Gliricidia sepium locally known as "kakawate" served as live trellis "balag" / or anchorage for annual crops and erosion control measure. (Mr. Baldwin Pine)

Highly Diversified Cropping in Live Trellis System (Philippines)

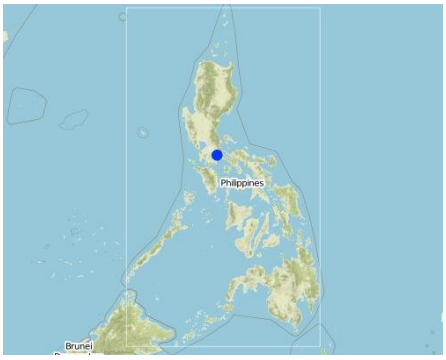
Kakawate as live trellis "balag"

DESCRIPTION

Gliricidia sepium locally known as "kakawate" served as live trellis / or anchorage for annual crops (mostly creeping-type vegetables) and erosion control measure. The technology is well-adopted in the community providing immediate food for the farmers and increased income due to diversified farming.

The Highly Diversified Cropping in Live Trellis System is a traditional or local farmers' initiative technology widely practiced in Brgy. Bukal, Nagcarlan, Laguna situated in the area of Mt. Banahaw. The area with rolling to hilly terrain is receiving an annual rainfall of 1000-2000 mm. Each of the farmers who practiced the technology has 0.5 to 1.0 ha production area. Moreover, the community is accessible to infrastructures such as schools and market. Soils in the area is relatively good for agriculture cultivation. Kakawate, a small to medium-sized, thornless tree which usually attains a height of 10-12 m is being used as live trellis or "balag" to various annual crops such as tomato, cucumber, chayote, beans, and ampalaya in the community. The cropping system is highly diversified since crop rotation is being practiced throughout the year. Aside from being an anchorage for annual crops, kakawate also stabilizes sloping lands and reduces soil erosion due to its strong roots which can grow 3-5 meters laterally, thereby holding the soil firmly. They are planted in a row of approximately 2-3 meters making it more effective in preventing soil erosion. Furthermore, kakawate is being trimmed and maintained every 3-6 months or as needs arise to a approximate 3 meters high as live trellis, the trimmed leaves are very rich in nitrogen and will eventually serve as compost or crop cover. These will help in improving soil quality and moisture in the soil. In addition, kakawate has multiple uses and benefits; they can serve as hardwood or firewood when matured, as materials in making furniture and anchorage for flowering plants like orchids. In establishing the live trellis system, kakawate trunks/or cuttings "quick sticks" with at least 2-meter height are planted in a row. An estimate of 0.5 to 1 meter planting distance within a row and also between rows is used. When the kakawate trunks are already set up and planted, they are interconnected using a metallic wires. Along these wires, plastic straws are tied in a vertical position whereby crops can utilize this straws for creeping/ climbing . Finally, the desired crop will be planted according to their cropping pattern. Maintenance of the technology includes: weeding and trimming. During infestation, application of pesticide is done but in minimal. The technology requires manual works resulting to elimination of machines that contributes to soil compaction. The technology has been a practice in the community for a long time, and land users continue to adopt the technology because of it's easiness and inexpensiveness to establish, and low cost in terms of maintenance activity. Adding up to this is the variety of plants to be grown, making their market more profitable. Gliricidia normally grows in tropical countries like the Philippines and is being utilized as hedgerows for erosion control measures. Over the years, its effectiveness as erosion control is known, and an increasingly used forage crop in cut-and-carry systems.

LOCATION



Location: Brgy. Bukal, Nagcarlan, Laguna, Philippines

No. of Technology sites analysed: single site

Geo-reference of selected sites

- 121.44696, 14.07943

Spread of the Technology: evenly spread over an area (approx. 1-10 km2)

Date of implementation: 1950; more than 50 years ago (traditional)

Type of introduction

- ☑ through land users' innovation
- ☑ as part of a traditional system (> 50 years)
- ☐ during experiments/ research
- ☐ through projects/ external interventions

Live trellis system widely practiced in Brgy. Bukal, Nagcarlan, Laguna (Mr. Baldwin Pine)

Under the live trellis are lettuce grown in the area as part of crop rotation practice (Mr. Baldwin Pine)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- ✓ improve production
- ✓ reduce, prevent, restore land degradation
- ✓ conserve ecosystem
- ✓ protect a watershed/ downstream areas – in combination with other Technologies
- ✓ preserve/ improve biodiversity
- ✓ reduce risk of disasters
- ✓ adapt to climate change/ extremes and its impacts
- mitigate climate change and its impacts
- ✓ create beneficial economic impact
- ✓ create beneficial social impact

Land use

Cropland - Annual cropping
Main crops (cash and food crops): Sayote, beans, tomato, cabbage,lettuce

Mixed (crops/ grazing/ trees), incl. agroforestry - Agroforestry
Main products/ services: Kakawate

Water supply

- ✓ rainfed
- mixed rainfed-irrigated
- full irrigation

Number of growing seasons per year: 3
Land use before implementation of the Technology: n.a.
Livestock density: n.a.

Purpose related to land degradation

- ✓ prevent land degradation
- ✓ reduce land degradation
- restore/ rehabilitate severely degraded land
- adapt to land degradation
- not applicable

Degradation addressed

soil erosion by water - Wt: loss of topsoil/ surface erosion, Wo: offsite degradation effects

SLM group

- agroforestry
- improved ground/ vegetation cover
- integrated soil fertility management

SLM measures

agronomic measures - A1: Vegetation/ soil cover, A2: Organic matter/ soil fertility, A3: Soil surface treatment

vegetative measures - V1: Tree and shrub cover

TECHNICAL DRAWING

Technical specifications
Kakawate cuttings are planted with an estimated planting distance of 0.5 m to 1 m. They are trimmed and maintained at around 3 meters high for every 3-6 months or as needs arise. In between the kakawate are annual crops like tomato, chayote, beans,cucumber, lettuce and cabbages which are planted in rotation depending on the season.

Author: Baldwin M. Pine

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology area (size and area unit: **0.5 hectare**)
- Currency used for cost calculation: **Philippine Peso (Php)**
- Exchange rate (to USD): 1 USD = 50.0.
- Average wage cost of hired labour per day: 300.

Most important factors affecting the costs

n.a.

Establishment activities

1. Clearing of the area (Agronomic; As needs arise or before planting of kakawate and annual crops)
2. Planting of kakawate cuttings (Vegetative)
3. Installation of metal wire and plastic straws (Agronomic)
4. Planting of annual crop: tomato (Agronomic)
5. Planting of annual crop: cucumber or beans (Agronomic)
6. Planting of annual crop: chayote (Agronomic)

Establishment inputs and costs

Specify input	Unit	Quantity	Costs per Unit	Total costs per input	% of costs borne by land users
Labour					
Manual labour: Weeding	person-days	3.0	300.0	900.0	100.0
Manual labour: Planting	person-days	3.0	300.0	900.0	100.0
Manual labour: Fertilizer Application	person-days	3.0	300.0	900.0	100.0
Manual labour: Harvesting and Hauling	person-days	3.0	300.0	900.0	100.0
Plant material					
Kakawate cuttings (cuttings are abundant in the area and not for sale)					100.0
Tomato @ 100grams per can	can	1.0	1950.0	1950.0	100.0
Cucumber @ 100grams per can	can	1.0	600.0	600.0	100.0
Chayote (seeds are abundant in the area)					100.0
Fertilizers and biocides					
Inorganic fertilizer: Urea	bag	5.0	1500.0	7500.0	100.0
Organic fertilizer: chicken dung	bag	5.0	450.0	2250.0	100.0
Pesticide	bottle	1.0	280.0	280.0	100.0
Construction material					
Metal wire (can be used for a long time, up to 10 years life span	roll	6.0	480.0	2880.0	100.0
Straw	roll	10.0	100.0	1000.0	100.0
Total costs for establishment of the Technology				**20060.0**	

Maintenance activities

1. Weeding (Agronomic; As needs arise but normally twice per cropping per crop)
2. Trimming of kakawate (Vegetative)
3. Application of organic fertilizer (Agronomic)
4. Application of inorganic fertilizer (Agronomic)
5. Spraying of pesticide (Agronomic)

Maintenance inputs and costs

Specify input	Unit	Quantity	Costs per Unit	Total costs per input	% of costs borne by land users
Labour					
Weeding	person-days	3.0	300.0	900.0	100.0
Trimming of kakawate	person-days	3.0	300.0	900.0	100.0
Application of organic fertilizer	person-days	3.0	300.0	900.0	100.0
Application of inorganic fertilizer	person-days	3.0	300.0	900.0	100.0
Equipment					
Spraying of pesticide	person-days	3.0	300.0	900.0	100.0
Total costs for maintenance of the Technology				**4500.0**	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1,000 mm
- [x] 1,001-1,500 mm
- [x] 1,501-2,000 mm
- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone
- [x] humid
- [ ] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate
Average annual rainfall in mm: 1500.0
Rainfall is evenly distributed throughout the year

Slope
- [ ] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [x] rolling (11-15%)
- [x] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landforms
- [ ] plateau/plains
- [ ] ridges
- [x] mountain slopes
- [ ] hill slopes
- [x] footslopes
- [ ] valley floors

Altitude
- [ ] 0-100 m a.s.l.
- [x] 101-500 m a.s.l.
- [x] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [ ] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [x] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [x] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [x] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [x] high (>3%)
- [x] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [ ] on surface
- [ ] < 5 m
- [ ] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [x] good
- [ ] medium
- [ ] poor/ none

Water quality (untreated)
- [x] good drinking water
- [ ] poor drinking water (treatment required)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Is salinity a problem?
- [ ] Yes
- [x] No

Occurrence of flooding
- [ ] Yes
- [x] No

Species diversity
- [x] high
- [ ] medium
- [ ] low

Habitat diversity
- [x] high
- [ ] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial
- [x] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [x] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [ ] poor
- [x] average
- [ ] rich
- [ ] very rich

Level of mechanization
- [x] manual work
- [ ] animal traction
- [ ] mechanized/ motorized

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [ ] youth
- [x] middle-aged
- [x] elderly

Area used per household
- [ ] < 0.5 ha
- [x] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village group
- [ ] individual, not titled

Land use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [x] individual

Water use rights

- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

- [x] individual, titled

- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [x] individual

Access to services and infrastructure

health	poor				✓			good
education	poor				✓			good
technical assistance	poor				✓			good
employment (e.g. off-farm)	poor				✓			good
markets	poor				✓			good
energy	poor				✓			good
roads and transport	poor				✓			good
drinking water and sanitation	poor				✓			good
financial services	poor			✓				good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

Crop production	decreased					✓		increased
crop quality	decreased					✓		increased
fodder production	decreased				✓			increased
fodder quality	decreased				✓			increased
wood production	decreased			✓				increased
product diversity	decreased				✓			increased
production area (new land under cultivation/ use)	decreased					✓		increased
land management	hindered			✓				simplified
expenses on agricultural inputs	increased			✓				decreased
farm income	decreased				✓			increased
diversity of income sources	decreased					✓		increased

An increase in production due to crop diversification

Organic farming is a common practice in the community, and with this, it aids in the development of crop quality.

Kakawate are being utilized as forage crop for ruminants in the area.

Kakawate is rich in Nitrogen.

Kakawate when matured can be utilized as firewood and materials for making furnitures.

Crop rotation makes the technology diverse.

The area is maximized for cultivation at a minimum soil disturbance.

The application of inorganic fertilizer is minimal due to organic farming.

Farmers' income is increased due to crop diversicification

Farmers' income is increased due to crop diversicification.

Socio-cultural impacts

food security/ self-sufficiency	reduced			✓				improved
SLM/ land degradation knowledge	reduced					✓		improved

The continued adoption of the technology testifies that SLM and/land degradation knowledge is improved in the community.

Ecological impacts

soil moisture	decreased			✓				increased
soil cover	reduced				✓			improved
soil loss	increased					✓		decreased
soil compaction	increased					✓		reduced
soil organic matter/ below ground C	decreased				✓			increased
vegetation cover	decreased			✓				increased
pest/ disease control	decreased			✓				increased
landslides/ debris flows	increased				✓			decreased
emission of carbon and greenhouse gases	increased			✓				decreased

Kakawate when left on the ground aids in the improvement of soil moisture.

Crop rotation practice improves soil cover.

Over the years, kakawate is proven to be an effective erosion control measure in the sloping areas.

Manual cultivation aids in minimal disturbance of the soil, thereby does not contribute to soil compaction in the area.

Organic farming is a practice in the community.

Crop rotation helps in the decreased of pest population.

The technology requires manual cultivation with least or no machine intervention, organic farming is a must with minimum usage of inorganic fertilizer, and biodiversity is also encourage. With that, the technology is believed to be effective to address carbon emission and greenhouse gases.

Off-site impacts

downstream flooding (undesired)	increased				✓			reduced	

Benefits compared with establishment costs

Short-term returns	very negative				✓			very positive	
Long-term returns	very negative				✓			very positive	

Benefits compared with maintenance costs

Short-term returns	very negative				✓			very positive	
Long-term returns	very negative				✓			very positive	

CLIMATE CHANGE

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- single cases/ experimental
- 1-10%
- 10-50%
- ✓ more than 50%

Number of households and/ or area covered

Almost all of local farmers practice the technology

Of all those who have adopted the Technology, how many have did so without receiving material incentives?

- 0-10%
- 10-50%
- 50-90%
- ✓ 90-100%

Has the Technology been modified recently to adapt to changing conditions?

- Yes
- ✓ No

To which changing conditions?

- climatic change/ extremes
- changing markets
- labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths

- (1) Low production cost (2) Easiness to maintain (3) Effective erosion control measure (4) Increase farm yield and income (5) Diverse farm produce (6) Easiness to transfer (land user's view)
- (1) Increase farm income (2) Diverse farm produce (3) Easiness to establish, no need for technical knowledge to establish (4) Inexpensive (4) Organic farming (compiler's or other key resource person's view)

Weaknesses/ disadvantages/ risks → *how to overcome*

- (1) The technology is very good in terms of erosion control and improving lives of farmers in the community, but then the technology is not well-known for the whole country. → *(1). The WOCAT database as an excellent information tool /or medium in the dissemination of this kind of technology, not only within Philippines but all over the world. These would highlight initiatives of the local farmers situated in remote areas in terms of managing the land productively and sustainably.* (compiler's or other key resource person's view)
- (1) Pest infestation → *(1) Pesticide application* (land user's view)

REFERENCES

Compiler

Philippine Overview of Conservation Approaches and Technologies - philcatsecretariat@gmail.com

Resource persons

Girlie Urriza - land user
Calixto Dela Pena - SLM specialist
Baldwin Pine (baldwinmp@gmail.com) - Soil Specialist / GIS Specialist
Jemar Raquid - Engineer
Mharicar Torino - Engineer
Aries Tayao - Engineer

Full description in the WOCAT database

https://qcat.wocat.net/en/wocat/technologies/view/technologies_1930/

Linked SLM data

n.a.

Documentation was faciliated by

Institution

- Bureau of Soils and Water Management

Project

- Decision Support for Mainstreaming and Scaling out Sustainable Land Management

Key references

Links to relevant information which is available online