

9. INTEGRATED AGRICULTURE-BASED LAND USE IN AREAS WITH SALINE SOIL

1. General Information description of best practice/technology

Introduction

The problem of soil degradation in areas with saline soil originates from chemical and physical degradation and low fertility which are main limitations for land use, including shortage of water in the dry season and intermittent rain during cropping season. Farmers in the area of growing rice every year between May and October by implementing wisdom going through error-and trial farming including knowledge gained from performing duties as soil doctors stationed at Non Thai district, Nakhon Ratchasima which is done by growing vegetables for export supported by Marketing Organization for Farmers, Non Thai district, Nakhon Ratchasima province cooperating with private companies. Regarding soil amendment for planting vegetables in the Northeast, the method to increase and keep the fertility level throughout the harvesting season, including off-season production of chili spur pepper is to increase organic matter and plant nutrients, and to adjust pH values to be suitable. They can be planted in the irrigation zone throughout the year. However, the best time for planting them is in the period of January and February which is when chili peppers have good prices. For areas outside the irrigation zone, they should be planted in the rainy season. Chili peppers can thrive in every kind of soil, but the most suitable soil is sandy loam. They do not like waterlogged or wet areas because this condition can cause the root to become rotten and the plant to die easily. The form of planting chili peppers in Thailand is different according to soil characteristics. In any case, whatever methods are used, farmers place importance on procedures of cultivation preparation, watering as well as maintenance for diseases and insect prevention. This also includes vetiver as soil covering together with application organic fertilizers, fermented bio-extracts and useful microorganisms. Good soil management will make chili trees become strong and disease and insect resistant. This has been brought about challenges to overcome the nature with limitations in terms of soil, water and the environment whereby there is a motto lived by stating that "*There is nothing easy and nothing difficult either if we understand the nature before taking actions. Do not view money as denomination, but look at the value of products to occur at first.*"

Operating facility Moo 5, Ban Kok Phrom, Non Thai sub-district, Non Thai district, Nakhon Ratchasima province

Land user Mr. Mana Siangsunthia

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Geographical location

Latitude 102.03417 Longitude 15.23985

Operation Start Date

The operation started in 2022

2. Approach, aims, and enabling environment

The objectives of best practice / technology

1. To gain knowledge in integrated-agriculture land use in areas with saline soils for planting vegetables
2. To implement the technology in producing toxic-free plants to connect with quality chili peppers markets
3. To build local incomes sustainably

3. Classification of the best practice/technology

Activities and details of the operation

Mr. Mana Siangsunthia is a farmer who has implemented the knowledge obtained from being a soil doctor stationed at Non Thai district, Nakhon Ratchasima province to build opportunities for himself and farmers in the area. The problem of soil degradation in areas with saline soil originates from chemical and physical degradation and low fertility which are main limitations for land use, including shortage of water in the dry season and spell of rain in the cropping season. This has been brought an association of farmers ready to learn about increasing soil management potentials to increase plant yields and solve problems in their own occupation areas. The group is supported in terms of factor of production, namely LDD microbial activators

producing organic fertilizers and bio-fertilizers, vetiver of Songkhla 3 variety and dolomite. Moreover, the guideline obtained from learning, observance, trial and errors has been implemented and developed in the 0.04 ha planting vegetables. Previously, the mentioned area was characterized by soil with soil fertility deficiencies and giving low yields due to the problem of soil degradation. The soil texture was sandy clay loam consisting of saline soil a little bit. Moisture in the soil was very low in the dry season. Moreover, the area was outside the irrigation zone. Therefore, an idea came up with developing occupations for farmers in the community located at Moo 5, Ban Kok Phrom, Non Thai sub-district, Non Thai district to implement knowledge regarding integrated utilization of areas with saline soil in the organic agriculture system whereby agencies from Land Development Department provide knowledge in analyzing soil and improving soil prior to cultivation area preparation. The wisdom of farmers themselves is used together with the technology of Land Development Department, namely dolomite application for pH value adjustment and killing germs affecting growth of chili peppers together with applying manure to increase organic matter to the soil. Fermented bio-extracts have microbes which help stimulate the root system. Regarding moisture storage in the plot where chilies are planted, the drip irrigation technology system has been installed. The soil is covered with straw and vetiver is used to restore soil conditions. The objective is to do this as a prototype in building incomes for the community further.

After soil amendment, the soil has a better structure and has become friable and suitable for planting chili peppers by selecting the Amphawa Gold according to the demand of the market. Moreover, regarding intercropping, parsley is also inserted to be planted between plots, resulting in using water efficiently and worthily. Average yields of chili spur peppers account for 400 kilograms per 400 square meters throughout the age at 180 days. The harvesting price is 2.47 USD per kg and yields of parsley account for 108 kilograms per 400 m² (byproducts from watering chili pepper trees) based on harvesting yields for 1 generation per round of chili pepper production.

4. Technical specifications, implementation activities, inputs, and costs

4.1 Technical plan of the technology



Methods of managing the plot for planting vegetables in areas with degraded soil and soil with slightly amount of salinity as follows:

Cultivation plot preparation

1. Plough and blast soil, followed by plowing in regular furrows for the second time by using a 65 HP tractor and a small Kubota tractor to disintegrate soil to become smaller and finer

2. Elevate the furrow for the dimension of 30 centimeters high and 60 centimeters wide. The spacing between plots is 1 meter. Burn a pile of plant residues with the height of about 30 centimeters in the cultivation plot until it becomes charcoal with red spark to kill bacteria and disease-causing fungi. After that, follow by watering it to extinguish the blaze.

3. Spread dolomite thinly for soil amendment with the rate of 25 kilograms per rai. This is followed by using dung which is waste from pigs going through the process of gas fermentation at the rate of 100 kilograms per rai. Incorporate together and use the bio-extract with the rate of 2 spoons per 20-liter water to help improve the soil and stimulate the growth of plant roots.

4. Mix the cultivation soil with the ratio of 3 handfuls of soil: 1 handful of dung.

5. Dry the soil for 7-14 days. Before planting, place a cut banana stem with the length of 10 centimeters at the bottom of the hole to mix with the soil in the planting hole.

Planting and maintenance

1. Plant the chili pepper young plant of the Amphawa Gold variety at the age of 35 days together with sprinkling parsley around the planting plot. Cover it with rice straw and grow vetiver around the planting plot.

2. Watering in the morning and watering mixed with the Indian Laburnum pod fermented extract at the rate of 2 spoons per 20-liter water in the evening. Spray wood vinegar to prevent fungi once a week.

3. When the chili pepper buds, spray with the LDD 2 in the evening for every 5 days.

4. Put in place the drip system to be used in case of labor shortage of morning watering in order to keep moisture

5. In case of the anthracnose epidemic, destroy the chili pepper stricken with the disease. During the outbreak of aphids, spray with plain milk at the point of the outbreak. Leave it for 20 minutes and then wipe it off.

6. Withdraw old leaves of the chili peppers when they are at the age of 45-50 days in order to make the trunk expose to the sun. This helps chili peppers grow well and increase their yields.

Harvesting yields

1. When the chili pepper tree is at the age of 65 days, harvest the yield of the first generation and harvest yields the next time for every 5 days for the period of 6 months.

3.2 Revenues and expenses in using the technology

1. Initial costs and expenses in using the technology

Inputs	Unit	Quantity	Expenses per unit (USD)	All expenses per inputs (USD)	% of expenses incurred by land users
Labor					
Plough to prepare plots	Labor	1	8.08	8.08	
Soil preparation		1	4.41	4.41	
Cultivation, watering, plot maintenance	Labor	1	24.25	24.25	
Yield harvesting	Labor	1	137.64	137.64	

Plant materials					
Chili pepper tree	Tree	1200	0.029	34.8	
Parsley seeds	gram	600	0.01	6.0	
Rice straw	kilogram	180	0.10	18.0	
Fertilizers and substances killing/ inhibiting growth of living things (Biocide)					
Fermented bio-extracts	Liter	120	0.29	34.8	
Dolomite	kilogram	13.6	0.73	9.93	
Dung	bag	35	2.5	87.5	
Others					
Drip line	meter	4.6	1.76	8.06	
PVC tubes	meter	10	0.59	5.9	
1,000 liter bucket	bucket	1	67.65	67.65	
Total expenses of establishing the technology (US dollars)				447.02	

Calculation of costs and expenses

Expenses are calculated per areas using technology (Unit of size and area: 0.04 ha)

The currency used to calculate expenses with the unit as USD

Exchange rate (to US. dollars) 1 US. dollars = 34.0 Baht

Average wage in hiring labor per day is 8.82 USD

Most important factors having effects on expenses

1. Labor costs

3.3 Incomes from selling products and net incomes

In an area of 0.04 ha, chili pepper yields can be collected for 65 kilograms per round on average. The yields have already been collected for 6 rounds. The selling price is 2.47 USD per kilogram, obtaining a total of 963.52 USD.

Parsley yields have already been collected for 1 round accounting for 108 kilograms. The selling price is 4.41 USD per kilogram, obtaining a total of 963.52 USD, obtaining a total of 16,200 Baht.

Total incomes = 963.52+476.47 = 1,439.99 USD

Net income = 1,440-447.97 = 992.03 USD

4. Environment

4.1 Characteristics of the natural environment

The mentioned area has the average amount of rainwater between 1,001 - 1,500 milliliters. It is situated in the zone of semi-arid climate. The area is flat. The altitude level is 200 meters from the sea level. The soil is sandy clay loam. The level of organic matter is low. The ground water cannot be used. The water at the soil surface is at a good level. Regarding water quality, the water can be used for agriculture only.

4.2 Characteristics of land users implementing the technology

Land users settle down and implement the technology as individuals/ households. They have incomes from outside the farm accounting for 30-50% of all incomes. Regarding the wealth level, they have enough to get by. The land where the technology is implemented accounts for 0.32-0.81 ha. Land ownership is individual. They receive rights of land tenure.

Service access and infrastructures

Aspect	Access
Health	Good
Education	Medium
Technical aid	Good
Employment (such as outside the agricultural sector)	Good
Market	Good
Energy	Medium
Road and transportation	Good
Drinking water and sanitation	Good
Financial services	Medium

4.3 Impact in the on-site from using the technology

1. Economic and social impact

Aspect	Impact	Before	After
<i>Production</i>			
Crops production	Very positive	Being areas with degraded soil, filled soil with lack of fertility	Going through soil amendment making the soil have better properties
Quantity of crops	Very positive	Plants could not grow.	Plant thrive and give yields continuously.
Product diversities	Very positive	Plants cannot be planted.	Integrated cultivation, namely chili peppers, parsley and vetiver for soil amendment
<i>Incomes and expenses</i>			
Expenses of factors of agricultural production	Moderately increased	There was no cultivation.	Expenses for cultivation labor and soil amendment materials easily found in the area such as fermented nio-extracts, dolomite, leaf debris etc.
Farm incomes	Highly increased	There was no cultivation.	The quantity of products can be sold and exported.

2. Other social and cultural impacts

Aspect	Impact	Before	After
Health situations	Positive	-	Conducting natural farming by avoiding fertilizer and chemical application
Institutes of the community	Moderately positive	Studied how to solve problems by themselves	Building interaction of farmers groups in the area based on consulting and mutual problem solving
SLM or knowledge of land degradation management	Positive	There was no knowledge propagation.	Farmers in the area accept the technology and gather together to learn methods of soil management so that they can grow plants and implement them in their own areas.

3. Ecological impact

Aspect	Impact	Before	After
<i>Soil</i>			
Soil indumentum	Moderately increased	Being earthfill areas	There is soil amendment by using plant debris, rice straw and growing plants.
Nutrient circulation and supplementation	Highly increased	-	Nutrients increase from integrated cropping such as chili peppers, parsley, vetiver etc.

Soil stabilization	Highly decreased	Soil was compact and aggregated as hard clod of earth	Plowing and improving soil with organic matter and plant roots help reduce soil stabilization
Organic matter in the soil/ lower than in the soil of C horizon	Moderately increased	-	Organic matter from soil amendment such as manure and cropping systems
<i>Biodiversity of plants and animals</i>			
Biodiversity of plants	Positive	-	Plant varieties which are cultivated in the area grow more such as chili peppers, parsley, vetiver etc.

Activities Pictures



Fig.1 Sampling for analysis



Fig.2 Measure the soil salinity level



Fig.3 Simple soil analysis



Fig.4 Soil quality amendment with manure and dolomite



Fig.5 Cover the soil with rice straw and put in place the drip irrigation system

Fig.6 Experts of Land Development Department give advice and exchange learning about utilization of areas with saline soils



Fig.7 Harvesting parsley products (by products)

Fig.8 Chili pepper products prepared to send to markets conducting MOU together