

# Distribution of Microorganisms in Peat Soil under Agriculture

By

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## Content:

- Introduction - Sampling location
- Summary
- Soil sampling analysis
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# INTRODUCTION

- The sites of the study were MARDI Station, Sessang, Sarawak and MARDI Station Jalan Kebun, Kelang, Selangor.
- Both stations stand on peat, however the latter station had been in operation since the early 80's.
- The soil is regarded as highly degraded to a more consistent texture completely different from Sessang. The Sessang Station is undergoing development stages since 2000.

- A small portion of the land had been developed after it went through different land clearing techniques;
  - i) felling and burning (FB),
  - ii) felling and stacking – outside (FSO),
  - iii) felling, chipping and stacking (FCS) and
  - iv) selective clearing (SC).

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## SUMMARY

- Felling of trees on peat for agriculture will alter the existing landscape quite drastically.
- The soil surface will be more arable as excess water is being drained for agriculture. It can be anticipated that due to the change in the soil environment, some microorganisms such as the degraders of woody biomass and organic matter may dominate.
- The proportion and composition of the microbial population may differ from the original peat ecosystem. The extent of the change may reflect the degree, intensity and the mode of the activity exist on the peat soil.

- Our current study focuses on the change in the composition of the aerobic heterotrophic bacteria, fungi and actinomycete during the conversion and development of peat for agriculture.
- Comparisons were made between Sessang soils and that of Jalan Kebun, which has been under extensive crop cultivation.

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## SOIL SAMPLING ANALYSIS

Soils were sampled over a period of time at Sessang.

- ✱ The first was taken on undisturbed peat soil under forest condition.

- ✱ Subsequent samples were taken on the cleared areas and in areas under continuous papaya and pineapple cultivation.

Soils of Jalan Kebun Station were taken from areas of continuous vegetable cultivation.

## Three major microbial groups:

- aerobic heterotrophic bacteria (Pankhurst et. al., 2002),
- fungi (Jae-Jung Lee et. al., 2004) and
- actinomycete (Charest, et. al. 2004)

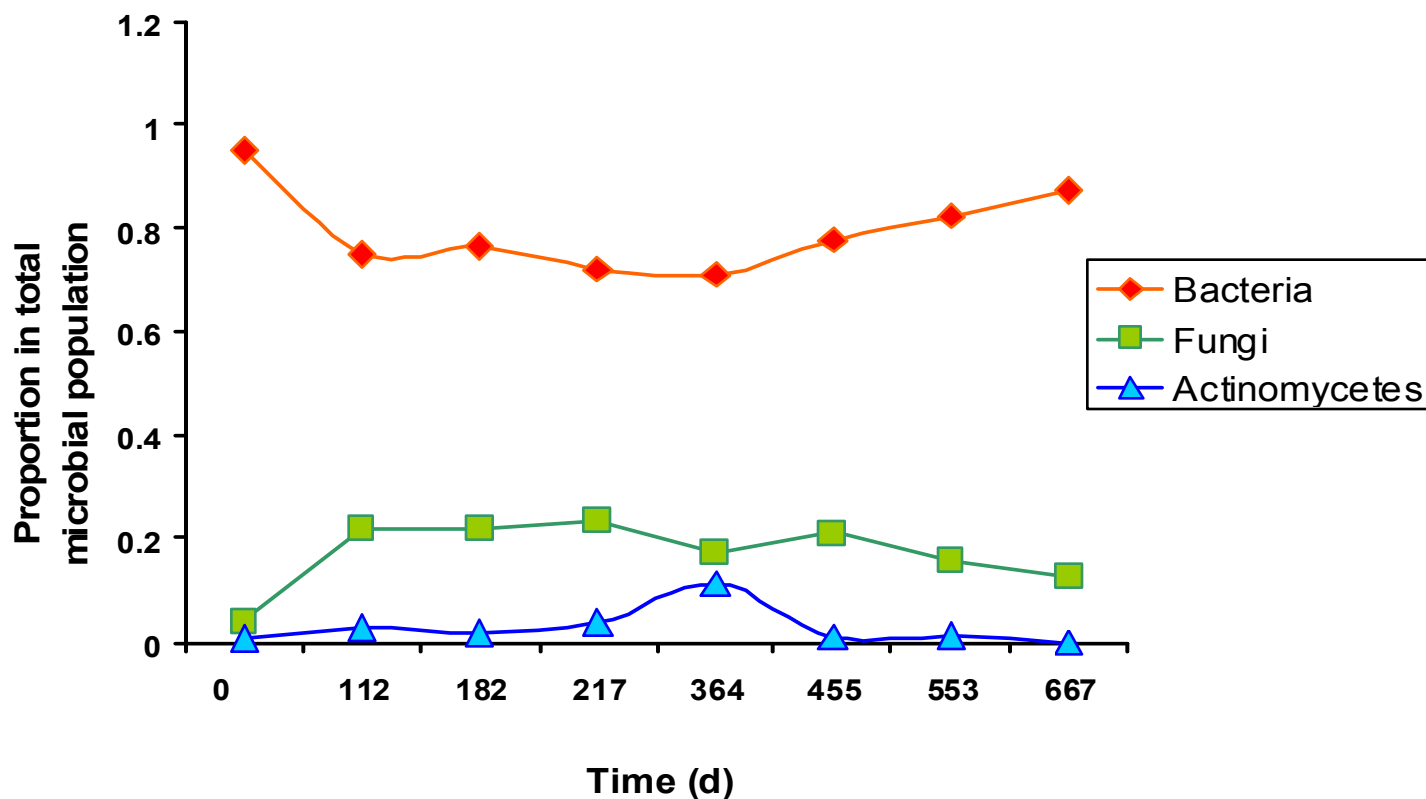
In this project, there were enumerated on their respective selective media.

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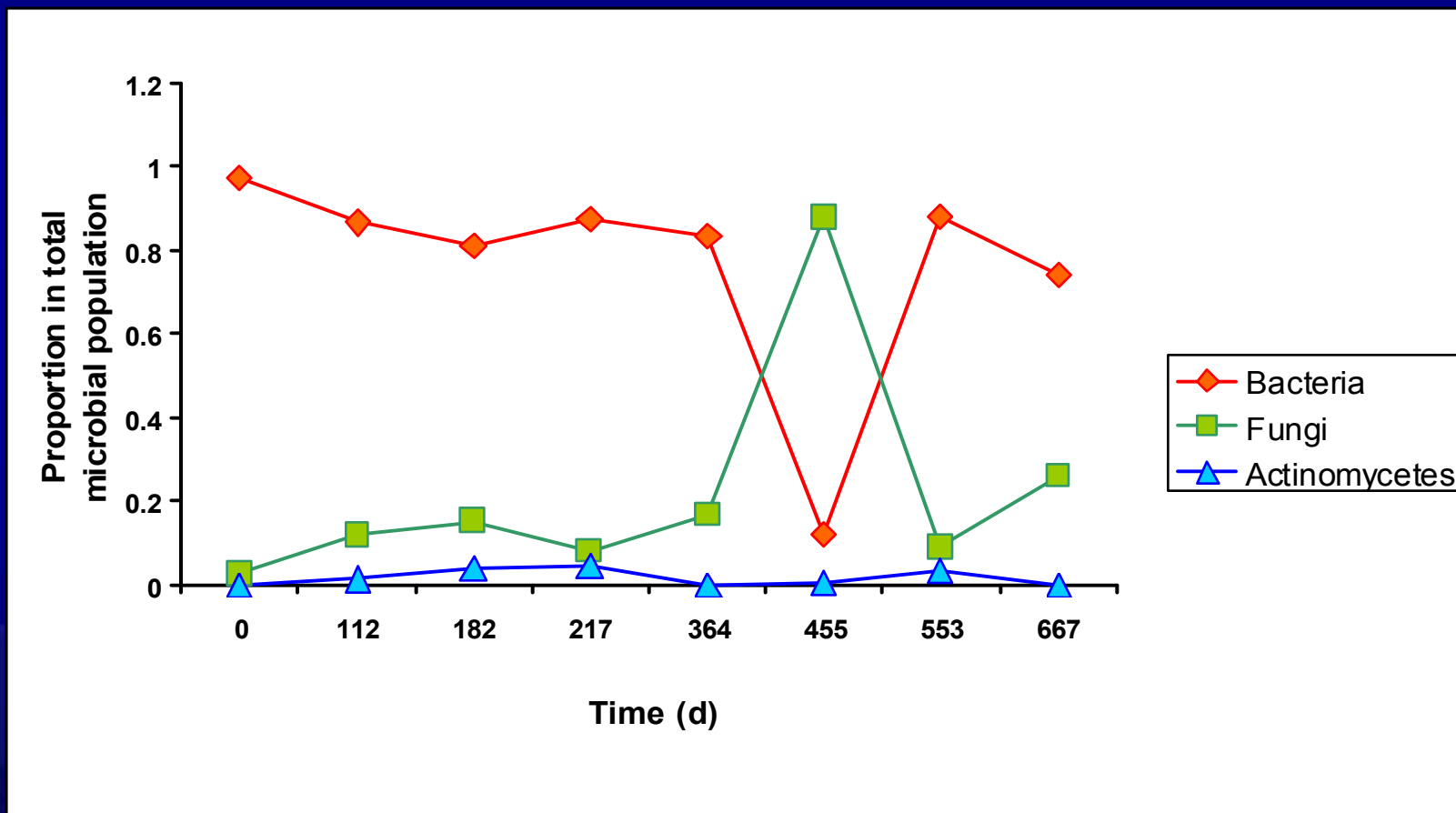
## RESULTS AND DISCUSSIONS

- In the initial studies to monitor the changes of the major microbial groups in Sessang revealed that the aerobic heterotrophic microbial group dominates.
- The bacterial population comprised more than 70% of the total.
- The composition remained until after about 200 days whereby drastic changes appeared in plots FSO, FCS and SC.

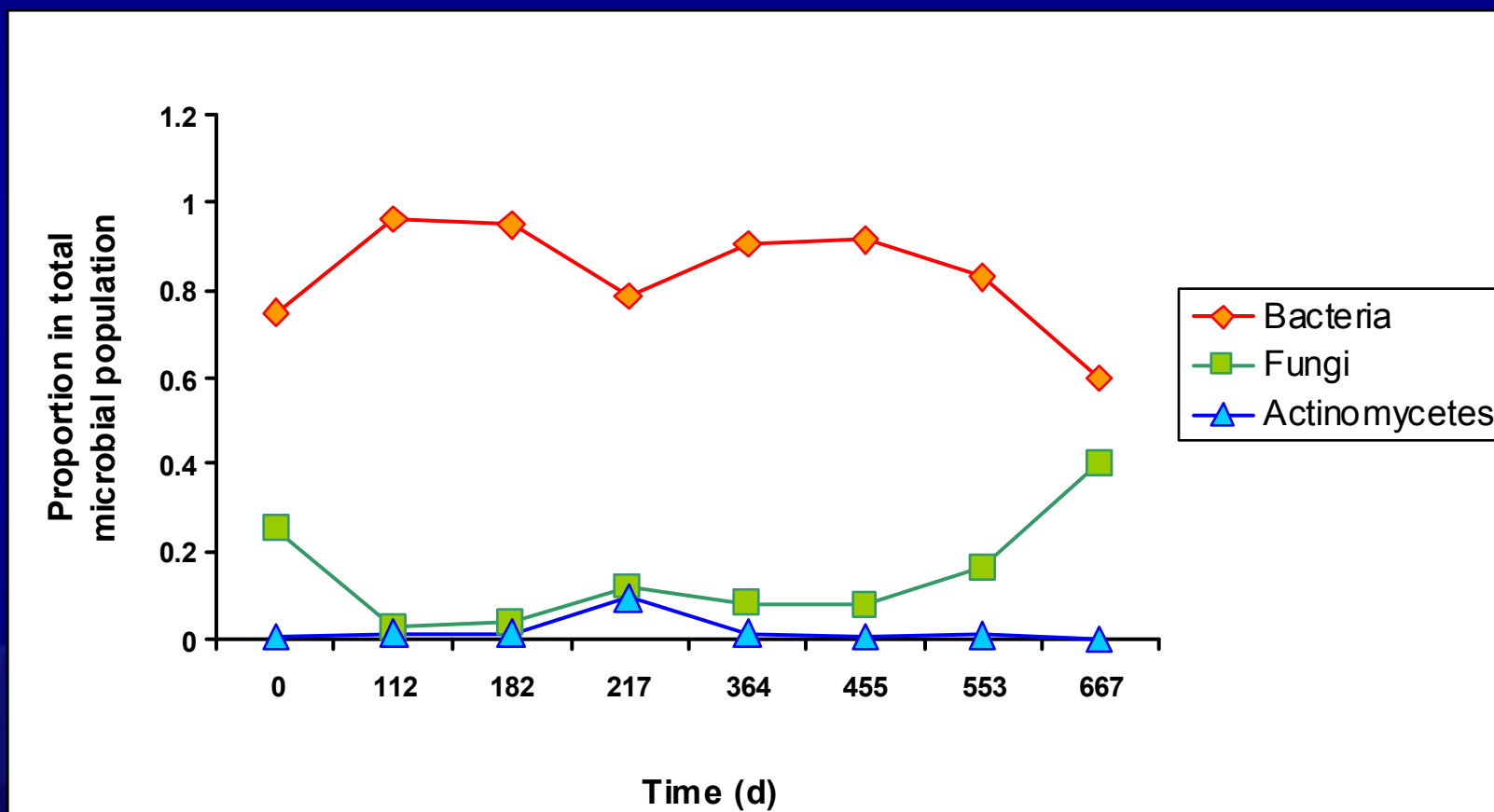
# Composition and changes in the bacteria, fungi and actinomycete population from felling and burning (FB)



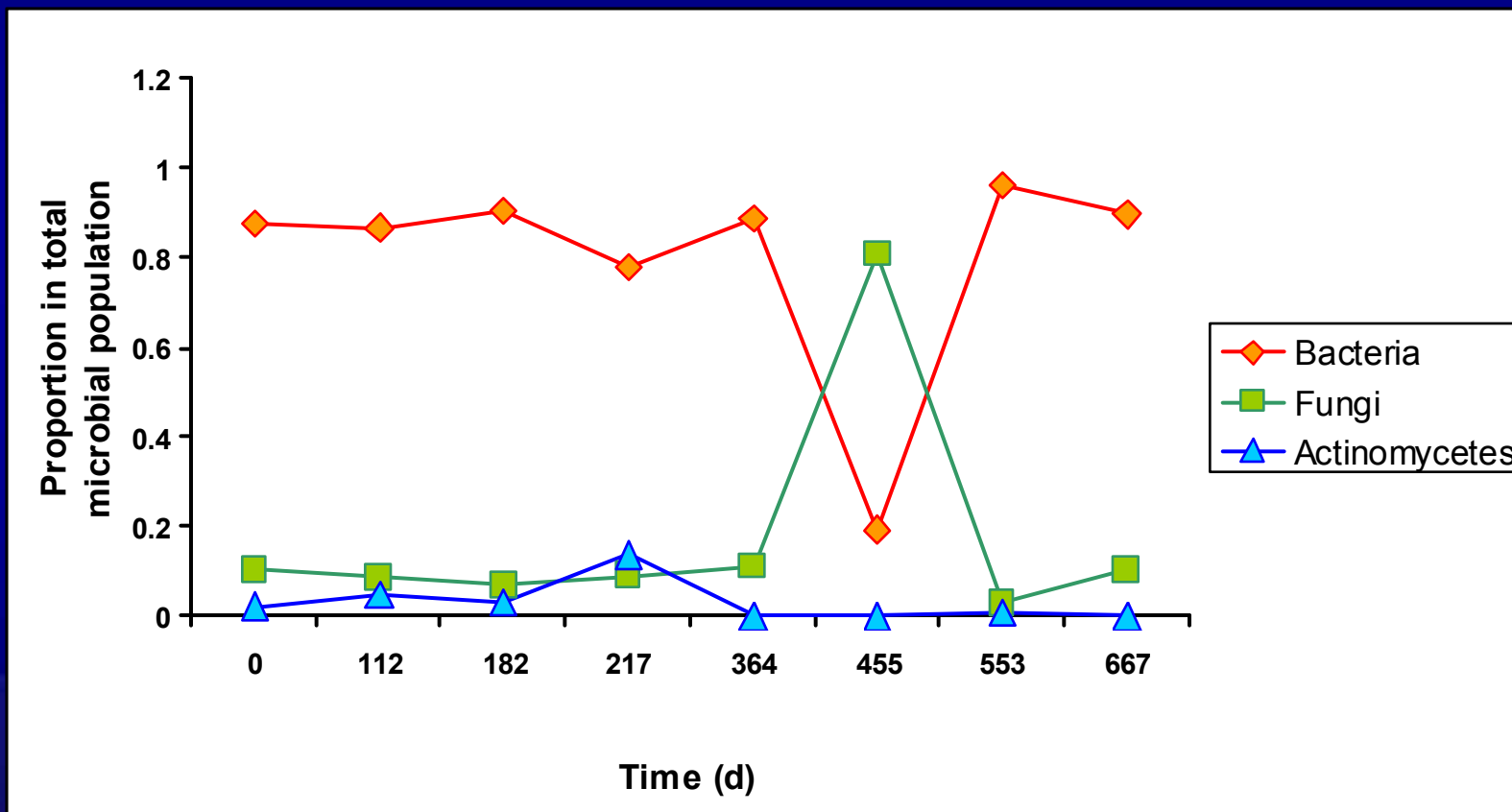
# Composition and changes in the bacteria, fungi and actinomycete population from felling and stacking - outside (FSO)



# Composition and changes in the bacteria, fungi and actinomycete population from felling, chipping and stacking (FCS)

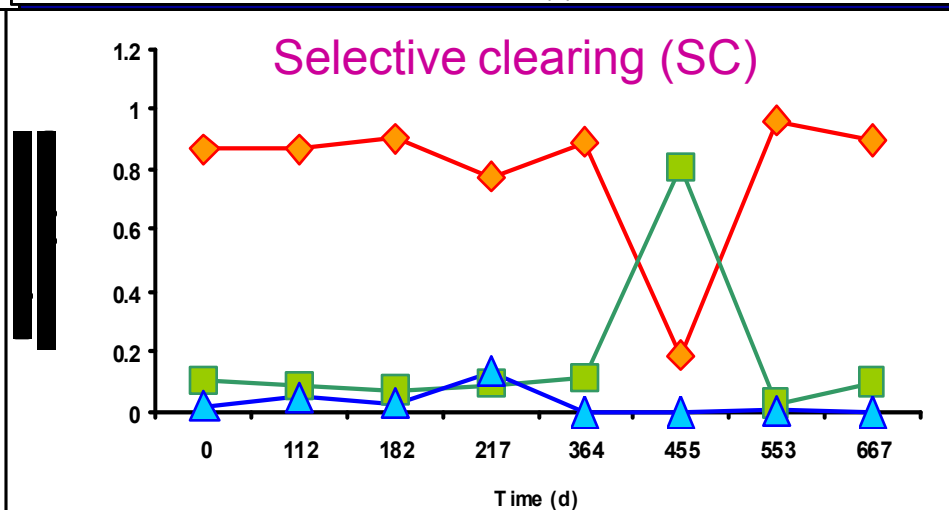
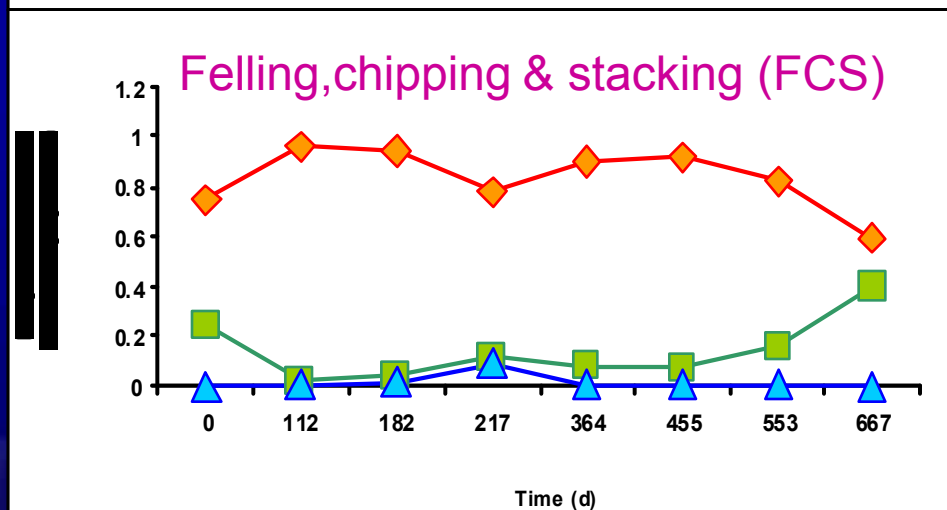
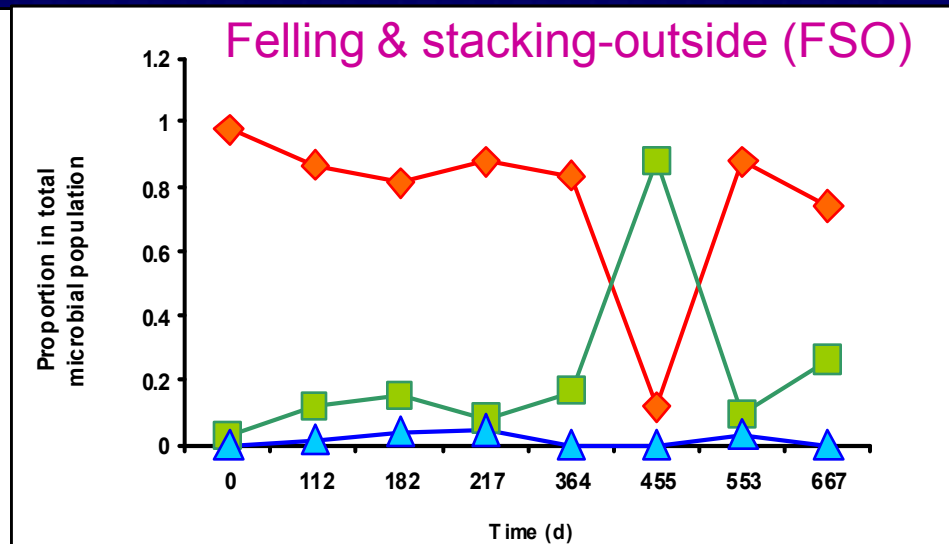
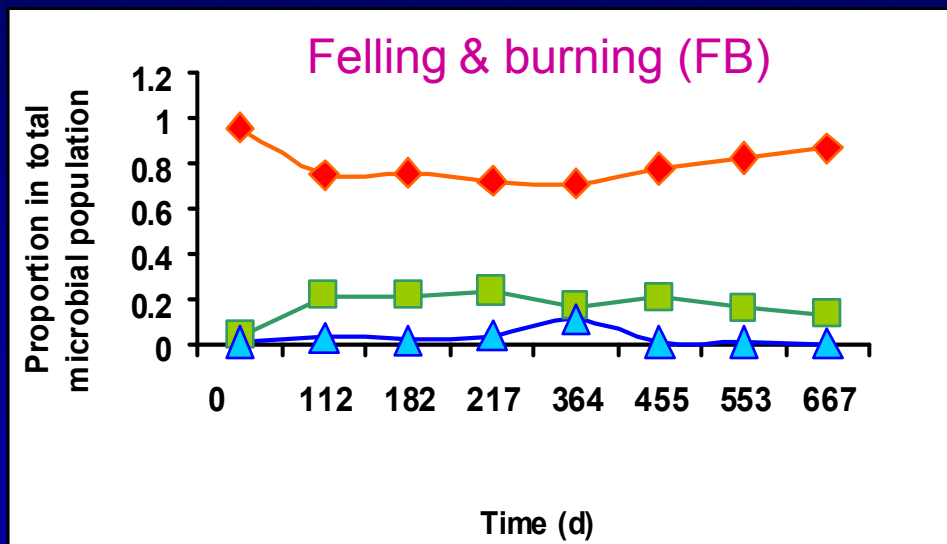


# Composition and changes in the bacteria, fungi and actinomycete population from selective clearing (SC)



✿ It was observed that when the fungal population increased, bacteria were affected negatively. The interaction was obvious only between these two microbial groups. Actinomycete whose numbers remained low throughout, responded very slightly to changes.

- ✿ Various land clearing techniques increased the availability of the virgin biomass as debris on soil.
- ✿ The presence of this biomass, affected the status and nature of the available microbial substrate.
- ✿ Where initially nutrients were available in balance for the various groups, the presence of debris disturbed the balance favoring the fungi. The growth of the bacteria was suppressed until latter when the food became available, which was released by the action of the fungi on the solid organic matter.



- The composition of the major microbial groups may indicate the degree of degradation of the peat soil.
- The effect of various felling & clearing techniques, already indicated these changes.

Further comparison involving areas of re-growth and cropping areas of Sessang and soils sampled from Jalan Kebun Station where the soil has been tilled for long periods. Table 1 indicates the proportion of bacteria to fungi and bacteria to actinomycete.

**Table 1: *The proportion of the major microbial groups in soils undergoing different degrees of cultivation***

Proportion	Sessang				Jalan Kebun
	Undisturbed	Re-growth	Papaya	Pine-apple	Vegetable
Bacteria:Fungi	46.65	52.66	12.54	34.77	17.60
Bacteria:Actinomyce	29.94	28.18	12.25	10.52	-*

- For the purpose of the assessment, the proportion of the undisturbed area is considered as the baseline data for comparison. In the area of re-growth, where no initial effort was made to cultivate the land thus allowing natural crops to flourish naturally, the proportion appears to stabilize to its original state.
- Under extensive crop cultivation (Jalan Kebun), actinomycete was not recovered (*Table 1*). The proportion of bacteria to fungi was found to be low and since actinomycete was not recovered, the proportion of bacteria to actinomycete was infinite.

- Information gathered in this study shows that agricultural activities impose a change trend in the composition of the major microbial groups.
- Although the isolation of the microorganisms has some limitations as it will not recover all, it is sufficient to say that the information can be used as one of the methods to be included in developing comprehensive tools for the management of peat soil for agricultural activities. It is indeed a method able to show physical evidence, through microbial growth, that changes have happened to the soil characteristics.



The status of microbial degradation and soil health may not be sufficiently indicated by the ratio of fungi and bacteria, as exemplified in this study

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## CONCLUSION

Peat under agriculture indeed changed the structure quite distinctively and the effects were profound under extensive soil cultivation. Overall, the effective population numbers decline and the proportion declined substantively; actinomycete was the major group worst affected. Several biological techniques have to be combined to allow the development of method to indicate change of peat soil under agriculture.



Thank You