

# Rationality Evaluation of Water Quota in Guizhou Province

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**Keywords:** Quota Management, Agricultural Water Quota, Rationality Evaluation.

**Abstract:** Quota management is a basic system of water resources management stipulated by water law. According to the technical requirements of water quota evaluation, the agricultural water quota in Guizhou Province was evaluated. The results show that:(1)The three items of comprehensive evaluation meet the requirements of rationality, so the rationality evaluation conclusion of agricultural water use quota in Guizhou Province is "reasonable".(2)The gap between the water use level of rice in Guizhou Province and the quota value is small, and the quota formulation is reasonable.(3)According to the water consumption data of corn, wheat, corn, potato, rape and vegetables (Capsicum and Chinese cabbage) in Guizhou, there is a big gap between 50% of the dry crop quota and the established quota standard, but the overall average deviation is 16.1%, which is in a reasonable deviation range.

## 1 INTRODUCTION

Quota management is a basic system of water resources management stipulated by water law, and it is an important basis for water resources demonstration, water intake permit, planned water use, etc (Zhang, 2018). Strengthening water quota management is helpful for sustainable utilization of water resources. Foreign countries adopted water quota management earlier after analyzing and studying the demand for water consumption (Liu, 2017; Okamura et al., 1992; Blair et al., 1998; Mc Affer et al., 1996; Maes, 1987). When managing the water quota in France, based on the water law, six River Basin Organizations in the whole country are managed in a unified way and six water affairs bureaus are established. The United Kingdom manages water resources through the establishment of the Ministry of environment. The United States, Canada, Mexico, Japan and other countries have generally adopted the form of quota management of water resources, which is the inevitable requirement of water resources management (Sanders, 1999; Anwandter, 2002; Colenbrander, 1986; Aida et al., 1998; Stephen, 1999; Qui, 2007).

In China, agricultural water consumption accounts for more than 50% of the total water consumption. However, by the end of 2019, 42 national standards for high water consumption industrial quotas such as thermal power generation and iron and steel complex have been issued; Since 2014, four water-saving technical specifications for service industry, such as car washing and bathing, have been issued, which stipulate the relevant requirements and quota standards for water-saving in service industry; Agricultural water quota is included in the water quota of each province in China, but the national standard of agricultural water quota is still lacking. In 2020, the Ministry of water resources issued seven agricultural irrigation water quotas with the document "notice on printing and distributing seven agricultural irrigation water quotas including rice". In April 2015, the water resources division of Ministry of water resources of China issued the technical requirements for water quota assessment. Therefore, taking the agricultural water quota of Guizhou Province as an example, the rationality evaluation standard is determined. By comparing the difference between the actual irrigation water consumption per mu and the quota, the rationality of the agricultural water quota is

evaluated, which provides the basis for revising the agricultural water quota and formulating the national standard.

## 2 ESTABLISHMENT OF AGRICULTURAL WATER QUOTA IN GUIZHOU PROVINCE

According to the water quota of Guizhou Province (DB52 / T 725-2019), the water quota of agricultural irrigation, forestry, animal husbandry and fishery is divided into 4 categories, 12 medium categories and 707 quota values. Compared with the "industrial water quota of Guizhou Province" (DB52 / T 725-2011), the forestry quota is added, and the quota is divided into level I (advanced value) and level II (general value).

Agricultural basic irrigation water quota includes 8 categories, 23 crops, 642 quotas. Forestry mainly formulates a kind of index, namely forest seedlings, with a total of 30 index values (see table 1).

Table 1: Release of agricultural irrigation water quota in Guizhou Province.

industry	classification	Crop name	Quantity of issued quota
Agriculture	Grain planting	middle-season rice	30
		Wheat	30
		Corn	30
	Bean, oil and potato cultivation	rape	30
		potato	30
	Cotton, hemp, sugar tobacco planting	flue-cured tobacco	30
		Chinese Cabbage	30
	Cultivation of vegetables, edible fungi and horticultural crops	Pepper	30
		Houttuynia cordata	30
		Thunb	30
		Flowers and horticultural crops	30
		Grape	30
		pitaya	12
		Fruit planting	Passion fruit
	kiwifruit		30

Forestry	Cultivation of nuts, oilseeds, spices and beverage crops	Peach and pear	30
		citrus	30
	Traditional Chinese medicine planting	Walnut	30
		Tea	30
		Dendrobium	30
	Grass planting and mowing	banxia	18
		Bletilla striata	30
		Radix Pseudostellariae	30
	Tree breeding and seedling raising	Grass planting (forage grass)	30
		Tree seedling	30
total	9 categories	24species	672

## 3 EVALUATION CRITERIA

According to the technical requirements of regional water quota evaluation, the rationality evaluation of agricultural water quota includes four aspects: first, whether the irrigation water quota is formulated according to the division of the province; Second, whether it is formulated according to different guarantee rates; Third, whether to revise regularly or timely; Fourth, whether the water quota is reasonable compared with the current water level. See table 2 for the classification standard of rationality evaluation.

Table 2: evaluation criteria for rationality of agricultural water quota.

classification	easy	reasonable	strict
assessment	2 or less	3 satisfied	4 satisfied

## 4 ASSESSMENT PROCESS AND RESULTS

The irrigation water consumption of rice in Guizhou Province is the largest, and the proportion of irrigation water in paddy field reaches 96.5%. Therefore, the water consumption level of 80% hydrological year type (75% hydrological year type in neighboring provinces) of irrigation area with rice as the main crop is mainly collected for irrigation quota evaluation. Although there is not much irrigation water for dry

crops, it accounts for a large proportion of the crop planting area in Guizhou. Wheat, corn, potato, rape and vegetables (hot pepper and Chinese cabbage) are selected as representative crops for evaluation.

#### 4.1 Rice

According to table 3, the difference between the net water consumption index of rice in 16 sample irrigation areas and the established quota is less than 20%.

Table 3: Water consumption statistics of sample irrigation areas in Guizhou Province.

Name of irrigation area	Agricultural irrigation Division	Rainfall frequency	Actual net water consumption index (m <sup>3</sup> /hm <sup>2</sup> )	Water consumption quota of Guizhou Province		Minimum difference between actual and quota
				Adjustment coefficient	Quota value (m <sup>3</sup> /hm <sup>2</sup> )	
Heshandun Irrigation District	I	81.50%	3675	1.04	4155~4785	11.8%
Hongyan Irrigation District	I	78.60%	3765	1	4005~4605	6.0%
Guoshui Irrigation District	I	84.50%	4275	1	4005~4605	0%
Xiaoshipo Irrigation District	I	75.50%	3165	0.96	3840~4425	17.7%
Momenshan Irrigation District	II	79.20%	5313	1.04	4530~5250	1.1%
Hongzhou Wuyi Irrigation District	II	79.20%	5487	1	4350~5055	8.5%
Cuili Irrigation District	II	80.30%	4698	1	4350~5055	0%
Tuanjie Irrigation District	III	74.60%	4725	1.04	4470~5145	0%
Minle Irrigation District	III	78.60%	5722.5	1.04	4470~5145	11.2%
Xiluohe Irrigation District	III	86.60%	3645	1	4305~4950	15.2%
Hongqi Irrigation District	III	83.50%	3675	1	4305~4950	14.6%
Jinqian Irrigation District	IV	86.6%	3675	1.04	3585~4155	0%
Fukuo Irrigation District	IV	86.6%	3378	1.04	3585~4155	5.8%
Kewang Irrigation District	V	82.80%	3810	1	3795~4350	0%
Mulanghe Irrigation District	V	81.20%	3390	1.04	3945~4530	14.1%
Xingxihu Irrigation District	V	81.20%	3390	1.04	3945~4530	14.1%

#### 4.2 Dry Crop

The main dry crop varieties planted in Guizhou Province are wheat, corn, potato, rape and vegetables. Wheat, corn, potato, rape and vegetables (Capsicum and Chinese cabbage) are selected as representatives of dry crops for irrigation quota evaluation.

According to the results of Xiuwen County Central Experimental Station in Guizhou Province from 2016 to 2017, the rainfall in 2017 was 239.4mm, which was a moderately dry year (the rainfall frequency was about P = 74%). The results of comparing the net irrigation quota of wheat, corn, potatoes and vegetables with the water quota of

Guizhou Province (db52/T 725-2019) are shown in Table 4. The average net quota of corn in dry year is 1695m<sup>3</sup>/hm<sup>2</sup>, which is 5.6% higher than the quota standard. The net quota of wheat, rape, potato and pepper is 23% - 26.8% lower than the quota standard. The average deviation of dry crop net quota and quota standard is 16.1%.

Table 4: Comparison table of dry crop test results and standard irrigation quota.

Typical irrigation area	crop	Year Type of precipitation	Test quota		Water consumption quota of Guizhou Province		Minimum difference between actual and quota
			net water consumption index (m <sup>3</sup> /hm <sup>2</sup> )	Condition of facilities	Quota value (m <sup>3</sup> /hm <sup>2</sup> )	Condition of facilities	
Xiuwen County Central Experimental Station	Wheat	Dry year	801	Open field	1095~1305	Open field	26.8%
	Corn	Dry year	1695	Open field	1350~1605	Open field	-5.6%
	Rape	Dry year	948	Open field	1305~1545	Open field	27.4%
	Potato	Dry year	1005	Open field	1305~1545	Open field	23%
	Chinese Cabbage	Dry year	1725	Open field	1500~1905	Open field	9.4%
	Pepper	Dry year	975	Open field	1155~1395	Open field	15.6%
	average	Dry year	1191	--	1284	--	16.1%

### 4.3 Conclusion of Rationality Evaluation

(1) The irrigation water quota of Guizhou Province is formulated according to the division of the province, which meets the requirements of "Article 1" of rationality evaluation.

(2) The irrigation water quota in Guizhou Province includes three guarantee rates of 50%, 80% and 90%, which meet the requirements of the second article of rationality evaluation;

(3) The agricultural water quota standard of Guizhou Province will be issued and implemented in 2018, and the revised draft will be officially released in 2019, which meets the requirements of "Article 3" of rationality evaluation;

(4) According to the existing irrigation test data, the difference of rice in Guizhou Province is less than 20%, and that of some dry crops is more than 20% (50% of the crops in the survey sample do not meet the requirement of 20% deviation), so it does not fully meet the requirements of "article 4" of rationality evaluation.

(5) Evaluation conclusion: according to the rationality evaluation standard of agricultural water quota, three

of the four items meet the requirements, and the evaluation result is "reasonable".

## 5 CONCLUSION

According to the technical requirements of evaluation, the main conclusions of agricultural water quota evaluation in Guizhou are as follows.

(1) The three items of comprehensive evaluation meet the requirements of rationality, so the rationality evaluation conclusion of agricultural water use quota in Guizhou Province is "reasonable".

(2) From the current water use level of sample irrigation areas, the gap between the water use level of rice in Guizhou Province and the quota value is small, and the quota formulation is reasonable.

(3) According to the water consumption data of corn, wheat, corn, potato, rape and vegetables (Capsicum and Chinese cabbage) in Guizhou Xiuwen Center Experimental Station, there is a big gap between 50% of the dry crop quota and the established quota standard, but the overall average deviation is 16.1%, which is in a reasonable deviation range.

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