2002 TAIWAN INTERNATIONAL SCIENCE FAIR

CATEGORY：Environmental Science

PROJECT TITLE：Improvement orchard Soil Ecology by Sustainable Cultivation

AWARD：First Award

SCHOOL：Chonnam Science High School

FINALISTS：Chu, In-Yeop

Jo, Seon-Mi

COUNTRY：South Korea

ABSTRACT

CATEGORY: Environmental Science
TITLE: Improvement orchard Soil Ecology by Sustainable Cultivation
NAME: In-yeop Chu, Seon-mi Jo
COUNTRY: KOREA

1. Purpose of the research

We observed frequent application of chemical pesticides and herbicides at the pear orchards near our school. Our concerning questions are the influences of agricultural chemicals on soil ecosystem which may be slowly deteriorating. There are many other orchards where the farmers are practicing environmentally-friendly agriculture using organic fertilizers such as composed manure instead of synthetic fertilizers. The purpose of this research is to examine chemical and microbiological quality of the orchard soil. We report biological control of pear disease using antagonistic microorganisms and suggest improvement of soil quality as a result of nature friendly agricultural practice.

2. Procedures and Data

Two orchards were selected: Conventional fertilizers and chemical pesticide application farm; Environmentally friendly farm using organic plant manure and biological control of disease. Several different aspects of soil micro-flora, indicator microorganisms, physiological characteristics of pear fruit, residues of synthetic chemicals in the soil, soil chemical properties were examined. We could observe that use of organic manure and biological control agents for disease control by indigenous microorganisms improved biological and chemical quality of the orchard soil. Results are summarized as follow:

A. Microbial diversity could be observed in organic farming orchard soil. Among 42 fungal genus, 7 species of *Penicillium* including *P. decumns*, 3 *Alternaria species, 4 Fusarium species including Fusarium graminearum,* 6 *Aspergillus species* including *Aspergillus niger* were identified. In case of bacteria, 59 samples were isolated and 17 genus including *Cystophaga johsonae* were identified.

B. Beneficial indigenous bacteria having several biological functions were isolated: *Enterobacter intermedium* produces organic acid therefore this bacterium can solubilize insoluble phosphate. Several *Pseudomonas* species were isolated. These bacteria produce iron chelating compound under iron limited environments and can control plant disease.

Interestingly, we could find indigenous biocontrol agent *Hypocrea vinosa* which can effectively control black star disease on pear surface.

C. We have formulated ten different microbial-pesticides using several combinations of indigenous microorganisms such as ***Hypocrea vinosa, Trichoderma atroviride, Rhizopus microsporus etc.*** These microbial-pesticides could inhibit 100 % of black star disease on pear surface which showed similar inhibition effect as commercial pesticides indicate that these microbial-pesticides may replace synthetic chemicals in the near future.

3.Conclusions

Our research demonstrates the eco-friendly organic farming system could improve soil eco-system of pear orchard, where no synthetic fertilizers and pesticides are applied. As a result of manure application, the soil chemical properties are more stable and microbiological flora was more diverse. Use of microbial and bio-pesticide resulted in strong inhibition of black-star disease incidence on pear surface. We suggest that eco-friendly farming systems are needed to diminish environmental pollution in soil and water caused by frequent and abundant use of agricultural chemicals.

評　　語

本研究針對作者校園周圍之梨園，探討是否可將傳統化學肥料與農藥，改爲對環境有善的生態肥料與農藥與培育方式。探討內容包含氣候環境之影響，傳統方式對土壤生態系統之影響，以及利用生態方法對土壤生態系統之改善。經一系列有系統及嚴謹之科學試驗，證明 eco-friendly organic farming system 確實可以改善梨園生態系統，在不添加合成肥料及農藥之情況下，仍可利用 bio-pesticode 控制 black-star disease，爲相當優秀之環境科學作品。