Recovering Vegetation of Volcanic Devastated Land Using the Symbiosis with Mycorrhizal Fungi

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Contents

1. Introduction
2. Method
3. Case : Sakurajima and Mt.Unzen
4. Example
5. Discussion

Introduction

- Volcanic Devastated Land
  - There are many volcanos in Japan.
  - After eruption often plants die out or a few trees are alive.
  - Soil erosion, volcanic ash and gas prevent the growth of plants.
  - Soil in these conditions

    have poor nutrition.

Introduction

- Necessity of vegetation recovery
  - Large amount of soil erosion
  - Landslide
  - Not good landscape

There are effective means!

Mt.Unzen

Method 1

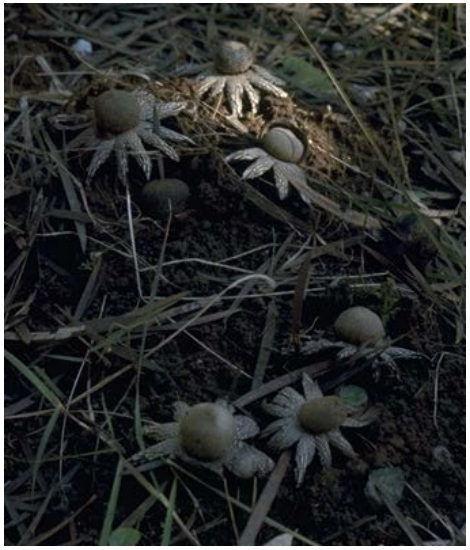
- Combination of a mulching sheet and ectomycorrhizal fungi(ECM) promote the growth.
- Mulching sheet protect soil from erosion and drying.

Method +

- Mycorrhizal fungi help trees to absorb P, N and water and they get photosynthetic products from trees.
  - > Trees colonized by mycorrhizal fungi grow well.
- Mycorrhizal fungi live inside/on fine roots of trees.
  - Ectomycorrhizal fungi (ECM) : on root tips
  - Arbuscular mycorrhizal fungi (AMF) : inside fine roots

Sakurajima

- Mulching sheet and ectomycorrhizal fungi
- There were few trees and plants after eruption.
- <u>Continued eruption</u>

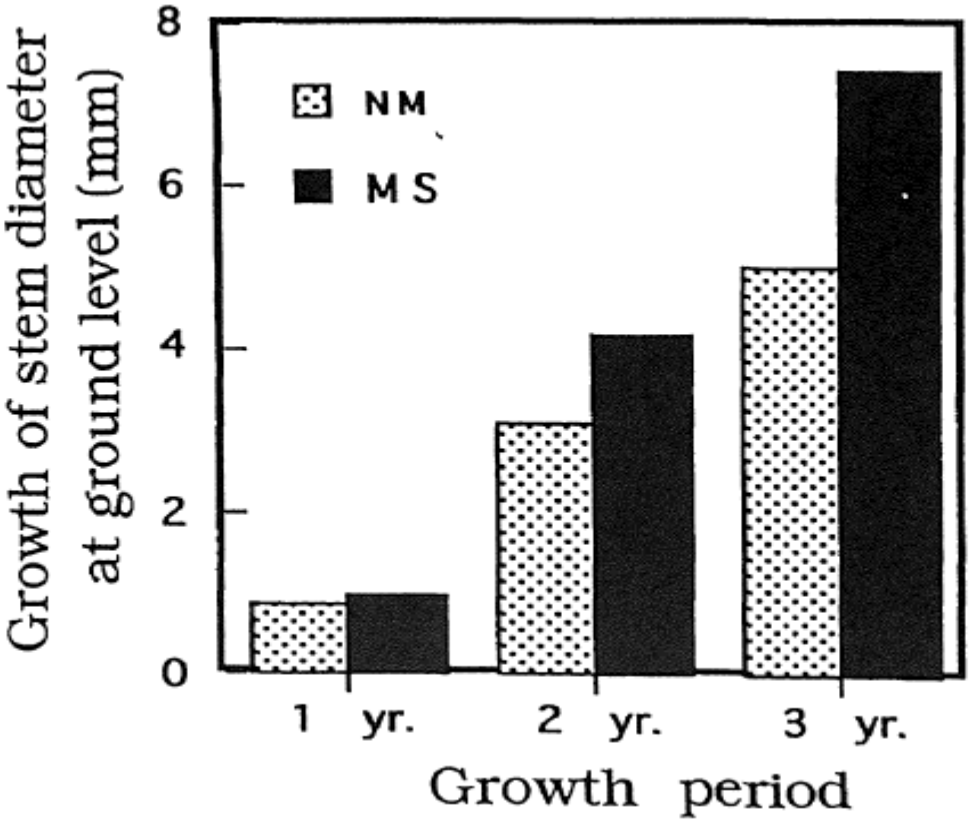


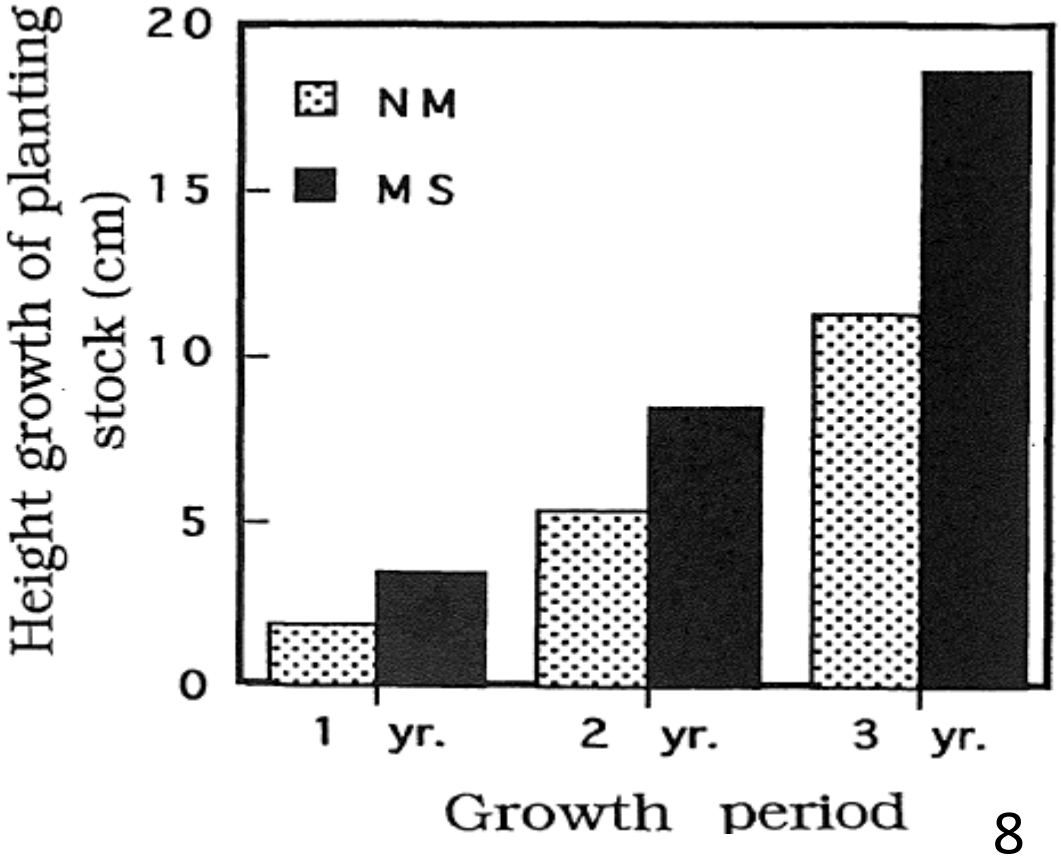
https://www.ffpri.affrc.go.jp/kys/index.html
森林総研　九州

Sakurajima

- Changes by mulching sheet : *Pinus thunbergii* (クロマツ) in Ohtsu

NM : no mulch MS : mulching sheet





Sakurajima

- surface coverage of ectomycorrhizal fungi (6 mo)
  - *Pinus thunbergii* in Sakurajima
  - *Pisolithus tinctorius* : コツブタケ (ECM)
  - *Astraeus hygrometricus* : ツチグリ (ECM)

表 2　桜島試験地におけるクロマツ根への外生菌根菌共生状況（1994.10：施工後 6 か月）

sheet	Mycorrhizal fungi	細根断片数（本）	surface coverage
−	No fungi	78	＋
＋	コツブタケ	78	＋＋＋
＋	ツチグリ	31	＋＋＋

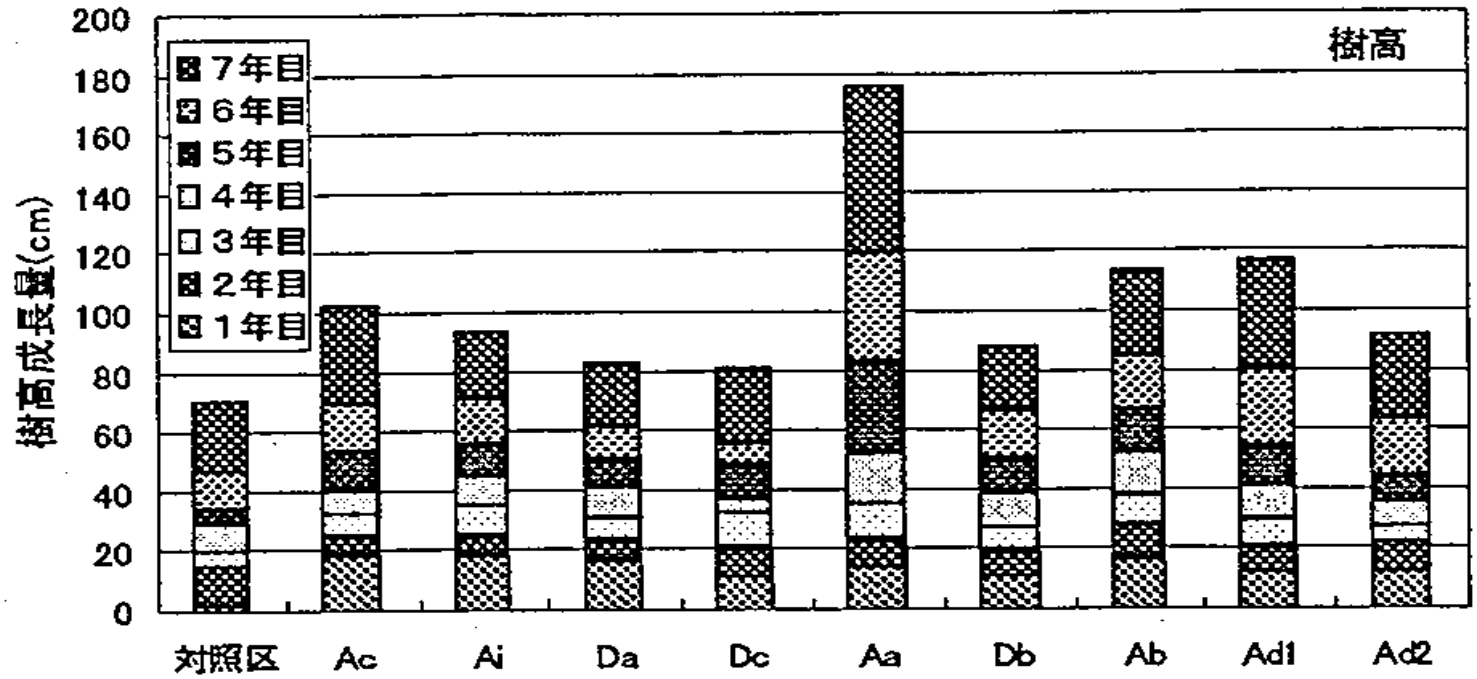
surface coverage　＋：5～10%，＋＋＋：＞50%。

Sakurajima

- Growth each of treatments : *Pinus thunbergii*

Growth of steam diameter at ground level

Height growth of planting



Ac 区:1, Ai 区:1+2, Da 区:1+3+4, Dc 区:1+4, Aa 区:1+3, Db 区:1+3+4+5+6, Ab 区:1+3+5, Ad1 区:1+7, Ad2 区:1+7

1.Only sheet　　2.*Astraeus hygrometricus* ツチグリ

3.*Pisolithus tinctorius* コツブタケ

4. *Miscanthus sinensis* ススキ with AM　　5.filler　　6.fertilization

Ezaki et al.

Sakurajima

- Mortality rate by volcanic ash and gas : *Pinus thunbergii* in Sakurajima
- After volcanic damage many “no sheet” seedlngs are died but almost all “mulching sheet” seedlings are recovered.

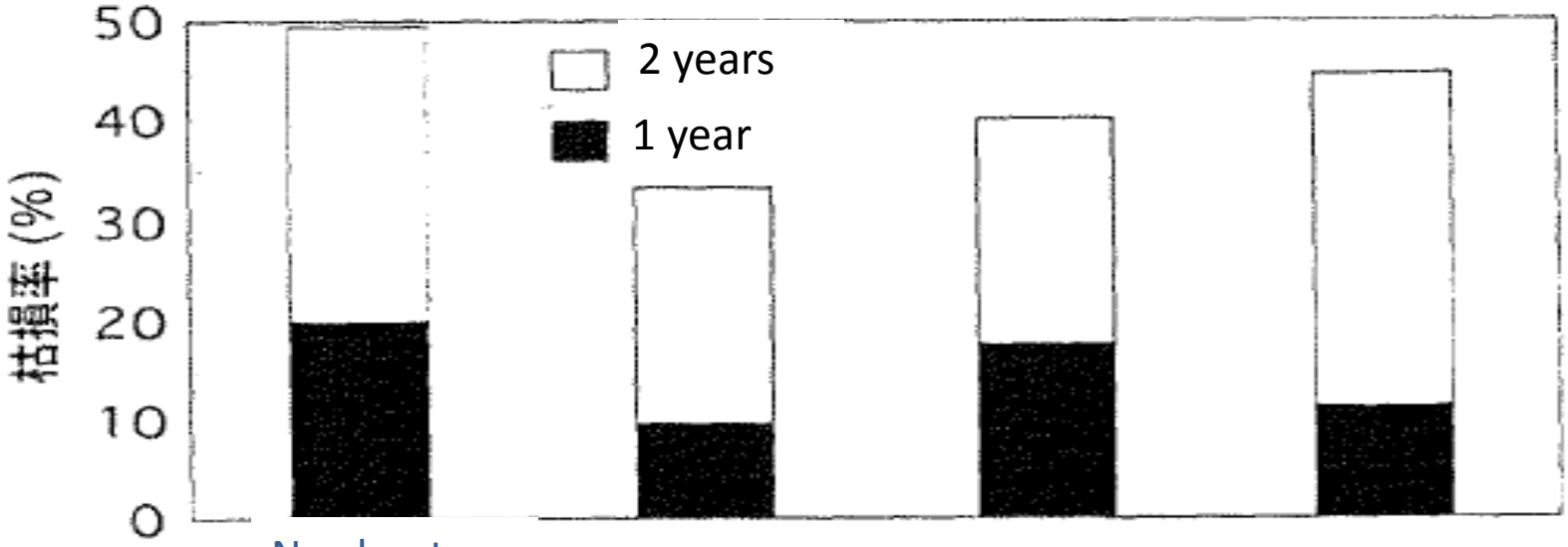


図 3　桜島の降灰およびガスによ
率 (1994.4～1996.10)

Sakurajima --Conclusion

- Mulching sheet and mycorrhizal fungi promote the growth of trees.
- Mulching sheet protect plants from volcanic ash and gas.

- Mulching sheet with mycorrhizal fungi is effective in areas of continued eruption.

Unzen

- Dropping bag in Mt.Unzen erupted in 1989
  - *Eragrostis curvula* (Weeping lovegrass)

Unzen

- The colonization rate of AM fungi : Weeping lovegrass

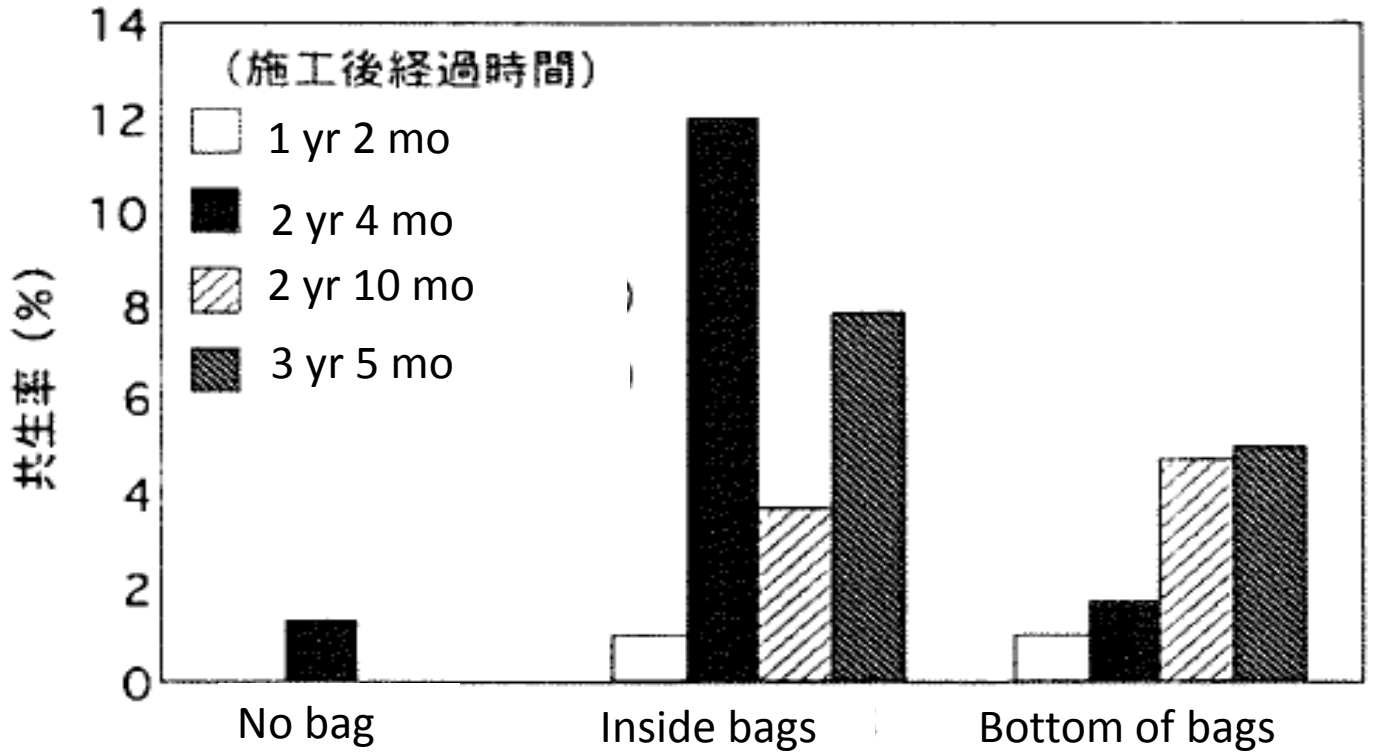


図 4　普賢岳垂木台地におけるウィーピングラブグラス根への AM 菌共生率（1995.5～1998.10）

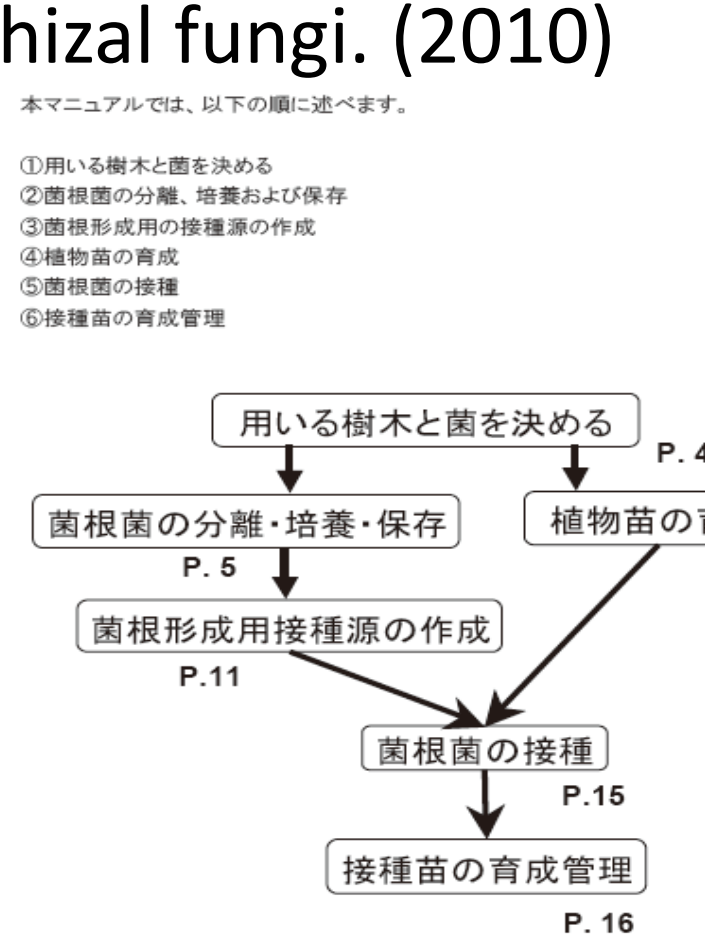
Unzen --Conclusion

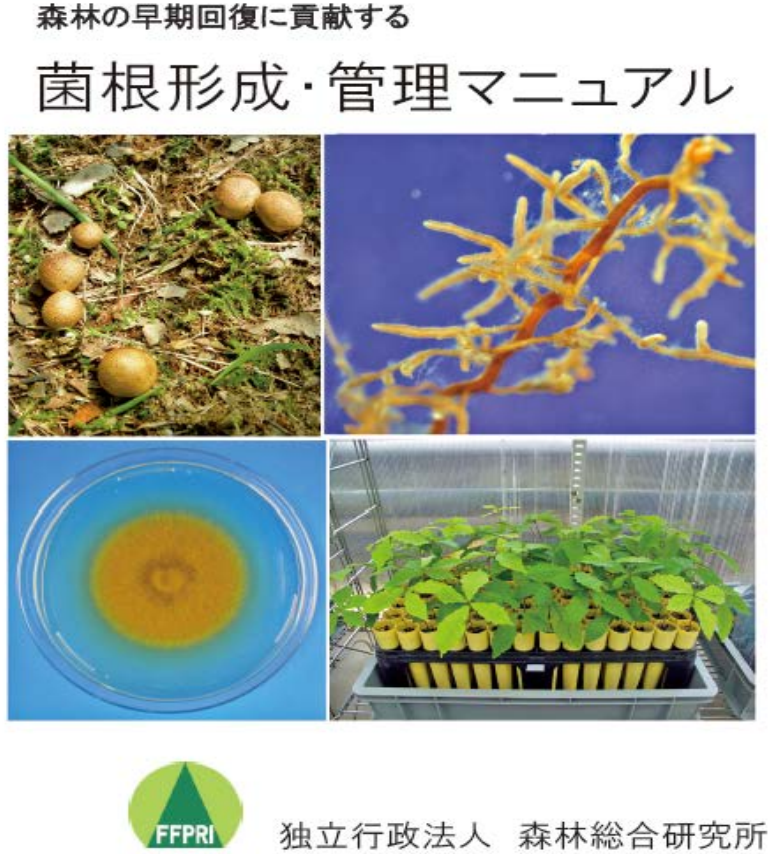
- Seed bag and AMF promote the growth of plants.
- Trees had grown 4m high after 6 years.
- Reports written at a later date show that plants have continued growing and little erosion have caused.

- Seed bag and AMF are effective in areas of no plants by eruption.

Recommendation

- Forestry and Forest Products Research Institute recommends technique of vegetation recover by mycorrhizal fungi. (2010)





Used in…

- Mulching sheet are used to recover vegetation on road side slopes.
- Mulching sheet with ECM are used to recover vegetation of devastated land.

Discussion

- Original mycorrhizal fungi + mulching sheet
- Selecting species of mycorrhizal fungi
  - Generalist can colonize many species of trees.
  - One species do not promote the growth of trees, but other species promote it well.
- Mulching sheet with ECM can reduce amount of work.
- Using in various field

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