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Study on Relationship Between Soil Moisture and Fruit Tree Growth

Lu Zhang[1, 2, 3, 4, 5, *], Dan Wu[1, 2, 3, 4, 5]

[1] Shaanxi Provincial Land Engineering Construction Group, Co., Ltd, Xi′an 710075, China
[2] Institute of Land Engineering and Technology, Shaanxi Provincial Land Engineering Construction Group Co., Ltd.. Xi′an 710021, China
[3] Key Laboratory of Degraded and Unused Land Consolidation Engineering, the ministry of Natural Resources, Xi′an 710021, China
[4] Shaanxi Engineering Research Center of Land Consolidation
[5] Land Engineering Technology Innovation Center, Ministry of Natural Resources
[*] Corresponding author: Zhang Lu (Email: luluqiaofeng@126.com)

Abstract: Soil moisture is very important for the growth of fruit trees. Nutrients are dissolved in water, and the flow of water drives the transport of solutes, so that they can be absorbed and utilized by crops.

Keywords: Soil moisture, Apple trees, Roots, Water stress.

1. Soil Moisture on Fruit Tree Development

Soil moisture condition directly affects the good growth and healthy development of fruit trees. If the moisture content of soil, the soil particles of water molecule adsorption force will increase, the corresponding the root absorption of moisture absorption is difficult, when it becomes invalid water, fruit trees show the strong effect of water shortage, income and expenditure of water balance function are destroyed, if further reduce the moisture from the soil, The crop will likely appear permanent wilting condition, in this case, if the crop is not timely adequate irrigation, then the normal development of the crop will have serious constraints. If the moisture content in the soil continues to decline at this time, the water in the root of the crop will seep out, which will have a very adverse effect on the growth and development of the fruit tree. If coupled with the poor atmospheric condition, the air will be dry, and the branches and leaves will be scorch, and the fruit will suffer. Therefore, the soil moisture condition, especially the available soil moisture condition, has a very positive significance for the healthy development of fruit trees.

According to the basic laws of fruit tree physiology, we know that the most rapid period of fruit enlargement is about 20 ~ 30 days before fruit ripening. At this time, sufficient water must be guaranteed to supply its growth and development; otherwise, fruit yield will be affected. At the same time, relevant studies also showed that when drought stress threatened the growth of crops, the water conductivity of these stressed crops would decrease (Passioura J B, 1988), and the holes in the woody parts of the tree trunk of crops would lead to the stems of crops (Sperry J S, 1993; Saliendra N Z, 1995), roots (Meinzer F C, 1990; Kavanagh K L, 1999), leaves (Kikuta S B, 1997; Salleo S, 2000) decreased water conductivity. When soil water stress occurred, the chlorophyll content of apple tree leaves decreased, and the field survival rate of its seedlings decreased obviously.

Dr Zrenner reasoned R et al. (1991) study showed that the crop of carbohydrate metabolism process is usually influenced by water stress, reducing the the starch content of leaf, so the crops are usually affected by drought stress in showing its blade polyols, fructose and glucose content increased, while the content of starch and sucrose will be reduced, (Keller F, 1993). Shan Changjuan et al. (2006) studied the effects of drought stress on Gala apple and showed that with the decrease of soil water content, the leaf water potential, photosynthetic rate, leaf relative water content and transpiration rate of fruit trees all decreased, while the content of bound water increased with the decrease of soil water content. In addition, protein and ATP content of fruit tree seedlings decreased. When the water stress time increased, the respiration rate of fruit trees showed a trend of first increasing and then decreasing, and the O2 production rate showed a significant trend of increasing. Some studies also indicated that dry matter mass and root length of fruit trees increased when soil moisture content increased.

2. Effects of Water Stress on Fruit Trees

Of course, it is not the occurrence of water stress, will be adverse to the growth of fruit trees, fruit trees in the growth process of water stress has a certain sensitive period. When fruit trees are subjected to appropriate water stress in a specific period, it will not affect their growth progress, but has a certain promoting effect. The specific period referred to here is mainly in the division stage of fruit cells. However, it is strange that when water stress is absent, fruit growth is affected to some extent (Li S H, 1989; Mitchell P D, 1984; Lotter J V, 1985), since the rate of fruit development was better and faster than that of trees in the normal irrigation period.

Some scholars have also studied the problem of excessive soil moisture, showing that excessive soil water content will affect the soil air quality, slow down the respiration of fruit tree roots, and the nutrients in the soil are difficult to be decomposed and absorbed by crops, in which the movement of microorganisms is affected, or even more seriously, Hypoxic respiration of crop roots will produce some toxic and harmful substances, which will affect the growth of crop roots and even cause their death. Too much water will reduce the growth of shoots and roots of fruit trees, and will affect the vegetative growth of fruit trees in the case of soil flooding. If there is flooding in summer, the dry weight of roots and leaves can be decreased (Olien W C, 1987). If there is long-term

flooding (≥110d) in callitic alkaline soil, the extended growth of mango branches will be reduced by about 94%. Short-term flooding (≤10 days) was reduced by 57% (Larson K D, 1989). Some scholars, after studying limes, pointed out that the branches of limes would stop growing under the condition of continuous flooding for 3 weeks, and even their roots would deteriorate and rot (Larson K D, 1991). Some scholars have pointed out that the dry matter weight of the stems, leaves and roots of fruit fruit carambola will decrease when the soil is submerged for a long time (Joyner M EB, 1989). Long-term waterlogging leads to soil moisture content exceeding the normal requirement, resulting in excessive water content. The influence and damage to fruits brought by this situation has long been scientifically demonstrated in apple and other fruit trees. The influence of flooding on leaves is self-evident, for example, leaves do not appear green or even necrotic (Schaffer B, 1992). Too much soil water content would affect the reproductive growth of fruit trees. If flooding occurs in both summer and winter, cranberry fruit size and its yield are likely to decrease (Schaffer B, 1992). Some studies also point out that the development and formation of flower buds of fruit trees may be more sensitive to flooding, or more sensitive than fruit setting (Schaffer B, 1994). Apple trees under waterlogging will have lower fruit setting rate and yield (Schaffer B, 1992). Flooding can also reduce the transpiration of apple and other fruit trees (Schaffer B, 1992), resulting in the accumulation of starch in citrus leaves and the reduction of starch in roots. In addition, the decline of photosynthesis is also an early response of fruit trees to excessive water, thus affecting the healthy growth of fruit trees.

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