

A New Technique of Soil and Water Conservation for the Development and Utilization of Hillside Land

—— An Intruduction to Hillside Ditches and Its Application Prospect

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1 A Survey of the Hillside Land Development and Utilization in China

The area of plateaux, hills and mountainous regions is about 70 percent of the Chinese territory. The high topography and the steep slope are the most essential potential factors which result in soil erosion. There is 30 percent of $\times 10^8 \text{hm}^2$ cultivated land distributed on hillside land, and the slop of more than $6.67 \times 10^6 \text{hm}^2$ steep hillside land of them is equal to or greater than 25° . The amount of soil erosion on cultivated hillside land forms the major source of that in the whole nation.

Since ancient times, the Chinese people have accumulated a wealth of experiences in hillside land conservancy; Yet, owing to the vast territory, the complex natural conditions and the unbalanced development of economy, the utilization patterns and conservancy measures to hillside land have nothing in common with each other (such as the compound system of cultivation, forestry and pomiculture, the terraced field, the soil conservancy cultivation, collecting soil through no-tillage and so on). Particularly, in the recent 10 years, the comprehensive harness of small watershed has become a very successful experience in soil and water conservation in China, and it plays an extremely important role in promoting soil and water conservation on hillside land.

Along with the reversely developing between Chinese population and cultivated land area, the cultivated land area per capita will keep decreasing; Meanwhile, with the development of social economy and the advancement of science and technology, the landuse patterns will be deversified gradually, and the problems resulted from it will still more conspicuous. In order to control soil erosion, and to ensure a sustained utilization of hillside land, people must adopt some effective utilization patterns and new techniques of soil and water conservation on hillside land.

2 The New Technique of Hillside Ditches

The hillside ditches (also known as Mr. Liao's hillsilde ditches) is established by conservancy workers with Dr. Liao Mianjun as the leader on the basis of summarizing soil and water conservancy practices and scientific researches in Taiwan for many years. The hillside ditches is a kind of shallow triangle ditches which is built opposit to the direction of original slope or along the contour lines. The ditches should be proper distance apart from each other, it is used for reducing slope length and intercept runoff at different sections to prevent the erosion of slope surface, then the goal of land conservation is achieved. since the ditch sections are wide and shallow, it can provid an operation road for mechanization on hillside land, conse-

quently, the field labour expend and the productive cost will be reduced, and the costruction will be easier, so it is convenient for bulldozer to operate, this is to say, it has the advantage of labour saving management. The length limit of hillside ditches is 100 m, the drainages are unidirectional, as the ditches is more than 100 m long, it could be two-way draining or draining concentrately in the middle. For this reason, there should be longitudinal overall drainages in the both end or the middle of the ditches. The criterial ratio of the hillside ditches gradient is 1% ,and there is a limitation of 1. 5% on it. The water exit must be connected with longitudinal drainage. The vertical distance between each two rows of hillside ditches could be calculated out by using a certain formula. In orchard construction, the distance between ditches is determined in accordance with the distance between 3~ 5 rows of pomiculture, the mechanical operation space (spredying insecticide for example) and the slope permissible distance.

There are two types of hillside ditches, they are the wide and the narrow (see Fig. 1~ 2), the former is often built on gentle slope with thicker soil layer, and the latter is mostly on steep slope with thinner soil layer. The ratios of its gradient are 1% or 1. 5% respectively.

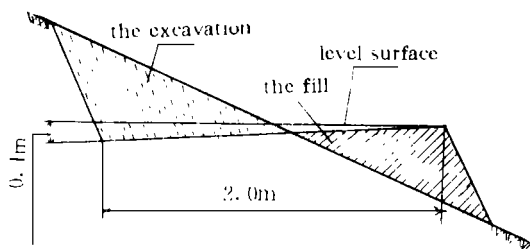


Fig. 1 The cross-sectional profile of wide type hillside ditches

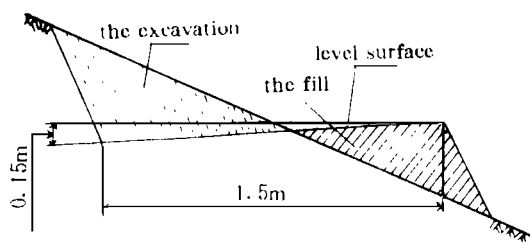


Fig. 2 The cross-sectional profile of narrow type hillside ditches

For the purpose of avoiding soil erosion of hillside ditches, the sythetic measures as follows must be taken (1) planting dense growth grass— the cover plant on ditches and its sideslope upward and downward; (2) covering the ground; (3) planting herbs on the drainages. Thus it can not only strengthen the effect of soil and water conservation and heighten the efficient of agricultural production, but also have the multiple function of afforesting and beautifying the environment and so on.

People can maintain soil moisture, regulate soil temperature, supply nutriment for plant and ameliorating the physical characteristics of soil by ground covering. Under given slope length, by combining the methods of ground covering with contour close planting, the amount of actual soil erosion can be controlled in the range of of the possible erosion. It is indicated by the experiment and researches in Taiwan that, it can attain to the objective of soil and water conservation on hillside land by contour planting crops(or fruit and tea) on hillside land, coordinating with hillside ditches, cover crops and ground cover measures as the same as by building terraced fields or terraces. Comparising with the latter, two third labour days could be saved by using measures of the former, it is a sort of good measures which have the ad-

vantages of re-tillage, low cost and labour saved management. The experiments conducted by Mr. Lu Chenglong and his comrades (1990) indicated that, on the original hillside land with fruit trees planted, the amount of soil erosion was reduced obviously, the sediment retained reached at a range of 62% ~ 73%. After whole covered with herbs, the sediment retained could be 9% . Because of the reducing of soil erosion and the increasing of cover herbs remains, the organic matter in soil will be increased, and the fertility will be improved.

3 The Application Prospect of Hillside Ditches

Since many years in Taiwan, hillside ditches have become a new technique system of modernized agricultural production and conservancy in hillside land cultivation which places stress on orchard, it has quite a good effect upon the conservancy of soil and water resources, the afforestation for hillside land, and promoting the development of rural economy in Taiwan. This new technique has been well received by international community, and it has been adopted and spread in the United States of America, Japan, South Africa, Southeast Asia, the Central and South America, and the World Food and Agriculture Organization of the United Nations. In March, 1989, "the International Seminar of Hillside Land Conservation" was convened in Taiwan, it made this new technique be further approved, and became the world's model for hillside land exploitation and utilization. In recent years, hillside ditches have been spread and used to some extent at Janyang, Jingle and Nanjing counties etc. in Fujian province, and a good effect has been obtained. The testing and spreading is also been conducted at some areas in Jiangsu and Jiangxi province.

It is the inevitable of coordinated development between soil and water conservation and economy that the hillside ditches is able to be used and spread in Taiwan. The population will gradually flow to towns, and the rural manpower will be weakness alongside the developing of Taiwan industry and commerce. Besides, the area of hillside land being used in some non-agricultural ways becomes larger and larger, it promotes all circles to pay further attention to soil and water conservation. On this new conditions, new techniques of soil and water conservation would be emerged as the times demand.

In line with the rapid development of Chinese economy, people will have more and ungentler enquirements to hillside land agriculture and conservation. From the view of development, the hillside land exploitation, orchard construction and conservancy techniques, should develop towards the direction of reducing labour intensity, increasing labour effect and convenient for mechanization operation from now on. Simultaneously, it should be adapted to the demand of afforestation and beautifying the environment. Therefore, the problems how to regulate the relationship among hillside land harness and exploitation, and the development of regional economy in China, and how to combine soil and water conservation with industry, agriculture, forestry, pomiculture, livestock husbandry and tourism should be emphasized. It is of important reference significance for many regions, especially, the subtropics and tropics regions that, to apply and spread hillside ditches which suit with the local conditions according to local natural conditions and social and economic conditions of different regions.