# 持続可能型農地基盤を目的とした斜面侵食量予測に関する研究

Soil erosion from sloped areas and its prediction for further use of agricultural conservative tool

○　金　玟永・李　尚奉　・全　鐘吉・廉　成顯・　金　玟暻

Kim Minyoung・ Lee Sangbong ・Jeon Jonggil・Yum Sunghyun・Kim Minkyeong

## I. Introduction

The field study of soil erosion and soil-conservation alternative was carried out in this study. Soil enhancer, Polyacrylamide (PAM), was applied on the bare surface of soil bed (lysimeter) and the amount of soil eroded from a lysimeter was monitored over time to assess its function of reducing soil erosion and improving soil structure. For sustainable agriculture, research on soil erosion and soil conservation is assisted by the use of a variety of models, which differ in their context, purpose, and degree of detail. Along with field study, the empirical model, Universal Soil Loss Equation (USLE), was implemented in this study to serve to estimate annual soil loss. The purpose of this study includes: 1) to investigate the impact of climate change on soil erosion, and 2) to evaluate soil-conservation alternative with aid of lysimeters under natural conditions.

## II. Materials and Methods

1. Description of study field and collection of experimental data

A total of 12 lysimeters were used in this study to assess the effect of PAM to prevent soil erosion and provide useful datasets for simulation. The dimension of each lysimeter was 5 m long and 2 m wide, and the slope angles were fixed at 10, 20 and 30% in grades per three lysimters. The type of soil, sandy loam, was filled up in lysimeters and their surfaces remained bare. After land leveling, soil enhancer, Polyacrylamide (PAM), was applied to evaluate its function to reduce soil erosion from sloped areas. Each lysimeter was treated with three different doses of PAM (0, 20 and 40 kg/ha).


Fig. 1 Full view of experimental lysimeters (left) and PAM powder (right)

The experimental investigation was carried out from May through October in 2009 (Experimental station, Rural Development Administration, Suwon, South Korea). Meteorological data was recorded throughout the experimental period from the weather station. All necessary data for simulation were collected, for examples, plot dimension, soil properties, amount of soil eroded and accumulated in the sedimentation basins, and so on.

2. Estimation of soil eroded from the sloped areas

The USLE is the most widely used empirical erosion model as a function of the rainfall and runoff erosivity, and the soil erodibility. Then this value is modified with the factors of topography, cover management and the support practices. In order to calculate the input values, a field survey was carried out and soil samples were collected to analyze soil physical and chemical properties, soil moisture content, bulk density, organic matter and so on.

## III. Results and Discussion

1. Runoff and sediment transport under natural rainfall

The sediment transported by natural rainfall was collected from May to October in 2009. Total rainfall during this period amounted to 910 mm. Three different doses of PAM were applied to the sloped areas, which are 0, 20 and 40 kg/ha. In the worst case, 15% reduction of soil loss (30% slope lysimeter treated with 20 kg/ha PAM) and 40% reduction of soil loss (30% slope lysimeter treated with 40 kg/ha PAM), respectively. In the moderate condition (20% slope), 10% and 40% reduction of soil erosion were monitored. In the lowest slope of lysimeters (10% slope), 70 and 82% reduction of soil erosion were monitored. This implies that the amount of soil eroded decreased as the dose of PAM treatment increases. In contrary, the amount of soil erosion is linearly correlated with the grade of lysimeters (Figure 2).

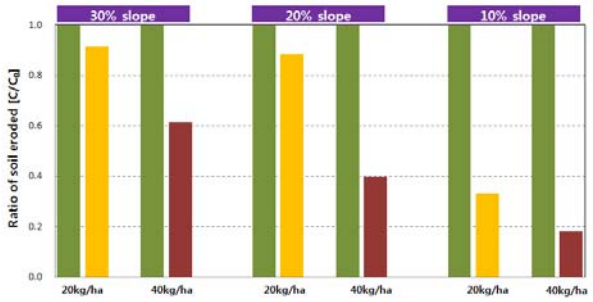


Fig. 2 Amount of soil eroded from each experimental plots depending upon PAM treatment

2. Prediction of annual soil loss from sloped areas

Overall comparison between measured and predicted soil erosion is shown in Figure 3. The predicted values were pretty consistent with the measured values ($R^2$ = 0.98), which implies that an empirical equation, USLE, functioned well to predict the annual soil loss from agricultural areas even though it may have some limitations to describe the physical properties of soil particles and runoff

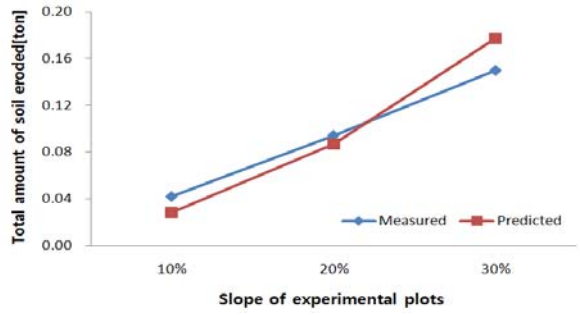


Fig. 3 Comparison of measured and predicted soil erosion from experimental plots

## IV. Conclusions

Soil erosion becomes a severe problem in Korea which stems from a combination of environmental impacts and crop productivity loss, which makes the understanding of the erosion process important to guarantee sustainable agriculture, soil conservation and environmental safety.

The implementation of soil enhancer, PAM, was investigated in this study using lysimeters with various slopes. Along with a series of field studies, the amount of annual soil loss was estimated using USLE. A fairly good relationship between measured and predicted values was achieved, which implies that USLE could be further used for establishing the strategies against soil erosion under various weather conditions. Future study regarding the erosion simulation will deal with a prediction of changes in future soil management under climate change.