

Problems and countermeasures for water resource security in dry-hot valleys of the Jinsha River in Yunnan province

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Objectives

Dry-hot valleys refers to the high temperature and low humidity valley area, which is characterized by both dry and hot, and widely distributed in the longitudinal range-gorge region in Yunnan province, Southwest China. One of the most widely distributed and largest areas of dry-hot valley is the Jinsha River Valley. The region is characterized by abundant light and thermal resources as well as fertile land, making it well-suitable for the development of plateau characteristic agriculture.

Yuanmou, Binchuan and Huaping County are the most typical and specific representative areas of the dry-hot valleys. Yuanmou vegetables, Binchuan grapes, Huaping mangoes are the most distinctive plateau characteristics agricultural products, selling well at home and abroad.

However, due to the higher cultivated field than available water in hot and dry climate, water scarcity has been become the primary constraint on the region's social and economic development. Therefore, investigating the countermeasures to address the challenges of water security in the dry-hot valleys is crucial for promoting the high-quality development of modern agriculture in the area.

Methods

Taking the dry-hot valleys of the Jinsha River as an example, after analyzing the existing problems with water resource protection, and considering the demands of regional plateau characteristic agriculture development, and focusing on the construction of plateau characteristic irrigation areas and water source projects. By increasing the development and utilization of water resources in the main stream of Jinsha River, optimizing the allocation pattern of regional water resources, and building a water resources security system with simultaneous development of large, medium and small-sized water conservancy projects, combination of water storage, diversion and pumping project, adjustable and complementary water resources. Promoting the high-quality development of modern agricultural industry in dry-hot valley area, and create a new growth pole of modern agriculture with Yunnan plateau characteristics.

Results

Through the prediction of water supply and demand and the analysis of water supply and demand balance in the dry-hot valley of Jinsha River, the results show that: Under the current situation, the total water shortage in the dry-hot valley of Jinsha River is 191 million m³, and the water shortage rate is 16.3 %. By 2035, with the economic and social development of the dry-hot valley of the Jinsha River and the completion of the plateau characteristic irrigation areas, without the construction of new water conservancy projects, the total water shortage will be as high as 1.21 billion m³, and the water shortage rate will be 58.9 % in the dry-hot valley of the Jinsha River. The water shortage situation will be more severe.

According to the results of water resources allocation, a total of 15 comprehensive utilization projects of water resources of cascade hydropower station in the mainstream of Jinsha River, 26 large and medium-sized water storage projects and 15 photovoltaic pumping group projects will be constructed to enhance the development and utilization of abundant water resources. These projects could provide additional water supply of 1.196 billion m³, and reduce the water deficit rate from 16.3% to 0.7%. By constructing 36 large and medium-sized irrigation areas, the irrigation rate of cultivated land is increased from 34.7% to 51.1%, creating a high-yield food base with plateau characteristics that meets the increasingly diverse food consumption needs of the people.

Conclusions

Based on the analysis of the problems existing in the development and utilization of water resources in the dry-hot valley area of Jinsha River, this paper puts forward a new batch of water source projects, constructs a regional water resources guarantee scheme, makes up for the shortcomings of water conservancy infrastructure, solves the problem of drought and water shortage in the dry-hot valley areas, and supports the development of plateau characteristic agricultural industry in the valley area.

The findings of this study can provide an important reference for water resource security for supporting rural revitalization through agricultural development.