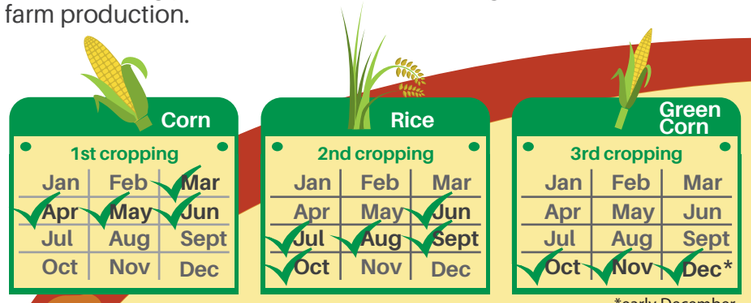
Context

Agusan del Norte, one of the provinces in Caraga Region, produces rice, corn, coconut, banana, and mango, with rice and corn farming being the dominant agricultural activities. However, climatic variability generally hampers farming activities, particularly in towns situated near Lake Mainit, the fourth largest lake in the country. This is the case in Jabonga, Agusan del Norte where every November to February, the municipality experiences inundation when water from the uplands flows into the lake. The inundation can reach up to 4-5 meters high affecting the low-lying barangays. As the water overflows, it washes away crops in farmlands, destroys poultry and swine production, and turns the area into a fishing ground for 3-4 months. The rotation of crops and adjustment of the cropping calendar to suit the onset and end of flooding has been the practice of farmers to minimize damages during flooding periods.

Corn-Rice-Green Corn Crop Rotation

The Corn-Rice-Green Corn Crop Rotation is done through the production of corn grain in the 1st cropping, followed by the production of rice in the 2nd cropping. With the anticipated onset of heavy rains and flood, the 3rd is a shortened cropping period for green corn production, which can harvested within 60-70 days after planting. Even though green corn sells lower than yellow corn, planting green corn in the 3rd cropping compensates for the price difference by shortening the production period, allowing the farmers to harvest early and avoid significant flood-induced crop damages.

Against the usual practice of corn production following the normal cropping calendar, the CRA practice on corn-rice-green corn rotation can help farmers realize optimal earnings by ensuring harvest before the onset of the flood. This income serves as buffer income during periods when land is submerged and unavailable for farm production.



Corn-Rice-Green Corn Crop Rotation

✓ *can replace:*

Corn monocropping

✓ *uses:*

Corn *(Dekalb or Pioneer Yellow Hybrid)*
Rice *(PSB RC 18)*
Sweet corn for green corn production

Available Technical Briefs

LUZON

Cordillera Administrative Region (CAR)
- Water Harvesting Tank for Cabbage in Benguet
- Blight-Tolerant Potatoes in Benguet

Region I-Ilocos Region
- Mango Production in Ilocos
- Rice-Corn Crop Rotation in in Ilocos
- Rice-Tomato Rotation in Ilocos

Region II-Cagayan Valley
- Rice-Rice-Mungbean Crop Rotation/Diversification in Isabela
- Climate-Smart Rice in Isabela

Region III-Central Luzon
- Water Conservation Technology (AWD) in Tarlac
- Climate-Smart Rice in Tarlac
- Crop Rotation-Zero Tillage Combination in Tarlac

Region IVA-CALABARZON
- Coconut-based Integrated Farming System in Quezon
- Rainwater Harvesting in Vegetable Production in Quezon

Region IVB-MIMAROPA
- Rice-Onion Crop Rotation in Oriental Mindoro
- Stress-Tolerant Rice in Oriental Mindoro

Region V-Bicol Region
- Organic Corn Farming in Camarines Sur
- Climate-Smart Rice (Green Super Rice) in Camarines Sur

VISAYAS

Region VI-Western Visayas
- Sloping Agricultural Land Technology for Corn in Iloilo
- Small Water Impounding Project for High Value Crops in Iloilo

Negros Island Region (NIR)
- Use of Submerence-Tolerant Rice Variety in Negros Occidental
- Organic Red Rice Production in Negros Occidental

Region VII-Central Visayas
- Corn-Peanut Crop Rotation in Cebu
- Protected Vegetable Cultivation in Cebu

Region VIII-Eastern Visayas
- Alley Cropping Using Pineapple as Hedgerow in Upland Rice Production in Samar
- Protected Vegetable Cultivation in Samar

MINDANAO

Region IX-Zamboanga Peninsula
- Alternate Wet And Drying for Rice in Zamboanga Sibugay
- Coconut-Yellow Corn Intercropping in Zamboanga Sibugay

Region X-Northern Mindanao
- Biodynamics in Corn Production in Bukidnon
- Corn-Banana Crop Diversification in Bukidnon

Region XI-Davao Region
- Crop Rotation with Integrated Nutrient Management in Davao
- Cacao-Coconut Intercropping in Davao

Region XII-SOCCSKARGGEN
- Organic Rice Farming in North Cotabato
- Integrated Rice-Duck Farming System (IRDFS) in North Cotabato

Region XIII-Caraga
- Corn-Rice-Green Corn Crop Rotation in Agusan Del Norte
- Corn-Squash+Corn Crop Rotation in Agusan Del Norte

Autonomous Region of Muslim Mindanao (ARMM)
- Coconut-White Corn Intercropping in Lanao Del Sur
- Coconut-Banana Intercropping in Lanao Del Sur

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Lin, B.B., 2011. Resilience in agriculture through crop diversification: adaptive management for environmental change. BioScience, 61(3), pp.183-193.

Tschakert, P. and Dietrich, K.A., 2010. Anticipatory learning for climate change adaptation and resilience. Ecology and society, 15(2), p.11.

About the Authors

This technical brief was produced through the CSU-CIAT-DA partnership under DA-BAR project titled "Climate-Resilient Agriculture (CRA) Assessment, Targeting & Prioritization for the Adaptation and Mitigation Initiative in Agriculture (AMIA) Phase 2 in Agusan del Norte Province (Caraga Region)".

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Acknowledgment

The authors would like to acknowledge the active participation of our farmer respondents, the local counterparts from the Local Government and the Department of Agriculture Regional Field Office - XIII and the financial support provided by the DA-Bureau of Agricultural Research (DA-BAR) and DA AMIA.

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DEPARTMENT OF AGRICULTURE AMIA

DEPARTMENT OF AGRICULTURE CARAGA

CARAGA STATE UNIVERSITY PHILIPPINES

TECHNICAL BRIEF
on Climate-Resilient Agriculture (CRA)
Caraga (Region XIII)

Corn-Rice-Green Corn Crop Rotation

The farmers in Jabonga, Agusan del Norte rotate planting of corn with rice and then back to corn to produce green corn before the onset of flooding. Having one cropping of rice after corn production ensures availability of staple food for the family during flooding. The second corn production is sold as green corn while crop residues are used for livestock feed. A shortened cropping period for green corn contributes to providing buffer income to farming households. With crop rotation and the adjusted production timing, farmers still obtain the optimum income while avoiding crop damage caused by floods.

Productivity

Reduce risk of production losses caused by floods

Potential to attain maximum yield and higher income

Adaptation

Optimized cropping calendar

Better pest and disease management

Cost & Benefit

Initial Investment/ha
PhP 39,500

Payback Period
3 years

*On top of profit from conventional practice

Estimated Additional Annual Profit/ha*
PhP 17,860
USD 348

Yield & Prices

	Without CRA: Corn	Without CRA: Corn	With CRA: Yellow Corn	With CRA: Rice	With CRA: Green Corn
	1st cropping	2nd cropping	1st cropping	2nd cropping	3rd cropping
Average annual farm yield	3,742 kg/ha	2,245 kg/ha*	3,742 kg/ha	4,020 kg/ha	4,746 kg/ha
Price per kg	PhP 15.14	PhP 15.14	PhP 15.14	PhP 16.5	PhP 5.25

*With losses due to flooding

vs

7 Reasons to Invest

1. Diversification of income source to reduce risk of financial losses
2. Higher potential farm income
3. Optimized cropping calendar
4. Better pest and disease management
5. Increase in soil carbon stock
6. Increase top soil formation
7. Increase in emissions from fossil energy inputs

Externalities

Social and Environmental NPV
PhP 121,013
USD 2,358

Social IRR
60%

Financial Analysis

Net Present Value	IRR
PhP 76,930 USD 1,499	42%

Sensitivity Analysis

The CRA practice will still be **more profitable** than non-CRA practice even when:

- Yield of Yellow Corn in 1st cropping decreases by **10%**
- Yield of Rice in 2nd cropping decreases by **10%**

Aggregate Impact*

*within the Province of Agusan del Norte

Current Adoption Rate	Projected Adoption Rate
3%	50%

Total area planted to Corn	Aggregate NPV
232 hectares	PhP 7.5 million

Assumptions:

Period of Analysis	Discount Rate	Exchange Rate
10 years	10%	$1 = PhP 51.32

Recommendations

When & Where?
The CRA practice can be adopted year-round in corn-producing areas of Agusan del Norte that are susceptible to flooding that lasts for 2-4 months.

What?
Farmers Field Schools (FFS) are encouraged to include sessions on experience sharing among CRA practitioners for proper and effective adoption of the corn-rice-green corn rotation strategy.

Who?
LGUs could strengthen information dissemination campaigns to inform farmers of the advantages of the Corn-Rice-Green Corn Crop Rotation practice.

The government is encouraged to offer special fund support packages and capacity building training with technical and entrepreneurial modules for farmers adopting the CRA practice to increase adoption rates.

Initial Investment Breakdown

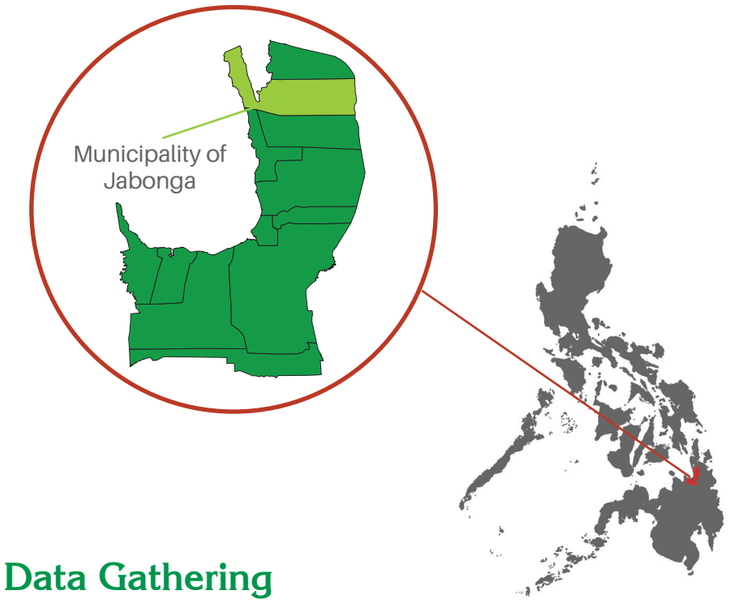
- Initial Investment **PhP 39,500**
- Labor & Services **PhP 10,300**
- Equipment **PhP 6,000**
- Inputs **PhP 23,200**

Cost of Adopting CRA

- Initial Investment — Installation costs (Year 1) **PhP 39,500**
- Maintenance — Annual costs (Years 2-10) **PhP 39,500**
- Operations — Irregular/ non-permanent costs **PhP 22,700**

Study Site

Agusan del Norte



Data Gathering

1. Analysis of experiences of 30 farmers in three barangays in the municipality of Jabonga in Agusan del Norte province.
2. Conduct of Experts' Workshop with experts from the academe (Caraga State University) and the government (Department of Agriculture Region 13) pooling knowledge and insights on emerging climate resilient farm practices
3. Conduct of interviews with the Municipal Agricultural Officer (MAO) and Barangay Captains to validate results from Experts' Workshop
4. Review and synthesis of secondary information

The CIAT CBA Methodology

Cost-Benefit Analysis (CBA) is used to determine the relative profitability of alternative cropping practices, involving the comparison of the annual flows of incremental benefits with that of incremental costs. The CIAT CBA Online Tool analyzes the full benefits and costs of identified practices and adoption response at both individual farmer level and at aggregate level for a particular area.

Specifically, the tool can:

1. Quantify economic and some environmental trade-offs of adopting CRA practices.
2. Provide sensitivity analysis
3. Estimate the level of peak adoption

http://cbatool.ciat.cgiar.org/