

## **ECONOMIC VALUE OF IRRIGATION WATER THE RED RIVER BASIN: A CASE STUDY IN CAU SON IRRIGATION SYSTEM**

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**Abstract:** *Irrigation plays an important role in socio-economic development in the Red River Basin because of not only ensuring food security but also increasing food export value. However, it is the largest water consumer. In the context of increasing water shortage, it is essential to determine the economic value of water used in irrigation for enhancing water use efficiency. This study analyzed the irrigation water value based on household surveys in Cau Son irrigation system for 2010 and 2018. Using the Total Economic Value framework and residual value method, analyzed results show that the economic value of irrigation water increased between these years. The water value of rice irrigation is lower about 1.8 times than that of cash crops. In addition, though the household's farming size remained, the water value of Spring crop with often water shortage occurred, was higher than that of Summer crop with a factor of 1.4. Several solutions are recommended: (i) changing the household's cropping structure toward increased crop area producing high value and using less water; (ii) applying advanced rice cultivation practices with saving-water irrigation, and improving water management including water reuse; (iii) applying water prices to increase water use efficiency in irrigation with adaptation to climate change.*

**Keywords:** Water value, irrigation, cultivation, water shortage, rice, cash crop.

### **1. INTRODUCTION**

The economic analysis of water use or quantifying economic value of water is considered a means to the better understanding the relationship between economic development and water use for the country as a whole (UN, 2012). In terms of value added, the analysis of the economic importance of the main water uses, production and revenues is to support the integrated water management. Water values are a central aspect of power and equity in water resources governance. Better measurement and understanding of the values of water, and their incorporation into improved decision-making enable the equitable comparison of multiple water values held by various stakeholders, and are essential for achieving sustainable water management (UN, 2021).

Irrigation development is seen as one of the means to reduce poverty and promote economic growth. Irrigated agriculture represents 20 percent of the total cultivated land and contributes 40 percent of the total food produced worldwide. Irrigated agriculture is, on average, at least twice as productive per unit of land as rain-fed agriculture, thereby allowing for more production intensification and crop diversification (WB, 2020). In Vietnam, irrigation for agriculture has played a significant role in providing sufficient food for nearly 100 million people and becoming a world leading rice exporter with an annual export value of about 3 billion USD. In addition, irrigation consumes as much as 82% of total annual withdrawal water (MONRE, 2021). Thus, improving the irrigation water use efficiency would be essential in the context of water scarcity. Continued increase in water use for food

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production over the last decades has exacerbated water scarcity conditions in many regions around the world (e.g. India, the Middle East and North Africa) (Wada, 2016).

Valuing water used for irrigation can play a key role in decision-making and priority-setting for investment and management of irrigation systems (Hellegers and Halsema, 2019). In additions, it also enables a better understanding of the causes of inefficient use of water in the food system and provides incentives to increase investments in the modernization of irrigation infrastructure. This can in turn increase the efficiency and productivity of water use for food production, while avoiding the negative impacts of inefficient water and ensuring that sufficient water remains for the environment and resilience to climate change. Along with the development of economic sectors, water is used not only for agricultural production but also for other economic sectors in Vietnam. The value of water in these sectors are different, therefore, it is necessary to have a sound assessment of the water value for different water uses especially agriculture production in the context of increasing water shortage.

In Vietnam, there a number of studies related to water value in irrigated agriculture. There is a study by Chinh (2018) focusing on the impact of water price policy in irrigated agriculture on the household economy in the Red River Basin (RRB). Khiem and et al. (2009) conducted a research reviewing the various method of calculating economic value of water for different water users in the RRB. Huong and Khiem (2011) revised the practical application the CVM method to estimate the willingness to pay for rural water use in the RRB. Also, there are several studies on theory and practice of water pricing in agriculture as Toan (2020), and Anh and et al. (2018). However, so far there have no detailed studies on valuing water in irrigated agriculture in the RRB.

## 2. METHODOLOGY

### 2.1. Selection of the study area

The study was carried out in Cau Son irrigation and drainage area (CS area), which is located about 70 km north-east Hanoi in Cau river sub-catchment in the mid-land of the RRB in Vietnam (Fig.1). The RRB is the second largest river basin in Vietnam and plays an important role in providing water sources for socio-economic development. This system is situated within one of 30 irrigation and drainage polders in the RRB and is characterized as a typical irrigation system as it combines both Cau Son gravity canal scheme and pump schemes. The Cau Son canal irrigation scheme was constructed in 1907-1909, first rehabilitated in period of 1966-1973 and was upgraded under the Vietnam water resources assistance project funded by the World Bank in 2010. A sub-catchment E of about 2,350 ha (Fig.1) was selected for in-depth study of the analysis of economic value of water in irrigated agriculture. The investigation was conducted in Tan An (TA) commune area in sub-catchment E.

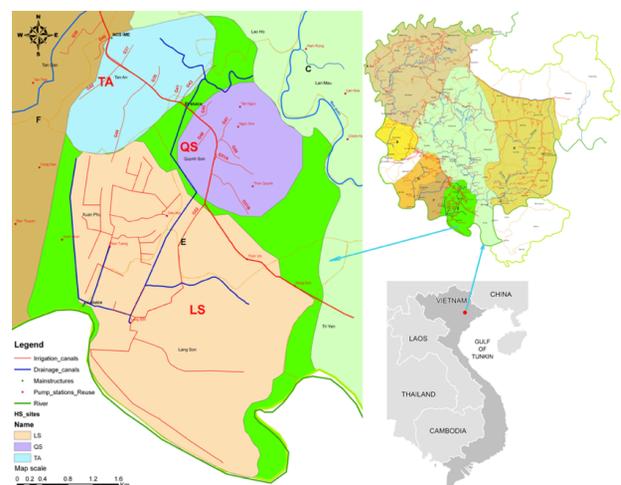


Fig 1. Study area in CS area with sub-catchments (Le and Jensen, 2014)

### 2.2. Surveys and data analysis

The data for valuing water in irrigated agriculture consists of (i) data from household economy undertaken in 2 separate years: 2018 and

2010 and (ii) Data on irrigation water use based on lift irrigation study conducted by Le and Jensen (2014). The household economy survey also was undertaken in TA area coinciding with samples in the lift irrigation study. The economy questionnaire covered: (i) socio-demographic characteristics; (ii) inputs and outputs of agricultural production such as investment for advanced farming practices, hired machine, labor, seeds, fertilizers, crop yield and crop prices (FOB price for rice), subsidies in agriculture production; and (iii) non-agricultural business activities. The sampling strategy of water use the irrigated and household economy surveys was exactly the same. 99 households were sampled for each year (2010 and 2018) in all hamlets of the site with the number of samples in each hamlet proportional to its irrigated area of the site. The households were then selected randomly from the hamlet's list of households. These samples (99) provided a confidence interval of about 10% at a confidence level of 95% (Le and Jensen, 2014).

### 2.3. Method of quantifying economic value of water used for irrigation

There are several methods in quantifying economic value of water as (i) Market-based approaches, (ii) Revealed preference techniques and (ii) Total Economic Value (TEV). Market-based approach uses data from actual markets, and thus reflect actual preferences or costs to individuals. These data are generally easy to obtain. The main limitation of these methods is that often ecosystem services do not have markets, or existing markets are often distorted. Another method is revealed preference techniques. These are based on the observation of individual choices in existing markets that are related to the ecosystem service that is subject of valuation. However, market imperfections and policy failures can distort the estimated monetary value of water. Also, good quality data and complex statistical analysis are required, thus these approaches can be expensive and time-consuming.

The (TEV) framework, developed by Pearce and Turner (1990) formulate the different types of welfare values of an environmental resources and ecosystems including *direct use values, indirect use values and non-use values*<sup>1</sup> (Fig. 2). This framework is widely accepted and recommended by the UN (2012 and 2021).

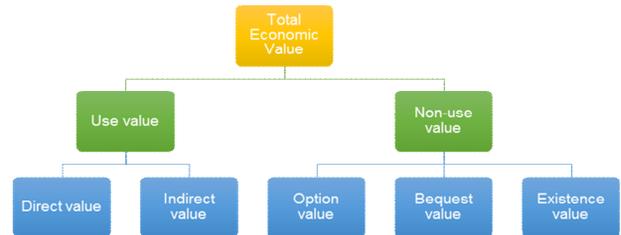


Fig 2. The Total Economic Value framework applied for water services. (UN, 2021)

As defined by this framework water as input for agriculture production is considered as direct use value. Valuing water as an intermediate input into agriculture is measured by several techniques as residual value, change in net income and production function approach. The residual value method has been widely used for irrigation as it is relatively easy to apply, though it remains certain assumptions about the market. The method is based on the idea that a profit-maximizing user will consume water up to the point where the net income obtained from one additional unit of water is just equal to the marginal cost of obtaining the water. Residual valuation assumes that if all

<sup>1</sup> *Direct use values*: this category refers to all direct uses of water, and it includes water-based or water-dependent raw materials or physical products that are used directly for production, consumption and sale. *Indirect use values* include all values associated with regulating and supporting services provided by water ecosystems for example catchment protection, flood control, nutrient cycling. *Non-use values* include all values intrinsic to water, regardless of its potential use, such as cultural, aesthetic or heritage values. These values are associated to the fact that an individual might want to preserve water ecosystems without ever using it, or gain satisfaction from knowing that an ecosystem is preserved for future generations.

markets are competitive except for water, then the total value of production exactly equals the opportunity costs of all the inputs. When the opportunity costs of non-water inputs are given by their market or shadow prices, then the shadow price of water is equal to the difference (the residual) between the value of the output and the costs of all non-water inputs to production, using the following formulas (UN, 2012):

$$TPV = \sum p_i \cdot q_i + VMP_w \cdot q_w$$

$$\text{or } VMP_w = \frac{TPV - \sum p_i \cdot q_i}{q_w}$$

Where:  $TPV$ : total value of the commodity produced;

$p_i q_i$  : the opportunity costs of non-water inputs into production (cultivation);

$VMP_w$  : the value of the marginal product of water;

$q_w$ : the cubic metres of water used in production.

The residual value method was applied to assess the irrigation water value for cultivation in the RRB.

### 3. RESULTS AND DISCUSSION

#### *Sampling characteristics*

According to surveyed data, the sample household's characteristics on socio-demography were quite similar with farming household in the RRB. As can be seen from Table 1, average household size, gender, education of household's headman are almost constant at the 2 separate study times (2010 and 2018). This indicated that there was a typical sample selected in terms of socio-demography.

**Table 1. Household's socio-demography in TA area**

Indicators	Unit	2010	2018
Sampled household	Household	99	99
Household's persons	Persons	4.3	4.1
Male	%	52.1	51.2
Female	%	47.9	48.8
Household headman's age	years old	54.2	53.7
Household headman's education	years	7.0	7.2
Household's irrigated area	m <sup>2</sup>	3721.0	3748.0

Sources: Survey 2010 and 2018

#### *Household's economy from cultivation*

**Table 2. Household's irrigated area and yield and prices of main crops by season**

Indicators	Unit	2010		2018	
		Spring crop	Summer crop	Spring crop	Summer crop
Irrigated area	m <sup>2</sup>	3721.0	3721.0	3748.0	3748.0
Irrigated area	Sao(=360 m <sup>2</sup> )	10.33	10.33	10.41	10.41
Rice irrigated area	%	88.2	96.8	88.5	97.1
Cash-crop irrigated area	%	11.8	3.2	11.5	2.9
Rice yield	kg sao <sup>-1</sup>	219.1	175.4	228.7	177.9
Peanut yield	kg sao <sup>-1</sup>	82.5	90.1	94.8	102.5
Sweet potato	kg sao <sup>-1</sup>	256	281	314	310
Rice price (FOB)	VND kg <sup>-1</sup>	8,872	8,061	10,260	9,211
Peanut price	VND kg <sup>-1</sup>	15,000	14,000	19,000	17,500
Sweet price	VND kg <sup>-1</sup>	1,550	1,500	1,900	1,950

Sources: Survey 2010 and 2018

In terms of household's agriculture production, it could be concluded that, the average size of irrigated agriculture land of the sample was not quite different between 2010 and 2018 and no seasonal difference in irrigated area between Spring and Summer crop seasons. Rice was the major crop cultivated and irrigated and accounted for nearly 93% of total annual irrigated area with more than 88% in Spring crop and 97% in Summer crop and this situation was quite similar for 2 different years (2010 and 2018). This illustrates that the cropping pattern of households in the study area was seasonal difference with more diversity in Spring crop season. In fact, in addition to rice, farmers in Spring crop season cultivated more other upland or cash crops as peanut, bean, maize, vegetables while in Summer crop season, cash crops were mainly sweet potato and peanut. This traditional cultivation practice may be influenced by high rainfall in Summer crop season with more quite frequency of flood and inundation. In terms of major crop yield, there was substantial reduction in rice yield (21%) in Summer crop season compared with that in Spring crop season while there was an increase (8%) in peanut yield. Furthermore, there was an increase in crop yield between 2010 and 2018.

For estimating irrigation water value, the total value of cultivation produced (total cultivation income) and the opportunity costs of non-water inputs into production (cost for cultivation) were quantified based on the household survey data

(2010 and 2018). The markets prices for cash crops as peanut, bean, sweet potato were used while the FOB price for rice, an export commodity, was taken. Cost for inputs of cultivation excluding water such as seeds, fertilizers, pesticides was calculated on the basis of market prices without subsidies. The labor cost for cultivation was estimated on the basis of prevailing wages in the study area while the cost for machine operation and/or hired machines and negligible investments for advanced farming practices also were taken into estimation.

According to the household economy surveys, income from cultivation was significant accounting for about 42% (in 2010) and 48% (in 2018) of total household's income. This indicates that farming practices remained and even more important in recent years for farmers in the RRB (Table 3). As can be drawn from Table 3, in 2018 income and cost in Spring crop season were substantial higher than that in Summer crop season. In fact, cultivation cost in Spring crop season of the household was about 9.3% higher but total income in Spring crop season was far higher with 26.8%. This leads to the fact that the net cultivation income in Spring crop season was much higher than (35.6%) the other season. With the net cultivation income accounting for 61% of the total annual cultivation income, the Spring crop season played a very important role for the household economy in the study area.

**Table 3. Household's economy from cultivation in irrigated area**

Indicators	Unit	2010		2018	
		Spring crop	Summer crop	Spring crop	Summer crop
Cost for cultivation ( $p_i q_i$ )	Mill. VND	5.6	5.1	6.7	6.2
Total cultivation income ( $TPV$ )	Mill. VND	19.0	13.1	23.1	15.2
Cultivation net income ( $VMP_w$ )	Mill. VND	13.3	8.0	16.4	9.0
Rice net income	Mill. VND	12.8	8.0	15.5	8.9
Crash-crop net income	Mill. VND	0.6	0.1	0.9	0.1
Rice net income per area	VND m <sup>-2</sup>	3,893	2,223	4,682	2,458
Crash-crop net income per area	VND m <sup>-2</sup>	1,262	714	2,087	869

Sources: Survey 2018 and 2010

**Table 4. Household's seasonal irrigation volume by area and crop season**

Indicators	Unit	Spring crop	Summer crop	Annual
Total irrigation volume ( $q_w$ )	m <sup>3</sup>	2,202	1,707	3,909
Total irrigation volume by area (ha)	m <sup>3</sup>	5,875	4,553	5,214
Irrigation volume for rice	m <sup>3</sup>	2,139	1,694	3,833
Irrigation volume for cash crops	m <sup>3</sup>	63.2	12.5	76

Sources: (Le and Jensen, 2014)

### **Household's irrigation volume**

The household-level irrigation volume by crop and season was calculated from available data in the lift irrigation survey conducted in 2010 with a publication in 2014 by Le and Jensen (Table 4). According to this publication, in Spring crop season, which was dry season with often occurred water shortage for cultivation in the RRB, on average, total irrigated volume of a household was 2,202 m<sup>3</sup> with 39% by lift irrigation using pumping and 61% by gravity. The average irrigation volume was 5,875 m<sup>3</sup> per hectare or 587.5 mm of irrigation depth in Spring crop season. In Summer crop, because of higher rainfall characterized by climate feature in the RRB, the irrigation application in the area was much lower (455 mm) than that of Spring crop season (587.5 mm).

In terms of crops, irrigation depth for Spring

rice of 645 mm was lower (by 8%) than that of Cau Son irrigation system (703 mm) (Chinh, 2012). This indicates more effective water use in the local small-scale irrigation area where farmers partly used their own lift irrigation (portable pumps). Also, results from Le and Jensen (2014) showed that the irrigation depth of rice (645 mm) was higher than irrigation depth of cash crop (mainly peanut and sweet potato, 147mm) with a factor of 4.4.

According to the surveys, the farming practices, cropping pattern and irrigation method in the study area for 2010 and 2018 were quite similar. The household's socio-demography and cultivation land size are also remained stable. Thus, the irrigation volume for crops estimated in Le and Jensen study (2014) could be used for calculation of water value for both 2010 and 2018.

**Table 5. Economic values of irrigation water by crops and crop season**

Indicators	Unit	2010			2018		
		Spring crop	Summer crop	Annual	Spring crop	Summer crop	Annual
Total water value	VND m <sup>-3</sup>	6,054	4,715	5,469	7,462	5,296	6,516
Rice irrigation	VND m <sup>-3</sup>	5,973	4,727	5,422	7,262	5,279	6,385
Cash crops	VND m <sup>-3</sup>	8,765	6,820	8,445	14,207	7,637	13,125

### **Economic value of water used for irrigated crops**

Results of the household survey in 2010 and 2018 indicates that the size of household's cultivated area was almost unchanged. Also, according to the land use planning of Bac Giang province, the irrigated cultivation area within the

Cau Son irrigation scheme will be remained (BGPPC, 2018). Thus, the estimated values in Table 3 and Table 5 are considered as the values of irrigation water including rice and cash-crops.

As shown in Table 5, there was a difference of water values of irrigated crops (rice and cash crops) in the study area for both 2010 and 2018.

Also, the water value of irrigated crops was seasonal dissimilarity. Rice was still important because rice net income per irrigated area was higher than cash crop with a factor of about 3.1 (in 2010) and 2.5 (in 2018) (Table 3) for both Spring and Summer crop in the both different years. However, because rice consumed much more irrigation water than upland or cash crops (with a factor of 4.4) as mentioned above, water value of cash crop was higher than that of rice with a factor of from 1.5 to 2. This indicates that it is worth for saving irrigation water for rice cultivation by improving irrigation practices in addition to expanding cultivated area of cash crops. The higher water value of Spring rice cultivation could be explained that the rice yield in Spring crop is higher about (21%) than in Summer crop. For cash crop, there was a higher yield but lower price of both peanut (8%) and sweet potato in the Summer crop. These led to water value of cash crops in Spring crop of both years were higher than in Summer crop. Thus, there was the higher total water value of Spring irrigated crops in comparison with that in Summer crop.

Estimated values from the study in Table 5 indicate that there was an increasing tendency in water value of crops between 2010 and 2018. While assuming the similar irrigation application of crop by season this could be explained by increased crop yield and price. According to the survey's data, because of enhanced quality of cultivation practice, the yield of main crops (rice, peanut and sweet potato) was increased from about 3% (rice) to 15% (cash crops). In addition, the price of crops also went up from about 19% (rice) to 26% (cash crops). The significant increase in crop's price was a likely contribution to enhancing the water value of crops. A study of irrigated water value from Armenia (OECD, 2016) showed an average water value of 98 AMD  $m^{-3}$  (equivalent to 4980 VND  $m^{-3}$ ) is relatively similar with the situation of the study area. D'Odorico et al. (2020) indicate that the global

mean values assigned to water in the production of the four major staple crops (wheat, maize, rice and soybean), representing about 60% of global food production, range between US\$ 0.05 and 0.25 (equivalent to VND 1,150 - 5,850) per  $m^3$ . Those values vary considerably within and among regions. The results from this study show that water value of irrigated agriculture in Cau Son irrigation system has been increasing recently and not less than the average global water value in this sector. However, there was a large gap between the water value of rice and cash-crop in the study as also indicated by Young and Loomis (2014). They pointed out that valuing water for food production has been carried out over the past 30 years. Existing water valuation studies often show the value of water could be very low for irrigating food grains, while it could be high where reliable supplies are needed for high-value crops such as vegetables, and fruits (FAO, 2004). Also, the value assigned to water in food production is low compared to its value in alternative water uses, such as domestic and industrial uses.

#### ***Recommendations***

The results from the analysis above about the different of water value of crops among seasons illustrates that where is possible *the change of cropping pattern is necessary toward a sustainable agriculture intensification*. The transition of agricultural development towards sustainable intensification is a strategic avenue to use resources, including water, more efficiently (FAO, 2018). In the study area, with the same farming size, the local household could cultivate more cash crops than rice area for the improvement of agricultural productivity and irrigated agriculture water value while reducing vulnerability to increasing water scarcity.

*Improving rice irrigation practices is highly advised*. Advanced irrigation with saving water technology for rice as alternative wet and drying irrigation is applied slowly (18% rice area) in Vietnam including the study area (MARD, 2021).

Thus, water value for rice irrigation is still low and increasing water use efficiency in irrigation is required while rice is still a dominant crop in the RRB. Increasing irrigation irrigation must be coupled with options to improve water use efficiency (better management practices and technology measures). Jägermeyr et al. (2015) showed that with proper water accounting and the enforcement of strict withdrawal regulations, the adoption of highly efficient irrigation systems could reduce non-beneficial water consumption while maintaining crop yields, enabling the reallocation of water to other uses, including the reuse of drainage water in irrigation system (Chinh, 2012).

*Water pricing can be used to improve water use efficiency in agriculture and to make users aware of the value of water* especially in the context of current water price subsidy in agriculture in Vietnam. Different water pricing instruments can be implemented to achieve different objectives (e.g. cost recovery, efficient use, reallocating water use) (Davidson et al., 2019). Low prices can have a negative bearing on the effectiveness of irrigation systems and water use. They result in poor maintenance and consequent inefficient operation of existing irrigation systems, limited capacity for improvements of infrastructure, and waste of water at the farm level. The price levels that can recover the costs of providing sustainable irrigation services would have to be very high to be feasible (Zhu et al., 2019).

### **Conclusion**

Irrigated agriculture in Vietnam in general and the RRB in particular uses the most fresh withdrawal water among water users. Identification and estimation of the right water value in irrigated agriculture will play an important role in improving water use efficiency. This valuation will support in providing important information for decision-making in water management at different levels from the

household to the river basin level. This study carried out surveys on household economy as well as household water use from previous studies to determine the economic value of irrigated water in Cau Son system through using the TEV framework and residual value method. Research results show that the water value in irrigated agriculture has improved in between 2010 and 2018 and is close to the regional values, though it is still low compared to the water value from services and industry areas. The study also shows that, although rice is a traditional crop and still plays an important role in the household's agriculture production, due to high water consumption than cash crops (with a factor of about 4.4), the water value of rice is much lower than the water value of cash crops (with a factor of 1.8). Furthermore, variation in crop yields as well as crop prices also make the water value of crops different. This study indicates that, the water value of Spring crops, which often faces water shortage in the RRB, is higher (about 40%) than that of Summer crops. From these findings, several recommendations are made to increase the water value and thereby improving the water use and water management efficiency in the study area, including: (i) The cropping pattern at the household level should be changed toward expanding the cultivation area of cash crops with high economic value and less water use, (ii) Advanced agricultural farming practices and water-saving irrigation methods are applied for rice cultivation. Besides, it is necessary to strengthen the management of the irrigation system to reduce water loss and to increase the drainage reuse for irrigation; (iii) Applying water prices in irrigated agriculture, which is regarded as one of the effective measures to increase the water value, is to improve the water use efficiency in agriculture production, especially in the context of existing subsidy for the irrigation sector. This is to move towards to the adaptation to climate change and water shortage.

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#### **Tóm tắt:**

### **GIÁ TRỊ KINH TẾ CỦA NƯỚC TƯỚI TRONG NÔNG NGHIỆP Ở LƯU VỰC SÔNG HỒNG: TRƯỜNG HỢP NGHIÊN CỨU Ở HỆ THỐNG THỦY LỢI CẦU SƠN**

*Tưới cho sản xuất nông nghiệp đóng vai trò quan trọng trong phát triển kinh tế xã hội ở Việt Nam nói chung và Lưu vực sông Hồng nói riêng vì nó không chỉ đảm bảo an ninh lương thực cho hàng triệu người, mà còn tăng giá trị xuất khẩu nông sản. Tuy nhiên, tưới là ngành sử dụng nhiều nước nhất. Trong bối cảnh khan hiếm nguồn nước trong lưu vực ngày càng gia tăng, việc xác định đúng giá trị kinh tế của nước tưới sử dụng trong nông nghiệp để đưa ra các giải pháp làm tăng hiệu quả sử dụng nước là rất cần thiết. Nghiên cứu này đã tiến hành khảo sát, đánh giá giá trị kinh tế của nước tưới của 99 hộ gia đình trong hệ thống tưới Cầu Sơn cho năm 2010 và 2018. Sử dụng kết hợp phương pháp tổng giá trị kinh tế (TEV) và giá trị dư, kết quả nghiên cứu cho thấy giá sử dụng nước nông nghiệp tăng trong giai đoạn này. Giá trị kinh tế của nước tưới cho lúa thấp hơn khoảng 1,8 lần so với cây trồng cạn. Ngoài ra, mặc dù quy mô canh tác là như nhau, nhưng giá trị kinh tế của nước tưới của cây trồng vụ Đông Xuân, vụ thường khan hiếm nước, cao hơn 1,4 lần so với giá trị kinh tế của nước tưới ở Vụ Hè thu. Một số giải pháp được đề xuất bao gồm: (i) thay đổi cơ cấu cây trồng của hộ gia đình theo hướng tăng diện tích canh tác cây trồng có giá trị kinh tế cao, sử dụng ít nước; (ii) Áp dụng biện pháp canh tác lúa tiên tiến, kỹ thuật tưới nước tiết kiệm đồng thời tăng cường quản lý giảm thất thoát nước, tái sử dụng nước trong hệ thống tưới; (iii) áp dụng giá nước trong nông nghiệp được tưới để tăng hiệu quả sử dụng nước, thích ứng với biến đổi khí hậu và thiếu nước.*

**Từ khóa:** Giá trị của nước, tưới, trồng trọt, khan hiếm nước, lúa, cây trồng cạn.

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Ngày nhận bài: 19/10/2021

Ngày chấp nhận đăng: 23/11/2021