

## Vegetation pellets development and feasibility evaluation for unmanned-aerial-vehicle seeding on post-landslide sites

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Frequent disturbances of typhoons, earthquakes and heavy rains have resulted in many landslides scattering over steep terrains and remote areas of Taiwan. As a result, the general engineering methods may not work well.

In the past, helicopters were used for aerial hydroseeding on such landslides. However, the remediation method with helicopters is complicated. This method takes a lot of manpower and materials. Additionally, the remediation timing is often missed because its preparation is time-consuming.

In recent years, the relevant research and technology of unmanned aerial vehicles (UAVs) are approaching maturity. Compare to helicopters, UAVs have the advantages of mobility and instantaneity. UAVs has many potentials to deliver vegetating materials to landslides.

Traditionally, vegetating materials (liquid or dry powder types) are sprayed to landslide sites through compressors. However, the load of UAVs is limited. They can't carry too much liquid or compressors. In other words, traditional vegetating materials won't work for UAV methods.

This study was to develop several types of agglomerates by mixing vegetating materials. The agglomerates look like a pellet, so it is called "vegetation pellet". To make sure which pellets can be applied to what environmental conditions, the water characteristics, pH value, nutrient content and seed germination rate of pellets with different ingredients were analyzed. In the field experiment, seed germination of pellets was monitored after pellets were applied to three different landslide sites.

Results showed that seed germination of pellets is directly related to the level of environmental moisture. If pellets were applied to landslides where rainfall and soil moisture were high, seed germination rates of pellets could reach 80% within three weeks. There were 1~3 germinating woody plants per square meter. Although germination rates of pellets applied during the dry season were nearly nill, seeds in pellets could germinate vigorously after the first wave of rainfall.

Although this study is still in the initial phase of the pellet development, the preliminary experiments showed that using UAVs to deliver vegetation pellets has considerable potentials for landslide remediation. Further studies can vary the fraction of ingredients and the size of pellets to maximize remediation effects.

Keywords: Aerial hydroseeding, engineering, remediation, UAV, vegetating material

