# Effect of On-field Sediment Traps on Sediment Control from a Sloping Upland Culture

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***Abstract.*** Three small sediment traps were tested with respect to sediment removal rate from a sloping potato field in the alpine belt of Korea in 2002. The sediment traps functioned well and the sediment removal efficiency exceeded 98%. Judiciary systems for farmers to build and maintain drainage channel system and for local government to set the maximum tolerable soil loss limit were suggested as the priority to control muddy runoff laden with sediment and NPS pollutants from sloping fields.

## Introduction

The mountain region higher than 600 m above the mean sea level is called as alpine belt and the region between 400 and 600 m as semi-alpine belt in Korea. The slope of upland along the alpine range is generally steep, the soil is mostly weathered granite of which apparent density is between 1.05-1.15 g/cm$^3$ and adhesion is very weak, and the top soil is completely disturbed annually by conventional tillage and bed preparation when the crops are seeded or transplanted. Rainfall in this region is generally intensive during the summer rainy season of June to September. Topographical, geological, agricultural management and rainfall conditions happen to be harmonized to accelerate upland soil erosion and dump a huge amount of muddy runoff laden with sediment and NPS pollutants into the upper reaches of the Han river every year causing a serious water quality degradation. The objective of this research was to investigate the applicability of on-field sediment traps to reduce sediment discharge from sloping uplands in the alpine and semi-alpine belts in Korea.

## Methods

Three small sediment traps were installed in a sloping upland (about 15,000 m$^2$) in the alpine belt of about 800 m in altitude. The soil of the land composed of sand and sandy loam and the slope was between 5 to 13%. Potato and radish were rotated every other year for many years and potato was cultivated during this research. Potato was planted April 20 and harvested September 20, 2002. Ridge and furrow preparation after a conventional tillage was made for potato planting. Table 1 shows the sediment strap, area, tillage mark, soil and crop. The bottom of a sediment trap was covered with a geo-textile to prevent from mixing eroded sediment with native soil. Daily runoff from each sediment trap was measured by a partial flume flow meter and recorded by a data logger. The total rainfall during the

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experiment was 1,371 mm and 69.5% of it was occurred July and August. Daily rainfall of 10 mm or greater occurred 30 times. Among the 30 rainfall events, only 5 rainfall events produced runoff and sediment.

Table 1. Sediment trap, tillage and land use.

| Sediment trap | Size ($m^3$) | Watershed($m^2$) | Tillage | Soil | Crop |
|---|---|---|---|---|---|
| 1 | 4.0 | 1,878.0 | Contour | Sand | Potato |
| 2 | 1.5 | 736.4 | UP-and-down | Sand | Potato |
| 3 | 0.5 | 209.9 | UP-and-down | Sandy loam | Potato |

## Results and Discussion

It was shown that runoff and sediment discharge from the field did not have direct relationship with daily rainfall but rather influenced by both rainfall amount and intensity. Runoff and sediment were observed only when rainfall intensity exceeded the infiltration rate of the soil. Also, it was observed that runoff and sediment discharge increased where subsurface flow emerged to the soil surface at the middle and low parts of the field. Sediment removal rate of the sediment traps was estimated with measured runoff and sediment data (Table 2). Total sediment was computed by adding sediment deposited in the traps and sediment discharged from the traps as suspended solids with runoff. The small sediment traps built in the lower part of a field could remove more than 98% of total sediment occurred in the potato field. Many factors related to soil loss were assessed and best management practices were suggested to reduce sediment and other NPS pollutants from the alpine belts.

Table 2. Sediment removal rate from Sediment traps 1 and 2.

| Sediment Trap | Date | Sediment deposited (kg) | Sediment discharged (kg) | Total sediment (kg) | Sediment removal rate (%) |
|---|---|---|---|---|---|
| 1 | ’02-08-31 | 840.0 | 5.0 | 845.0 | 99.4 |
| 2 | ’02-08-07 | 1,250.0 | 15.0 | 1,265.0 | 98.8 |
| 2 | ’02-08-31 | 930.0 | 5.0 | 935.0 | 99.5 |

## Conclusion

Three small sediment traps were built on a sloping potato field in the alpine belt in Korea. Highly permeable sandy soil produced 5 runoff and sediment throughout this research from January to December, 2002. The sediment traps functioned well and the sediment removal efficiency of the traps exceeded 98%. Priority to control sediment and other NPS pollutants was suggested to build drainage channel system and to set the maximum tolerable soil loss from a field after investigating many factors related to soil loss. It also was suggested that agricultural best management practices and other measures to reduce muddy runoff could be effectively carried out if the two systems are established.