The role of mechanization in strengthening smallholders' resilience through conservation agriculture in the Philippines

Presented by

***Rossana Marie C. Amongo**, PhD- Director and Associate Professor*

***Maria Victoria L. Larona**, PhD-University Researcher II*

***Jose D. de Ramos**, University Extension Specialist III*

***Marck Ferdie V. Eusebio**, University Extension Specialist I*

***Ronnie C. Valencia**, University Research Associate II*

Center for Agri-Fishery and Biosystems Mechanization

College of Engineering and Agro-industrial Technology

University of the Philippines Los Baños

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Outline of Presentation

- Introduction and background
- Status of Conservation Agriculture (CA) and CA Mechanization
- Good practices and successful cases in adoption of CA and CA mechanization
- Constraints and challenges to adoption and promotion of CA and CA mechanization:
- Recommendations
- Conclusion
- References

Introduction

- The **Philippines** is still an **agricultural-based economy**.
- Total Population (2018): **106.5 million Filipinos**
- Agriculture total share of employment in the country: **11.06** million Filipinos **(8.31 million** men and **2.76 million** women)
- Agricultural products for food, feed, fiber and alternative fuel contributes to about **9%** of the **total GDP** of the country.
- The major staple food are **rice and corn** while other major products are **sugarcane and coconut**.
- The Philippines **ranked 8th** in terms of total rice production area of **4.5 million hectares**. However, it also ranked **11th among top 15 countries** depending on rice importation to feed its population.

Source: Countrystat, Philippines accessed April 2018

Country Background

PARAMETER	DESCRIPTION	DATA
Geographical Location	Latitude :	NL: 4.7 º N SL: 21.5 º N
	Longitude:	EL : 117 º E WL:127 º E
Meteorological conditions	Temperature	Min. 26.1 º C Max. 28.4 º C
	Annual Precipitation	2000 mm/year
Agricultural Conditions	Total Area	300,000 km^2
	Total Land Area	298,170 km^2
	Total Water Area	1,830 km^2
	All farm holdings (2012 CAF)	7,190,000 ha
	Temporary Crops	3,444,000 ha
	Permanent Cropland	3,329,000 ha
	Agricultural Farms (2012 CAF)	5,562,577 farms

Source: Countrystat, Philippines accessed April 2018

Country Background

PARAMETER	DESCRIPTION	DATA
Agricultural Conditions	Staple foods	RICE: (2016) Area Harvested: 4.566 million ha Production: 17.627 MMT Farm gate Price: PhP 19.07/kg
		CORN: (2016) Area Harvested: 2.484 million ha Production: 7.219 MMT Farm gate Price: PhP 11.78/kg
	Other staples	Root Crops and Plantain
	Other major crops	Sugarcane, Coconut
	Top Export crops	Coconut Oil (22%), Banana (14%), Tuna (5%),Pineapple & Products (14%)

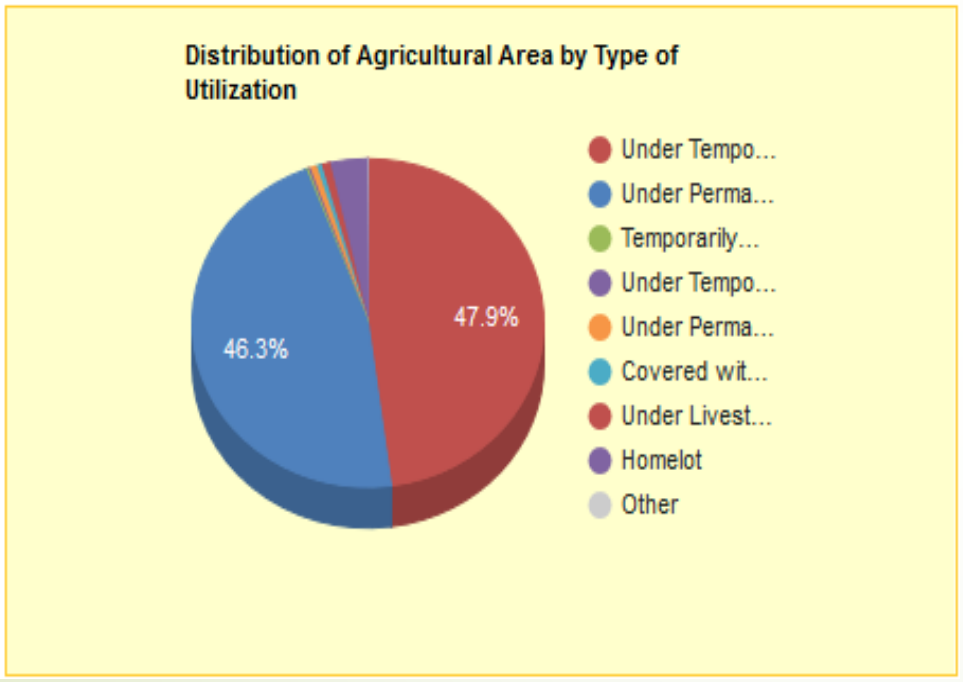
Source: Countrystat, Philippines accessed April 2018

Country Background

PARAMETER	DESCRIPTION	DATA
Population and Employment	Total Population	106.512 million
	Total Employment	41.00 million
	Employment in Agriculture (2016)	11.06million (27 % share) Male: 8.31 million Female: 2.76 million
	Ave Wage Rates (2016) Agricultural sector	PhP 267.03
Economy (2016)	GNI at current prices	PhP 17,430 billion
	GDP at current prices	PhP 14,481 billion (9% share from agriculture)
	GVA at current prices (agriculture and fishing)	PhP 1,395 billion

Source: Countrystat, Philippines accessed April 2018

Country Background



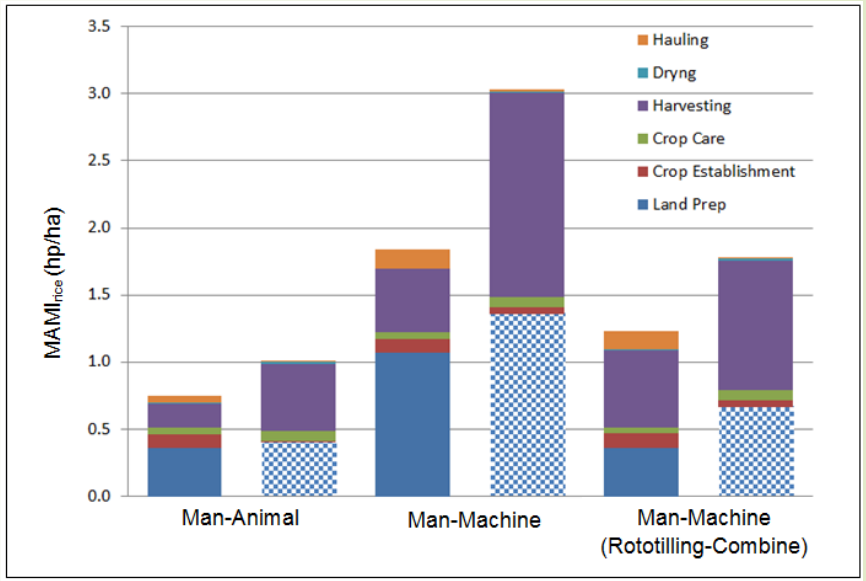
Location:	Southeastern Asia, archipelago between the Philippine Sea and the West Philippine Sea, east of Vietnam
Area:	total: 300,000 square kilometers
	land: 298,170 square kilometers
	water: 1,830 square kilometers
All Farms/Holdings:	7.190 million hectares
Under Temporary Crops:	3.444 million hectares
Under Permanent Crops:	3.329 million hectares
Temporarily Fallow:	0.014 million hectares
Under Temporary Meadows and Pastures:	0.014 million hectares
Under Permanent Meadows and Pastures:	0.044 million hectares
Covered with Wood and Forest:	0.033 million hectares
Under Livestock and Poultry Raising:	0.057 million hectares
Under Aquaculture:	0.002 million hectares
Other Main Use of Farm/Holding Parcels:	0.005 million hectares
Homelot:	0.248 million hectares

Land distribution of agricultural area and type of utilization, Philippines
Source: (Countrystat, Philippines accessed April 2018)

Country Background

PARAMETER	DESCRIPTION	DATA
Agricultural Conditions	Level of Mechanization (Mechanization Index)	Rice: (MAMI rice 2017) Mindoro Or. 3.029 hp/ha Laguna: 1.836 hp/ha
		Other Crops (2013): 1.23 hp/ha
	Average Farmer's Land Holding	Rice (2013): 2.62 ha
		Corn (2013): 1.76 ha
		National Average: 2 ha
	Average Age of Farmer	57 years old

Source: Amongo, et al. 2013; Amongo et al. 2017; Amongo, et al., 2018



Level of mechanization in Laguna and Oriental Mindoro, Philippines using MAMI.

MAMI was adopted as a National Policy in determining the Level of Mechanization in the Philippines in 2017 by DA.

Country Background

YEAR	M.I. (hp/ha)	CONSIDERATIONS	SOURCE
1968	0.198	Rice-based farming system	RNAM (1994) as cited by PCAARRD, 2007. Mechanization Status. Agricultural Machinery Information Network.
1980s	0.360	Rice-based farming system	as cited by S.C. Capareda.1994. Issues and Trends in Farm Power and Machinery. Philippine Agricultural Mechanization Bulletin. Vol. II No.3. AMDP, CEAT, UP Los Baños.
1990	0.520	Rice-based farming system	RNAM, 1990. Technical Report. Economic and Social Commission for the Asia and the Pacific. Regional Network for Agricultural Machinery (ESCAP-RNAM).
1998	1.680	Rice and Corn based farming system utilizing human, animal and mechanical	Rodulfo, V.A. Jr., R.M.C. Amongo and M.V.L. Larona. 1998. Status of Philippine Agricultural Mechanization and Its Implications to Global Competitiveness. Philippine Agricultural Mechanization Bulletin. Vol. V No.1. AMDP, CEAT, UP Los Baños.
2010	1.500	Rice-based farming system utilizing single cylinder engines	Panagsagan, J.R. 2011. 2006-2010 Engine Sales Statistics Relevant to Determining the Level of Mechanization. Paper presented during the Harmonization Workshop on the Level of the Philippine Agricultural Mechanization. (presented by AMMDA)
2013	2.310 1.230	Rice- based farming system For all crops	R.SM. Dela Cruz, S.B. Bobier. 2013. Farm Power Available for Utilization in Philippine Agriculture. Unpublished Report. PHilMech (paper submitted for publication)

Source: Amongo, et al. 2017

Agricultural and Fisheries Mechanization

RA 10601 otherwise known as the Agricultural and Fisheries Mechanization Act of 2013 defines:

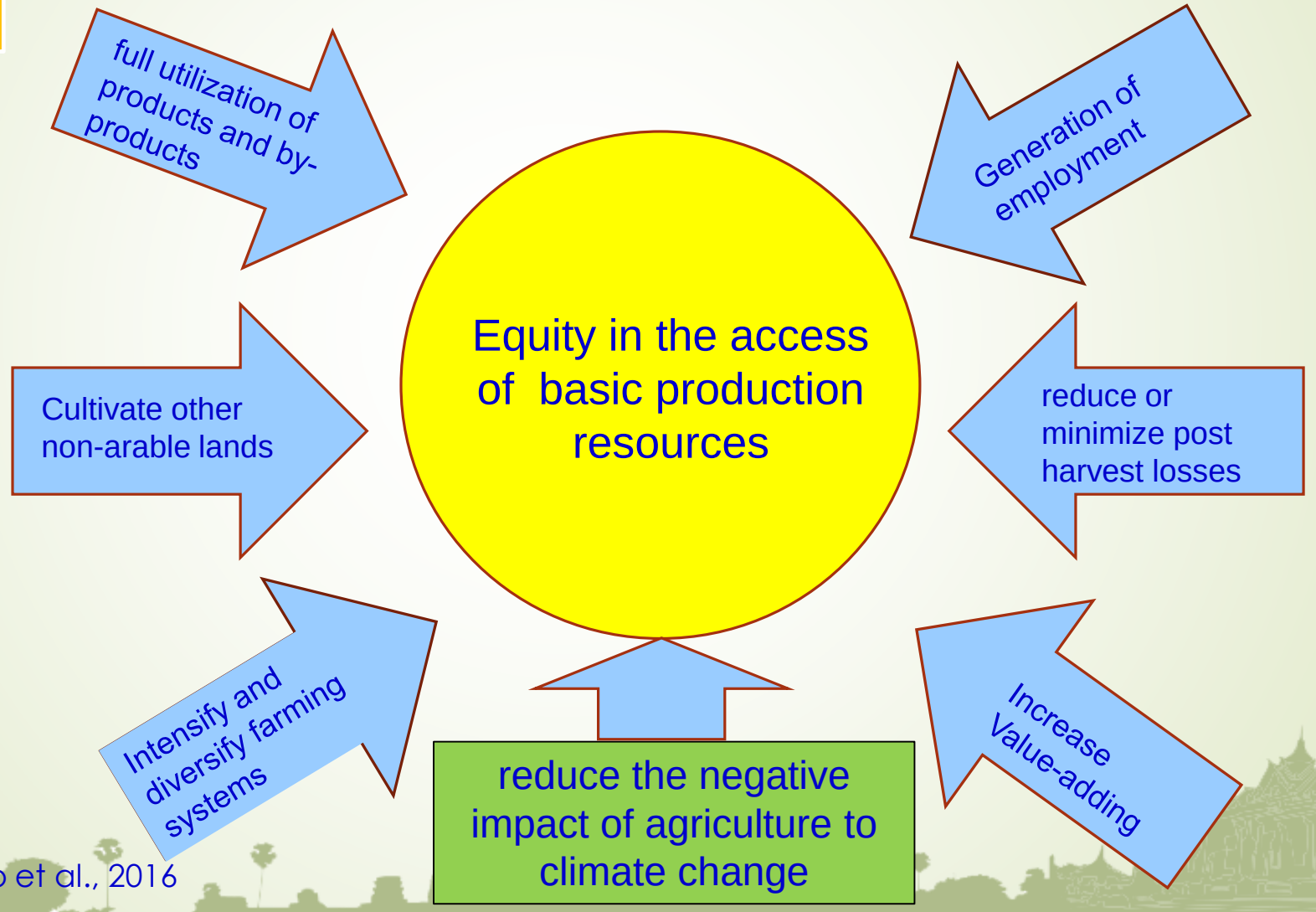
agricultural and fisheries mechanization
refers to the development, adoption, assembly, manufacture and application of appropriate, location specific and cost-effective agricultural and fisheries machinery using human, animal, mechanical, electrical, renewable and other nonconventional sources of energy for agricultural production and postharvest/ postproduction operations consistent with agronomic conditions and for efficient and economic farm and fishery management towards modernization of agriculture and fisheries.

Agri-fisheries Mechanization Technologies (AFMTs) as propellers to sustainable agriculture

The use of agricultural and fisheries mechanization technologies (AFMTs) is necessary to sustain agricultural and fishery production systems in view of the changing environment, advancement of technologies and way of life to produce food, feed, fiber and energy sustainably and to meet the requirements of the ever-growing population.

Agri-fisheries Mechanization Technologies (AFMTs) as propellers to sustainable agriculture

AFMTs contribution



Source: Amongo et al., 2016

Introduction

This paper aims to present:

- the different conservation agricultural activities implemented in the Philippines;
- Good practices and successful cases in adoption of CA and CA mechanization
- Constraints and challenges to adoption and promotion of CA and CA mechanization and some recommendations for the successful implementation of CA and CA mechanization in the country

Conservation Agriculture (CA) and CA Mechanization

ASEAN Multi Sectoral Framework on Climate Change Agriculture and Forestry Towards Food Security (AFCC)

Sustainable Food Security Program
(DA & DAR)

- Irrigation
- RDE
- Credit & Marketing
- **Farm Mechanization**
- Land Tenure Improvement
- Other Support Services

Environmental Protection
(DENR/Climate Change Commission)

- **Conservation(Soil, Water, Forest , ETC**
- Solid Waste Management
- Clean Air
- Climate Change Adaptation and Mitigation

Philippine Development Plan

2010-2016
Aquino Administration

2017-2022
Duterte Administration

Source: Amongo ,et al. 2016

Status of Conservation Agriculture (CA) and CA Mechanization

- CA is an approach to managing agro-ecosystems for improved and sustained productivity, increased profits and food security while preserving and enhancing the resource base and the environment (FAO).
- CA is a concept for resource saving agricultural crop production that strives to achieve acceptable profits together with high and sustained production levels while concurrently conserving the environment (UNEP).
- CA is an agro-ecological approach in associating rural development with environmental preservation, integrating all agricultural practices for viability and sustainability of agriculture as well as environmental protection (CANSEA – Conservation Agriculture Network for Southeast Asia).
- CA is any cropping system integrating the three principles of minimum soil disturbance, permanent soil cover, and crop rotations (FAO, Erenstein, 2008).

Source: Ella, 2016

Conservation Agriculture (CA) and CA Mechanization

- **CONSERVATION AGRICULTURE**
- Minimum Soil Disturbance
  - May involve controlled tillage with no more than 20-25% soil surface disturbance
  - Direct seeding
- Continuous Mulch and Residue Cover
  - Minimum of 30% permanent organic soil cover
- Diverse Crop Species Rotation
  - Rotation should involve at least 3 different crops
  - Legumes are recommended as rotational crops for their nitrogen fixing function
  - May involve inter cropping

Source: Ella, 2016

Conservation Agriculture (CA) and CA Mechanization

Farm Machinery Population, 2012 (Estimate)

Agricultural Machines	Number 2012
Agricultural Tractors	
1) 4-Wheel Tractor	9,306
2) Power Tiller	1,000,000
Paddy Threshers	
1) Rice Thresher	74,551
2) Pedal Thresher	20,149
3) Multipurpose Thresher/sheller	6,259
Mechanical Harvester	
1) Combine Harvester	50
2) Reaper	100
Post Harvest Machinery	
1) Corn Sheller	5,340
2) Flat Bed Dryers	2,620
3) Recirculating/Columnar Mech. Dryer	1,330
4) Corn Mill	2,340
5) Rice Mill (Single Pass)	24,420
6) Rice Mill (Multi-Pass)	904

Source: AMTEC; www.unapcaem.org as cited by Rico, 2016

Status of Conservation Agriculture (CA) and CA Mechanization

- **CA EXPERIMENTAL RESEARCH Claveria, Misamis Oriental, Philippines**

Period: 2010-2014
Project: SANREM
Crop: Maize
Driver: USAID

Select cropping pattern that give maximum economic benefit promote fast turn-around period and improve soil carbon, structure and fertility.

Assess the effects of moderate and high fertility levels on the growth and yield of crops under CAPS

Sources: Ella, 2015; [SANREM Innovation Lab], 2014

Status of Conservation Agriculture (CA) and CA Mechanization

- **CA EXPERIMENTAL RESEARCH**
  Claveria, Misamis Oriental, Philippines

Sources: Ella, 2015, [SANREM Innovation Lab], 2014; Aguiba, 2017

World Agroforestry Centre (WAC) project
Elevation: 350-950 meters above mean sea level
Soil: acid upland w/ soil erosion = 200-350 Mg/ha
Terrain: 62% rolling and very steep
60% of farmers earning below food threshold level of $215 per month

Soil OMC (0-5cm) steadily declined under plow based and generally increased slightly under CAPS after 4 years of cropping

High fertility level, CAPS treatment T2 (maize + stylosanthes guianensis) exhibited the highest rate of increase in soil OM over time at the uppermost soil layer

Moderate fertility level, CAPS treatment T5 (cassava + stylosanthes guianensis) exhibited the highest rate of increase in soil OM over time

Soil quality parameters (BD, N, P, pH) did not exhibit a well-defined pattern of temporal variability for all soil layers after 4 years of cropping, t
Transport or loss of nutrients through leaching tends to be faster under plow-based systems than under CAPS
Ammonium adsorption in soil under CAPS is better than under plow based systems.

Status of Conservation Agriculture (CA) and CA Mechanization

- After the CAT in Claveria, Misamis Oriental pilot work, CAT has been adopted by **10,000 Mindanao farmers** with Trees as against climate change

- In a University of the Philippines Los Baños project, environmental experts established conservation farm villages in five areas:
  - Ligao City, Albay, 49 hectares;
  - Alfonso Lista, Ifugao, 17 hectares;
  - Quezon 40 hectares
  - La Libertad, Negros Oriental, 93 hectares; and
  - Panabo City, Davao del Norte, 40 hectares.

Source: Aguiba, 2017

Status of Conservation Agriculture (CA) and CA Mechanization

- **Conservation Agriculture in the Philippines (24 March 2016)**

Source: [SANREM Innovation Lab], 2014

Status of Conservation Agriculture (CA) and CA Mechanization

- **PROJECT AMIA**

  (Adaptation and Mitigation Initiative in Agriculture)

  Objectives:

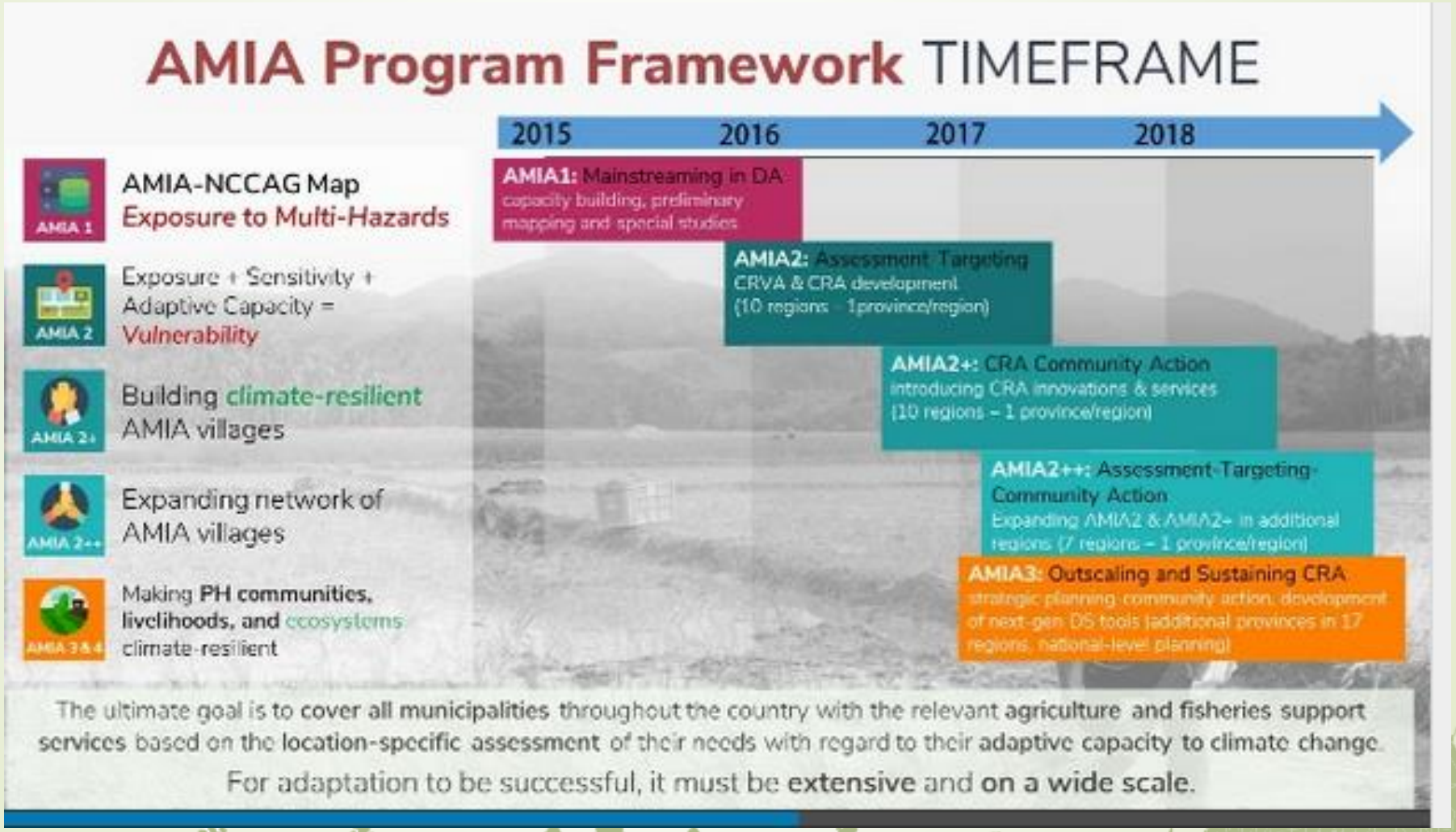
  - To assess exposure, sensitivity, and adaptive capacity of the agri-fisheries sector to climate risks in the AMIA target regions.
  - To identify and prioritize region-specific climate risks that threaten the resilience of agri-fishery communities.
  - To plan and design climate-risk responsive research and development interventions to build resilience among agri-fishery communities.

This project was implemented in nine pilot provinces: Ilocos Sur, Isabela, Tarlac, Quezon, Camarines Sur, Iloilo, Bukidnon, Davao Oriental, and Negros Occidental

Source: https://www.slideshare.net/UNDP-daptation/delivering-amia-villages-across-the-philippines

Approach: Climate Resilient Agriculture (CRA) through **implementing technologies and practices**, introducing institutional and social innovations, accessing climate-relevant support services

Status of Conservation Agriculture (CA) and CA Mechanization

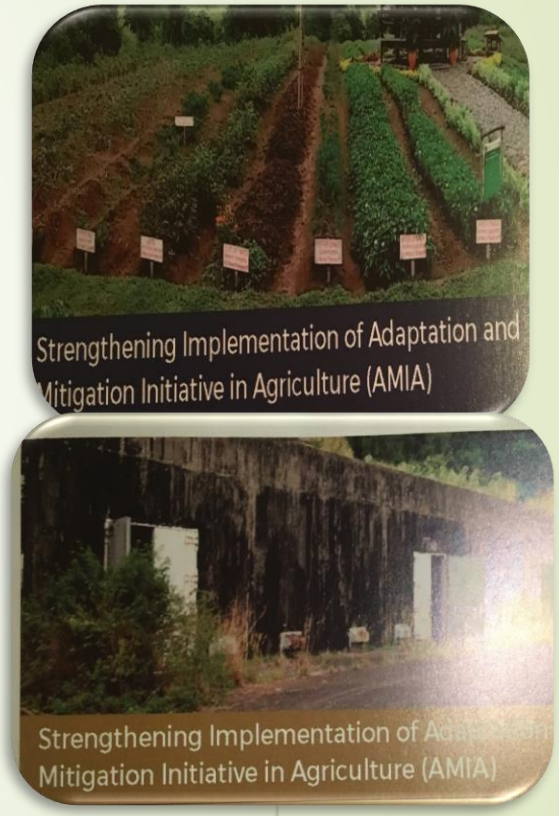


Source: https://www.slideshare.net/UNDP-daptation/delivering-amia-villages-across-the-philippines

Status of Conservation Agriculture (CA) and CA Mechanization

Strengthening the Implementation and Adaptation and Mitigation Initiative in Agriculture (AMIA)

- ✓ bunker- based storage systems for seed production
- ✓ water harvesting and sustainable agricultural productivity.
- ✓policies on research and development
- ✓ policies on agricultural extension
- ✓analysis and evaluation on renewable energy utilized in the production systems
- ✓best practices and disaster risk reduction and management due to typhoons, drought and floods in agriculture,
- ✓ language of disaster in major language groups in farming and fishing areas



Source: AMIA Brochures as citrd by Amongo, et al., 2016

Status of Conservation Agriculture (CA) and CA Mechanization

- **PROJECT MANa**
  (Maunlad na Agrikultura sa Nayon)

- DA led project to support and match enhanced provision of agricultural investments and services to empower more farmers and fisherfolk
- Two major components:

  Rehabilitation for El Niño damaged areas and Mitigation plan for La Niña,

  Identification of potential one million hectares for rice expansion area, rehabilitation of existing irrigation facilities and provision of appropriate irrigation system to rice rainfed areas.

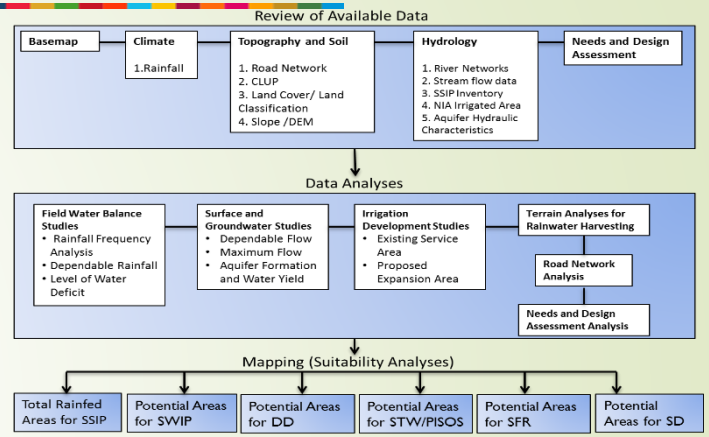
Source: httpshttps://www.google.com.ph/search_project+Maunlad+na+Agrikultura+sa+Nayon,+Philippines

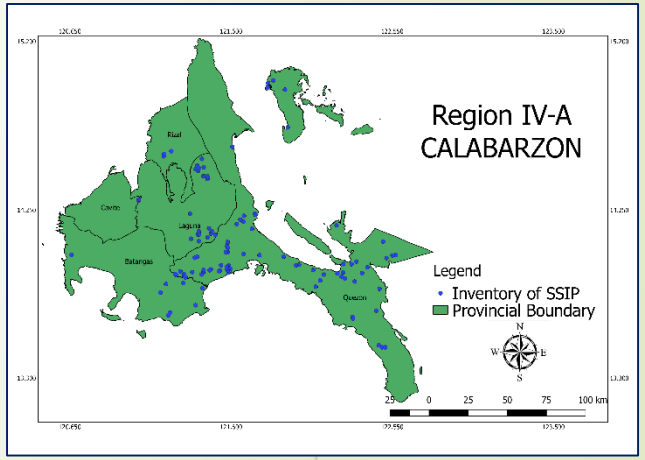
Status of Conservation Agriculture (CA) and CA Mechanization

- **PROJECT SMALL SCALE IRRIGATION PROGRAM (SSIP)**
  - Mitigating climate change and improving the adaptive capacity of farmers through provision of relevant technologies and information
  - Increase rainwater use efficiency and water availability in rainfed areas through rainwater conservation and rainwater harvesting interventions

- Development of a regional water assessment map for identifying the suitability of an area for SSIP shall provide an efficient decision tool in policy making and development planning.

- The output of the project shall promote optimal utilization of both physical and financial resources.

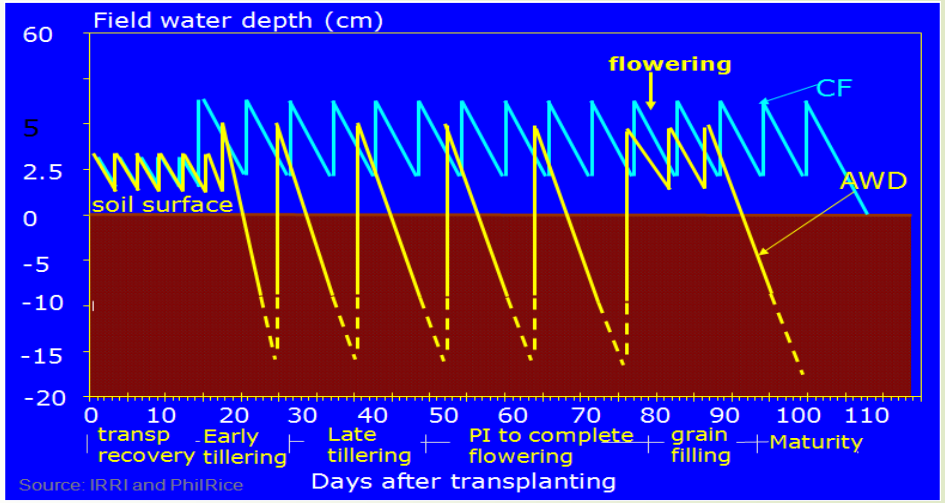




Source: Amongo et al., 2018

Status of Conservation Agriculture (CA) and CA Mechanization

- **ALTERNATE WETTING AND DRYING (AWD)**
  - water-saving technology that farmers can apply to reduce their irrigation water consumption in rice fields without decreasing its yield.
  - irrigation water is applied a few days after the disappearance of the ponded water (15cm below soil surface)
  - The number of days of non-flooded soil between irrigations can vary from 1 to more than 10 days depending on the number of factors such as soil type, weather, and crop growth stage.
  - Dissemination of Safe AWD (large scale dissemination > 100,000 farmers in the Philippines)

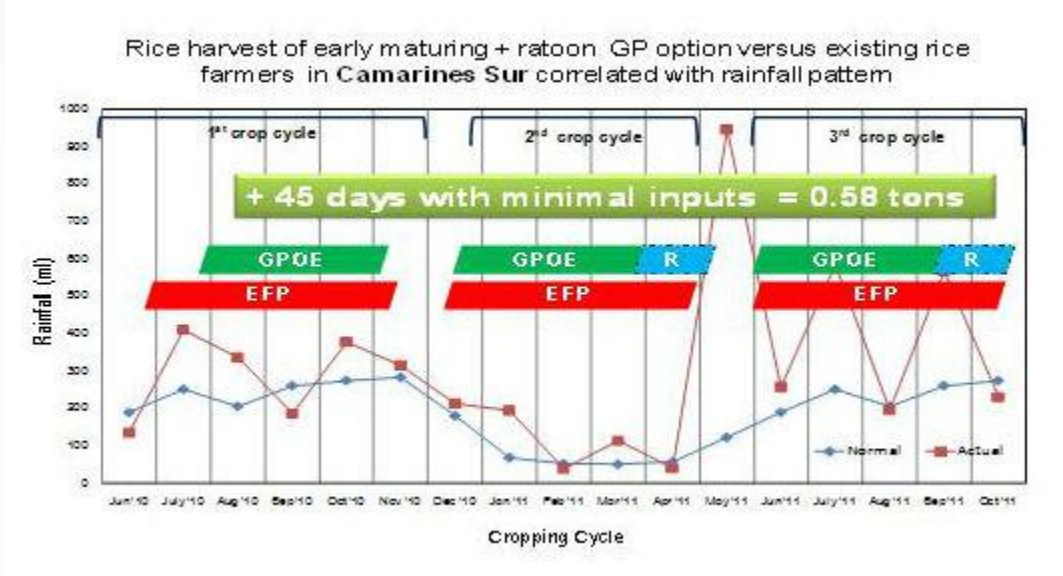


Water management scheme using AWD
Source: PhilRice as cited by Ruzgal et al. 2014

Approach: Standing water of 3-5 cm is maintained during early tillering stage. At 30 DAT, the water is drained up to 15 cm below the ground before applying irrigation. During flowering, the standing water is again maintained until the milk grain stage. AWD is returned during dough grain stage until 1-2 weeks before harvesting.

Status of Conservation Agriculture (CA) and CA Mechanization

- **RATOONING**
  - a practical way of utilizing the residual water and reducing the risk of crop failure.
  - Rice ratooning (suli, saringsing), is a “traditionally known” practice in Bicol.
  - Uses appropriate short-maturing rice variety with good ratoon ability.
  - Enhances environmental adaptation in rice cultivation;
  - it is a practical way of utilizing the residual water and reducing the risk of crop failure or establishment.
  - It aims to reduce crop losses in typhoon prone areas



Rice harvest of early maturing + ratooning GPO
Source: http://teca.fao.org/read/7739

Additional yield of 25-30 cavans (1cavan = 50kg) are possible within 60-75 days after harvest (Malabanan, 2008 & BAR, 2004), using appropriate varieties, both certified and hybrid rice varieties.

Status of Conservation Agriculture (CA) and CA Mechanization

- **CA cropping systems, production inputs, experience with no-till, mulch from residues and cover crops, and crop diversity**.
  - “annual” system: growing of banana between rows of trees "planted along the contour of sloping lands."
  - "perennial" system: perennial trees like rubber are intercropped with cacao and *Arachis pintoi* (Pinto peanut)
  - growing of corn with cowpea intercropped with rubber and banana trees and forages.

Source: Aguiba, 2017

Status of Conservation Agriculture (CA) and CA Mechanization

- **CA cropping systems, production inputs, experience with no-till, mulch from residues and cover crops, and crop diversity.**
  - Mulching

Corn	Sweet Pepper
Asparagus	Tomato
Beans	Vines (watermelon, squash, honeydew)
Eggplant	Root crops (carrot, raddish, turnip)
Onion	Cucumber (and other creeping plants)
Garlic	Leafy vegetables (cabbage, lettuce,
Spinach	broccoli, pak choi, etc.)

Source: Epino, 2003

Status of Conservation Agriculture (CA) and CA Mechanization

- **Rotation/association/sequences, productivity, response to labour, water, nutrients, pesticide,etc.**
  - Increased profitability of crops cassava with *A. Pintoi* from 492% to 863% after four years.
  - Grain legumes (cowpea and rice beans) integrated systems had higher total profitability than the other systems due to higher bean price

Source: Aguiba, 2017

- **In the case of Safe AWD in irrigated rice production**:
  - Irrigation water savings of up to 30%. No yield difference (Lampayan et al. 2015)
  - Promotes higher zinc availability in soil and in grains (Beebout et al. 2011)
  - Reduces methane emissions (Liang et al 2015; Hosen et al. unpubl.; Sander et al.)
  - Promote better root anchorage, and thus reduce lodging (Quicho, unpub thesis)

Status of Conservation Agriculture (CA) and CA Mechanization

- **Availability of equipment & machinery, sources & service providers of CA equipment & machinery.**

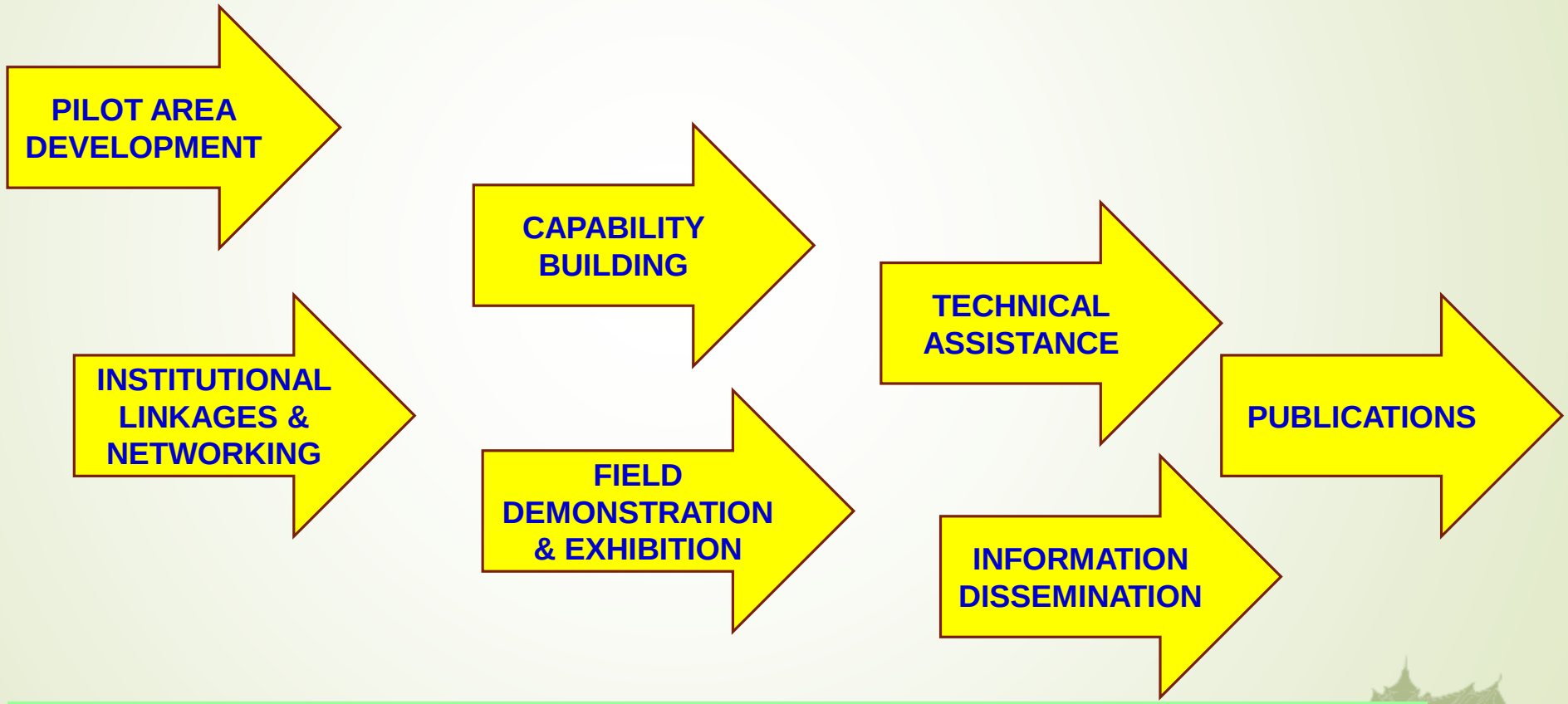
Distribution of agricultural machinery manufacturers and dealers in the Philippines

REGION	NUMBER	PERCENT
Luzon: I	18	5.1
II	22	6.2
III	35	9.9
NCR	113	31.9
IV	29	8.2
V	27	7.6
Visayas: VI	30	8.5
VII	2	0.6
VIII	7	1.9
Mindanao: IX	13	3.7
X	18	5.1
XI	19	5.4
XII	21	5.9
TOTAL	**354**	**100**

Source: AMTEC, 1999

Status of Conservation Agriculture (CA) and CA Mechanization

Extension Approach of CA, CA equipment and machinery other inputs



Feedback Mechanism: Monitoring and Evaluation (Impact Assessment)

Status of Conservation Agriculture (CA) and CA Mechanization

Extension Approach of CA, CA equipment and machinery other inputs

Pilot Area Development

To develop mechanization technology packages for the agricultural production and post-production system in the area

To extend and popularize these commodity-based technology packages in the project area

To develop the capabilities of local manufacturers in the fabrication of selected agricultural machines

To document the impact of the introduction of agricultural mechanization technologies on farmers' income and livelihood

Status of Conservation Agriculture (CA) and CA Mechanization

Extension Approach of CA, CA equipment and machinery other inputs

Institutional Linkages and Networking

Research Development Institutions for Agricultural & Fisheries Sector

Higher Education Institutions for ABE and Fisheries

Agricultural Machinery Manufacturers Association and other local fabricators

International Organizations

Status of Conservation Agriculture (CA) and CA Mechanization

Extension Approach of CA, CA equipment and machinery other inputs

Capability Building (Training, Seminar,etc.)

Trainings on the fabrication of different agricultural and fisheries mechanization technologies; technical drawing interpretations using Auto-CAD; operation, repair and maintenance (ORM) of selected agricultural machinery; entrepreneurship training for women in agriculture among others

Fabrication of jigs and fixtures to produce tools and machinery on commercial scale

Status of Conservation Agriculture (CA) and CA Mechanization

Extension Approach of CA, CA equipment and machinery other inputs

Field Demonstrations and Exhibitions

National and local exhibitions of agricultural and biosystems mechanization technologies for wider dissemination of AFMTs

Status of Conservation Agriculture (CA) and CA Mechanization

Extension Approach of CA, CA equipment and machinery other inputs

Publications

1. Philippine Agricultural Mechanization Journal (PAMJ) - technical non-refereed Journal

2. Philippine Journal for Agricultural and Biosystems Engineering (PJABE)- the **first ever** refereed journal in agricultural and bio-systems engineering in the Philippines

Status of Conservation Agriculture (CA) and CA Mechanization

NATIONAL POLICES AND STRATEGIES CURRENTLY APPLIED TO PROMOTE CA AND CA MECHANIZATION

- DA AO 25 Signed Sept 11, 2009: Guidelines for the Adoption of Water Saving Technologies in Irrigated Rice Production in the Philippines
- Republic Act 10068 otherwise known as the Organic Agriculture Act of 2010
- RA 10601 otherwise known as Agricultural and Fisheries Mechanization Act of 2013
- RA 10915 otherwise known as the Philippine Agricultural and Biosystems Engineering Act of 2015

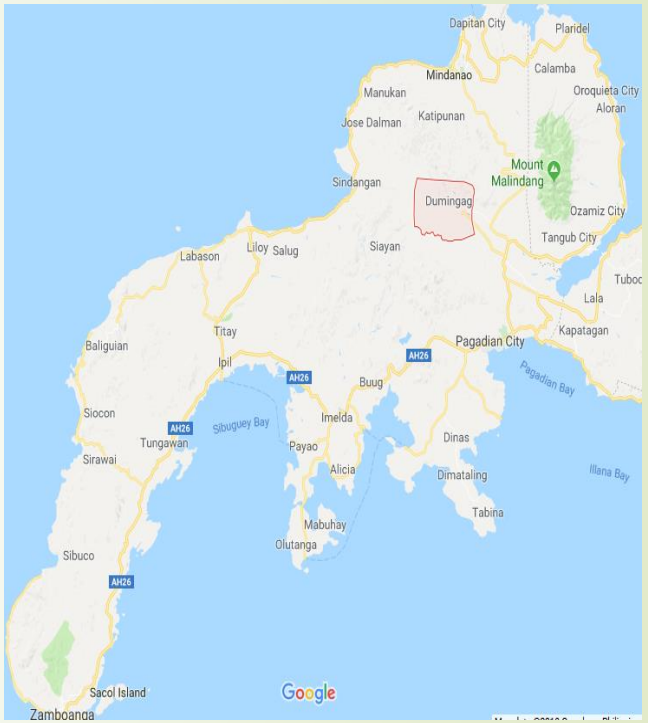
Good practices and successful cases in adoption of CA and CA mechanization

- **Development of agricultural mechanization technology in support of the organic agriculture program of the Municipality of Dumingag, Zamboanga del Sur**

  Composed of 44 barangays

  Total land area: 618 km^2

  Topography: mountain ranges, lowland areas, rolling hills and plateaus. The lowlands form about 9.0% of the total land area.



The increase in crop productivity and the preference for organic farming created production constraints which limit further increase in production and cropping intensity. This could be addressed through the introduction of appropriate agricultural mechanization.

Source: De Ramos, et. al., 2017

Good practices and successful cases in adoption of CA and CA mechanization

- Collaborative project activities by BIOMECH and the LGU with the following objectives:
  - ✓To develop mechanization technology packages for the organic farming systems of Dumingag particularly on rice, corn, root crops and vegetables;
  - ✓To develop, test and evaluate machinery for value-added processing of root crops and vegetables;
  - ✓To develop the manufacturing capabilities of local manufacturers in the fabrication of agricultural machines;
  - ✓To document the effects of the introduction of agricultural mechanization technologies on farmers' income and livelihood.

Pledge of Commitment signing between BIOMECH-CEAT-UPLB and the Local Government Unit of Dumingag, Zamboanga del Sur

Source: De Ramos, et. al., 2017

Good practices and successful cases in adoption of CA and CA mechanization

- AMTs introduced to the area for organic farming activities.

BIOMECH-developed AMTs :
- **UPLB hand tractor,**
- **Rice drum seeder,**
- **Lowland rice weeder,**
- **Manual corn sheller**
- **AMDP mechanical two-drum corn sheller**
- **Rice hull carbonizer**

Source: De Ramos, et. al., 2017

Good practices and successful cases in adoption of CA and CA mechanization

- Capability Building for machine Fabricators

Training on the fabrication of the BIOMECH manual lowland rice weeder, rice drum seeder, hand jabber and hand-held corn sheller

Training on the use of jigs and fixtures for the mass production of agricultural machines

Source: de Ramos, et al., 2017

Good practices and successful cases in adoption of CA and CA mechanization

- Commercialization of Fabricated AMTs

The manual rice weeders on display at the Dumingag Organic Trading Post

Source: De Ramos, et al., 2017

Good practices and successful cases in adoption of CA and CA mechanization

- Introduction of Postharvest Processing Technology

AMT package developed by BIOMECH for the processing of powder from turmeric, herbs and other root crops, installed at
(a) Dumingag Organic Processing Center
(b) multi-crop slicer
(c-d) 30-tray and 20-tray cabinet-type dryer
(e) pulverizer
(f) sieve separator.

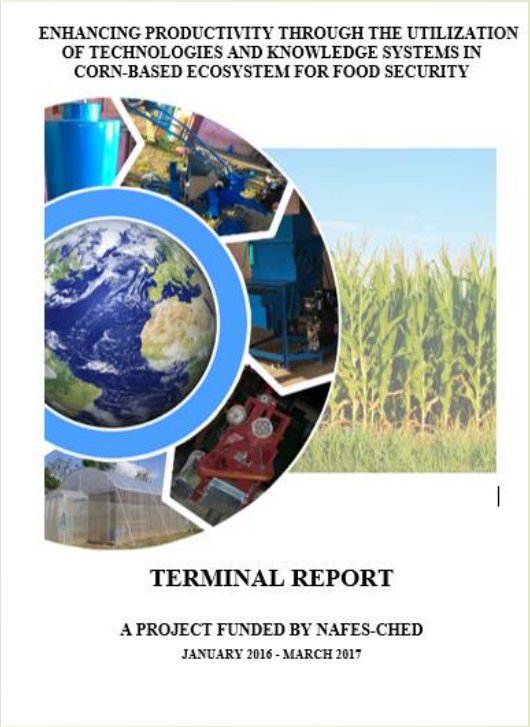
Production of powder from turmeric, sambong leaves and ginger for TEA.

Source: De Ramos, et al., 2017

Good practices and successful cases in adoption of CA and CA mechanization

"Enhancing Productivity through the Utilization of Technologies and Knowledge Systems in Corn-based Ecosystem for Food Security"

- *A project on the diffusion and utilization of UPLB Corn Mechanization Technologies for food security was implemented by BIOMECH and IAE in the province of Masbate.*
- Some of the CA technologies introduced were:
  - ✓ Automated Two-wheel Tractor Mounted Fertilizer Applicator
  - ✓ Drip Irrigation System
  - ✓ Sprinkler Irrigation System
  - ✓ Hydroponic Vegetable Production & Greenhouse Protective Structure



Source: Amongo, et. al., 2017

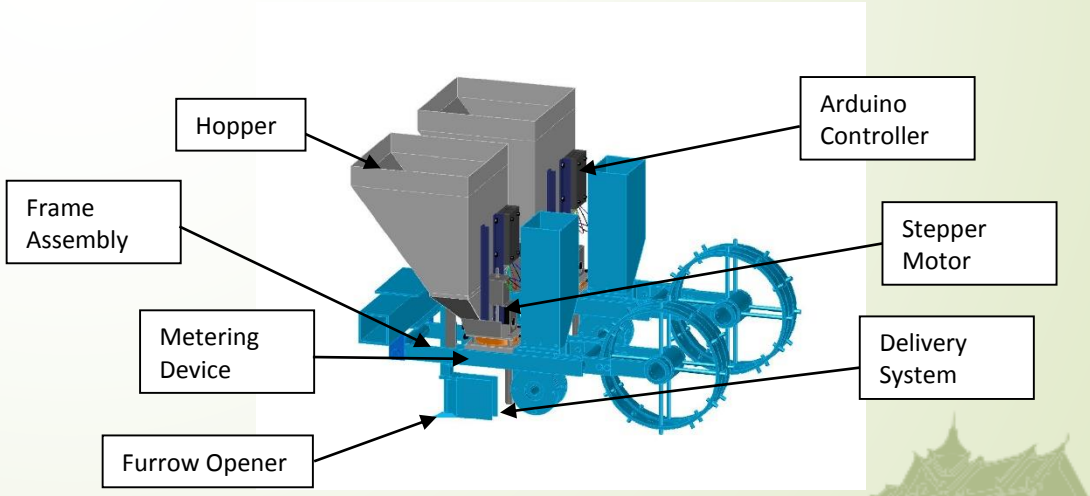
Good practices and successful cases in adoption of CA and CA mechanization

- ***CORN CROP CARE***
  - In Lantangan, Mandaon, Masbate, the common practice of corn farmers in applying solid fertilizers is through manual means using bare hands and broadcasted in the field or applied in bands along the furrows during planting operation.
  - An average of 5.92 bags (296 kilograms) of basal fertilizer is applied for a hectare of corn farm. This is being done manually and about 6.13 man-days is required for basal fertilizer application (Amongo et al., 2013).
  - The introduction of a mechanized system for corn crop care operation in the project area will help farmers to:
    - ✓more precise in the application of basal fertilizers
    - ✓to dispense only the exact amount of basal fertilizer for every planted seed.
    - ✓lessen the costs and time spent in applying fertilizer
    - ✓lessen the effect of soil pollution because of the precise and exact application

Source: Amongo, et. al., 2017

Good practices and successful cases in adoption of CA and CA mechanization

- ***AUTOMATED TWO-WHEEL TRACTOR MOUNTED FERTILIZER APPLICATOR***
  - precise and automated application rate
  - metering device made of engineering plastic
  - with infra red sensor that only drops fertilizer granules along with the seed
  - stainless steel hopper assembly to avoid corrosion



Source: Amongo, et. al., 2017

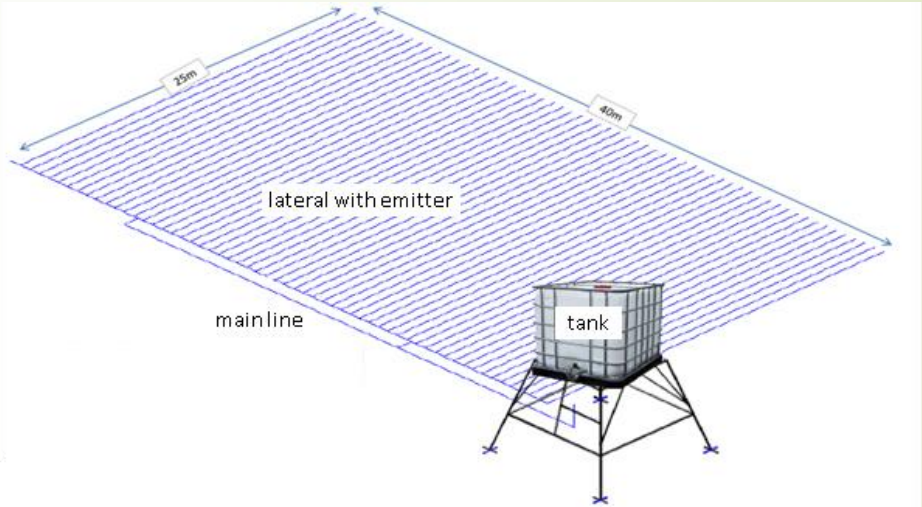
Good practices and successful cases in adoption of CA and CA mechanization

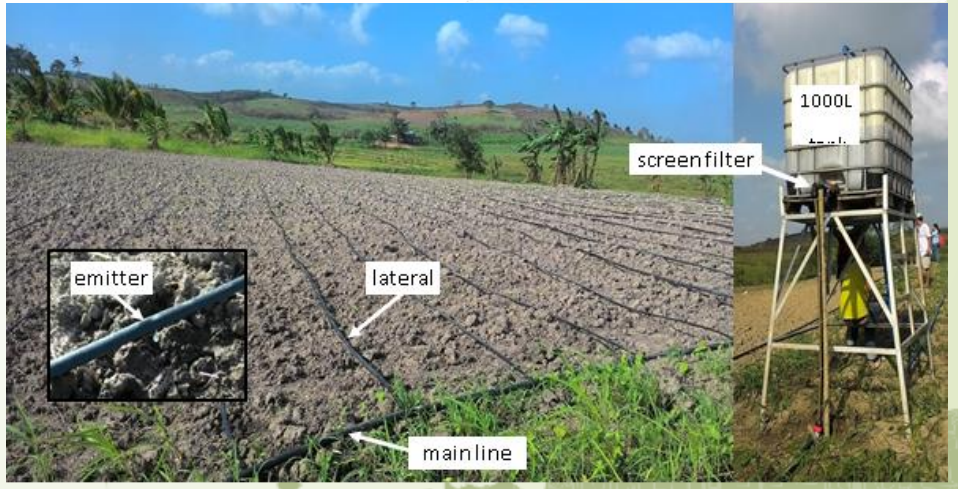
- ***IRRIGATION AND WATER MANAGEMENT TECHNOLOGIES FOR CORN-BASED FARMING SYSTEM***
  - In the Philippines, agriculture accounts for about 60% of the total water use, and rice is the major consumer of this irrigation water.
  - As the demand for industrial, municipal, environmental protection and other uses rises, less water will be available for agriculture.
  - Introducing appropriate irrigation and water management technologies is needed to maximize the use of limited water for agriculture
  - It can help determine and control the volume, frequency and application rate of irrigation water in a planned, efficient manner.

(Source: Amongo, et. al., 2017)

Good practices and successful cases in adoption of CA and CA mechanization

- ***DRIP IRRIGATION SYSTEM***
  - low cost, lightweight and movable
  - has top drip pressure-compensating and anti-siphon thin-walled dripline
  - allows longer laterals with high uniformity
  - pressure of 4-25 psi and discharge rate of 1.6 lph

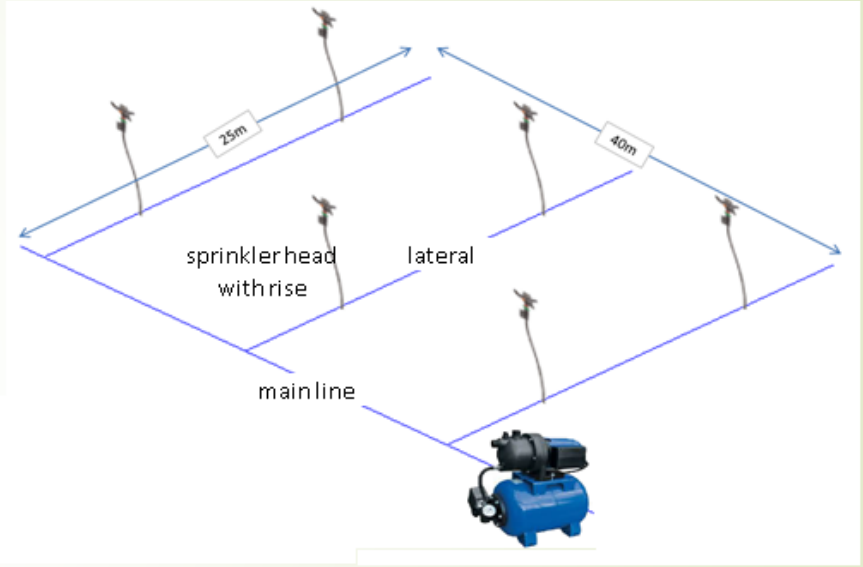




(Source: Amongo, et. al., 2017)

Good practices and successful cases in adoption of CA and CA mechanization

- ***SPRINKLER IRRIGATION SYSTEM***
  - low cost and high impact system with riser
  - made of plastic materials resistant to corrosion, chemicals and UV radiation
  - applicable for varied topography and field edges
  - pressure of 20-40 psi provided by a booster pump
  - discharge rate: 450 lph; wetted perimeter: 22 m



Source: Amongo, et. al., 2017

Good practices and successful cases in adoption of CA and CA mechanization

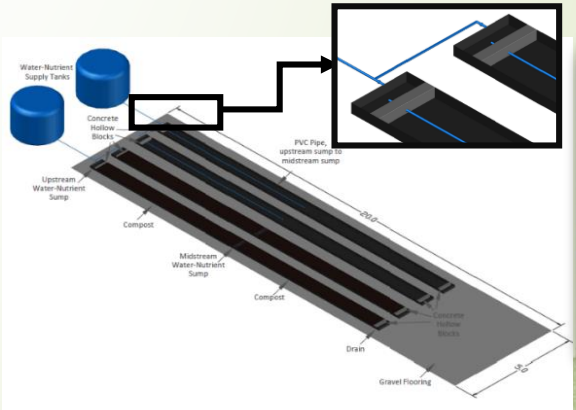
- ***HYDROPONIC VEGETABLE GARDENING & GREENHOUSE PROTECTIVE STRUCTURE***
  - Hydroponics is a cultivation technology of producing crops without soil.
  - It is usually popular in urban and peri-urban settings as a production technology for high value crops and ornamentals. In rural areas, the success of hydroponic vegetable farming would require awareness on production benefits of hydroponics and nutritional value of vegetables among the community.
  - Promotion of a community-based hydroponic farming allows capacity building and empowerment of rural community to produce their own food and also become entrepreneurs.
  - Combining it with the greenhouse protective structure minimizes losses from unpleasant environmental conditions, minimizes losses from insects and plant diseases, optimal use of resources (water, farm inputs, etc), and ultimately increases crop yield.

Source: Amongo, et. al., 2017

Good practices and successful cases in adoption of CA and CA mechanization

- ***HYDROPONIC VEGETABLE GARDENING & GREENHOUSE PROTECTIVE STRUCTURE***
  - gravity type run-to waste hydroponic system with geomembrane growing beds
  - vermicompost as a growing medium
  - 100 m2 quonset style greenhouse

    (5m x 20m x 3.5m)
  - made of GI pipes as structural frame and UV-resistant
  - polyethylene (PE) film as covering material
  - ante room to prevent insects from entering the structure
  - designed to withstand Typhoon Signal No. 3



Source: Amongo, et. al., 2017

Good practices and successful cases in adoption of CA and CA mechanization

- **PERCEPTION SURVEY OF INTRODUCED TECHNOLOGIES**
  - Technology perception parameters were identified for the technologies introduced in the area such as:
    - ✓ Applicability/ Compatibility in the area;
    - ✓ Willingness to try;
    - ✓ Comparative advantage to the existing practice;
    - ✓ Teaching ability;
    - ✓ Recommendability;
    - ✓ Willingness to utilize;
    - ✓ Learning ability;
    - ✓ Ease of operation;
    - ✓ Technology complexity;
    - ✓ Trial ability; and
    - ✓ Trial ability for custom hiring

Source: Amongo, et. al., 2017

Good practices and successful cases in adoption of CA and CA mechanization

- **PERCEPTION SURVEY OF INTRODUCED TECHNOLOGIES**
  - The composite scores for the perception for each identified parameter were computed using 5-level Likert analysis.

Technology perception parameter scores =

$$\frac{(n_a*5) + (n_b*4) + (n_c*3) + (n_d*2) + (n_e*1)}{n_a + n_b + n_c + n_d + n_e}$$

where:
- a is the highest rating (Strongly Agree, Very easy, Very Simple or Immediately)
- b is the second highest rating (Agree, Easy, Simple, or After the current season)
- c is the third highest rating (Neutral, Moderate, Moderate, or After two seasons)
- e is the fourth highest rating (Disagree, Hard, Complex, or Wait and see)
- d is the lowest rating (Strongly Disagree, Very Hard, Very Complex, or Never)
- n_i is the number of respondents responding to the 5 Likert scale of each perception parameter

Source: Amongo, et. al., 2017

Good practices and successful cases in adoption of CA and CA mechanization

TECHNOLOGY PERCEPTION PARAMETERS	CA TECHNOLOGIES			
	Automated Two-wheel Tractor Mounted Fertilizer Applicator	Drip Irrigation System	Sprinkler Irrigation System	Hydroponic Vegetable Gardening & Greenhouse Protective Structure
LEVEL OF ACCEPTANCE/AGREEMENT				
Applicability/ Compatibility in the area	4.28	4.11	4.11	4.11
Willingness to try	4.41	4.33	4.33	3.89
Comparative advantage to the existing practice	4.34	3.78	3.78	4.22
Teaching ability	4.07	3.89	3.89	3.22
Recommendability	4.21	4.00	4.00	3.56
Willingness to utilize	4.34	4.11	4.11	4.00
3.B. LEVEL OF EASE				
Learning Ability	3.62	3.33	3.33	3.44
Ease of Operation	3.48	3.33	3.33	3.11
LEVEL OF TECHNOLOGY COMPLEXITY				
Degree of technology complexity	3.41	3.11	3.11	3.56
TRIAL USE OF TECHNOLOGY WITHIN A GIVEN TIMEFRAME				
Trial ability	4.00	3.22	3.22	2.78
Trial ability for custom hiring	3.93	2.44	2.44	3.33

Source: Amongo, et. al., 2017

Constraints and challenges to adoption and promotion of CA and CA mechanization:

- **Political**

Dialectical views:

1. CA and CA mechanization vs. Intensive Farming (intensive use of farm inputs such as irrigation water, pesticides, etc.) intensive use of inputs have negative impacts to the environment.

2. Upscaling CA and CA mechanization is cognizant to government's policy advocacy on conservation measures in agriculture as stipulated in Republic Act 10068 "Organic Agriculture Act of 2010" Section 2:

".. promote, propagate, develop further and implement the practice of organic agriculture in the Philippines that will cumulatively condition and enrich the fertility of the soil, increase farm productivity, reduce pollution and destruction of the environment, prevent the depletion of natural resources, further protect the health of farmers, consumers, and the general public, and save on imported farm inputs. Towards this end, a comprehensive program for the promotion of community-based organic agriculture systems which include, among others, farmer-produced purely organic fertilizers such as compost, pesticides and other farm inputs, together with a nationwide educational and promotional campaign for their use and processing as well as adoption of organic agriculture system as a viable alternative shall be undertaken."

Constraints and challenges to adoption and promotion of CA and CA mechanization:

- **Political**
- The Agricultural and Fisheries Mechanization Law of 2013 (AFMech Law) or Republic Act 10601: provision of AE position in Local Government Units (Article 7, Section 29). The AE units are to provide engineering services on **soil conservation and management**. They are also tasked to "administer, supervise and coordinate the construction, operation, maintenance, improvement and management of irrigation, small water impounding, soil and water conservation structures and facilities, farm machinery, postharvest facilities, auction markets, farm-to-market roads and other agricultural and fisheries infrastructure projects of the LGUs."
- The challenge to the government is how to balance its efforts in integrating CA and CA mechanization both in smallholder agriculture and in large mechanization efforts needed for the implementation of contiguous farming that is advocated in the AFMech Law.

Constraints and challenges to adoption and promotion of CA and CA mechanization:

- **Technical**
- A balance interplay of both technical and ecological requirements in up-scaling CA and CA mechanization for both smallholder agriculture and large-scale farming or contiguous farming.
- Sustainable agriculture which include CA should be able to provide profits for farmers, sustainable practices focusing on economic benefits, and preserve environmental health.
- One major challenge is the establishment of technical requirements for CA and CA mechanization which may vary from one agro-ecology to another.

Constraints and challenges to adoption and promotion of CA and CA mechanization:

- **Economic**
- Most often, smallholder agriculture resort to conventional methods of farm production.
- In many cases, small farms are operating at a benefit cost ratio (BCR) of below 1.0. A study conducted by Larona, *et al.*, 2013 shows that prior to BIOMECH introduction of mechanization interventions in Bondoc Peninsula of Quezon Province, Philippines, the mechanization needs assessment showed that majority of the small farmers (88%) had a benefit cost ratio of less one in producing corn. Only about 12% of the farmers surveyed had a BCR of more than 1.0.
- Upscaling CA and CA mechanization in smallholder agriculture may not necessarily increase production levels immediately. It is generally true, that sustainable agriculture will not match up to conventional agriculture in terms of production levels

Constraints and challenges to adoption and promotion of CA and CA mechanization:

- **Social**
  - Social preparation measures are needed to educate and convince small farmers about the long-term benefits of CA and CA mechanization.
  - There could be challenges in introducing conservation agriculture to smallholder farmers since traditionally, there is a notion that CA may not match up to the production levels of conventional agriculture.
  - Since smallholder agriculture has limited economic productivity, government efforts should be geared towards improving the smallholder agriculture.
  - Implementing large scale mechanization with integration of CA and CA mechanization pose a greater challenge in convincing small farmers towards this path.

Recommendations

- Research and development efforts should be conducted that would prove the benefits and positive impacts of CA and CA mechanization. This should be done for both smallholder agriculture (in areas where full mechanization may not be possible because of the terrain and topology of the area), and contiguous farms which could contribute to attaining food sufficiency and security.
- The implementation of the AFMech Law through the National Agriculture and Fisheries Mechanization Program should highlight CA and CA mechanization, integrating the balancing act of attaining food security and sufficiency and at the same time protecting the environment through conservation measures in agricultural production.
- As included in the Organic Agriculture Act of 2010, research, development and commercialization of appropriate, innovative and viable organic agricultural technologies should be strengthened; This should also be applicable in the implementation of CA and CA mechanization strategies;

Recommendations

- Investing in CA and CA mechanization and sustainable agriculture could be enhanced through to maximize participation of big players in agricultural production. For instance, the Organic Agricultural Act promotes/recommends income tax holidays, exemption from import duties; zero rated VAT; and special loan windows. The nationwide implementation of the organic agriculture law will benefit consumers of organically grown food products for health and food safety; and other important agricultural products such seeds, fertilizers, among others.
- Demonstration and model farms should be established integrating CA and CA mechanization applicable to smallholder and contiguous farms. Practically, there would be areas whereby full mechanization could not be introduced but still conservation agriculture measures could be integrated for sustainable agriculture and increased productivity can still be obtained. The demonstration farms will aide to hasten the social preparation process in convincing stakeholders towards CA and CA mechanization. Such farms should be able to showcase the long-term socio-economic, technical, and environmental benefits of CA and CA mechanization.

Conclusion

There are political, technical, economic, and social challenges that need to be addressed for the successful promotion of CA and CA Mechanization Technologies.

- CA and CA Mechanization Technologies if harmoniously implemented can address the negative impact to the environment (soil erosion, sedimentation, loss of soil fertility and soil degradation)
- CA and CA Mechanization can minimize water resources depletion and water quality degradation
- CA and CA Mechanization Technologies should be resilient to climate change and climate variability to ensure food production sustainability and food security.
- CA and CA Mechanization Technologies can aid in the creation of livelihood and employment in the agricultural production systems which can enhance poverty alleviation in the countryside.

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END OF PRESENTATION

Thank You for Listening! ☺