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Effects of biological metabolism of *Metasequoia glyptostroboides* on nutrient element content and enzyme activity in seedling soil

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Abstract: Soil has high spatial variability. Under the change of water level, soil nutrient element content and enzyme activity do not show regular changes. Therefore, the effects of biological metabolism on soil nutrient element content and enzyme activity in the adult stage of *Metasequoia glyptostroboides* were proposed. The characteristics of the soil were extracted, the irreversibility, accumulation, concealment and refractory rationality of the nutrient element content in the soil were expounded. According to the soil characteristics, the relationship between the nutrient element content and enzyme activity in the soil was analysed. The pH value, organic matter, lead and manganese contents of the soil were determined, and the effects of biological metabolism of *M. glyptostroboides* on the nutrient content and enzyme activity of the soil were studied. The results showed that the content of nutrient elements in soil was relatively high after the biological metabolism of *M. glyptostroboides* in the adult stage, the infiltration rate of seedling soil changed, and the effects of different Metasequoia glyptostroboides roots on soil enzyme activities were different.

Key words: *Metasequoia glyptostroboides,* adult, biological metabolism, seedling soil, nutrient element content, enzyme activity

1. Introduction

The nutrient element content is one of the basic properties of soils. It directly or indirectly affects most chemical processes and changes in soils (Azadbakht et al., 2020; Yu et al., 2021;Nowroz et al., 2021). On the one hand, the nutrient element content dominates all the redox reactions, precipitation, dissolution, adsorption and desorption in the soil, on the other hand, the nutrient element content has a significant influence on the soil enzyme activity. The pH of soils will increase, the pH of alkaline soils will decrease and eventually tend to be neutral. The pH of the soil of *Metasequoia glyptostroboides* at low and middle altitudes was higher than that at high altitudes, which indicated that the pH of the soil of *M. glyptostroboides* was higher under the condition of strong anaerobic reduction(Williams, 2005;Beheshti Ale Agha et al., 2018; Hamsa and Nagabovanalli, 2020).

With the increasing contradiction between ecological environment and economic benefits, people have gradually realized the importance and urgency of the influence of natural vegetation restoration on the nutrient element content and enzyme activity of unripe soil, and the relevant experts have proposed a large number of studies on this. The reference (An et al., 2020) has proposed the bioavailability characteristics of selenium-enriched soil in the southern Fangshan area of Beijing. Based on the detailed soil geological survey data in the southern Fangshan area of Beijing, it is found that the accumulation frequency classification of soil available Se content and available Se content show a good consistency in spatial distribution. Further correlation analysis shows that the content of elements Carbon (C), Nitrogen (N), Sulfur (S), organic matter and heavy metal elements Cadmium (Cd),Lead(Pb), Copper (Cu), Zinc (Zn) in surface soil has a high correlation with the content of soil Selenium (Se), and the correlation with element Phosphorus (P) and pH values is lower. The reference (Smakov et al., 2019) put forward the effect of amending method rich in organic matter on the fluidity of selenium in soil. Soil organic matter plays an important role in soil selenium dynamics. Three soils with different physical and chemical parameters were selected, namely river soils, chernozem and leached soils, and three types of earthworm compost based on a variety of biological wastes, such as digestives (earthworm compost 1), kitchen waste containing wood chips (earthworm compost 2) and garden biological wastes (earthworm compost 3) (Ali et al., 2020; Hassanpour, 2020), were used. In order to evaluate the potential effect of vermicompost on soil adsorption characteristics, intermittent adsorption tests were conducted. The results

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showed that the absorption intensity of selenium in soil was higher than that of selenite, no matter what kind of soil or improved material was applied.

Nutrient elements are essential for plant growth provided by soils. Mineral nutrient elements in soils that can be absorbed by plant roots either directly or after transformation, including elements such as nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, boron, molybdenum, zinc, manganese, copper and chlorine (Chai et al., 2019).

M. glyptostroboides metabolism in adulthood embodies certain rules and seems to be quite free in a certain soil area. Such metabolic patterns in adult metasequoia allow every part of a piece of soil to be repaired (Zhang et al., 2014; Zhao, 2019; Han et al., 2019; Romano et al., 2021). Soil restoration needs to establish a plane sequence, follow the principle of integrity, with the whole care parts, to complete the restoration of the whole land. *M. glyptostroboides* adult metabolism contains two important elements including material and texture. *M. glyptostroboides* has a different texture in its adult metabolism. Texture cannot only play a decorative role but also have a functional role. *M. glyptostroboides* has many morphologies in its adult life. A study on the effects of texture on nutrient element content and enzyme activity in seedling soil has a better promoting effect (Zheng et al., 2018; Zhao et al., 2019; Imran et al., 2020).

Different adults of *M. glyptostroboides* had different effects on the content of nutrient elements and enzyme activities in the soil. The natural characteristics of *M. glyptostroboides*, the color and texture of the plants and the changes in different seasons should be taken into account when planting. It is easier to combine with rocks and terrain after considering their characteristics (Sharma et al., 2019; Liu et al., 2019).

M. glyptostroboides biological metabolism is easy to enter the soil in adulthood. At present, the nutrient content and enzyme activity of soil are mainly from natural sources. The natural source refers to the nutrient elements and enzyme activity contained in the parent rock of the soil, which is weathered into the soil, and enter into the environment with the input of materials; the existence form of biological metabolism of *M. glyptostroboides* in the soil in adulthood is complex, and the valence state is not a single valence state, which will vary with the ligand in the soil (Ma et al., 2019). Not all valences of *M. glyptostroboides* in adulthood are toxic. Because of the different kinds of compounds, the valences of *M. glyptostroboides*in adulthood are different. The metabolic accumulation of *M. glyptostroboides*in adulthood became deeper and deeper, and the nutrient content of soil increased with time (Carvalho et al., 2019; Migliore et al., 2019). The content of nutrient elements and the activity of enzymes in the soil cannot be detected directly by the naked eye, so we must use biological and chemical methods to find out.

The biological metabolism of *M. glyptostroboides*in adulthood is regarded as the point source, and the content of Pb and Mn in the soils within 1 km from the transfer station and within 0–20 cm and 0–100 cm from the surface layer of the soils are regarded as the reference factors for measuring the pollution characteristics of the soils (Ngela et al., 2020).

In the process of analyzing the characteristics of Se rich soils in the high background area, considering the geological conditions, environmental conditions and external forces, it is necessary to calculate the abundance and degree of heavy metals in the soils (Christopher Ileanwa et al., 2020; Qayyum et al., 2020). Traditional scholars often use remote sensing imaging, spectral imaging and other methods to simulate soil conditions, so as to obtain soil characteristics. Although this method can be used to simulate the soil conditions, the inaccuracy of the calculation results will affect the accuracy of the characteristic analysis (Ahmed et al., 2019).

The roots of adult *M. glyptostroboides* have their absorption function, and the fixed root exudates can effectively reduce the concentration of soil pollutants. When the *M. glyptostroboides* plants are grown, there are three steps in the process (Williams, 2005), as shown in Figure 1.

Although the above studies have made some progress, there are few studies on the effect of the biological metabolism of *M.glyptostroboides* on soil nutrient element content and enzyme activity in the soil. This experiment aimed to the study effects of the biological metabolism of *M. glyptostroboides* on nutrient element content and enzyme activity in seedling soil.

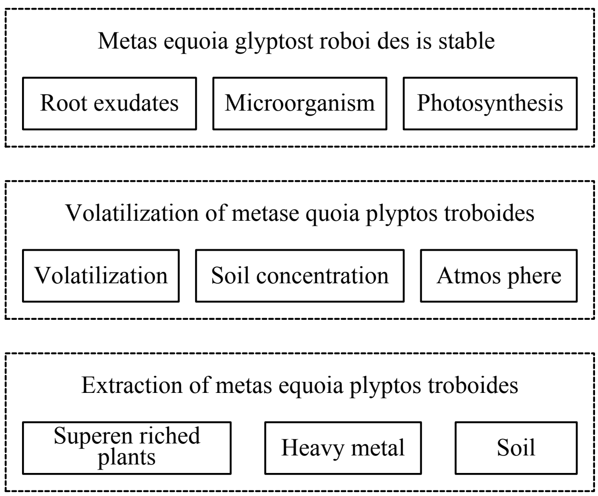

Figure 1. Structure of *M. glyptostroboides* Linn (Williams, 2005).

2. Materials and methods

In this experiment, 50 adult *M. glyptostroboides* trees with the same growth in 20 years were selected as the study subjects, and 50 adult *M. glyptostroboides*trees were potted (soil is mixed purple soil, about 5kg per pot, 18cm in the center diameter and 20cm in height). At the same time, 45 pots of the same size with the same substrate soil without any seedlings were used as blank control, and all pots were placed under the same light and water acclimatization under the canopy at the laboratory base (elevation of 249m, transparent ceiling, open around). The experiment was formally carried out, at this time, the seedlings of *M. glyptostroboides*were (0.85 ± 0.11) mm and (97.05 ± 1.53) cm in height.

Since the survival rate of all *M. glyptostroboides*plants is 100% at the whole treatment stage when sampling the soil samples for the experiment, the aboveground parts of the plants were divided first, and the soil in the seedling pots was poured out, and the roots and other impurities were removed. Then, the soil samples in each pot werefully mixed and the soil samples were ground after natural air-drying indoors.The soil samples screened with 2mm soil were used for the determination of the contents of alkaline hydrolyzed nitrogen (AN), effective phosphorus (AP) and rapidly available potassium (AK). The other part of the soil samples screened with air-dried soil was used for the determination of the contents of soil organic matter (OM), total nitrogen (TN), total phosphorus (TP) and total potassium (TK) through soil screening with 0.25mm soil. The soil samples screened with air-dried soil groups without plants were subject to the same treatment. Soil pH value was measured by a potentiometer (soil:water = 1:2.5). The soil OM content was measured by potassium dichromate plus heating method; soil TN content was determined by automatic Kjeldahl nitrogen meter; soil AN content was determined by alkali-hydrolysis-diffusion method; soil TP and AP content was determined by silver paving anticolorimetric method, and TK and AK content was determined by atomic absorption spectrometer (according to Motsara and Roy, 2008).

M. glyptostroboides were planted in a beautiful environment, at the same time, the contaminated soil was repaired, the plants were cultivated, and the heavy metals moved in the soil were fixed by the combined microorganisms in the roots of *M. glyptostroboides*.

2.1.Analysis of physicochemical properties of experimental samples

2.1.1. pH of soils

The pH value of soils was determined by the potentiometric method, and distilled water without CO2 was used as a leaching agent. In order to reduce the error caused by salt difference, the pH value was measured by Model 868 pH meter. Nessler's reagent method was used. Enzymatic extraction of nutrient elements in solid soil: select 0.15g root material sample, put it into a mortar and pour 1.5mL of phosphoric acid buffer (pH7) into it, carefully grind it until it is uniform, pour it into the centrifuge tube, operate at 0°C at 1350r/min for 35 min, obtain the supernatant to be used and take 0.6ml. Select a suitable number of clean test tubes, pour 2.5mL 0.4mol/L urea-0.06 phosphate buffer solution (pH7) into the tube, place the tube in a 35°C constant temperature water bath pot, and heat for 5 min. A tube was used as a blank tube, 0.6 mL water was poured into it, 0.6 mL enzyme solution was poured into other tubes, then mixed and heated at 35°C for 5 min. After the reaction ends, 2mL 10% trichloroacetic acid was poured into each test tube to stop the reaction. The 1.5mL reaction solution was taken out and diluted with 10 mL distilled water, shaken and poured into 0.6mL potassium sodium tartrate for reaction, then added 1.5 mL Nessler reagent for color development. Compared with a blank tube, the data were obtained by calculation.

2.1.2.Determination of soil organic matter

The soil organic matter was measured by an optimized Vern method. A total of 0.1–1.0g soil samples were placed in a 200 mL beaker, first with 1 mL of mercuric sulfide solution, then with 9 mL of distilled water, with 2 mL of silver sulfide solution and mixed again (Gao et al., 2021; Valueva and Borovikova, 2019). Then open the furnace to heat it, by adjusting the temperature so that the solution was in the micro-boiling state reflux for 2 h. After cooling for 15 min, the condenser tube was flushed with 30mL distilled water, the beaker was removed, titrated by ferric sulfide, and its blank was determined, so the determination of soil organic matter was realized.

2.1.3. Determination of lead and manganese in seedling soil

The determination process of lead and manganese content is as follows:

(1) Put 0.1g soil sample in PTFE digester, add 6mL HNO3, 3mL HCI and 2mL HF in turn, shake gently, make the solution mixed evenly, and leave it at room temperature for 30 min (Pfeiffer et al., 2019);

(2) Put the PTFE digester on the sleeve, then seal it and place it in the microwave digester;

(3) The contents of lead and manganese shall be determined under the working conditions as shown in Table 1. When the pressure of the main control tank drops to 0.5 MPa and the temperature drops to 75°C, the digestion tank shall be taken out, the solution shall be placed in a beaker and heated until thick white smoke appears, the residue is dissolved by 1mL nitric acid under the condition that the solution is in the form of rolling beads, and the supernatant shall be measured by atomic absorption spectrophotometer.

The working conditions of the flame atomic absorption spectrophotometer are shown in Table 1, and the optimum working conditions of the microwave digestion system are shown in Table 2.

Along with the further development of the related research, many scholars have proposed to establish fuzzy model, linear model and probabilistic model to compute soil characteristics. In order to solve the problem of traditional methods, the characteristics of Se-rich soils in high background areas were extracted, and the modified vertical drought index (Chaghakaboodi et al., 2021) was used to invert the soil information.

2.2.Experimental analysis

According to the investigation, there are not only abundant elements, but also many kinds of trace elements, nutrient elements and organic matter in the seed-soil, and more than 30 kinds of elements. Soil samples were collected from the B layer with a depth of 20–50cm. A total of 2113 samples were collected and 81 samples per km^2 were collected. The experimental parameters are shown in Table 3.

2.2.1.Selection of experimental indicators

2.2.1.1.Plaque importance

The important value of impermeable patch, i.e. the proportion of impermeable patch area, has an important effect on the infiltration characteristics of soils. In order to analyze its influence on the infiltration property of soil, the important values were 0, 3/4 and 1, respectively.

2.2.1.2.Patch shape

Patch shape refers to the use of patch geometry to measure the characteristic value of landscape spatial structure, which is an important factor to describe the urban landscape. Under the condition of the same absolute area, the spatial distribution of plaque is different and the effect is different (Yang et al., 2019). Using the ratio of the perimeter of the plaque and the circumference of the area of the plaque, the shape of the plaque is described.

$$S = \frac{P}{2\sqrt{\pi A}} \quad (1)$$

In Formula 1,the plaque perimeter was represented by *P*, and the plaque area was represented by *A*. The results show the similarity between the patch shape and the circle. If the numerical result is 1 or close to 1, it means that the shape of the patch is close to the circle; if the numerical result is greater than 1 or the numerical value is larger, it means that the shape of the patch is more irregular. In order to study the influence of this factor on the infiltration properties of soil, the patch importance value was 0.5, and the patch shape index values were square and round, i.e. the length ratio was 1 and 4:1.

Table 1. Working conditions of flame atomic absorption spectrophotometer.

Element	Wavelength/ nm	Slit/ mm	Lamp current/ mA	Acetylene flow/ Lmin-1	Air flow/ Lmin-1
Pb	294.4	0.8	11	1.6	11
Mn	169.8	0.5	15	1.1	6

Table 2 . Optimum working conditions of microwave digestion system.

Operational procedure	Temperature/°C	Pressure/ Mpa	Time/ min	Power/W
1	150	12	5	950
2	180	20	5	950
3	210	26	6	950

2.2.1.3. Plaque uniformity

Compared with patch area, the distribution proportion of patch area is more important. Even patch area has better ecological effect and landscape effect compared with equal patch area. The evenness degree of different landscape types is called patch evenness index, which can be described as:

$$E = (H/H_{max}) \times 100\% \quad (2)$$

In Formula 2,the evenness index is represented by , the modified Simpson index is represented by , and the maximum evenness of landscape structure is represented by under the condition of richness. The calculation formula of Simpson index and maximum uniformity is as follows:

$$\begin{cases} H = -\log\left[\sum_{k=1}^{m}(P_k)^2\right] \\ H_{max} = \log(m) \end{cases} \quad (3)$$

In Formula 3, the ratio of patch area to total landscape type area is represented by ; the number of patches of a certain patch type is represented by .

2.2.1.4.Plaque resolution

The factor refers to the arrangement of different patches in the landscape mosaic of the same type, and its formula can be described as follows:

$$I_k = \frac{\frac{1}{2}\sqrt{\frac{n_k}{A}}}{\frac{A_k}{A}} \quad (4)$$

In the formula 4, the patch separation degree of landscape type is represented by ; the patch number of

Table 3. A part of an experimental parameter.

Matter	Content
Organic matter	7.22g/kg
pH	5.8
P content	82.56 g/kg
Zncontent	159.24mg/kg
Cd content	0.82 mg /kg
Cr content	324.01 mg /kg
Ni content	85.25 mg /kg
Mn content	175.61 mg /kg

k landscape type is represented by ; the total landscape area is represented by *A*; the area of *k* landscape type is represented by *Aκ*.

3. Results

After 60 mesh screening and drying, all the samples were sent to the laboratory of a testing center of a certain research institute for biological metabolism during the adult period of *M. glyptostroboides*. The 15 analytical elements Cu, Pb, Zn, Au, Ag, W, Sn, As, Mn, Bi, Ni, Co, Cr, Mo and Sb are shown in Table 4.

From Table 4, the analysis results are calculated by the geochemical parameters such as mean value, deviation, coefficient of change and enrichment coefficient. Among them, the elements with enrichment coefficient > 1 are Pb, W, Cr, Sn, Ag, Zn, As, Sb, Bi; the elements with enrichment coefficient > 3 are Pb, As, Bi; the elements with change coefficient > 0.25 are Cu, Pb, Mo, Mn, Ag, Co, Sb, As, Au; and the elements with change coefficient > 0.4 are Mn, Ag, As, Sb, Au. Generally speaking, the content of Ag, As and Sb in the soil is relatively high, the coefficient of change is large, and the distribution range is wide, indicating that these elements participate in the secondary enrichment and halo formation, and are easy to form geochemical anomalies.

Through the research method, the seed-soil is divided into a whole, and the sample is sampled. The statistical results of the abnormal parameters of the seed-soil are shown in Table 5.

According to Table 5, among these elements, Ni, Zn, etc. are part of the high background, while other elements form a local high background.

Under the condition of constant rainfall and duration, the other three factors, patch shape, patch evenness and patch segregation, were used to study the effect of other landscape structure factors on clay soil infiltration rate (Table 6).

Table 4. Statistics of geochemical parameters of trace elements.

Nature of sample	Element	Maximum value Max	Minimum value Mix	Average value X	Deviation S	Coefficient of change Cv	Enrichment coefficient q	Crust abundance
Seedling soil survey	Cu	129.3	11.7	35.598	8.91	0.25	0.57	63
	Pb	144.9	13	40.173	10.30	0.26	3.35	12
	W	4.9	0.8	2.320	0.28	0.12	2.11	1.1
	Ni	83.3	14.9	46.576	8.90	0.19	0.52	89
	Cr	217.9	32.1	113.634	22.98	0.20	1.03	110
	Mo	1.21	0.07	0.585	0.15	0.26	0.45	1.3
	Sn	6.16	1.3	3.731	0.65	0.17	2.19	1.7
	Mn	4932	153	679.374	334.56	0.49	0.52	1300
	Ag	0.689	0.025	0.099	0.05	0.51	1.24	0.08
	Zn	274	32.4	132.627	30.31	0.23	1.41	94
	Co	70.9	5.9	20.368	5.84	0.29	0.81	25
	As	36.225	0.516	8.276	4.35	0.53	3.76	2.2
	Sb	3.483	0.263	0.737	0.30	0.41	1.23	0.6
	Bi	2.101	0.188	0.606	0.12	0.20	151.50	0.004
	Au	8.18	0.24	1.168	0.51	0.44	0.29	4

Note: omega (Au) × 10-9; omega (other elements) × 10-6.

Table 5. Statistical results of abnormal characteristic parameters of selenium-rich seedling soils.

Element	Area/km^2	Anomalous mean	Enrichment coefficient
Cd	356	0.29	1.03
Ni	219	45	1.05
MgO	147	1.63	0.89
Zn	230	107	1.25
Cu	58	52	1.12
Cao	316	1.59	0.67
Cr	324	87	1.01

Table 6 shows the effects of other factors on the infiltration rate of soils under the condition that the total rainfall and the duration of rainfall do not change. The results showed that when the patch shape changed from circle to square, the yield decreased, but the rate of soil infiltration increased; when the patch evenness index decreased, the yield increased, but the rate of soil infiltration decreased; when the patch separation degree changed from 3 to 17, the yield decreased, but the rate of soil infiltration increased.

In order to reduce the inducement of external nutrients on soil enzymes, the effect of wetland plant roots on soil enzymes was only considered, and only water was poured during the experiment. Wetland plants were planted in February and stopped growing until July. Therefore, the rhizosphere enzyme activity was measured at 150 days from February to July, and compared with the blank sample. The specific values of the above 6 plant enzyme activities and blank sample curves are shown in Figure 2.

Table 6. Effects of other factors of landscape structure on clay infiltration rate.

Influencing factor of landscape structure		Rainfall yield (L)	Infiltration rate (%)
Plaque shape	1 (Circular)	4476	52.7
	4:1 Degree of separation	1590	84.8
Plate uniformity	1.2015	1810	84.6
	0.5045	3454	62.3
Plate separation	1.500 (3)	5013	55.9
	4.500 (17)	2007	80.1

Figure 2 shows the urease activity curve of 6 different plant seedlings soil samples and blank seedlings soil samples. From the graph, it can be seen that the urease activity of 6 different plants generally increased with the growth period, and the plant growth tended to be stable after 60 days, and the enzyme activity value of plant began to be higher than that of blank seedlings. Different wetland plants have different urease activity. It can be seen from Figure2 that the urease activity of butterfly ginger is the highest after vigorous growth.

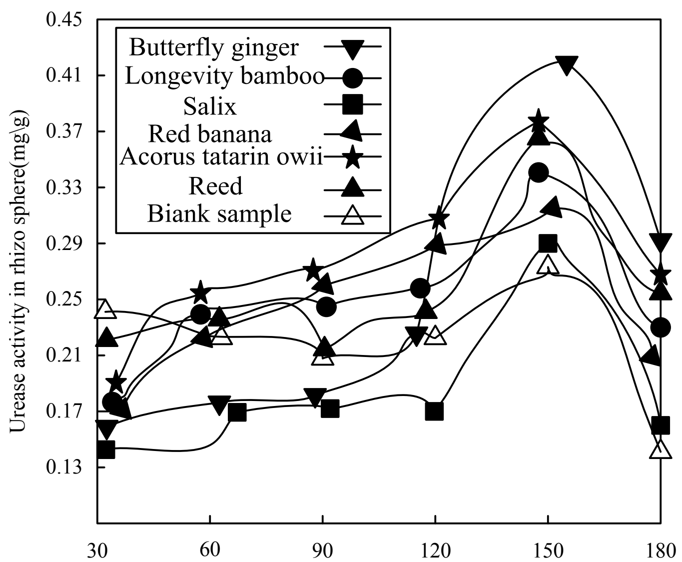

Figure 2. Comparison of urease activity between different plants and blank samples.

4. Discussion

Soil pH is one of the basic properties of soil, it directly or indirectly affects most chemical processes and chemical changes in the soil. On the one hand, soil pH dominates all the redox reactions, sedimentation, dissolution, adsorption and desorption, on the other hand, soil pH has a significant impact on the availability of soil nutrients. The pH of acidic soil increases, the pH of alkaline soil will be reduced, and eventually tend to be neutral (Zhao et al., 2019). The pH of *Metasequoia glyptostroboides* soils was significantly higher than that of altitude *M. glyptostroboides*soils, which may be due to the formation of a large number of alkaline ferric carbonates in the soils.

Soil organic matter (OM) is one of the most important sources of soil nutrient elements, and its content can indicate the quality of soil health and fertility. On the one hand, the content of soil OM depends on the humification coefficient of organic residues, on the other hand, it comes from the return of organic residues and litter to soil. In this study, there is no significant difference in soil OM content, which may be due to the flow of water in situ, making it difficult for plant drop to enter the basin bowl.

Generally, the soil can release N and P under certain conditions, and the dry-wet environment tends to increase the ability of nitrogen and phosphorus release (Norouzi et al., 2021). Soil TP decreased, but soil P was released to some extent, and soil AK was rich enough for the growth of *M. glyptostroboides*, so the content of available potassium in soil decreased with plant growth. Therefore, although for the same species, but also due to different habitats will have different effects on the content of soil nutrients.

Root exudates are an important source of soil enzymes. Root exudates or secretes ions and a large amount of organic matter into the soil while the root exudates nutrients and water. The activities of soil enzymes are affected by many factors, and the activities of plant roots restrict these factors. Generally, the decomposition process of plant root exudates and residues in the soil can stimulate microbial activities, which leads to the intensification of microbial activities and enhances soil enzyme activity. But in the same soil background, the difference of sea activity caused by planting different plants is obviously related to the species and quantity of root exudates in the soil microecosystem (Beheshti Ale Agha et al., 2018). On the other hand, soil enzyme activity and soil microbial activity, microbial biomass and the number of soil microbial significant correlation. A large number of studies have proved that soil microbial activities are directly related to deer sugar enzyme, urease, acid enzyme and catalase activities. The feedback effect of plant roots on soil was reduced, resulting in the significant decrease of soil enzyme activity.

5. Conclusion

Through the biological metabolism of *M. glyptostroboides*in adulthood, the content of Ag, As and Sb elements in the soil is relatively high, the coefficient of change is relatively large, and the distribution range is relatively wide, indicating that these elements participate in the secondary enrichment and halo formation and are easy to form geochemical anomalies.

When the patch shape changes from round to square, the yield of flow decreases and the rate of soil infiltration increases; when the patch evenness index decreases from high to high, the yield of flow increases and the rate of soil infiltration decreases; when the patch separation degree changes from 3 to 17, the yield of flow decreases and the rate of soil infiltration increases.

Different plant roots can have a relevant influence on soil urease, and the enzyme activity in the rhizosphere is higher than that in the nonrhizosphere at the stage of stable growth of plants, and the higher the urease activity in the rhizosphere is, and the different plant roots have different influence on soil enzyme activity.

6. Prospects

It is suggested that more experiments should be designed in the future to reveal the adaptability of the biological metabolism of *M. glyptostroboides*to nutrient element content and enzyme activity in the seedling soil. In order to study the change mechanism of soil chemical properties, we need to use more macroscopic and microscopic methods, such as geostatistics and GIS, together with the research on the structure and function of soil microbial community, clearly grasp the situation of soil microbial ecological environment, further reveal the distribution, variation and related characteristics of random variables in space, and explain the influence of natural and artificial processes on the spatial variation of variables, so as to plan the vegetation allocation more scientifically and rationally, and protect and restore the soil environment that has been eroded in situ.

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