Study on the Plant Diversity Under the Economic Fruit Forest in the Red Soil Erosion Area

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Abstract. Navel orange garden and camellia oleifera forest are the most characteristic important economic industrial tree species in Jiangxi Province, and are mainly planted in mountainous and hilly areas. Because the species diversity of plants under the economic fruit trees is not rich, soil erosion and non-point source pollution are caused. Therefore, in view of the problems of soil erosion and nutrient deficiency under the economic fruit forest, this paper points out that the sustainable development of the economic fruit forest ecosystem can be promoted by increasing the plant diversity under the economic fruit forest, improving the ground cover of the economic forest, preventing and controlling the soil erosion, cultivating the soil fertility, restoring the biodiversity and promoting the sustainable development of the economic fruit forest ecosystem. At the same time, the future research and development direction of this field are discussed, which can not only provide scientific basis for the sustainable development of economic fruit forest industry in red soil erosion area, but also provide theoretical and technical support for the ecological construction of soil and water conservation and the development of ecological agriculture on slope land. It is of great significance for promoting the construction of ecological civilization in Jiangxi Province.

1. Introduction
Economic fruit forest is an important model in the process of agricultural development on sloping land. It is an important measure not only to control soil erosion, protect and improve the ecological environment, but also to adjust the agricultural industrial structure and promote economic and social development. Navel orange garden and camellia oleifera forest are the most important economic and industrial tree species in Jiangxi Province. Jiangxi Province is the second largest producing area of camellia oleifera planting in China, with navel orange planting area and output ranking the second and fifth in China, and mainly planted in mountainous and hilly areas. Forest land erosion is one of the main problems of soil erosion in Jiangxi Province, which is mainly distributed in economic woodlands, sparse and young woodlands, etc. While oil tea and navel orange are the main economic forest trees, soil erosion is more serious. In addition, the traditional clear tillage and extensive management led to a
significant reduction of plant species diversity under the economic fruit tree, resulting in soil erosion and non-point source pollution. Plant measures are the fundamental measures for soil erosion control [1]. Therefore, in view of the problems of soil erosion and nutrient loss under the economic fruit forest, the effects of increasing the diversity of undergrowth plants on the growth, runoff, sediment and nitrogen and phosphorus loss of the orchard were studied. It is hope that through this study, we can screen out the new excellent plant species and planting patterns which have the advantages of reducing flow and controlling pollution, improving environment and high economic value. And we can promote and demonstrate it. In this way, it is beneficial to improve the ground cover, prevent and control soil erosion, cultivate soil fertility, restore biodiversity, and promote the sustainable development of economic fruit forest ecosystem. It can not only provide scientific basis for sustainable development of economic fruit forest industry in red soil erosion area, but also provide theoretical and technical support for ecological construction of soil and water conservation and ecological agriculture development of slope land. Moreover, it is of great significance to promote the construction of ecological civilization in Jiangxi Province.

2. Overview of Soil and Water Loss Research of Economic Fruit Forest
In the 1950s-1970s, some countries began to apply the ecological point of view to the management of forest land and orchard to solve the problems faced by the management mode of clean tillage system. During this period, the orchard was covered with grass and herbicides were used widely [2], but the resulting soil and water loss and pesticide and fertilizer residues led to soil water pollution and environmental damage and other aspects have been reported more and more [3], which has attracted people's general attention, forcing people to find a new way to effectively manage the economic fruit forest. In this period, a large number of screening experiments on planting different grass species under the forest were carried out [4–5]. The results show that planting grass in orchard can improve the growth environment of fruit trees, improve the quality of fruit, and greatly promote the rapid development of orchard grass.

In the red soil area, there are large areas of camellia oleifera forest, navel orange forest and other economic fruit trees. The remote sensing images show that the vegetation in this area is in good condition. However, due to the poor soil environment under the forest and the exposure of the earth’s surface caused by human factors, there will still be moderate or even strong soil and water loss. There exists the problem of "soil and water loss under forest ", which is " looking at green oil from far away and soil and water flow from near " [6].

With the continuous reduction of arable land area and the serious damage of soil texture, the problem of soil and water loss of economic fruit forest has attracted the attention of many countries around the world, and has been identified as an important reason for the deterioration of ecological environment by scholars [7]. In recent years, with the change of production and life style, the planting area of economic fruit forest has also increased significantly, but the soil erosion of economic fruit forest is still serious. Xiaobo PENG (2017) pointed out that the long-term clean-up measures of Castanea henryi orchard resulted in the imbalance of soil nutrients in the forest land and the decline of soil fertility [8]. As an important part of the economic fruit forest ecosystem, the undergrowth vegetation plays an important role in preventing raindrops from splashing and runoff scouring the surface soil, improving the physical and chemical properties of the soil, etc. [9]. In addition, many scholars have made a comprehensive study on the influencing factors of soil and water loss in slope forest land, mainly revealing the characteristics and laws of soil and water loss under the forest from the aspects of soil characteristics, climate characteristics, landform characteristics, vegetation types, cultivation and land use patterns, occurrence mechanism, etc.

3. Ecological Effects of Planting Under the Economic Fruit Forest
Because of the adverse effects of soil and water loss on the ecological environment and economic and social development under the economic fruit forest, scholars have carried out a lot of practical research on intercropping plants.
3.1. Conservation of soil nutrients by means of Undergrowth Plant Measures
Under the action of soil microorganism, the litter formed by interplanting shrub grass under the economic fruit forest releases various effective nutrients for the absorption and utilization of the forest root system. At the same time, it can produce a large number of humus, promote the formation of soil aggregate structure, improve the soil permeability, and enhance the capacity of soil water and fertilizer conservation. Interplanting under the forest has a better protective effect on the retention of soil nutrients, which can improve the nitrogen content of the soil, control the water content of the soil and the role of fertilizer conservation [10]. The results show that in the slope land or red soil hilly area with low coverage, the main nutrient loss is carried by runoff and sediment, and the loss of available nutrients is serious, which has a great impact on soil fertility. The loss of phosphorus and potassium can be effectively controlled by improving vegetation coverage and porosity [11]. In conclusion, reasonable plant measures, such as planting protective belt, hedgerows, greening slope and reasonable close planting, can effectively protect soil nutrients and effectively reduce nutrient loss on the slope.

3.2. Interception of Runoff and Sediment by Undergrowth Vegetation Measures
Soil erosion is an important factor leading to soil nutrient loss and soil degradation through the economic fruit forest. Most studies believe that increasing vegetation coverage is an important measure to control soil erosion. The runoff and sediment in the citrus forest area with grass coverage is significantly less than that in the citrus clear cultivation area. Strip planting is an effective measure to control soil erosion in the citrus forest area. It has obvious flow and sediment reduction effect and water accumulation effect [12]. Secondly, different vegetation types and their combined allocation modes have different benefits in controlling soil erosion [13]. At present, the most widely used measure is intercropping under the forest. Compared with the traditional model, the effect of intercropping and shrub grass on the physical and chemical properties and runoff of soil is greatly improved, and the biodiversity and the stability of plant community under the forest can be improved.

3.3. Effects of plant measures under the economic fruit forest on ecological environment and fruit quality
Interplanting under the economic fruit forest has an impact on the temperature and humidity environment of the plot, which can effectively improve the microclimate of the plot. Moreover, interplanting under the forest makes the environmental conditions in the plot not change dramatically due to the influence of external climate conditions, which creates a suitable small environment for the growth of natural enemies of pests, improves the biodiversity index, effectively reduces the population density of pests, reduces the harm caused by them, and gives full play to the role of biological potential [14]. At the same time, interplanting and intercropping under the economic fruit forest have obvious effect of increasing yield and improving quality. After the apple garden is covered with Hangzhou white chrysanthemum, the yield and quality of apple are improved to varying degrees [15]. Reasonable arrangement of interplanting crops in the newly-built orchard can make up for the gap period of income in the previous period of the orchard. Due to the short growth cycle of shrub grass, the income can be obtained in the same year, while green manure or herbage can provide raw materials for large-scale livestock breeding such as cattle and sheep. Reducing fertilizer input due to increased biodiversity can make fruit become a real green food, increase market competitiveness and increase production and efficiency.

4. Conclusion
Throughout the history of interplanting research and development, interplanting technology is developing in a deeper and more detailed direction. At present, the commonly used species of interplanting plants are not very rich, mainly to meet the basic coverage and water conservation effect. With the development of modern new sightseeing fruit industry, the development demand for multifunctional plants with significant economic value, ornamental value and ecological service value under the economic fruit forest is more and more obvious.
At present, the ecological and leisure tourism industry has opened up a new field of economic fruit forest development, and is becoming a new trend of industrial development. While providing high-quality fruits and trees, the economic fruit forest also puts forward higher requirements for comfortable and beautiful ecological environment. It is a trend to select suitable shrub and grass species suitable for planting under the economic fruit forest, optimize their combination, pay attention to the three-dimensional compound hierarchical collocation of plant communities under the fruit forest, so as to form an efficient and practical ecological restoration technology mode of fruit forest, so as to meet the development needs of modern ecological agriculture. This may become a new research and development direction. It is of great significance to control soil erosion in red soil erosion area.

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