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Analysis of Agricultural Irrigation Water in Tarim River

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ABSTRACT. *Based on the data of "four sources and one dry" irrigation water in the Tarim River Basin in the past decade, this paper compares and analyzes the characteristics of irrigation water change before and after the implementation of unified management, and uses the ratio of net irrigation water to irrigation water to explore whether the irrigation water efficiency can be Enhance to reveal the effectiveness of unified watershed management in the management and utilization of irrigation water.*

KEYWORDS: *Tarim River Basin, agriculture, irrigation water, ecology*

1. Preface

The current agricultural water use in the Tarim River Basin accounts for more than 96% of the total water use in the basin [1-2], and the utilization level and efficiency are extremely low. To achieve the orderly and rational use of agriculture and improve the efficiency of agricultural water use is to alleviate the ecological and agricultural water use in the basin. The important way of contradiction is one of the important goals of implementing unified management in the basin [3-6]. Therefore, based on the data of "four sources and one dry" irrigation water in the Tarim River Basin in the past decade, this paper compares and analyzes the characteristics of irrigation water change before and after the implementation of unified management, and uses the ratio of net irrigation water to irrigation water to explore whether the irrigation water efficiency can be Enhance to reveal the effectiveness of unified watershed management in the management and utilization of irrigation water.

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2. Data sources and research methods

2.1 Data source

The data provided by the Tarim River Basin Authority includes: (1) measured data of annual irrigation water use in the Yarkant River Basin, Aksu River Basin, Hetian River Basin and Kaikong River Basin in the source area of 1998 and 2002-2013 and the mainstream of the Tarim River in 1998. The annual irrigation water consumption data from 2006 to 2013 and the incoming water data from 2002 to 2013; (2) the actual irrigation area and the net irrigation quota per unit area of the "four sources and one dry" irrigation area in 2005 and 2013. In addition, in order to maintain the consistency of the time series, the amount of irrigation water in the Xinjiang Tarim River Basin Water Resources Bulletin from 2002 to 2005 was used to determine the amount of water used for irrigation from 2002 to 2005.

2.2 Research methods

The amount of irrigation water includes the amount of water needed for the normal growth of the crop, and the amount of water lost from the diversion channel to the irrigation water unit during transportation and distribution. The amount of net irrigation water refers to the amount of water needed to grow the crops entering the cultivated land, that is, the water loss during the diversion irrigation process, which can be obtained by multiplying the irrigation area of the basin with the net irrigation quota. Therefore, using the ratio of net irrigation water to irrigation water can better clarify the water use efficiency. If the ratio is smaller, the utilization efficiency of irrigation water is improved.

$$W_{GG}=W_N+W_C$$

$$W_{N=}M\lambda$$

$$p=W_N/W_C$$

In the formula, WGG is the irrigation water volume (108 m3), WN is the net irrigation water volume (108 m3), WC is the invalid loss water volume (108 m3), M is the actual irrigation area (hm2) in the tank area, and λ is the net irrigation quota (M3/hm2), p is the ratio of net irrigation water to irrigation water.

3. Analysis of changes in water use for irrigation in river basins

3.1 Variation characteristics of irrigation water use in source and catchment areas

The "four source flow" of the Tarim River is an important part of the basin irrigation area and a key area for comprehensive river basin management. The change of agricultural water consumption is directly related to the protection of ecological water in the area and the completion of the discharge index to the

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mainstream. Therefore, this paper first analyzes the variation characteristics of "four source flow" irrigation water in the past ten years based on the measured data of irrigation water consumption from 2002 to 2013 (Figure 1).

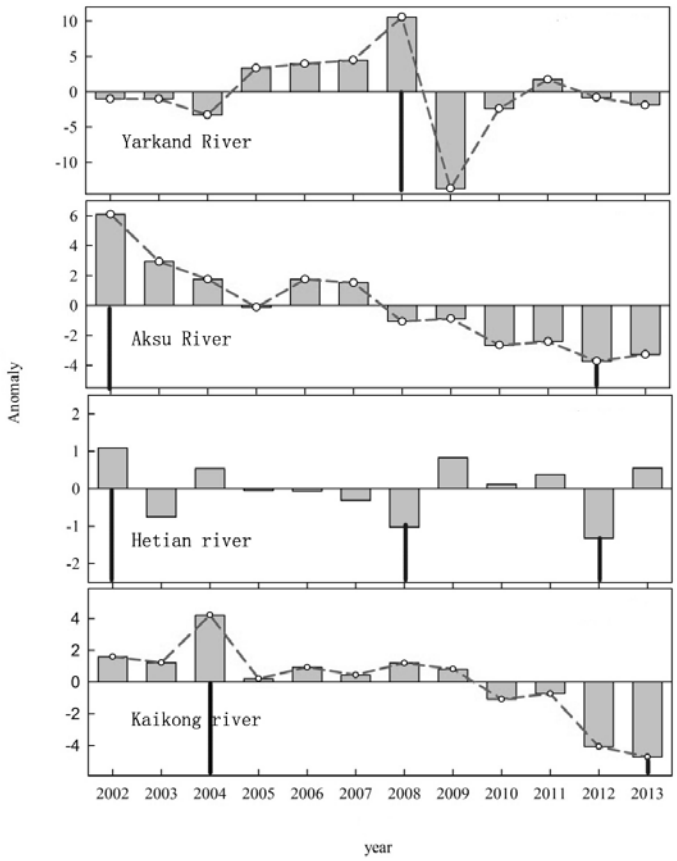

Figure. 1 Variation of agricultural water in Tarim River Basin from 2002 to 2013

Combined with Figure 1, between 2002 and 2013, the annual irrigation water consumption in the Yarkant River Basin showed a trend of increasing first and then decreasing. The Aksu River Basin and the Kaikong River showed a significant downward trend, while the Hetian River Basin was irrigated annually. The amount of water used did not change significantly. The annual irrigation water consumption in the Yarkant River Basin showed a significant increase trend from 2002 to 2008. The annual irrigation water anomaly reached 10.57×108m3 in 2008. However, in 2009, the watershed was reduced in the basin, and the irrigation water was reduced. Sharply reduced, the anomaly fell to -13.7 × 108 m3; between 2010 and 2013, the annual irrigation water consumption of the Yarkant River basically maintained the average annual water consumption level, and showed a small downward trend. The

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annual irrigation water consumption in the Aksu River Basin and the Kaikong River Basin decreased at an annual rate of 0.753×108m3 and 0.552×108 m3, respectively. The annual irrigation water anomaly in the Aksu River Basin showed a negative value in 2008 (-1.06×108m3).), and after 2010, the anomaly becomes smaller, the average distance from 2010 to 2013 is -3×108 m3; the annual irrigation water anomaly in the Kaikong River Basin has a negative value in 2010 (-1.08×108 m3), and 2012 The annual irrigation water consumption was the least in 2013 and 2013, and the anomalies were -4.07×108 m3 and -4.73×108m3, respectively. The annual irrigation water consumption in the Hetian River Basin has changed little, and the anomalies in 2008 and 2012 exceeded 1×108m3.

3.2 Analysis of changes in annual irrigation water consumption and its influencing factors

Based on the data collected from the mainstream of the Tarim River and the annual irrigation water consumption data, the characteristics of the water volume and irrigation water consumption from 2002 to 2013 were compared and analyzed (Figure 2).

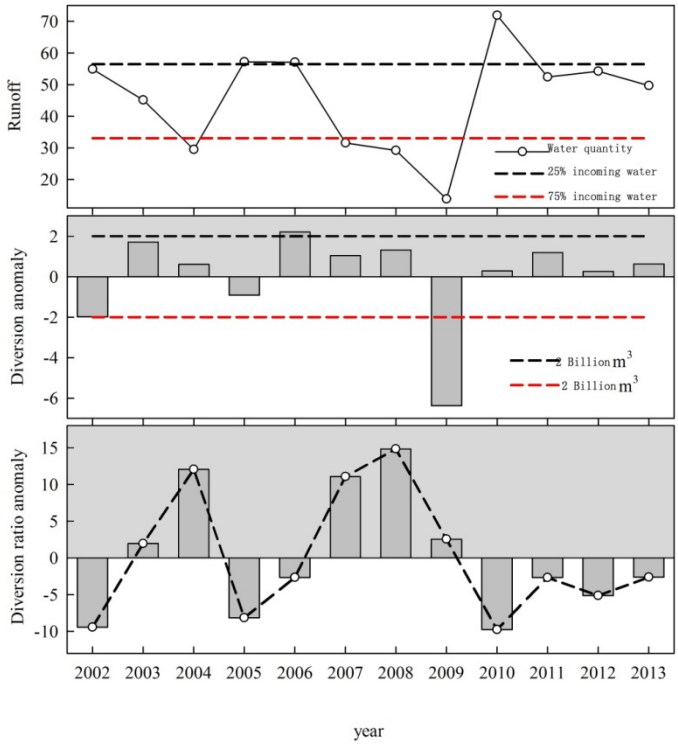

Figure. 2 Variation of agriculture water and runoff in the main stream of Tarim River

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Between 2002 and 2013, the annual average incoming water volume of the main stream was 45.5×108m3, which was generally in a state of partial abundance, and the amount of water discharged from the source flow to the main stream was effectively guaranteed. The average annual irrigation water consumption of the main stream is 10.07×108m3, and the water diversion ratio is 22.12%. It does not exceed the planning index set in the Tarim River Basin "Four Sources and One Dry" Surface Water and Water Allocation Scheme approved by the Xinjiang Uygur Autonomous Region. Except for the extremely dry year of 2009 (the current year's dry water was only 13.83×108 m3), the irrigation water consumption decreased significantly, and the anomaly reached -6.37×108 m3. The annual irrigation water consumption of the Tarim River mainstream was smaller, and the anomaly was [-2×108 m3, 2×108 m3], in particular, between 2010 and 2013, the amount of irrigation water is more stable, and the diversion anomaly is less than 1×108 m3. It should be pointed out that the area of cultivated land has increased significantly between 2002 and 2013. According to the data provided by the TATA, the area of cultivated land in the main stream increased by 37.3% in 2013 compared with 2005. Combined with the characteristics of the change of the main stream irrigation water, it can be seen that although the main stream is rich in water and the area of cultivated land is rapidly expanding, the amount of irrigation water has not increased significantly, which indicates that the main stream of agricultural water diversion has been effectively managed, and the irrigation water efficiency is obtained. A certain degree of improvement.

4. Comparison and analysis of watershed irrigation watersheds by time period

In order to further clarify the impact of unified management on irrigation water use in the basin, combined with the data of relevant irrigation water consumption before the implementation of comprehensive river basin management (1998), the characteristics of irrigation water change before and after the implementation of unified management were compared and analyzed. Figure 3).

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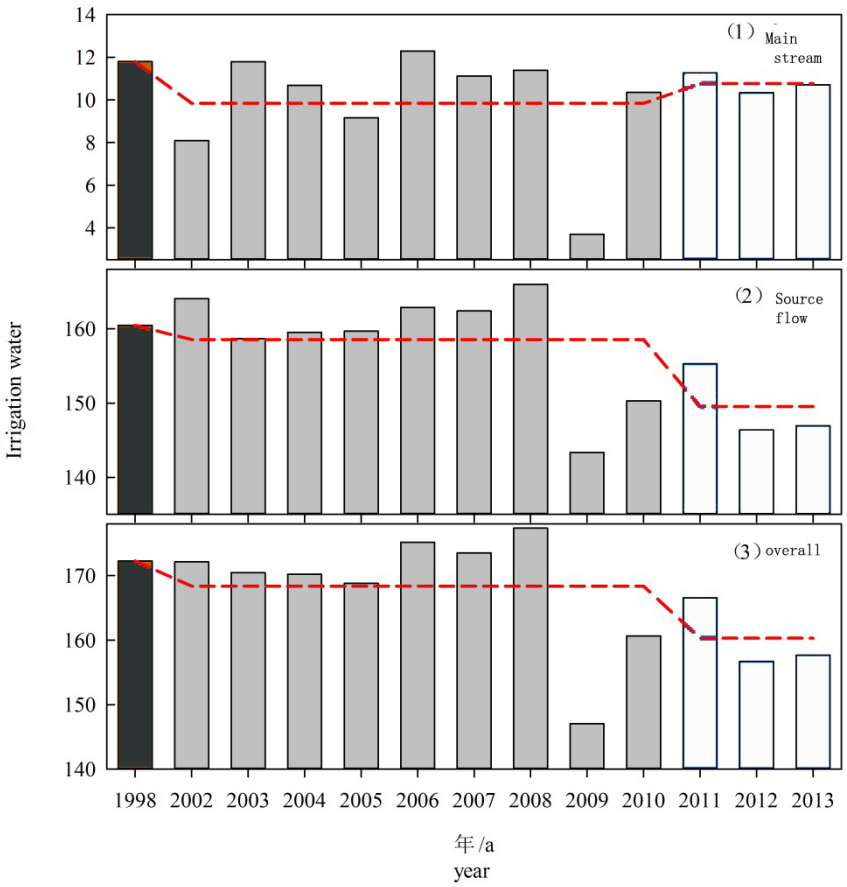

Figure. 3 Variation of agriculture water in different periods of Tarim River Basin

According to Figure 3, after comprehensive management and unified management have been implemented, the overall irrigation water consumption in the basin has continued to decrease. Compared with the implementation of comprehensive management (1998), the basin implemented comprehensive management (2002~2010) and after unified management (2011-2013), the overall annual average irrigation water consumption in the basin decreased by 2.2% and 6.9%, respectively. After the implementation of integrated management and unified management, the average annual irrigation water consumption decreased by 16.6% and 8.7% respectively compared with 1998. Although the average annual irrigation water consumption increased by 10.5% after unified management, it still did not exceed the target value of the plan for the “four sources and one dry” surface water and water distribution plan in the Tarim River Basin. The source stream area is consistent with the overall change of the basin, showing a gradual decrease trend.

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Compared with the comprehensive treatment, the average annual irrigation water consumption decreased by 1.2% and 6.8% respectively after the implementation of comprehensive management and unified management. In addition, it should be pointed out that the area of cultivated land in the basin in 2013 increased by 25.3% compared with 1998. Under the condition of continuous increase of cultivated land area, the amount of irrigation water consumption showed a decreasing trend, indicating that water resources management and water resources utilization level in the basin have been significantly improved.

5. Summary

After the implementation of comprehensive management and unified management, the overall irrigation water consumption in the Tarim River Basin showed a trend of continuous decline, and the reduction after unified management was more obvious. Compared with the implementation of comprehensive management, the river basin implemented comprehensive management and unified management. The overall annual average irrigation water consumption in the basin decreased by 2.2% and 6.9%, respectively. Under the pressure of large expansion of cultivated land, the amount of irrigation water has decreased. The increase of net irrigation water is mainly due to the improvement of water use efficiency.

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