Influence of plant roots on the shear strength and hardness in loess soils

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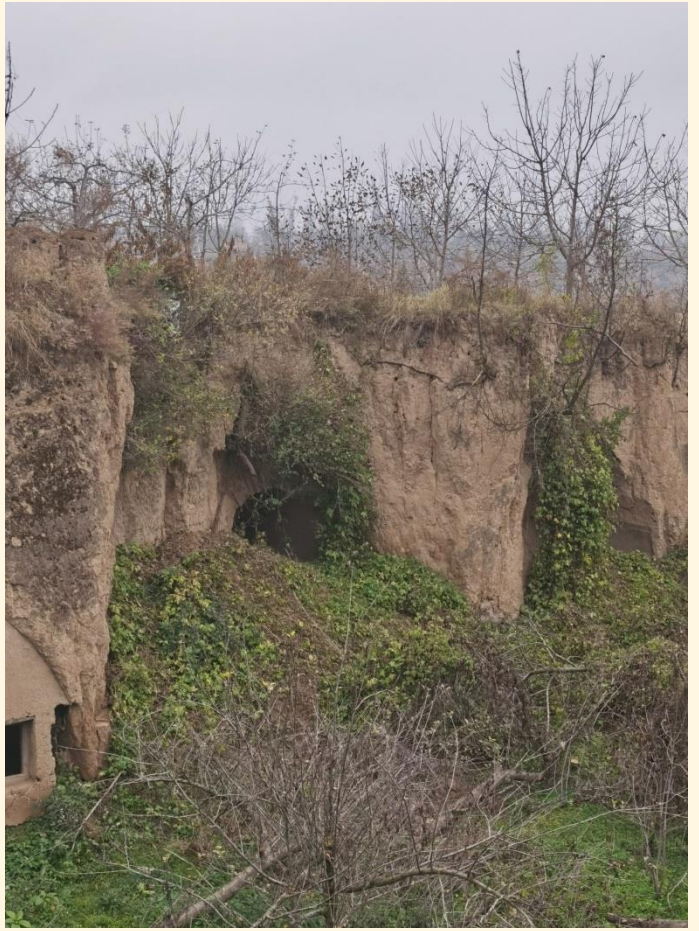
Contents

INTRODUCTION

- In the arid and semi-arid climate of the Loess Plateau region, severe long-term erosion has resulted in its hilly, gully eroded landscape.

- The ecological environment of the Loess Plateau Gully is fragile and soil erosion is dominated by hydraulic and gravity erosion.

The incidence of erosion in areas with well-developed vegetation is relatively low and there is no substitute for the role of vegetation in soil erosion control.



INTRODUCTION

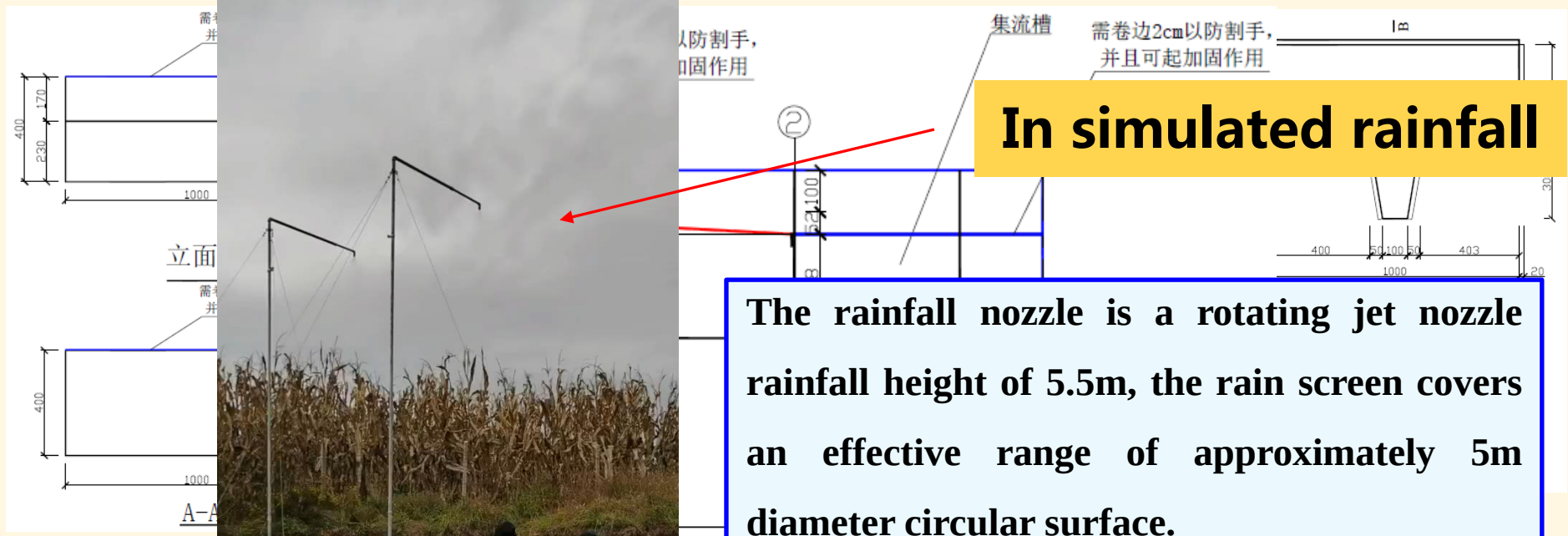
- The presence of plant roots in the soil increases the cohesion of the soil and thus the shear strength of the soil.
- Studies have shown that the root systems of different vegetation types have different abilities to enhance soil erosion resistance, with trees having a significantly stronger effect on soil erosion resistance than shrubs, and herbs being the weakest

On the basis of the analysis of different working conditions, the effect of the root system of Yaoshuo Pine and Ziziacia on the shear strength and hardness of the soil is evaluated to reveal the mechanism of their soil and water conservation effects.

RESEARCH METHODS

Test set-ups

Test Rainfall devices



In simulated rainfall

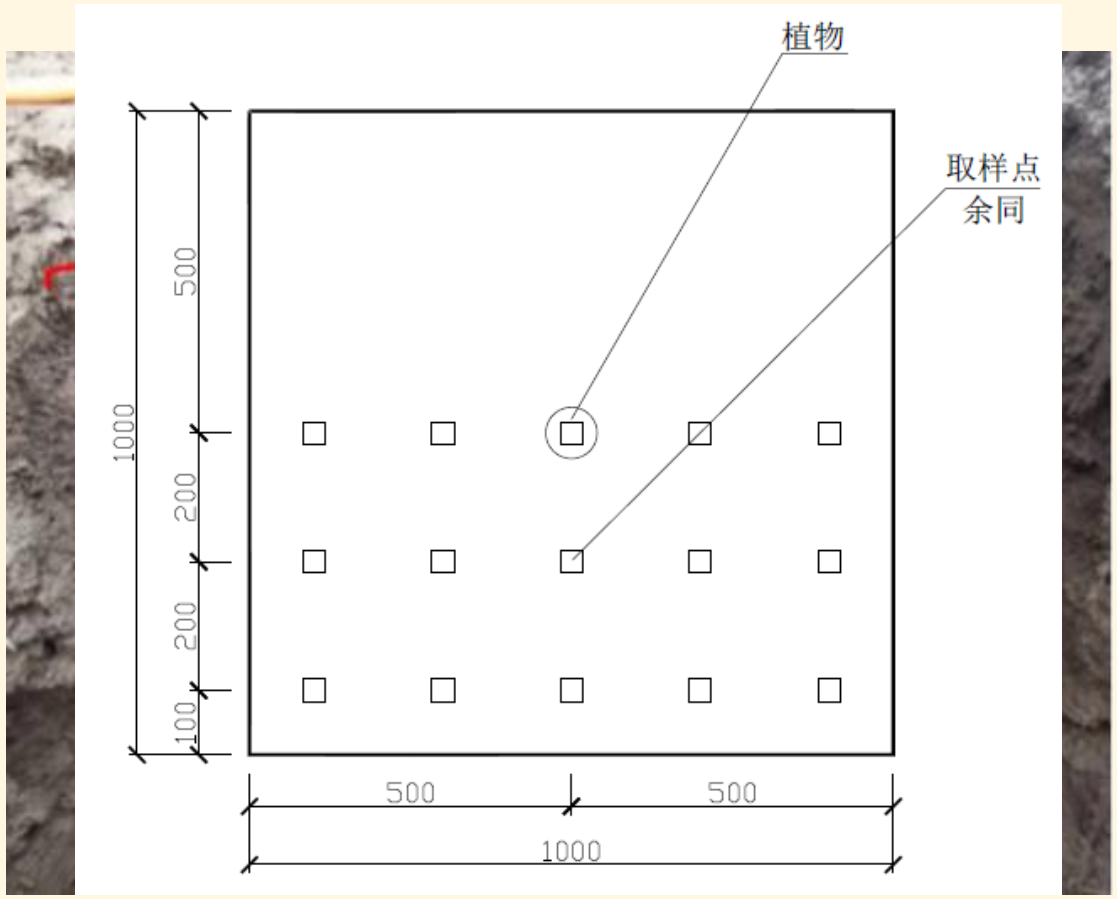
The rainfall nozzle is a rotating jet nozzle rainfall height of 5.5m, the rain screen covers an effective range of approximately 5m diameter circular surface.

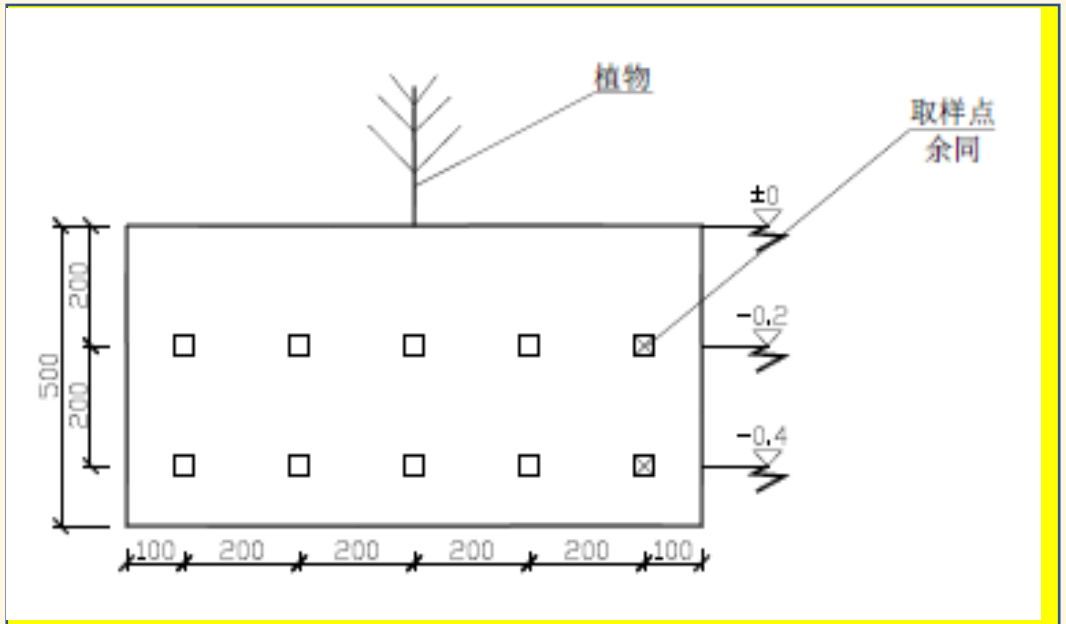
Micro-te **design**

Map of **ombination with the catch basin**

RESEARCH METHODS

Test Method

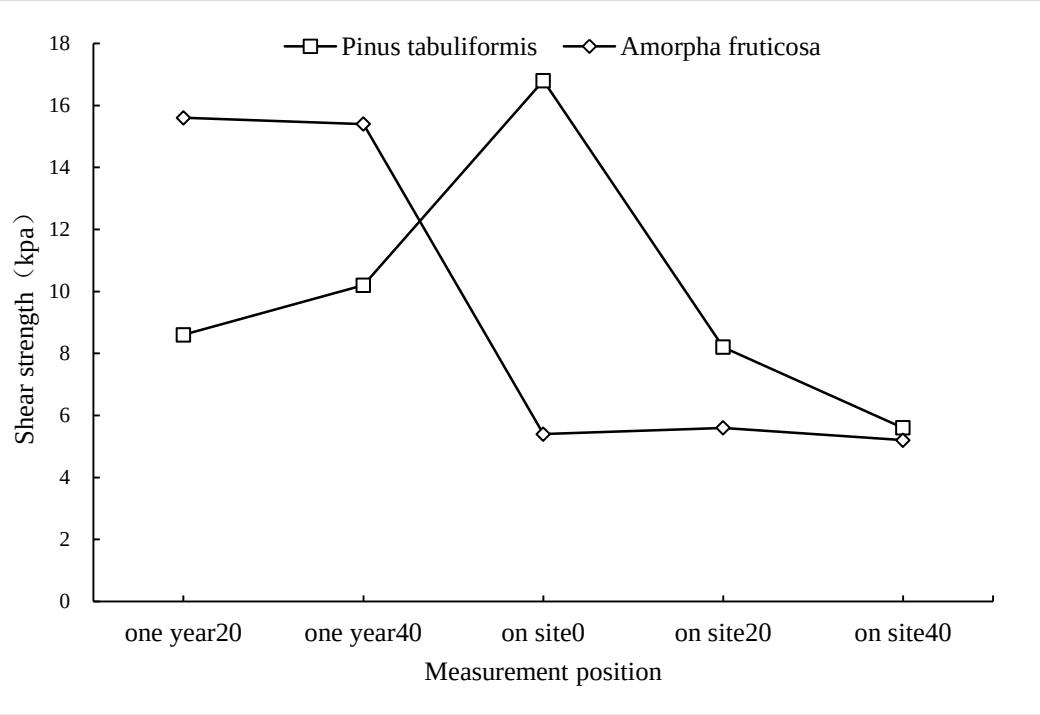


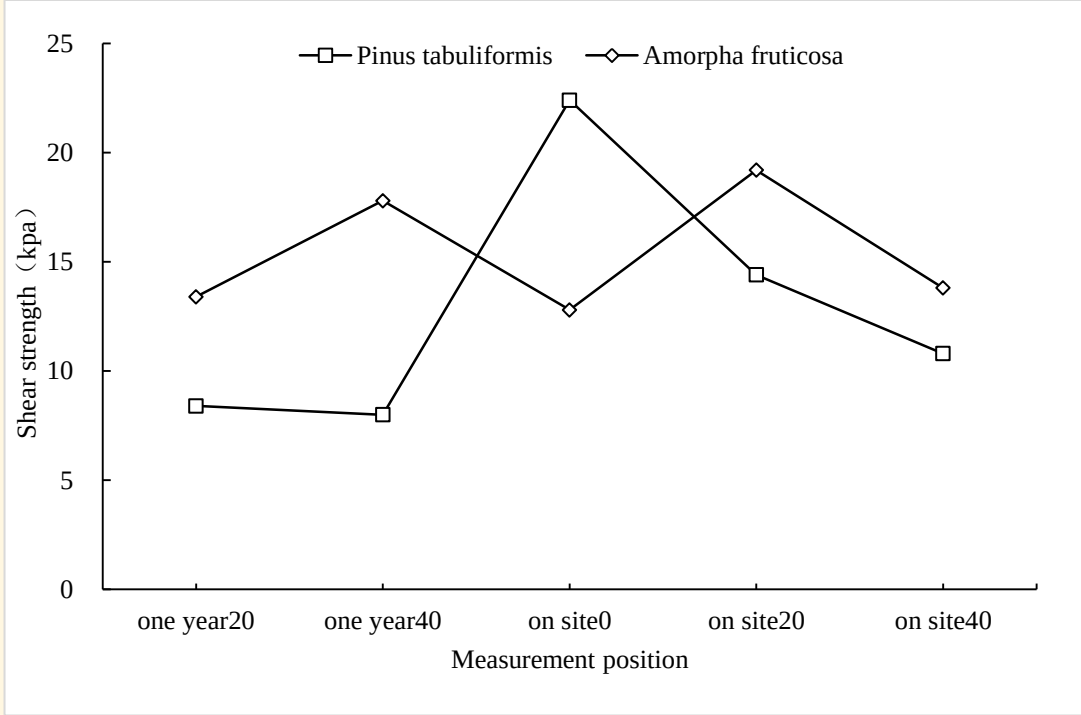


from the left side of the test plot in the vertical direction.

Sampling site design

1. Influence of Pinus tabuliformis and Amorpha fruticose on soil shear strength



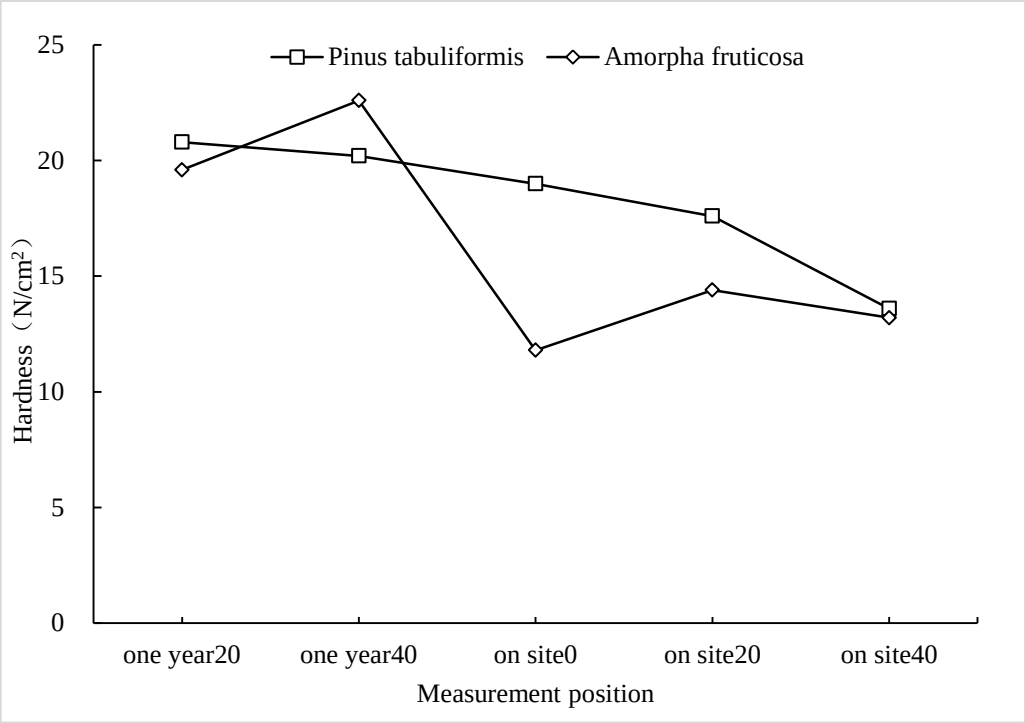


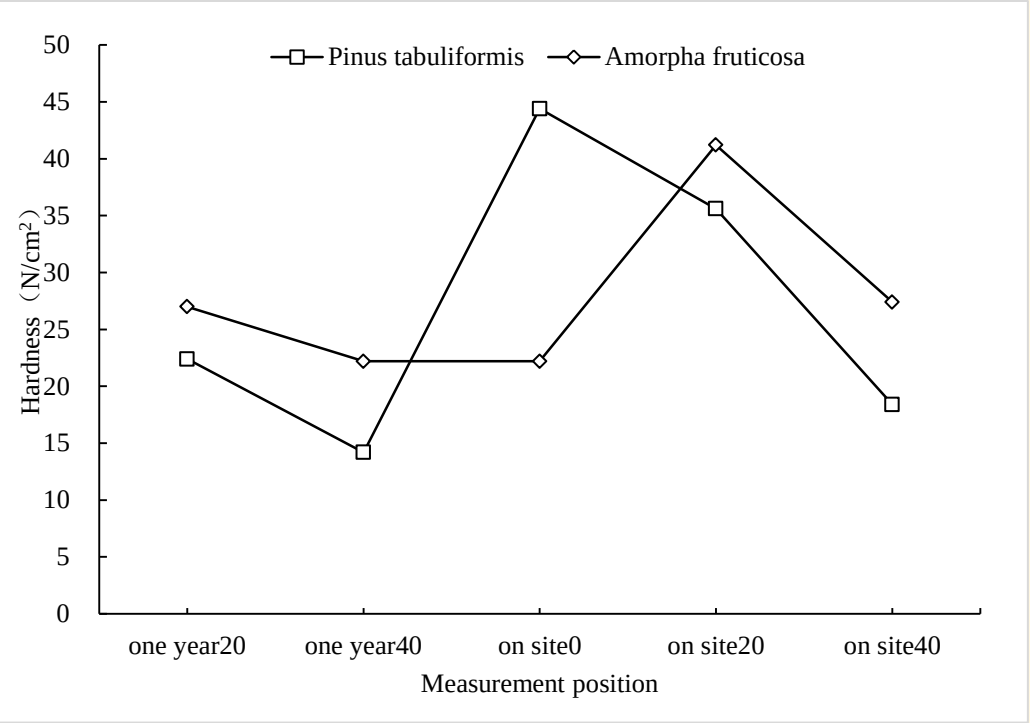
At a soil depth of 20 cm, the reinforcing soil effect of transplanted one-year Amorpha fruticose roots was more significant than that of transplanted one-year Pinus tabuliformis, while the opposite was true for in situ transplants.

At a soil depth of 40 cm, the soil consolidation effect of transplanted one-year Amorpha fruticose roots was more significant than that of transplanted one-year Pinus tabuliformis, while the soil consolidation ability of field transplanted vegetation Amorpha fruticose was stronger than that of Pinus tabuliformis.

RESULTS AND DISCUSSION

2. Influence of Pinus tabuliformis and Amorpha fruticose on soil hardness

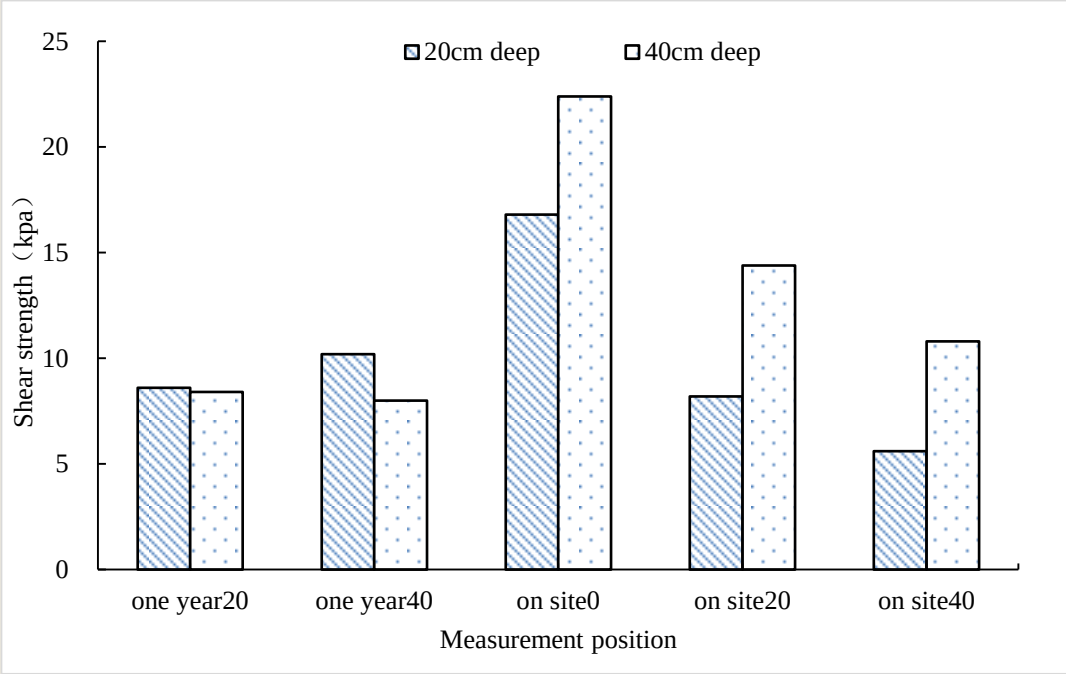




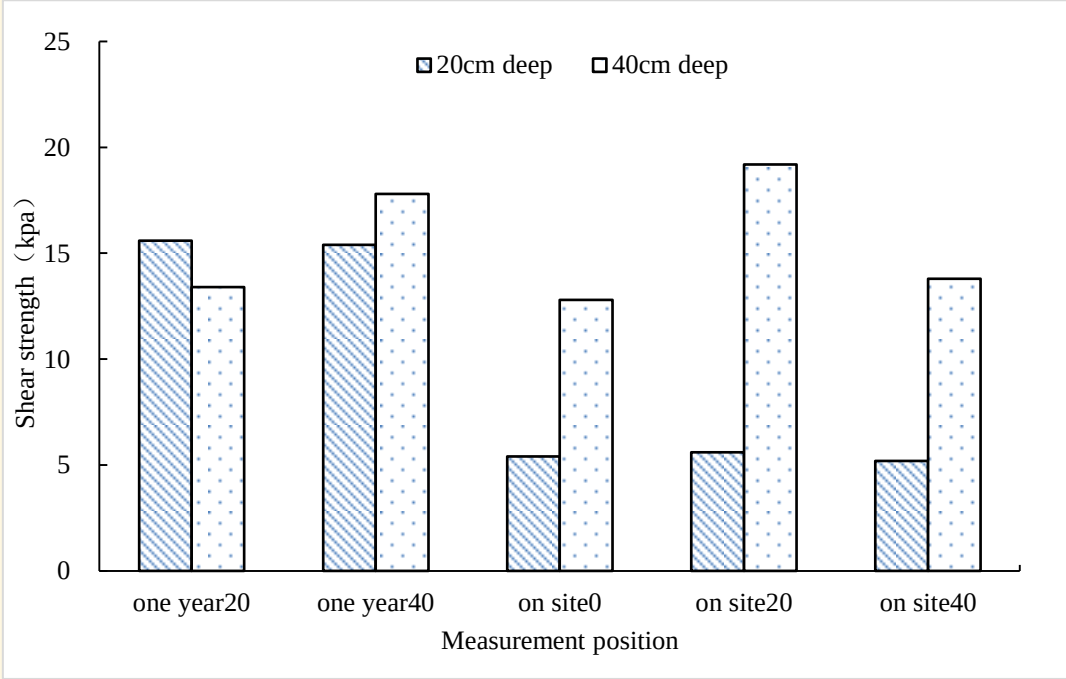
At a soil depth of 20 cm, the effect of Pinus tabuliformis on soil erosion resistance was higher than that of Amorpha fruticose at most locations.

At a soil depth of 40 cm, the erosion resistance of the roots of the Amorpha fruticose was significantly higher than that of the Pinus tabuliformis at most locations.

3. Influence of different depths of Pinus tabuliformis and Amorpha fruticose on soil shear strength



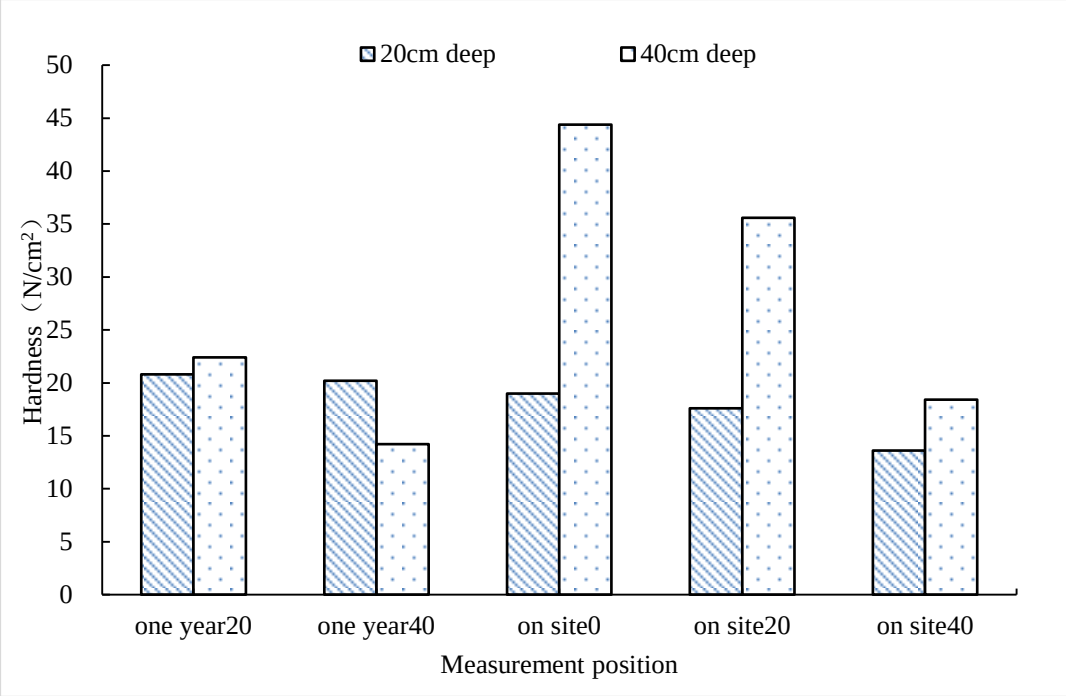
The effect of transplanting one-year-old Pinus tabuliformis on soil shear strength decreased with increasing soil depth; the effect of field transplanting Pinus tabuliformis on soil shear strength increased with increasing soil depth.



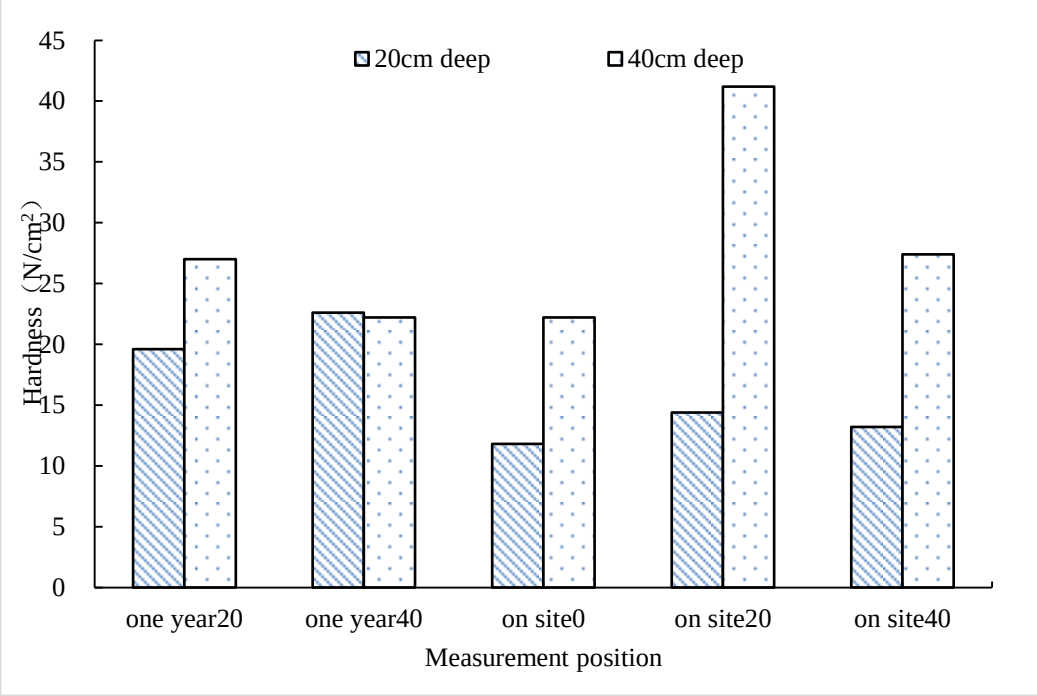
The effect of transplanted one-year-old Amorpha fruticose on soil shear strength decreased with increasing soil depth near the root system and increased with increasing soil depth away from the root system; in situ transplanted Amorpha fruticose increased with increasing soil depth.

RESULTS AND DISCUSSION

4. Influence of different depths of Pinus tabuliformis and Amorpha fruticose on soil hardness



The effect of transplanted one-year Pinus tabuliformison soil hardness increased with increasing soil depth near the root system and decreased with increasing soil depth away from the root system; field transplanted Pinus tabuliformis increased with increasing soil depth.



The effect of transplanted one-year-old Amorpha fruticose on soil hardness increased with increasing soil depth near the root system and decreased with increasing soil depth away from the root system; in situ transplanted Amorpha fruticose increased with increasing soil depth.

5. Differences in the effects of different vegetation on soil shear strength and hardness

- The shear strength and hardness of the measured points at 0 cm from the plant root system were significantly higher than the other locations.

Analysis: As this area is close to the plant root system, the roots and soil are tightly bound together when measured at this location, and the shear strength is significantly increased by the entanglement of plant roots when measured with the cross-plate shear gauge.

Analysis: Due to the differences in the root systems of the two plants, the root type of Pinus tabuliformis is a vertical root type with well-developed horizontal roots, while the root type of Amorpha fruticose

Pinus Tabuliform

20cm from the root system in the plane

0cm from the root system in the plane

morpha ruticose

Conclusions

The following conclusions were drawn from studies on the resistance of soil to slope stabilisation in different vegetation and at different soil depths.

- Within the influence of vegetation root system, the influence of tree and shrub roots on soil consolidation capacity increases with the increase of soil depth; and the influence on soil consolidation capacity decreases with the increase of distance from the root system at the same level.
- The difference in root type made a difference in their ability to fix the soil, with tree roots having a stronger effect on soil fixation than shrub roots under the conditions of this test.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Attention!