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IMPACT OF WATER ENVIRONMENTAL CHARACTERISTICS IN DRY-HOT VALLEY OF JINSHA RIVER ON SOIL DESERTIFICATION①

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ABSTRACT: Based on the field investigation and the analysis of soil moisture curve, it is clearly shown that there is a positive relationship between vegetation coverage rate and soil moisture capacity and soil depth in dry-hot valley of the Jinsha River, and also there is a desertification process with seasonality. It is suggested that the basic factor of desertification in the area is water deficiency (seasonal drought and low soil water capacity) and the direct dynamic of desertification is soil erosion. Some effective countermeasures are presented, of which water-saving planting and irrigation techniques should be firstly applied in the studied area.

KEY WORDS: desertification, dry-hot valley of the Jinsha River, water environment

With the social development, human beings had to pay much attention to the crisis of environment as to the economic crisis. Water deficiency and desertification are considerable among these crises, they are closely related to the living of human, because the former can cause life of human to be shorten (Water is the source of life) and the latter can lead to destroying the living space. The area of dry-hot valley of the Jinsha River(DHVJS) of China is a typical example of desertification(Liu, 1996).

1 METHODS

1) In investigated area, vegetation coverage rate, soil depth etc. of various desertified soils were measured in field. And concerning analyses were made according to the measured data.

2) The soil characteristic curve was determined by the Suction Cell Apparatus. The tested soil type is dry-red soil that is primary soil in researched area.

2 RESULT AND DISCUSSION

2.1 The Water Conditions and Their Impact on Desertification

2.1.1 Features of water condition

Dry-hot valley of the Jinsha River belongs to typical climate of dry-hot valley, its average annual temperature is 20– 23 ℃, accumulated temperature of ⩾10 ℃ is 7000 to 8000 ℃, average annual rainfall is 600– 800 mm, average annual evaporation is 2500 – 3800 mm, which is 4 to 6 times of rainfall(Table 1). Particularly, in this area, most rainfall precipi

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tates during May to October, accounting for 90% of the total rainfall. And drought season lasts 6 months, in this period evaporation is over 10 times of rainfall, the aridity is above 10.0. According to the above results, it was given an idea that though the rainfall of this area is more than that of arid area, the evaporation intensity is considerable and drought season is long, which lead to soil water shortage and sequentially desertification.

Table 1 The climate characteristic of investigated region

Site (county)	Annual rainfall (mm)	Annual evaporation (mm)	Drought season(Nov.-Apr.)		
			Rainfall (mm)	Evapo. (mm)	Aridity
Yuanmou	634.0	3847.8	60.4	1283.1	10- 16
Dongchuan	700.5	3604.1	86.3	1392.3	9.7
Panzhihua	764.4	2425.5	103.8	1161.6	10- 200
Huidong	624.0	2946.5	76.3	1014.7	4.6

The previous research (Cao, 1995) has shown that desertification will become serious as aridity upgrading. Globally, deserts are distributed in arid areas, and semi-deserts exist in semi-arid zones. According to the Chinese criterions of aridity and nature landscape (Shi, 1996; Zhang, 1996), where the average annual aridity is over 2.0 is steppe desert. There is a seasonal desertification process in the research area, because its aridity is over 4.0. Therefore, seasonal water deficiency is the primary cause of desertification in the dry-hot valley of the Jinsha River.

2.1.2 Moisture capacity of water curve of dry-red soil and its effect on vegetation coverage

In Fig. 1, the relationship between vegetation coverage and water content is shown as follows:

1) When soil moisture is zero, the higher the vegetation coverage, the higher the soil water content. In other words, soil water storage is directly related to vegetation coverage.

2) The lower the vegetation coverage, the higher the absolute value of the slope of water curve, it is indicated that when the coverage is lower, soil is quickly dehydrated and has weak drought resistance.

3) The lower the vegetation coverage, the more narrow the available moisture range. That is to say, even if there is water, it is not sure that plants will be satisfied by it. This result can be further explained from Fig. 2 that shows a positive line relationship between vegetation coverage and specific capacity of soil water.

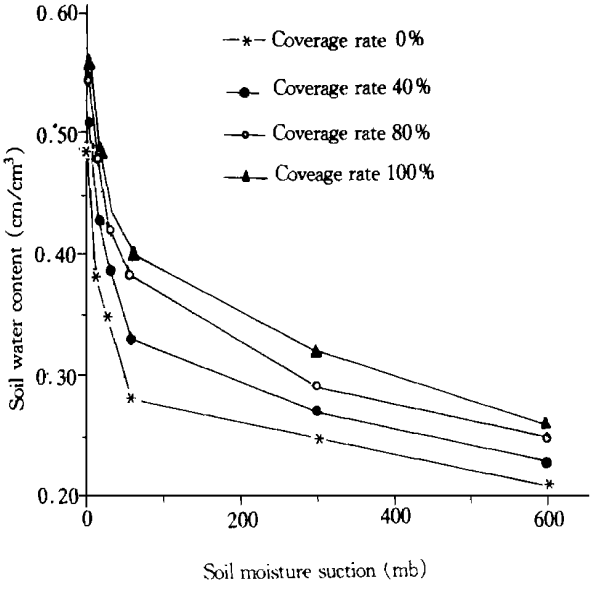

Fig. 1 The relationship between soil water characteristic and vegetation coverage rate

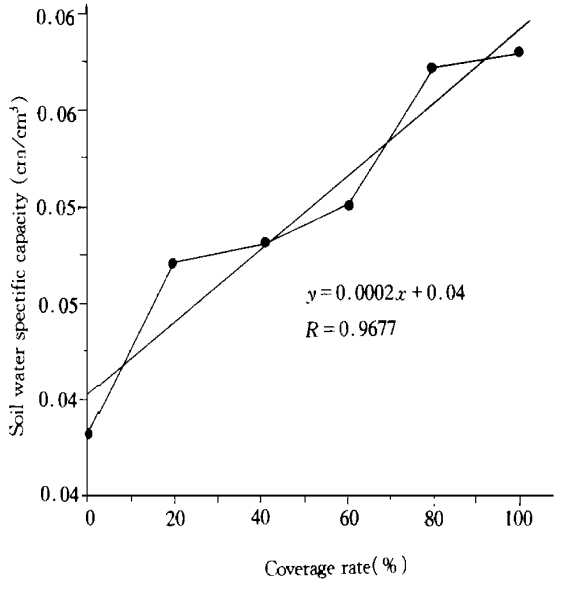

Fig. 2 The relationship between soil water specific capacity and vegetation coverage rate

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In general, the desertification of dry-hot valley of the Jinsha River was caused by the seasonal rainfall deficiency and the function deterioration of soil storing and supplying water.

2.2 The Causes of Water Deficiency in Dry-hot Valley of the Jinsha River

2.2.1 Drought climate

This region belongs to the zone with typical dry-hot valley climate and foehn efficacy is apparent, which lead to that rainfall is little comparing woth its evaporation potential. Particularly, in drought season (November to April), aridity reaches to the criterion of desert.

2.2.2 Topography

Topography not only affects the air activity to determine a certain kind of climate, but also regulates the distribution of precipitation. For instance, little water or no water was stored at the division or the steep slopped land where desertification often appears firstly. Such an example also can be seen at the Laoshan slope of Niugu village and around the Hope Primary School of Baiyan Village, in Huidong County.

2.2.3 Soil erosion

Serious soil erosion is often caused by the irrational exploring of land and excessive cutting of forest. The previous research shows that the transport-sediment modulus is up to 2400 t/(km^2•a). Erosion surely induces soil to be thinning and water to be recycling worse. As Fig. 3 shown, vegetation coverage is directly related to soil depth. Therefore, it is revealed that soil erosion is the direct impetus of desertification.

2.2.4 Human activities

Water shortage or being unavailable also resulted from the unreasonable management such as excessive grazing, exploration etc. Arable, grass and rock lands are often distributed in the same topography, such as at the south slope of the Mopan Mountain of Lumao Village and mineral dregs cover many blocks of arable land at Yinming Town of Dongchuan City, China.

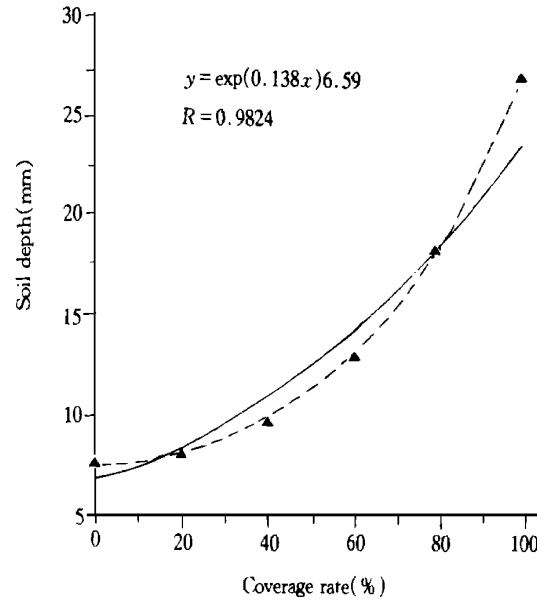

Fig. 3 The relationship between soil depth and vegetation coverage rate

In a word, all these appearances hinted that human activities have an effect on desertification.

2.3 Countermeasures of Controlling Water Shortage of DHVJS

Based upon the characteristics of investigated region, adaptable approaches for controlling water shortage are as follows.

2.3.1 Runoff harvesting farming

This technique, originated from West Africa, is conducted by doing a collection area of runoff at upper reaches and planting at lower reaches or depress area of a certain block. This practice can be applied to the blocks where stand conditions are worse, such as steep slope or the land far away from farmer houses(A Gnew, 1995).

2.3.2 Tied ridge planting

This practice is done by connecting ridges within which planting is conducted. In DHVJS, this technique should be implemented intensely. The ridge can be performed by hedgerow in network or arc shape in steep slope(Laryea, 1992).

2.3.3 Water-saving irrigation technique

In the region with irrigation facilities, this prac-

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tice should be applied to the upmost. At present, drip irrigation technique should be extensively used.

3 CONCLUSION

From the above discussion, the following conclusion can be reached: in DHVJS, vegetation coverage rate is positively related to soil function of storing and supplying water, and soil depth. It is revealed that relative water deficiency is the essential reason for desertification, and soil erosion is direct impetus of desertification in the studied area. For controlling desertification, water-saving planting and irrigation techniques should be firstly applied.

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