SHORT DESCRIPTION OF THE PROJECT

"Study on the potential use of vetiver grass (*Chrysopogon zizianioides L*) in mitigating soil contaminated by toxic chemicals and dioxins – A case study at Bien Hoa airbase"

1. Introduction

The project was established and conducted by VIGMR since 2013 to study the potential of using vetiver grass in the reduction and mitigation of inorganic heavy metal (Arsenic), persistent organic pollutants, (2,4-D and 2,4,5-T), and especially the highly toxic dioxins in areas with medium and low level of contamination.

This project is sponsored by MONRE and is expected to be completed in November 2016.

In order to obtain this objective, Bien Hoa airbase, Dong Nai Province was selected to carry out an *in situ* experiment, as this airbase stored or handled large quantities of Agent Orange herbicide during the Vietnam War (Cecil, 1986). Bien Hoa airbase is one of hotspots of dioxin contamination in Vietnam now. Previous investigation show that TEQ concentration of dioxin in this airbase ranges from low to medium and very high. The experimental area was 300 m^2 and was divided in three plots of 100 m^2 each, in which Vetiver grass (*Chrysopogon zizanioides L.)* (cv Monto) was planted on November 2014 in two plots (G1, G2) with the initial dioxin concentration in the soil of about 1000–1800 ppt TEQ; the third one was not planted with vetiver grass and used as Control to compare with other plots. As the soil of these plots was highly eroded and extremely poor agronomically, a soil supplement DECOM1, was added to the first plot (G1) to promote growth of indigenous microorganisms in the rhizosphere, and the second plot (G2) was planted with vetiver grass but without the soil supplement. The growth rate of vetiver and the levels of toxic chemicals and dioxins in the soil, roots and shoots were compared, as was soil samples from areas with and without Vetiver grass (Control plot).

The Project was completed after 18 months (on May, 2016) and samples were processed and analyzed in the laboratories of Center for Environment Monitoring, Vietnam-Russia Tropical Center and Vietnam Institute of Biotechnology to determine the levels of dioxins, 2,4-D and 2,4,5-T. In addition, Arsenic concentrations, soil physio-mechanical characteristics including pH, Eh, EC, soil texture, permeability, moisture,

total organic matter, and microorganism (total microorganism and microbial diversity in root: extract DNA for PCR-DGGE analysis) were also analyzed.

Results showed that Vetiver grass can grow well on poor quality and moderately toxic chemicals and dioxins-contaminated soil, and this grass, especially when combined with soil supplement DECOM1, has the capability of remediating soils contaminated with dioxins. However, within the framework of the project, we could not investigate the ability of Vetiver in converting dioxins from highly toxic forms to the low/nontoxic forms. As this investigation is very important, it is necessary to be carried out in the future.

2. Some main findings

- Vetiver grass can grow well in highly adverse conditions such as poor quality soil and soil moderately contaminated by other toxic chemicals and dioxins.
- Dioxins and arsenic can be absorbed by vetiver grass. The analytical results showed that vetiver roots and shoots have different dioxin and arsenic concentrations and these concentrations in soil tended to decrease by each sampling times.
- Soil supplement, DECOM1, promotes the growth of indigenous microorganisms in the rhizosphere that plays a vital role in increasing the capability of vetiver in reducing dioxins and arsenic contamination. Analytical results of vetiver roots taken in G1 indicated that dioxins concentration was much lower than that in G2. However, the result also showed that the dioxin levels in soil of G1 decreased faster than in other groups (G2 and G3).
- There is a translocation of dioxins from soil to vetiver roots and to shoots. It was shown that the dioxin concentration in vetiver roots and shoots were much higher in G2 than those in G1 and decreased sharply over the experimental period, especially in G2 (roots: from 972 to 652 pg/g wet weight; shoots: from 228 to 6.3 pg/g wet weight).

3. Expected outputs

- The planting of vetiver in poor quality and moderately contaminated by toxic chemicals and dioxins soil will be published and can become a useful reference for scientists in the field.

- The method of toxic chemicals and dioxins remediation using vetiver will also be published and can be used as one of effective technologies in remediating soils contaminated by toxic chemicals and dioxins.
- Vetiver can be widely applied in treating the contaminated environment in Vietnam, especially dioxin contamination and heavy metals. The results of this project will be used as the scientific basis of treatment of these contaminations.