13. TECHNOLOGY OF PLANTING HALOPHYTES (DIXIE GRASS) FOR RESTORING HIGHLY SALINE SOIL

1. General Information and description of best practice/technology

Introduction

Dixie grass (*Sporobolus virginicus*) is a halophyte plant. The objective of growing is to increase suitable land use change for farmers and to prevent saline soil distribution. Dixie grass can be used as fodder. Land Development Department has been trying to propagate Dixie grass to cover the area severely affected by salt. Growing halophytic grasses (Dixie grass) aims to make farmers able to utilize land and to decrease distribution of areas with saline soil. Dixie grass can be used as a plant, fodder for cattle.

Land Development Department has brought the technology of planting halophytes for restoring areas with highly saline soil to be used in the area of Mr. Chalong Munkarn residing at the address: 6, Moo 8, Kud Jok sub-district, Bua Yai district, Nakhon Ratchasima province. The area is a plateau with the steep slope of 0-2%. The soil has an electrical conductivity of more than 16 dS/m. The area has soil with high salinity and a semi-arid-climate. The amount of rainfall accounts for 751-1,000 mm. per year. Most farmers grow crops based solely on rainwater. This is due to the fact that the area has a condition of highly saline soil, making farmers obtain low productivity. Halophytes are plants which grow and give good yields at the level of high salinity especially for Dixie grass (*Sporobolus virginicus*) with the ability to survive accounting for 100% in the salinity of 40 ppt (NaCl). Dixie grass has adapted itself to have smaller vascular bundles and has adjusted the osmotic pressure. There is salt excretion at the glands on the leaves. Planting halophytes is to utilize areas with saline soil and to grow cover crops. This helps control moisture at the soil surface and prevent salt accumulation at the soil surface. This also includes being fodder for farmers conducting livestock farming whereby there is excreted salt on the leaves of the grass which cows like to eat them. The grass has qualities similar to other fodder plants.

Operating facility Ban Don Pae, No. 5, Moo 8, Kud Jok sub-district, Bua Yai district, Nakhon Ratchasima province

Land user Mr. Chalong Munkarn

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Geographical location

Latitude 102.477 Longitude 15.556

Operation Start Date

The operation started in 1983 - 2012

2. Approach, aims, and enabling environment

Objectives of the technology

1. to prevent highly saline soil distribution
2. to utilize farmers' land to bring about most benefits
3. to use the grass as a cover crop and restore the ecosystem in areas with highly saline soil.

Activities and details of the operation

Planting halophytes has been supported from Land Development Department under the project of promoting integrated development of areas with saline soil in sub-watershed areas and activities of restoring areas with highly saline soil by growing salt resistant perennial plants and halophytes. The stakeholders are officers working together with soil doctors and community leaders in making public relations and coordinating the project work with farmers. Regional office of Land Development Department has supported Dixie grass varieties based on compost, chemical fertilizers to plant them on levees and the unused area with highly saline soil. Planting them on the levee with the width of 1.5 meters and the plant spacing of 20x20 centimeters. They are alternatively planted with *Acacia auricuriformis* with spacing between the trees of 2 meters. Dixie grass propagation can be done by cutting the grass tree with the length of 2-3 inches for the number of 3 nodes to be cultured in black bags. When the young plant is at the age of 1 month, it can be cultivated. Using this technology has brought about changes within 3 years. Numerous types of

plants come back to grow such as several types of wild grass. As a result, living things such as dragonflies, birds, rats etc. have come to live in this area. Farmers who grow Dixie grass on the levee can grow rice. Also, Dixie grass can be used as fodder for cows, resulting in increasing farmers' incomes due to having occupations in their own areas. Moreover, this also reduces migration to make a living in other areas. Farmers are satisfied with the technology in terms of the fact that it can restore the area with highly saline soil so that the area can be utilized more. It is the practice with small investment. Dixie grass can replace fodder and helps increase farmers' incomes from selling the young plant of Dixie grass to Land Development Department. Although growing Dixie grass is improving saline soil based on the period of time in restoring saline soil conditions which gives results not so fast as based on engineering management, investment is lower than using the engineering approach with high investment.

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

3.1 Classifying types of technology to reduce distribution of highly saline soil

Areas with highly saline soil are the area with no farming conducted. The area is deserted. The area is chemically degraded in terms of salinization or alkalinization. As a result, farmers cannot utilize in desert the area. Therefore, Land Development Department must promote farmers to restore highly saline soil by using the technology of planting halophytes (Dixie grass) for restoring highly saline soil. This is the conservation method based on planting grass. The main purpose is reducing, preventing and restoring degradation of saline soil, conserving the soil and plant ecosystem as well as maintaining or improving biodiversity in areas with saline soil. The goal of preventing degradation of areas with saline soil is promoting and transferring degradation prevention and restoring areas with saline soil with using the technology of planting halophytes (Dixie grass) to restore highly saline soil for farmers. Advising regarding guidelines for sustainable land management is also included, which is growing Dixie grass to prevent saline soil distribution, to cover the ground to salt movement to the surface. After the area with highly saline soil has been improved with planting Dixie grass for 3-5 years, the environment of soil and plants is better and integrated land use occurs in the area. Plants and livestock are integrated by using Dixie grass as fodder for conducting livestock farming and reducing risks of occurrence of dry areas.

3.2 Technical drawing plan of the technology

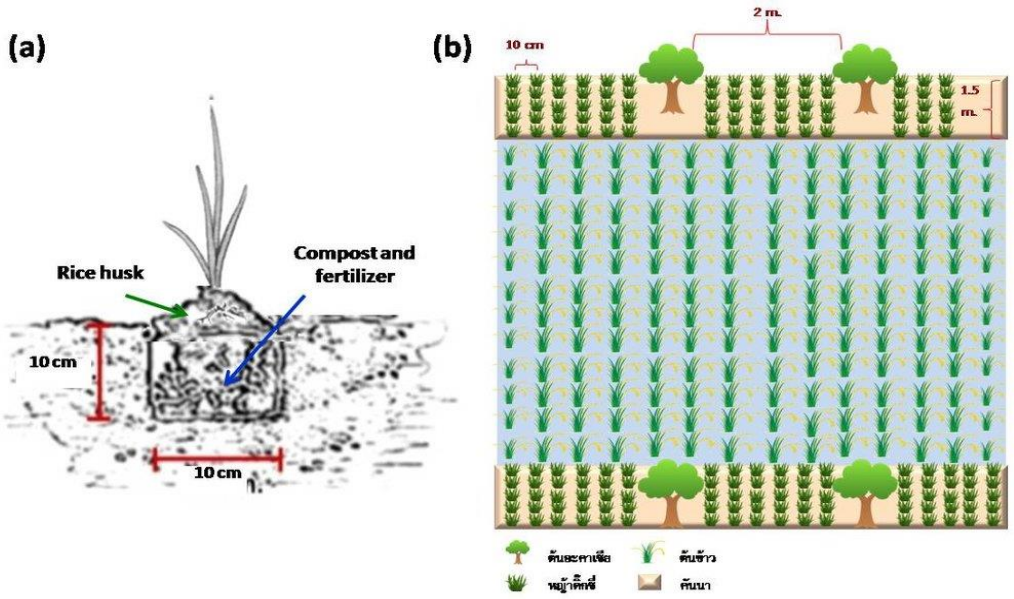

Fig 1 Dixie grass propagation and plating Dixie grass on the area with highly saline soil

(a) Propagating Dixie grass can be done by cutting the grass tree for the length of 2-3 inches with 3 nodes. Bring the piece to be cultivated in a black bag with mixture of soil and compost used as growing media. When the grass seedling is 1 month old, it can be cultivated. Prepare soil by digging a hole with the size of 10x10x10 cm^3. Put compost for 200 grams per hole and the 15-15-15 chemical fertilizer for 6.25 grams per hole. After that, cover it with paddy husk for 400 grams per hole and the planting spacing is 30x30 centimeters; (b) The picture shows growing Dixie grass in the area with highly saline soil between levees where Acacia Auricuriformis is planted to prevent saline soil distribution.

Activities for setting up are 1) Planting Dixie grass seedlings (period of time/frequency: May-July 2015), 2) soil preparation for cultivation (period of time/frequency: May-July 2015) and 3) using chemical fertilizers (period of time/frequency: May-July 2015).

3.5 Incomes 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 input (USD)
Labor				
Labor for planting Dixie grass: 1 person/day for 300 USD per day and 1 rai requires labor for 4 persons, accounting for 1,200	ha	1	35.2	220
Plant material				
Dixie grass seedlings for 1,600 trees/ha, 0.5 USD/tree	Seedling	10,000	0.015	147
Fertilizers and substances killing/ inhibiting growth of living things (Biocide)				
Compost price: 0.10 USD/kg., 0.2 kg/hole	kg	320.0	0.10	32
Paddy husk price: 0.12 USD/kg., 0.4 kg/hole	kg	640.0	0.12	76.8
15-15-15 chemical fertilizer price: 0.59 USD/kg, 6.25 kg/hole	kg	10.0	0.59	5.9
All expenses of setting up technological (US dollars)				**481.7**

Calculation of costs and expenses

Expenses are calculated per the area of using the technology

the currency calculated for expenses: Baht

The exchange rate is 1 US dollar = 34.19 Baht

Average wage in hiring daily labor is 300 Baht.

The most important factor having an effect on expenses is the policy of the government on the minimum wage which is an important factor having an effect on the cost of the project.

2. Activities for maintenance There is no maintenance for these activities because Dixie grass can grow and propagate by itself.

3. Incomes and expenses of farmers can be compared from benefits from expenses: It was found that for short term returns, there are short term returns and long term returns in the positive trend greatly. Regarding benefits from expenses in maintenance, it was found that for short returns, there are short term returns and long term returns in the positive trend greatly.

4. Environment

Regarding changes of severity of the climate (disaster) such as disasters from drought, forest fire, fire on the land, flash flood and invasion of insects, worms, there are trends which are constant and decreasing. There is not much impact from consequences related to other climates such as extended period of cropping and reduced period of cropping.

4.1 Natural environment of the area around the area with highly saline soil

1. Regarding climate data from 1983 to 2012, the annual average amount of rain water accounts for 1,028 millimeters. The agricultural climate is semi-dry. The average temperature is 21-36 °C. Relative humidity is 75%. Source: Meteorological Station: Meteorological Department

2. The area is plain to plateau with the gradient of 0-2%. The altitude from the sea level is 101-500 meters.

3. The soil depth is about 81-120 centimeters. The top soil texture is coarse sand. The soil texture is 20 centimeters lower than the soil surface. The soil is silt loam and there is low amount of organic matter in the soil.

4. Ground water can be dug at the level less than 5 meters but there is a problem of water salinity.

5. There are low diversities of plants and animals.

4.2 Characteristics of land users applying the technology: Farmers have the main occupation which is doing farming and the secondary occupation is doing business. The main income outside the farm accounts for about 10-50% of the entire income. Livelihood is at the medium level. Most farmers are male and middle aged. They own areas for about 1.6 – 2.4 ha with their own ownership. They use labor within the family to conduct farming and receive a right of using the irrigated water.

4.3 Access to services and infrastructures Farmers receive public health services, education, knowledge promotion from the government, employment outside agricultural areas and building marketing opportunities at the medium level for support in terms of energy, transportation, utilities and sources of investment funds for loans at the low level.

4.4 Impact

4.4.1 Economic and social impact

Farmers have areas for producing quality plants, increased plants used for feeding livestock and for supporting utilities with good water such as quality drinking water, quality water for livestock and irrigated water with qualities for cultivation. The main income of farmers comes from products from their own plots. Some incomes come from other sources such as being employed and doing business etc.

4.4.2 Social and cultural impact

Farmers have good health and self-reliance food security. Social conditions of the community and culture have stability. Using areas with saline soil sustainably can be transferred. There is unity in the community. There is help for people in the community to reduce social inequality.

4.4.3 Ecological impact

Using the technology of planting Dixie grass to restore highly saline soil revealed that the ground has more plants which can grow to cover the ground. As a result, there are diversities of numerous types of plants and animals. Water has better qualities, decreasing soil salinity and increasing more fertility.

4.4.4 Impact outside the operation area

There are few changes in the environment of the outer area of the project: Pollution of usable water in the water source has been reduced. Seasonal flooding is normal, causing a few damages to the cultivation area and infrastructures of the community.

5. Conclusion

5.1 Strengths

Regarding opinions of the farmers using the technology, they view that Dixie grass is the plant which resists salt highly and after planting it, salinity is clearly reduced. The environment becomes better. As a result, other plants return to grow in the area. The area in not empty any more. Also, the owner of the area can grow and propagate Dixie grass for Land Development department.

The only grass halophyte is Dixie grass which can grow in areas with highly saline soil. After growing Dixie grass for 2-3 years, soil salinity has been reduced, resulting in the occurrence of biodiversity of animals and plants such as butterflies, birds, rats, worms and indigenous plants etc. It is better for farmers to use their own land for more extension than leaving the land become dry. Dixie grass can be used as fodder, increasing the land owner's incomes.

5.2 Weaknesses/risks

Farmers' opinions: Lack of knowledge of planting halophytes to reduce distribution of highly saline soil and there are no other alternatives to find better incomes than planting Dixie grass. Farmers from nearby areas always burn rice straw after harvesting, making the Dixie grass partly. Suggestions are that officers should meet farmers and transfer knowledge about reducing highly saline soil distribution to farmers. Public relations are necessary to stop burning rice straw.

Every researcher and officer must understand and be trained regarding mechanism of halophytes, importance of Dixie grass on the working plan of this project and monitoring results of the operation efficiently. Suggestions are that officers must be trained at levels such as receiving more training and knowledge about the project and placing importance on weak points and obstacles of achievement of the project more.

Activities Pictures

Fig. 1-2 Planting Dixie grass in the area with restoring highly saline soil