Planting sunn hemp as green manure for soil amendment (Mr. Pisan Poonkasaem)

Planting sunn hemp as green manure for soil improvement (Thailand)

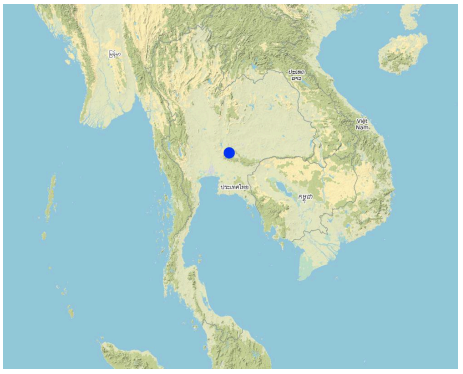
Por Toeng

DESCRIPTION

Growing sunn hemp in rice paddy fields as a green manure increases organic matter, and generally improves and nourishes the soil.

Planting sunn hemp (Crotalaria juncea) as green manure is an effective way to improve the fertility of the paddy fields in the irrigation zone of Chao Phraya River basin in the Central Plain of Thailand. Most farmers produce rice twice a year; some even grow 5 crops in 2 years. This is due to the fact that the water from the irrigation system is available also outside the rainy season. Continuous cropping without letting the land rest has a negative effect on the soil structure, because the soil has been prepared by small- to medium-sized machines, and preparation is done when there is moisture in the soil, leading to structural deterioration. As a result, its suitability for growing rice is reduced. In addition to this, the organic matter in the soil also decreases, resulting in low rice yields. Farmers solve the problem by increasing the amount of chemical fertilizers, but this increases costs. They therefore chose to grow sunn hemp instead which is a well known green manure - it is leguminous therefore it adds nitrogen to the soil and when it is ploughed in, and its bulky organic matter helps improve structure. At one stage, farmers experimented to know how to manage their paddy land by growing the sunn hemp as green manure crop appropriately. In the trial the land area being used was around one ha. Half of the land was under treatment Type 1 and the second half under Type 2.
Type 1 operation: Water was pumped into the paddy to moisten the soil. If a large amount of water was available, pumping would be done until the soil became well saturated or slightly flooded. The land would be left for a night. After that, the water was drained. On the following day, the sunn hemp seeds were sown.
Type 2 operation: The land was plowed at the start of the trial and the sunn hemp seeds were sown immediately. The sunn hemp plants were allowed to grow for 40-50 days or until the flowering was about 70-80%.
Then, the plots under both types were plowed over and were left idle for 15-30 days. Then, both plots were made muddy by plowing and harrowing for about 5-7 days; after that the rice seeds were sown.
Comparison between Type 1 and Type 2 showed they were not different in terms of production. However, Type 1 showed that some cash could be saved for plowing.

LOCATION



Location: 50 Moo 3, Po ThaLae sub district, Bang-Rajan District,, Singburi province, Thailand

No. of Technology sites analysed: 10-100 sites

Geo-reference of selected sites
- 101.42578, 14.60485

Spread of the Technology: applied at specific points/ concentrated on a small area

In a permanently protected area?: Nee

Date of implementation: 10-50 years ago

Type of introduction
- [x] through land users' innovation
- [ ] as part of a traditional system (> 50 years)
- [ ] during experiments/ research
- [ ] through projects/ external interventions

Sunn hemp in the rice field (Mr. Pisarn Bunkasem)

Sunn hemp - a legume - for soil improvement as a green manure (Mr. Pisarn Bunkasem)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

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

Land use

Land use mixed within the same land unit: Nee

Cropland

- Annual cropping: cereals - rice (wetland). Cropping system: Continuous wetland rice

Number of growing seasons per year: 2
Is intercropping practiced? Nee
Is crop rotation practiced? Ja

Water supply

- [ ] rainfed
- [x] mixed rainfed-irrigated
- [ ] full irrigation

Purpose related to land degradation

- [ ] prevent land degradation
- [x] reduce land degradation
- [x] restore/ rehabilitate severely degraded land
- [ ] adapt to land degradation
- [ ] not applicable

Degradation addressed

chemical soil deterioration - Cn: fertility decline and reduced organic matter content (not caused by erosion), Ca: acidification

biological degradation - Bc: reduction of vegetation cover, Bl: loss of soil life

SLM group

- integrated soil fertility management
- home gardens

SLM measures

agronomic measures - A1: Vegetation/ soil cover, A2: Organic matter/ soil fertility, A3: Soil surface treatment (A 3.2: Reduced tillage (> 30% soil cover)), A4: Subsurface treatment, A5: Seed management, improved varieties, A6: Residue management (A 6.3: collected)

TECHNICAL DRAWING

Technical specifications

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology area (size and area unit: **4.45 ha**; conversion factor to one hectare: **1 ha = 6.25 Rai**)
- Currency used for cost calculation: **USD**
- Exchange rate (to USD): 1 USD = n.a
- Average wage cost of hired labour per day: n.a

Most important factors affecting the costs

n.a.

Establishment activities

1. After rice harvesting, prepare sunn hemp seed (Timing/ frequency: March)
2. Pumping water into the paddy field (Timing/ frequency: March)
3. Slightly flooding water out of land, then harvesting sunn hemp seeds (Timing/ frequency: March)

4. The land plots were plowed over after sunn hemp growth was 40-50 days (Timing/ frequency: January - February)
5. Sunn hemp plants were left idle for 15-30 days (Timing/ frequency: February-March)
6. Muddy rice field by plowing and harrowing for about 5-7 days (Timing/ frequency: April-May)

Establishment inputs and costs (per 4.45 ha)

Specify input	Unit	Quantity	Costs per Unit (USD)	Total costs per input (USD)	% of costs borne by land users
Labour					
seed harvesting	kg per ha	320.0	0.02	6.4	
Other					
pumping water	rai	10.0	30.0	300.0	
Total costs for establishment of the Technology				**306.4**	
Total costs for establishment of the Technology in USD				*306.4*	

Maintenance activities
n.a.

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [x] 751-1,000 mm
- [x] 1,001-1,500 mm
- [ ] 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: 1100.0
Rainy season is from May-October
Name of the meteorological station: Ministry of Meteorological hot and humid

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

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

Altitude
- [x] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [ ] 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
- [x] not relevant

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

Soil texture (topsoil)
- [ ] 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
- [ ] high (>3%)
- [x] medium (1-3%)
- [ ] low (<1%)

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

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

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

Water quality refers to: surface water

Is salinity a problem?
- [ ] Ja
- [x] Nee

Occurrence of flooding
- [x] Ja
- [ ] Nee

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

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

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

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

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

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

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

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

Individuals or groups
- [x] individual/ household
- [ ] groups/ community

Gender
- [x] women
- [ ] men

Age
- [ ] children
- [ ] youth

- [ ] Nomadic
- [ ] cooperative
- [ ] employee (company, government)
- [x] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [x] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

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

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

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

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

Socio-economic impacts

Crop production	decreased	increased
product diversity	decreased	increased
production area (new land under cultivation/ use)	decreased	increased
land management	hindered	simplified

Socio-cultural impacts

food security/ self-sufficiency	reduced	improved	
health situation	worsened	improved	
land use/ water rights	worsened	improved	
cultural opportunities (eg spiritual, aesthetic, others)	reduced	improved	religion activities decrease
recreational opportunities	reduced	improved	activities decrease
community institutions	weakened	strengthened	
SLM/ land degradation knowledge	reduced	improved	
conflict mitigation	worsened	improved	increase good relationship
situation of socially and economically disadvantaged groups (gender, age, status, ehtnicity etc.)	worsened	improved	

Ecological impacts

water quantity	decreased	increased
harvesting/ collection of water (runoff, dew, snow, etc)	reduced	improved
excess water drainage	reduced	improved
soil moisture	decreased	increased
soil cover	reduced	improved
soil loss	increased	decreased
soil accumulation	decreased	increased
soil compaction	increased	reduced
soil organic matter/ below ground C	decreased	increased
vegetation cover	decreased	increased
biomass/ above ground C	decreased	increased
plant diversity	decreased	increased
habitat diversity	decreased	increased

Off-site impacts

water availability (groundwater, springs)	decreased	increased
reliable and stable stream flows in dry season (incl. low flows)	reduced	increased

downstream flooding (undesired)	increased	reduced
downstream siltation	increased	decreased
groundwater/ river pollution	increased	reduced
buffering/ filtering capacity (by soil, vegetation, wetlands)	reduced	improved
wind transported sediments	increased	reduced
impact of greenhouse gases	increased	reduced

COST-BENEFIT ANALYSIS

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

Gradual climate change

seasonal rainfall increase — not well at all — very well — Season: winter

ADOPTION AND ADAPTATION

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

- [ ] single cases/ experimental
- [x] 1-10%
- [ ] 11-50%
- [ ] > 50%

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

- [x] 0-10%
- [ ] 11-50%
- [ ] 51-90%
- [ ] 91-100%

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

- [ ] Ja
- [x] Nee

To which changing conditions?

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

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- Government support for sunn hemp seeds to farmers every year.
- Sunn hemp crops are easy to take care of and also growth rate is very good.
- Sunn hemp crops are resisted to insects and diseases.

Strengths: compiler's or other key resource person's view

- Rice production increases after sunn hemp was plowed over and was left idle for 15-30 days before sowing rice.
- The flowering of sunn hemp is beautiful, therefore is attractive for tourists.
- Sunn hemp crops are resisted to insects and diseases.
- Sunn hemp crops reduce chemical fertilizer rate of application for rice.

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

- There is a sunn hemp seeds support for farmers every year, however there are not enough summ hemp seeds. Should have the good plan for sunn hemp seeds production.
- Land preparation costs are increased Support farmer's groups for decreasing costs of Land preparation, which may be in the agricultural cooperative system.
- Some farmers are in a hurry to grow rice, so they do not use this technology. Promoting and training for this technology

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome

- Soil are low moisture in some areas, then sunn hemp can not grow well. Coordinate with irrigation department to provide irrigation system.

REFERENCES

Compiler
Bunjirtluk Jintaridth

Editors

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Resource persons
Pisan Poonkasaem - SLM specialist
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Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_4336/

Linked SLM data
n.a.

Documentation was faciliated by

Institution
- n.a.

Project
- n.a.

Key references
- Sunn hemp plowing and cooperating: Land Development Department

Links to relevant information which is available online
- Sunn hemp production: http:\\www.1ldd.go.th/WEB_PSD/prnew/2561/sr1-61/sr2.pdf

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