FACTORS AFFECTING SOIL RESPIRATION
IN REFERENCE WITH TEMPERATURE’S ROLE
IN THE GLOBAL SCALE

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ABSTRACT: Soil respiration is CO₂ evolution process from soil to atmosphere, mainly produced by soil micro-organism and plant roots. It is affected not only by biological factors (vegetation, micro-organism, etc.) and environmental factors (temperature, moisture, pH, etc.), but also more and more strongly by man-made factors. Based on literature survey, main factors affecting soil respiration were reviewed. The relationships of soil respiration to latitude and to mean annual temperature were analyzed by using the data measured from forest vegetation in the world. As a result, soil respiration rate decreased exponentially with an increase of latitude, and increased with increasing temperature. Following the relationship between soil respiration and temperature, Q₁₀ value (law of Van Hoff) was obtained as 1.57 in the global scale.

KEY WORDS: effect factors, Q₁₀ value, latitude, soil respiration, temperature

I. INTRODUCTION

Soil respiration is CO₂ evolution process from soil to atmosphere. It is mainly produced by oxidizing organic matter by micro-organisms and the respiration of plant roots, and partially released from soil animal’s respiration and oxidization (Raich et al., 1992). As an important

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part of the carbon cycle in terrestrial ecosystems, soil respiration is usually used as an indication of soil organism’s activity, soil fertility and soil aeration (Anderson et al., 1975; Macfadyen, 1970; Reiners, 1968; Neilson et al., 1990). Meanwhile, studies on soil respiration have been paid a great attention upon, as it is the only pathway of the soil carbon pool to atmosphere and the important source of atmospheric CO₂.

Early in the 19th century, people had paid attention to effect of soil CO₂ and soil O₂ on activities of soil organism (Saussure, 1804). In the second half of the 19th century and the beginning of this century, people had already started to measure soil respiration rate (Albert, 1912; Clements, 1921; Russel et al., 1915). Since the 1960s, studies on soil respiration had been one of the hot topics in soil science and biology due to improvement of measurement methods and equipment and in order to meet a need of IBP (International Biological Program). Especially in recent years, the increasing atmospheric CO₂ concentration and the global climate change have become one of the focuses of the public and scientists; and therefore a special attention has been paid to the measurement of soil respiration as CO₂ released from soils is one of the most important greenhouse gases. As a huge carbon pool (1200 × 10¹⁵ - 1500 × 10¹⁵ g C) (Jenkinson et al., 1991; Fang et al., 1996), soil is one of the most important sources of atmospheric CO₂; about 68 × 10¹⁵ g C is released to air from soil annually (Raich et al., 1992), while fuel burning about 5.2 × 10¹⁵ g/a C (Detwiler et al., 1988). This means that even its small change will generate an big change of the CO₂ concentration in the air. Based on the literature review on data of soil respiration published around all the world, this paper will discuss main effect factors of soil respiration, and analyze change in soil respiration with the global climate change.

II. THE EFFECT FACTORS OF SOIL RESPIRATION

As a complicated biological process, soil respiration is affected by a variety of factors. Fig. 1 shows main effect factors.

![Fig. 1 Factors affecting soil respiration](image)

1. Effect of Biological Processes

Although physical and chemical processes of soil, such as the oxidization of organic matter