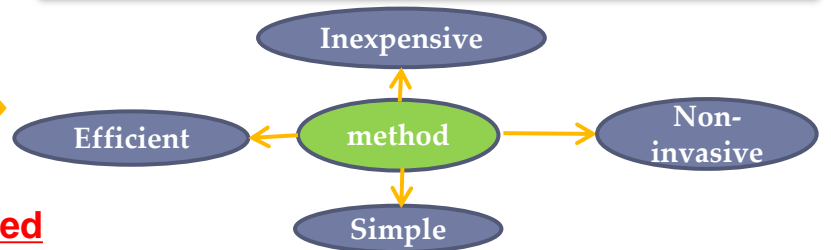


Restoration of Salt-Affected Soils Utilizing Halophiles Retained in Rice Bran

1. Background

- ◇ Salt is **inducing one-fifth** of world's irrigated land and causing around \$27.3 billion per year in economic losses.
- United Nation University 'The Economics of Salt Induced Land Degradation and Restoration'
- ◇ The efficiency to wash out salt from farming fields is extremely low.

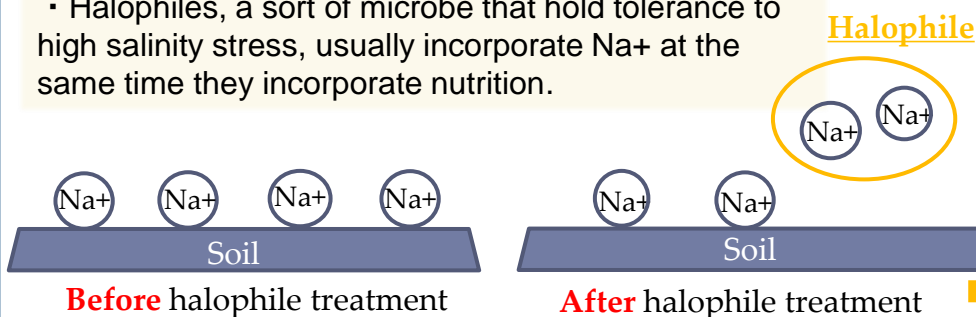
What an innovative method would have to look like?



Some efficient measures to deal with salt damage are required

2. Basic Ideas

- The organic acid secreted from halophiles are considered to combine with Na^+ or other ions.
- Halophiles, a sort of microbe that hold tolerance to high salinity stress, usually incorporate Na^+ at the same time they incorporate nutrition.



- Ethanol enhances high-salinity stress tolerance by detoxifying reactive oxygen species in arabidopsis thaliana and rice (Huong et al. : 2017)

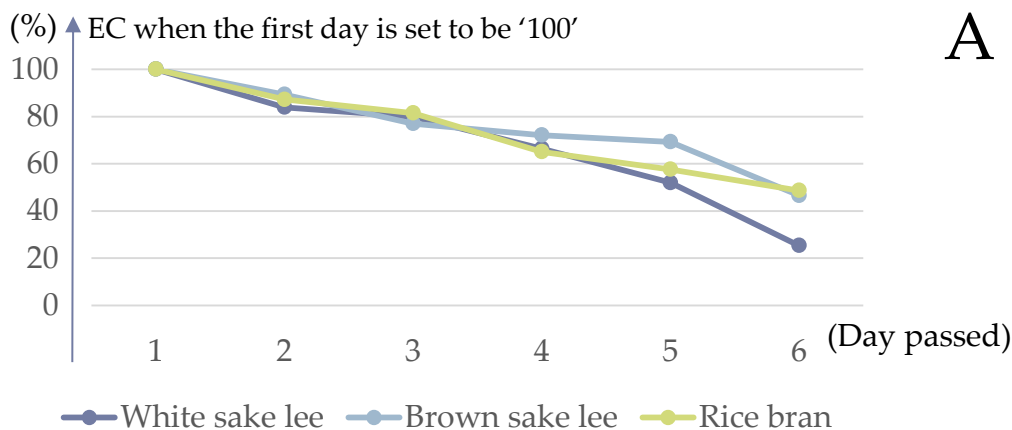
- B. Ethanol can be produced by the **fermentation of yeast in anaerobic conditions**. Utilizing yeasts that produce ethanol, plants' tolerance to high-salinity stress can be improved.
- A. As **halophiles multiply with nutrition given from exterior**, Na^+ can be torn off from soil particles and the efficiency to **wash salt away** from the salt-affected fields can be improved.

3. Methods

- ① Do halophiles change the EC in salt-affected soil?
Sodium Chloride solution was poured into soil until the soil showed EC of 3.5mS/cm. Then the change of EC was observed in the 'salt-affected soil' mixed with three sorts of sample, which were determined based on the amount of halophiles and nutrition each sample contains.

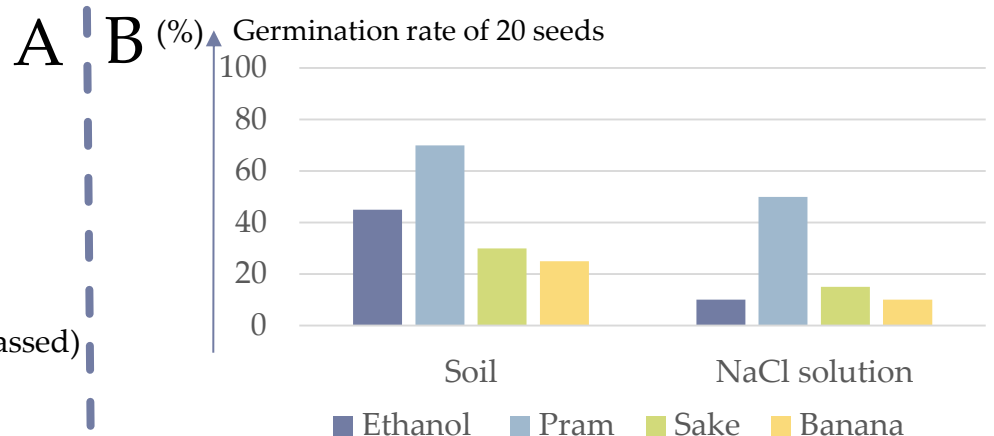
- ② Does ethanol affect the germination rate of radish sprout?
Prams and banana were soaked in sugared water and fermented in anaerobic condition. Then radish sprouts were grown in 1.5% NaCl solution and artificially generated salt-affected soil with the treatment with ethanol extracted from four sorts of sample.

4. Result



Graph ① Percent of decreased EC

- ※ 'Bed of salted rice bran used for picking' was added to all the three ingredients. The experiment was conducted using two replicates.
- ◇ As the final result, white sake lee decreased EC for nearly 80%.
- ◇ The amount of halophiles in soil was proportional to decrease of EC.



Graph ② Germination rate

- ※ The experiment was conducted using two replicates.
- ※ The germination rate was observed on the 6th day.
- ◇ In both salt-affected soil and NaCl solution, the radish sprouts in NaCl solution with pram wine most efficiently germinated.

5. Conclusion

- A. The overall of the experiment showed;
 - (1) all the ingredients used are considered to positively affect the decrease of EC
 - (2) the amount of halophiles continuously increased everyday
 - (3) the more EC decreased, the more halophiles multiplied.

Therefore, **halophiles retained in leftover are considered to contribute to the restoration of salt-affected soil.**

- B. Pram wine is considered to be **adaptable to both soil and NaCl solution**. Since radish sprouts usually take two weeks to grow in hydroponic culture, the germination rate is considered to increase if radish sprouts are cultivated longer.

Utilization of more sorts of fruits that natural yeast is adhering to the surface will be beneficial to more practical and effective methods.

More samples and experiments are required to confirm the results.

Combination of some measures can be more beneficial and effective to deal with high-salinity stress.