

Correlations between soil properties and plant growth for special synthetic soils added with five components used in high-and-cut rock slopes

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Introduction It is well known that the outside soil spray seeding (OSSS) is most effective among the various techniques used for re-vegetation of bare rock slopes because of its high mechanization, high efficiency and fast restoration (Albaladejo-Montoro, 2000). However, the study by Esther (2004) showed that though OSSS behaved well on the low and gentle rock slopes whose gradients are less than 45°, it was not effective on high-and-cut rock slopes. Previous studies on OSSS were mainly focused on the improvement of engineering techniques (Fowler and Maddox, 1974; Carr and Ballard, 1980). However, the physico-chemical and biological properties of the soils after adding different components used for OSSS remain less known. Therefore, we designed a few synthetic soils with five variables by using an orthogonal array method to study the properties of the special synthetic compound soils.

Materials and methods Twenty-five treatments were assigned to tray-planted (40 cm×30 cm×15 cm) experiments by using an orthogonal array design OAD₂₅(5⁵) matrix with five levels for each factor and five replicates for each treatment. Italian ryegrass was selected as the tray-planted species to assess the status of plant growth. Soil samples for each treatment were collected by using soil core rings (30 mm in diameter and 50 mm in length). In the experiment, plant biomass, soil pH, organic carbon, total nitrogen and phosphorus and soil invertase activities were used as response functions, respectively. Plant biomass was dried at 65°C to constant weight and expressed on a weight basis. Above ground biomass was measured with the clipping method at plant maturity and below ground biomass was measured with the washing method. PH was measured by Glass calomel Electrode (Smith and Doran, 1996). Organic carbon was measured by the methods of Mebius (1960). Total nitrogen and phosphorus were determined by the methods of Bremner and Mulvaney (1982). Enzyme activities were analyzed using the method of Schinner and Mersi (1990). The Pearson's correlation coefficient was used to quantify the strength of relationships existing among all the indices.

Results The *r*-matrix showed that most indices exhibited high and significant relationships between plant growth, soil physico-chemical and biological properties at all concentrations of the five application factors. The plant biomass showed highly significant and positive correlations with invertase as well as negative correlations with soil pH, total nitrogen, and total phosphorous. These results indicated that the high pH and the too much soil available fertilizers have hurt plant growth. Considering the correlations between soil physico-chemical and biological properties, soil pH was negatively and significantly correlated to invertase activity, whereas organic carbon was positively and significantly correlated with invertase activity, which suggested that the effects of soil physico-chemical properties on soil enzyme activities were significant.

Discussion From the results, we can see that the addition of five amendments significantly affected plant growth and soil physico-chemical and biological properties.

References

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