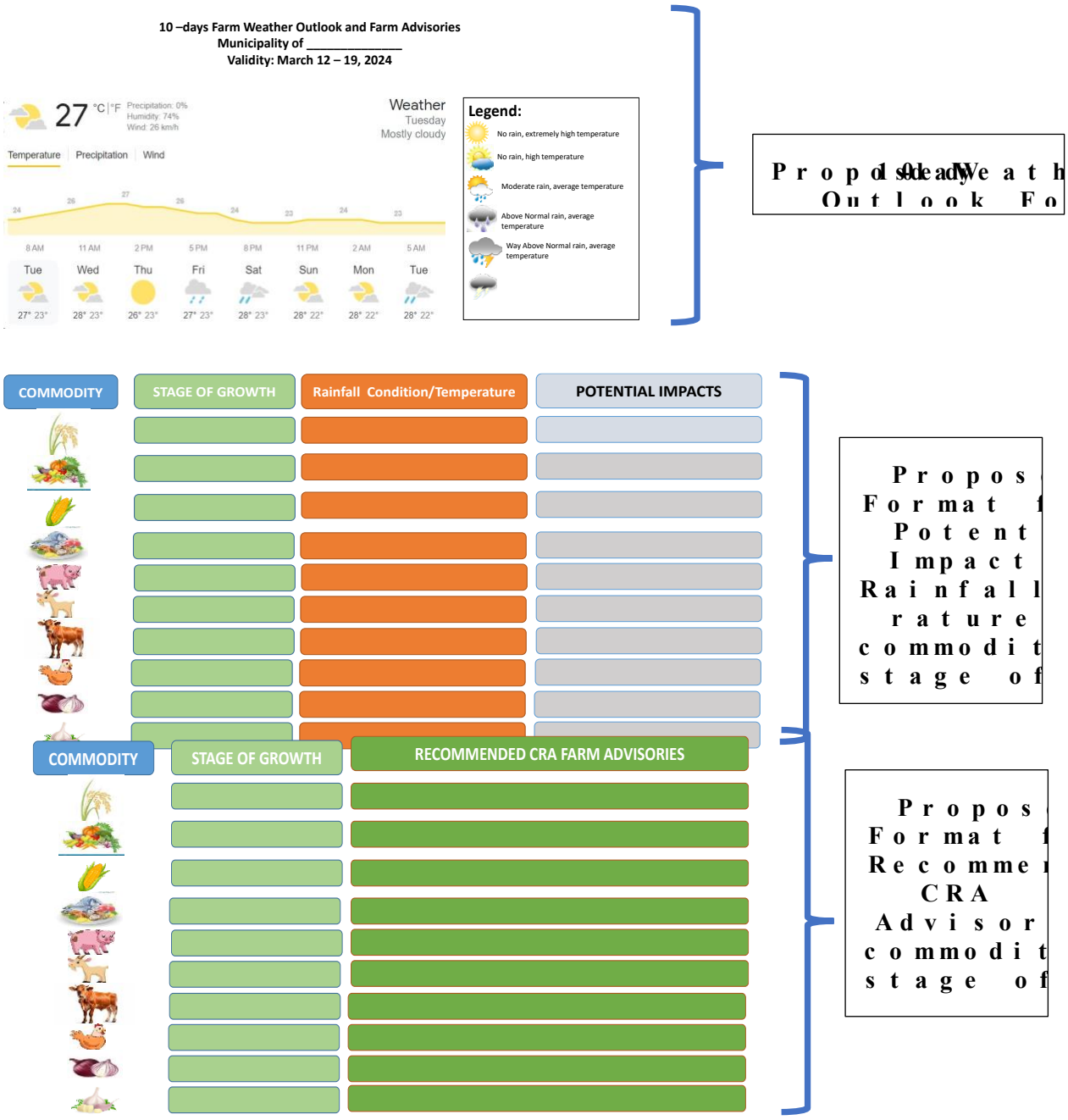
Weather Outlook and Advisories

Below is a proposed content, and Format of the 10-day weather outlook and advisories. Colors used in the proposed Format are colors used by researchers that somehow represent climate change. This Format is still for comments and approval of the CIS Team and CRAO.

Proposed content of 10-day Weather Outlook and Advisories

Content of Current 10-day Weather Outlook and Advisories	**Proposed content of 10-day Weather Outlook and Advisories**
ü 10-day weather outlook	ü 10-day weather outlook
ü Commodities and Fram Operation per stage of growth	ü Impact Outlook per Commodity, per Stage of growth based on rainfall condition
ü Impact Outlook	ü CRA Farm Advisories per Commodity, per Stage of Growth
ü CRA Practices	

Proposed Format of the 10-day Weather Outlook and Advisories



Development of the Web-Based Centralized-Climate Information System

BACKGROUND

The envisioned agricultural information and climate services platform aims to empower farmers and fisherfolks with user-friendly tools for informed decision-making. The system's development involves creating an intuitive interface, an Administration Module for efficient data management, and features such as Farmers and Fisherfolks Data Management, Cropping Calendar Data Management, and Climate Information Services. With a focus on accessibility, the system integrates a web crawler for data retrieval and presents information through public-facing pages, including a map dashboard for visualizing climate data.

To enhance user engagement, the system incorporates client feedback mechanisms and provides visual analytics. This multifaceted approach ensures a comprehensive and user-centric Centralized-Climate Information System, addressing the diverse needs of stakeholders in the agriculture sector while facilitating data-driven decision-making in a dynamic and ever-changing environment.

GENERAL OBJECTIVE AND PURPOSE

The core objective of the agricultural information and climate services platform is to empower farmers and fisherfolks with accessible tools that facilitate informed decision-making and sustainable agricultural practices. The purpose extends to the efficient organization and utilization of data pertinent to farming activities, ensuring that users can navigate and leverage information effectively. Additionally, the platform aims to democratize valuable climate insights, providing accurate and timely information to assist farmers in making decisions that enhance productivity and resilience. By incorporating user-friendly interfaces, robust data management features, and advanced climate services, the platform aspires to catalyze positive changes in agriculture, fostering a more technologically adept, sustainable, and adaptive farming community.

TECHNICAL SPECIFICATIONS

A. Server Environment Setup:
- **a.** Establish a local/development server environment using a Linux-based virtual machine.
- **b.** Configure and optimize the server for optimal performance and resource utilization.

B. Software Stack Configuration:
- **a.** Set up Apache, PHP, MySQL, Python, and Java to ensure compatibility and seamless integration.
- **b.** Configure each component to adhere to best practices for security and performance.

C. Database Development:

a. Develop the system's database using MySQL.
b. Define and implement the necessary tables, relationships, and constraints to support data requirements.
c. Optimize database queries for efficient data retrieval and manipulation.

D. User Interface and API Development:

a. Design and implement a user-friendly interface for the Account Registration and Login Pages.
b. Develop the necessary Application Programming Interface (API) for seamless interaction with backend functionalities.

E. Administration Module Development:

a. Create a Superadmin module with features for user management, including the ability to create, edit, and block/unblock users.
b. Implement dropdown libraries and integrate third-party data sources for PAGASA and SMS Gateway.
c. Develop functionalities for maintaining databases related to advisories, questions/indicators, and datasets for the Cropping Calendar Matrix.

F. Farmers and Fisherfolks Data Management:

a. Design and implement modules for managing profiles, RSBSA registration information, contact details, farm locations, and farming activities (crops, livestock, services, etc.).

G. Cropping Calendar Data Management:

a. Develop modules for managing cropping calendar data for each crop and location (municipality or barangay).
b. Ensure efficient storage and retrieval of cropping-related information.

H. Climate-Resilient Agriculture Practices (CRAs) Library Management Module:

a. Create a module designed to manually capture and store data uploaded or entered by experts on Climate-Resilient Agriculture Practices (CRAs). This data will encompass detailed practices suitable for various commodity stages and farm operations, alongside the relevant climate outlooks for specific stages of crop or commodity development within established climate thresholds. The module will facilitate the organized collection of expert contributions, ensuring that CRAs are tailored and responsive to precise agricultural needs and climate conditions.

I. Web Crawler Development:

a. Design and implement a web crawler to retrieve data from PAGASA Public Data Pages.
b. Process the retrieved data and store it internally for further use.

J. Climate Information Services and Recommendations:

a. Develop content automation mechanisms for generating 10-day weather forecasts, seasonal forecasts, and special weather forecasts.
b. Implement SMS and email blasting functionalities for timely dissemination of climate information.

K. Public Pages Development:

a. Create public pages for climate information services, cropping calendar display, recommendation generation, bulletins, about/disclaimer, and contact information.

L. **Map Dashboard Development:**
   a. Design and implement a map dashboard to showcase climate information services and forecast data in a visually engaging web-map format.

M. **Client Feedback and Satisfaction Survey Forms:**
   a. Develop forms for collecting client feedback and satisfaction surveys to enhance user experience and system effectiveness.

N. **System Analytics:**
   a. Implement analytics features, including charts, tables, and maps (bubble, thematic), to provide stakeholders with valuable insights into agricultural landscapes and climate conditions.

The goal of these technical specifications is to create an integrated and powerful agricultural information system that not only meets but exceeds the expectations of end-users, fostering informed decision-making and sustainable practices in the agriculture sector.

FUNCTIONAL REQUIREMENTS

The functional requirements section in a system design document outlines the specific features and functionalities that the Web-Based Centralized-Climate Information System must possess to meet its objectives. Here's an overview of the functional requirements aligned with the provided technical specifications:

1. **User Authentication and Authorization:**
   a. Implement a secure user authentication system for farmers, fisherfolks, and administrators.
   b. Define user roles (Superadmin, Admin, Farmer, Fisherfolk) with specific permissions.
2. **Account Management:**
   a. Enable users to register accounts, providing essential information for profile creation.
   b. Allow users to update and manage their profiles, including contact details and farming activities.
3. **Administration Module:**
   a. Administrator should be able to manage user accounts (create, edit, block/unblock users).
   b. Integrate dropdown libraries for efficient data entry in various modules.
   c. Integrate third-party data sources for PAGASA and SMS Gateway.
4. **Farmers and Fisherfolks Data Management:**

a. Design modules to oversee the management of contact information for farmers and fisherfolks, encompassing details such as RSBSA registration no., farm locations, and various farming activities.
b. Allow farmers to input and update data related to crops, livestock, and services.

5. **Cropping Calendar Data Management:**
    a. Implement modules for managing cropping calendar data for each crop and location.
    b. Ensure efficient storage, retrieval, and updating of cropping-related information.
6. **Climate-Resilient Agriculture Practices (CRAs) Library Management Module:**
    a. The module shall enable experts to manually upload or enter data on Climate-Resilient Agriculture Practices (CRAs), categorize this information by commodity stages, farm operations, and relevant climate outlooks for specific stages of crop or commodity development within defined climate thresholds. It must include secure data entry interfaces, robust data management systems for storing and retrieving information, and user access controls to ensure data integrity and security. The interface should be user-friendly, supporting various data formats and providing tools for detailed reporting and integration with existing agricultural management systems.
7. **Web Crawler:**
    a. Design and implement a web crawler to quickly extract and retrieve relevant data from PAGASA Public Data Pages.
    b. Process and store the retrieved data in the system for further use.
8. **Climate Information Services and Recommendations:**
    a. Develop content automation mechanisms for generating advisories for the **10-day weather forecasts**, **seasonal forecasts**, and **special weather forecasts**.
    b. Implement SMS and email blasting functionalities for timely dissemination of climate information for notifications and warnings for extreme weather events or climate-related risks.
9. **Public Pages :**
    a. Create public pages and other platforms for public access to climate information. services, cropping calendar display, recommendation generation, bulletins, about/disclaimer, and contact information.
    b. Ensure the information is presented in a clear and accessible manner.
10. **Data Filtering and Sorting:**
    a. Create a filter that enables users to search data based on specific parameters, regions, or timeframes.
11. **Map Dashboard:**
    a. Create an interactive map to display climate data on maps, allowing users to explore geospatial patterns.

b. Design and implement a map dashboard to visually showcase climate information services and forecast data to enhance accessibility, facilitate data interpretation, and support decision-making processes.
c. Present data trends over time or compare different variables.
d. Allow users to interact with the map for a more engaging experience.

12. **Client Feedback and Satisfaction:**
    a. Develop forms for collecting client feedback on the system's usability and effectiveness.
    b. Implement satisfaction survey forms to gather insights for continuous improvement.
13. **System Analytics:**
    a. Implement analytics features such as charts, tables, and maps to provide stakeholders with valuable insights into agricultural landscapes and climate conditions.
    b. Ensure the analytics tools are user-friendly and accessible.
14. **Security Measures:**
    a. Implement encryption for sensitive data transmission.
    b. Regularly update and patch software components to address security vulnerabilities.
    c. Implement user access controls to prevent unauthorized access.
15. **Compatibility and Integration:**
    a. Ensure compatibility and seamless integration of Apache, PHP, MySQL, Python, and Java.
    b. Verify that the system can interact with external data sources and services.
16. **Performance Optimization:**
    a. Optimize server environment, database queries, and codebase for optimal performance.
    b. Conduct performance testing to identify and address bottlenecks.
17. **Documentation:**
    a. Provide comprehensive documentation for administrators and end-users.
    b. Include user guides, API documentation, and system architecture documentation.
18. **Testing:**
    a. Conduct thorough testing, including unit testing, integration testing, and user acceptance testing.
    b. Address and resolve any identified issues before deployment.
19. **Scalability:**
    a. Design the system to be scalable to accommodate potential growth in user base and data volume.
    b. Ensure that the system can handle increased load without significant performance degradation.

20. **User Training:**
    a. Develop training materials and resources for users to understand and effectively utilize the system.
    b. Conduct training sessions for administrators and end-users.
21. **Backup and Recovery:**
    a. Implement a robust backup system to regularly back up critical data.
    b. Develop a recovery plan to restore the system quickly in case of data loss or system failures.
22. **Regulatory Compliance:**
    a. Ensure the system complies with relevant data protection and privacy regulations.
    b. Implement mechanisms for data anonymization and user consent.

These functional requirements aim to ensure the successful development and deployment of the agricultural information and climate services platform, meeting the diverse needs of its users and stakeholders.

TECHNOLOGY AND RESOURCES

The successful implementation of the "Web-Based Centralized-Climate Information System" requires a robust technology stack and appropriate resources. The following outlines the essential components and requirements:

A. Web Development Tools and Technologies:
    a. PHP for server-side scripting.
    b. Laravel framework for web application development.
    c. HTML, CSS, and JavaScript for front-end development.
    d. Python for heavy data processing tasks.

B. Database Management System: MySQL as the preferred database management system to ensure secure, efficient, and scalable data storage.

C. **Leaflet:** Utilization of Leaflet, an open-source JavaScript library, for rendering maps and shapefiles directly in the browser. This integration is essential for visualizing thematic maps related to municipality and barangay rankings based on computed indexes.

D. **Metabase:** Integration of Metabase, an open-source business intelligence (BI) tool, to enable users, including engaged consultants, to easily visualize and analyze data within customized dashboards.

E. Web Host Server Requirements - Dedicated Server:
    a. CentOS 7
    b. The server is equipped with PHP, Laravel, Java Development Kit, and Python runtime environments.
    c. Adequate server resources to handle the expected load and data processing requirements:

i. Cores 16; Threads: 32; Turbo Speed: 2.9 GHz
ii. At least 64 GB RAM
iii. Storage at least 1 TB (upgradable it is demand-driven) solid-state drive RAID
iv. Unlimitted bandwidth

d. Other Specs:
i. Website Security
ii. Site backup & restore
iii. SSL Certificate
iv. cPanel & WHM (if available in DA server)
v. Next Generation Firewall
vi. Intrusion Prevention System
vii. Antivirus
viii. Antispam
ix. Antibot
x. SSL traffic inspection
xi. Identity awareness, URL filtering, Application Control
xii. Managed firewall policies
xiii. Monitoring dashboard for viewing
xiv. Multi threat security

These technology and resource requirements ensure a well-rounded and capable foundation for the development, deployment, and operation of the Web-Based Centralized-Climate Information System. The combination of these tools and technologies contributes to the system's efficiency, security, and usability, aligning with the project's objectives and stakeholder needs.

METHODOLOGY

A. Agile development methodology with iterative testing and feedback.
B. Regular client collaboration for requirement adjustments.

TASK DURATION

The project tasks outlined are estimated to have a total duration of 8 weeks maximum, considering the various activities, dependencies, and resources required for successful completion. This timeline encompasses planning, execution, and monitoring phases to ensure the project's overall success and timely delivery.

Task	Weekly Schedule	Detailed Tasks
Server Environment Setup	Week 0	Establish local/development server environment using a Linux-based virtual machine. Configure and optimize the server for optimal performance and resource utilization.
Software Stack Configuration	Week 1	Set up Apache, PHP, MySQL, Python, and Java for compatibility and seamless integration. Configure each component to adhere to best practices for security and performance.
Database Development	Week 1	Develop the system's database using MySQL. Define and implement necessary tables, relationships, and constraints.
User Interface and API Development	Week 2 and Week 3	Design and implement a user-friendly interface for the Account Registration and Login Pages. Develop the necessary Application Programming Interface (API) for backend functionalities.
Administration Module Development	Week 4	Create the administrator module for user management. Implement dropdown libraries and integrate third-party data sources.

Farmers and Fisherfolks Data Management	Week 4	Design and implement modules for managing profiles, RSBSA registration, contact details, farm locations, and farming activities.
Cropping Calendar Data Management	Week 4	Develop modules for managing cropping calendar data for each crop and location. Ensure efficient storage and retrieval of cropping-related information.
Web Crawler Development	Week 5	Design and implement a web crawler to retrieve data from PAGASA Public Data Pages. Process the retrieved data and store it internally for further use.
Climate Information Services and Recommendations	Week 5	Develop content automation mechanisms for generating 10-day weather forecasts, seasonal forecasts, and special weather forecasts. Implement SMS and email blasting functionalities for timely dissemination of climate information.
Public Pages Development	Week 6	Create public pages for climate information services, cropping calendar display, recommendation generation, bulletins, about/disclaimer, and contact information.

Map Dashboard Development	Week 6	Design and implement a map dashboard to showcase climate information services and forecast data in a visually engaging web-map format.
Client Feedback and Satisfaction Survey Forms	Week 7	Develop forms for collecting client feedback and satisfaction surveys to enhance user experience and system effectiveness.
System Analytics	Week 7	Implement analytics features, including charts, tables, and maps (bubble, thematic), to provide stakeholders with valuable insights into agricultural landscapes and climate conditions.
Knowledge Transfer	Week 8	Production of Users Manual, System Migration to Production Servers, and Online Training Workshops

SCOPE AND LIMITATIONS

1. **SMS Subscription Management:**
    a. The system relies on end users and the client-provided production Web-Server to manage their SMS subscriptions independently.
    b. The platform does not provide direct control or management of external SMS subscription services.
    c. Hence, the CIS team is not responsible for the expenses of securing SMS gateway and subscription.
2. **SMTP Server Configuration:**

a. Users need to configure and provide their SMTP server details for email functionality.
b. The system does not include an integrated SMTP server; instead, it relies on external server configurations provided by the client.
c. To make this possible, the premium subscription of the email blasting shall be provided by the client.

3. **Port Configuration:**
   a. The system may use additional ports, such as port 3000 for Metabase integration.
   b. Users, especially the client-provided production Web-Server administrator, are responsible for configuring and managing these additional ports.
4. **Sudoer Account Responsibilities:**
   a. The server sudoer account, provided by the client, is necessary for administrative tasks, including resource and software installation.
   b. The client-provided production Web-Server administrator is responsible for maintaining the security and integrity of the server environment.
5. **Dependency Installation:**
   a. The platform requires Java, Python, and other dependencies for optimal operation.
   b. The client-provided production Web-Server administrator is responsible for ensuring the installation and upkeep of these dependencies.
6. **External Resource Compatibility:**
   a. While the system is designed to seamlessly integrate with various external resources, compatibility with specific servers, software versions, or configurations may vary.
   b. Users, specifically the client-provided production Web-Server administrator, are encouraged to verify and ensure compatibility with their specific environment.

This scope and limitations statement clarifies that the client will provide and manage the necessary resources for the successful implementation and operation of the Web-Based Centralized-Climate Information System.