

The Rapeseed Project for Restoring Tsunami-Salt-Damaged Farmland after the GEJE

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The Rapeseed Project for Restoring Tsunami-Salt-Damaged Farmland after the GEJE

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Abstract

The Graduate School of Agricultural Science, Tohoku University, launched an Agri-Reconstruction Project in 2011 immediately after the March 11 Great East Japan Earthquake disaster, and this continues to date. We started the Rapeseed Project for Restoring Tsunami-Salt-Damaged Farmland immediately after the disaster. Damaged farmlands were surveyed and salt-tolerant rapeseed varieties from Brassicaceae and related species were used to restore the soil. The plants came from the gene bank developed at the Graduate School of Agricultural Science, and were planted on damaged farmland in Sendai and Iwanuma. As part of the project, the production and sale of edible as well as fuel oil obtained from rapeseed plants was organized in coordination with the Miyagi Prefecture, Sendai City government, a number of private companies and other partners. This enterprise and the genetic selection of the salt-tolerant varieties

of Brassicaceae plants continue to date.

Introduction

Many lives were lost and horrendous damage was caused by the Great East Japan Earthquake and tsunami disaster of March 11, 2011. Farmers and farmlands were also severely damaged by tsunami. We considered that we should support the agricultural, forestry and fisheries reconstruction process in the tsunami disaster area. Then the Graduate School of Agricultural Science launched the Agri-Reconstruction Project in March 23, soon after the disaster. The project is based at our Graduate School in a consortium-like group of independent researchers.

Along the Tohoku region, 37 research projects were done. These activities have been carried out in close cooperation with local residents. Among these, one of outstanding projects was the Rapeseed Project for Restoring Tsunami-Salt-Damaged Farmland.

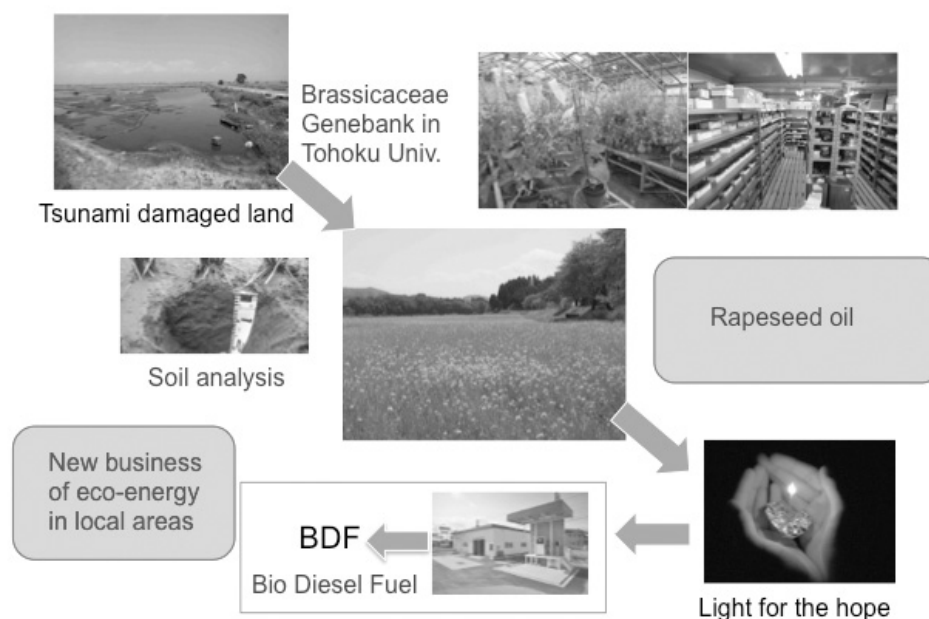


Figure 1. Concepts of Rapeseed (Nanohana) Project for restoring tsunami-salt damaged farmland

The rapeseed project objectives included soil surveys of the affected farmlands and selection of Brassicaceae plants such as rapeseeds suitable for the level of salt damage. Moreover, it included sowing these seeds on the damaged land, planting yellow rapeseed flowers to improve the landscape and to symbolize the agricultural revival and eco-energy development. Oil is obtained from the harvested rapeseed to produce biodiesel fuel, BDF. This fuel is used to operate machinery for the restoration of the affected areas, and will be a new business of eco-energy in disaster-stricken areas.

The members of the project were professors who worked in the leading edge of each specific research field in plant breeding, soil science, agronomy, microbiology and agricultural economics. Our Graduate School of Agricultural Science is a leading research institution in Japan in the field of genome sequencing of Brassicaceae plants and holds a renowned gene bank of phyletic lines specializing in Brassicaceae-related plants. Brassicaceae related species include *Raphanus* (radish), *Capsella* (shepherd's purse), *Eutrema* (Japanese horseradish) and others. The genus *Brassica* alone includes *B. juncea* (mustard, mustard greens, Sichuan vegetable (zha cai), *B. oleracea* (cabbage, cauliflower, Brussels sprouts and others), *B. napus* (rapeseed) and *B. rapa* (Chinese cabbage, turnips, Japanese mustard spinach (komatsuna), potherb mustard (mizuna) and others. Over the last 50 years the gene bank has sampled and managed roughly 800 phyletic lines from 177 species in 58 genera, gathered from research institutions overseas. Ancestors of rapeseeds were considered to be Mediterranean seashore origin. Some of the lines had been clarified as salt tolerance lines through cultivation trials in our school.

We decided to launch the project with objectives of soil surveys on the affected farmlands as well as selection of Brassicaceae plants suitable for the level of salt damage. Moreover, it included sowing these seeds on the damaged land, planting yellow rapeseed flowers to improve the landscape and to symbolize the agricultural revival and eco-energy development. Oil is obtained from the harvested rapeseed to produce biodiesel fuel. This fuel is used to operate machinery for the restoration of the affected areas, and run school buses for children living in disaster-stricken communities.

It was considered that the construction of a regional autonomous energy supply system making use of rapeseed would play a useful role in the restoration of the disaster-affected areas.

As a complementary objective, it was hoped that through the cultivation of rapeseed local farmers would be encouraged to resume farming at the earliest possible time, as this would lead on to the revival of the farming economy.

Detailed and wide-ranging soil survey covering the entire (14,300 ha of) tsunami-affected farmland in Miyagi Prefecture was carried out in coordination with prefectural research institutes and other partners. The survey at 344 locations in the area showed that there were significant differences in the damage from region to region. In some places, the soil surface had been covered by a tsunami deposit consisting of mud, while in others the plow layer was covered in a thick deposit of sand. In other places, the topsoil had been washed away, while the other land had simply been immersed in seawater. It was clear that the farmland restoration method would differ according to the type of damage found in each area.

We sampled soil in the east area of Sendai to investigate the growth of rapeseed. Rapeseed could not grow in the Tsunami sludge, but could well in plow layer well. It was decided that the salt damaged fields could be restored by removal of surface Tsunami sludge. We announced the results through our web site and newspaper. This approach was welcomed by the local community and farmers. This in turn encouraged the local people to keep looking forward despite the difficulties.

We planted out salt tolerant lines and conventional lines 'Kizakinonatane' in Sendai Nogyo Engei Center and paddy fields in Sendai, and conventional lines at four private farms' farmland in Iwanuma.

We removed weed and Tsunami sludge on the paddy field in Sendai with 120 volunteers, and seeded it with 30 volunteers. We planted seedlings of salt-tolerant lines with 70 volunteers. At the end of January, migratory wild swans completely devoured the leaves. The birds fed on the plants, because they could not find any grains and other type of feed on the Tsunami damaged farmland. It was a new finding that few leaves of *B. juncea*, a kind of mustard were eaten. The reason may be the spicy taste of the plant.

Conventional rapeseeds eaten by the swans bolted in the spring, and the field was filled with yellow

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flowers. In front of the flowers, one of the neighboring farmers commented,

“Although almost were totally eaten, I was greatly encouraged by the rapeseed flowers that sprang up strongly. I should follow them.” We thought that it must be one of the greatest achievements of our project.

We sold harvested plant in April as edible vegetable rapeseed in markets and a department store. In July, we harvested it to produce rapeseed oil. In the year 2011-12, culturing area was 2.7 ha, and we obtained 4,500 kg of seed. We pressed 63 L edible oil from 450 kg seed, and purified BDF. In the year 2012-13, culturing area was 2.55 ha. We obtained 1,200 kg of seed from 30 a of the Sendai Nougyou Engei Center. We pressed 34 L edible oil from 250 kg seed, and purified BDF. We are still continuing the cultivation, harvest and production. We have tried to produce various products such as the lamplight, candle and preserved flower.

We perform pot experiments for salt tolerance with the plant crops to produce strongly salt-tolerant lines. This led us to believe that a certain degree of salt-removal effect could be expected from the strongly salt-tolerant lines. We also perform the research for the elucidation of the salt tolerance mechanism and the development of strongly salt-tolerant *B. napus* lines. Besides using the salt-tolerant varieties of the

plants in tsunami-damaged fields, they are also used overseas in the rehabilitation of salt-damaged farmlands.

We have been collaborating with the rapeseed project in Minamisoma city. The city was damaged by tsunami and polluted by radioactive substances. We are providing seeds, performing trial cultivation on farmland, and field experiments with the objective of assessing the migration of radioactive substances to the plant body and seeds.

In the project, we worked with prefectural and city governments and many private companies. The aim of our project is the implementation of scientific knowledge and research resources in our university on the damaged farmlands and farm operations. However, people have paid attention our activities as one of social movements. We think that the reason is the nonprofit attitude of our university. Our professors worked voluntarily in fields as well as laboratories to act as the main sector of the activities. After the earthquake, several professors around us have changed their mind to jump out to the fields and farmlands.

We hope to continue the enterprise. Rapeseeds are suitable to plant in the salt or radioactive polluted areas, and we can construct a recycle system as an eco-energy production as shown in Figure 2. We would like to construct a local-production-for-local-

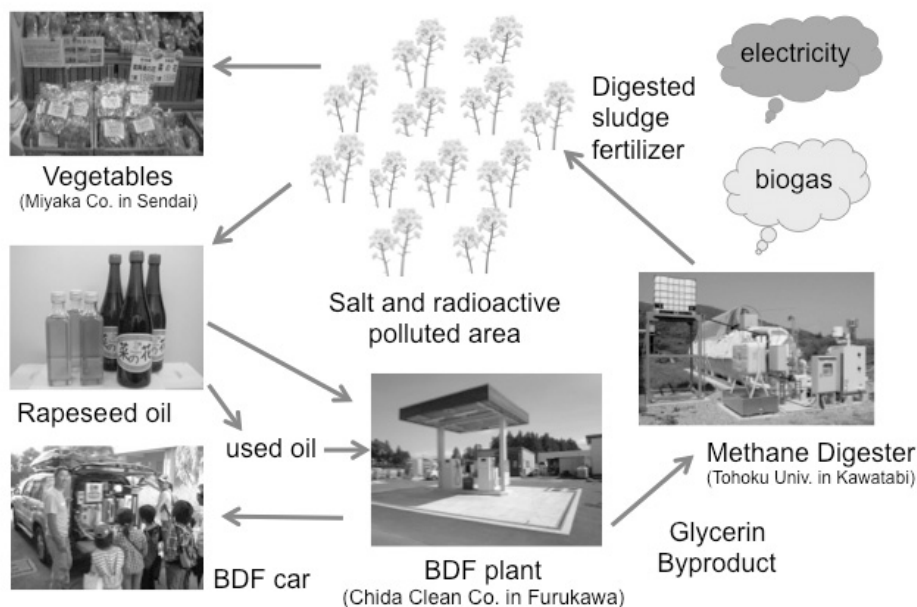


Figure 2. Restoration of agriculture and production of eco-energy by rapeseed

consumption energy system for from rapeseed oil.

Full bloom of rapeseeds on the spring farmland is the landscape that depicts the minds of Japanese people. We would like to carry out the project with the heart-warming yellow flower.

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