

# Rational Use Of Water In Agriculture Of The Republic Of Uzbekistan And Its Problems

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***Abstract:****The article analyzes the state of water use in agriculture in Uzbekistan and examines the reasons for their waste. It analyzes the current state of water use on irrigated agricultural lands in the world and in the country, as well as programs of measures to address issues and problems of efficient use, and makes relevant proposals for their more efficient use. It also analyzes the views of experts on the recognition of water efficiency indicators in relation to key indicators, based on the fact that the same indicators cannot be applied uniformly as a result of global climate change, given the characteristics of specific and relative indicators of water use efficiency. In Namangan region, econometric models of changes in the volume of production depending on the conditions of water use in arable lands were developed and analyzed. As an indicator of water efficiency, crop yields were studied and suggestions and recommendations for water efficiency were presented.*

***Keywords:****agriculture, water, aquaculture, water scarcity, irrigated lands, water consumer associations, productivity.*

## 1. INTRODUCTION

The fact that in the Republic of Uzbekistan agricultural production and care of basic agricultural crops are fully entrusted to farms, the main share of farms in the production of food products, including fruits, vegetables and livestock, testifies to the fact that production is carried out entirely on private property.

The total area of agricultural lands in the country is 20,236.3 thousand hectares, of which arable lands - 3988.5 thousand hectares, perennial forests - 383.1 thousand hectares, gray lands - 76 thousand hectares, hayfields and pastures - 11028.3 thousand hectares, other lands - 4760 hectares. 4,000 hectares[1]. Agriculture is the leading sector of the economy in the country, employing 3.6 million people (27% of those employed in the economy). The share of the industry is 32% of the country's GDP.

In recent years, the country has been implementing consistent reforms to ensure food security, improve the quality of agricultural products and export potential. Exports of agricultural and food products bring to the Republic of Uzbekistan about 20-25 percent of total export earnings. Currently, more than 180 types of agricultural and food products are exported to more than 80 countries.

As a result of the reforms, a cluster approach to agricultural production was introduced, which covered 62% of agricultural land in cotton and textiles, 8% in animal husbandry and 7.5% in fruit and vegetables.

At the same time, there are a number of untapped opportunities for further development of the sector, increasing farmers' incomes, ensuring food security and sustainable use of natural resources. In particular, the increase in the number of privately owned water-using agricultural enterprises has led to an increase in the complexity of the water use system, which in turn has led to problems in the distribution of water in the water system.

Such negative consequences can be observed not only in the Republic of Uzbekistan, but also around the world. Studies show that agriculture currently accounts for 70 percent of the world's freshwater consumption, but in many countries water use efficiency is less than 50 percent. According to the FAO forecast, by 2050, the growth of water for agriculture will increase by 50 percent, taking into account the needs of the growing population.

However, the misuse and misuse of water in the global freshwater supply and its decline due to climate change will lead to problems such as water scarcity and pollution in many countries around the world, with serious impact on food security and environmental sustainability in the future. Also, as a result of global climate change, periodic water shortages in recent years and the deterioration of the main part of domestic irrigation networks have led to the deterioration of the reclamation status of irrigated arable lands and their decommissioning over the years.

In this regard, large-scale irrigation and reclamation measures are being implemented in the Republic of Uzbekistan within the framework of state programs to increase the productivity of irrigated lands, improve the reclamation status and water supply. As a result, during 2008-2017, the water supply of more than 1.7 million hectares of irrigated land and the reclamation of 2.5 million hectares were improved. It should be noted that the basis for the rational and efficient use of water resources is the value of consumers to the water supplied. At the same time, it is important for water consumers to work with water suppliers and regulate water use.

### *The purpose of the study*

To study the state of water use in agriculture and identify ways to optimize water efficiency. Achieving this goal is possible by solving the following tasks:

- Carrying out economic and econometric assessment of water use in agriculture in Namangan region;
- Development of proposals and recommendations on the directions of efficient use of water, taking into account the standard level of water in the study area, and identification of key areas.

## **2. LITERATURE REVIEW**

On the topic of increasing water productivity in agriculture, D.Molden et al., Improving Irrigation. J.M. Faurès et al. on comprehensive assessment of food and water management in agriculture, G. Fischer on climate change mitigation for irrigation water demand in 1990–

2080, F. Nachtergaele on global land and water use trends, on drought lands The use of groundwater to meet demand has been studied by H. Garduno and S. Foster. [2-6]

In addition to the impact of climate change on the hydrological cycle, other challenges, including water mismanagement, Vijayetta Sharma, S.Jackson, Prospects for Water Use in the Tropical Region of Northern Australia, Surface and Groundwater, Atmospheric Air, Soil, Flora and Fauna V.V. Kundius conducted scientific research on the effect of [7-9]

### 3. RESEARCH METHODOLOGY

Always the methodologies used in the research process are selected based on the purpose. The article uses a number of methods, including statistical grouping, comparison, economic and modeling (forecasting) methods to search for rational measurements and determine the optimal solution in the new economic and organizational conditions.

### 4. ANALYSIS AND RESULTS

In many parts of the world, including the Republic of Uzbekistan, the demand for water resources is growing, and the shortage of water is growing from year to year. Until 2000, the low-water season was observed once every 6-8 years, but in recent years this process has been repeated every 3-4 years. At the same time, water shortages are deeply felt by consumers, especially in the lower reaches of rivers and away from canals and other water sources. In our view, in order to make reasonable use of the water used to irrigate the fields, the farmer must first establish and fully comply with its water supply contractual relations with its Water Consumers Associations (SIUs) and pay for water supply services in a timely manner. should go.

In the analysis of cases of efficient use of water on the example of agriculture in Namangan region of the Republic of Uzbekistan, we aimed to realize the impact of land and water on the gross agricultural output using econometric models.

To do this, we will first consider the analysis of cotton and wheat crops grown in the early days of agriculture in the Republic of Uzbekistan on the state order and now grown on demand. To do this, the volume of cotton grown in Namangan region in 2000-2019 – Water consumption for growing cotton -  $S_{sc}$  and land area allocated for cotton –  $E_{mc}$  correlation coefficient is determined (Table 1).

Table 1 Correlation coefficient of factors affecting the volume of cotton grown in Namangan region

|          | $Y_c$    | $E_{mc}$    | $S_{sc}$ |
|----------|----------|-------------|----------|
| $Y_c$    | 1        |             |          |
| $E_{mc}$ | 0,730742 | 1           |          |
| $S_{sc}$ | 0,722046 | 0,697339186 | 1        |

According to the results in Table 1, the factors were selected correctly and the factors were more intensive than the outcome factor ( $r_{Y_c, E_{mc}}=0,730742$  and  $r_{Y_c, S_{sc}}=0,722046$ ) between connected and factors  $r_{E_{mc}, S_{sc}} \leq 0,8$  conditionally, ( $r_{E_{mc}, S_{sc}}=0,69734$ ) multicollinearity does not exist.

It should be noted that since the selected units of measurement are different, it is advisable to obtain a natural logarithm for each indicator column. This allows, first of all, to prevent various collisions arising on the defined equation, as well as to ensure the reliability of the result obtained. The coefficients of the regression equation for the calculated columns and the results for their significance are given in Table 2 below.

Table 2 Coefficients of the regression equation and results on their significance

Dependent Variable: LNYC

Method: Least Squares

Date: 06/30/20 Time: 11:03

Sample: 2000 2019

Included observations: 20

| Variable           | Coefficient | Std. Error           | t-Statistic | Prob.     |
|--------------------|-------------|----------------------|-------------|-----------|
| LNEMC              | 1.943862    | 2.214357             | 0.877845    | 0.0323    |
| LNSSC              | -1.093422   | 2.327844             | -0.469567   | 0.0446    |
| C                  | 4.617068    | 6.106485             | 0.756093    | 0.0499    |
| R-squared          | 0.544722    | Meandependentvar     |             | 12.31421  |
| Adjusted R-squared | 0.491160    | S.D. dependentvar    |             | 0.169783  |
| S.E. of regression | 0.121111    | Akaikeinfocriterion  |             | -1.246729 |
| Sumsquaredresid    | 0.249356    | Schwarzcriterion     |             | -1.097370 |
| Loglikelihood      | 15.46729    | Hannan-Quinn criter. |             | -1.217573 |
| F-statistic        | 10.16992    | Durbin-Watsonstat    |             | 1.834513  |
| Prob(F-statistic)  | 0.000046    |                      |             |           |

Based on the data in Table 2, when the t-Statistic criterion is  $df = 19$  and  $\alpha = 0.05$ ,  $t_{tab} = 2.093$  parameters in the equation ( $t_{Emc} = 0.8779$  and  $t_{Ssc} = -0.4696$ ) insignificance. However, it is possible to test the significance of the parameters using MAPE (Mean Absolute Percentage Error) and TIC (Tayl inequality coefficient) (Figure 3).

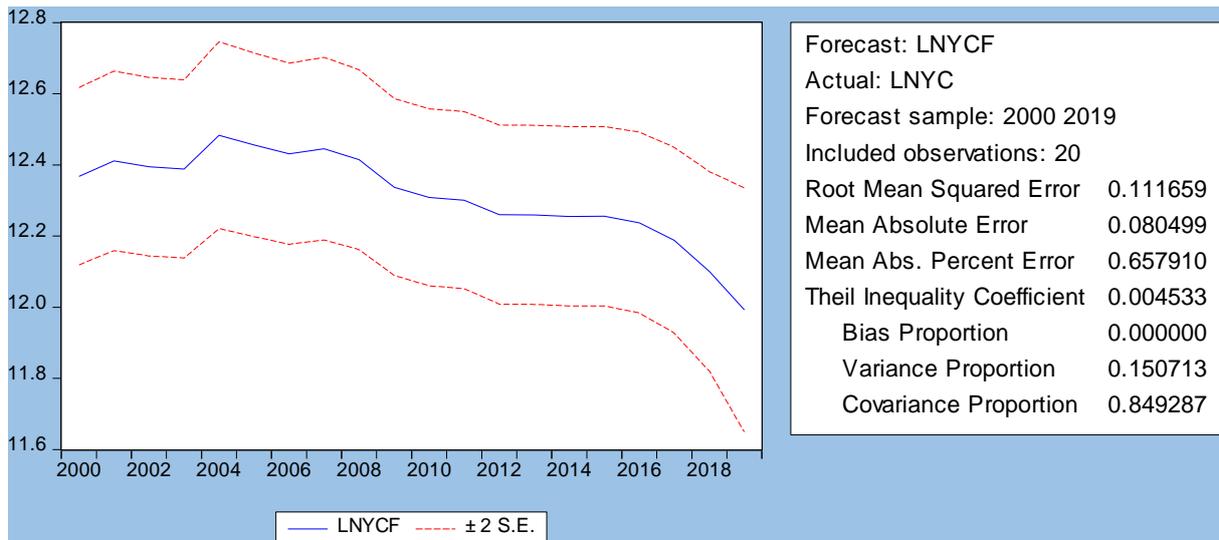


Figure 3. The result of the MAPE and TIC criteria of the importance of the parameters

From the data in Figure 3, it can be seen that MAPE = 0.6579, which in turn means that the higher the MAPE <10% forecast accuracy and the higher the TIC = 0.005 forecast accuracy, the greater the coefficient tends to zero. This gives the following (y) -regression equation:

$$\text{LnYc} = 1,944\text{LnEms} - 1,0934222\text{LnSsc} + 4,62 \quad (1)$$

The logarithmic equations are generally potentiated in order to simplify the calculation of the (1) -model described above, to achieve the accuracy of the result, and to make the future results reliable and easy to calculate. When this equation is potentiated, it looks like this:

$$Yc = \frac{Emc^{1,944} \cdot e^{4,62}}{Ssc^{1,0934222}} \quad (1^*)$$

From this potentialized (1 \*) - regression equation and the time-dependent equations of each selected factor:

Water consumption for growing cotton –  $Ssc = 647127,3 - 10671,1 * t$ ;

Land allotted for cotton –  $Emc = 98087,5 - 1618,4 * t$ ;

A multi-factor forecast of gross cotton yield in Namangan region is made using the results of which is given in Table 4.

Table 4  
Multifactorial forecast of gross cotton harvest in Namangan region

| Years | Gross yield of cotton, tons | Landarea, e | Consumed water, thousand cubic meters |
|-------|-----------------------------|-------------|---------------------------------------|
| 2020  | 158118,7                    | 64101,1     | 423034,2                              |
| 2021  | 154712,7                    | 62482,7     | 412363,1                              |
| 2022  | 151293,5                    | 60864,3     | 401692                                |

|      |          |         |          |
|------|----------|---------|----------|
| 2023 | 147860,7 | 59245,9 | 391020,9 |
| 2024 | 144413,8 | 57627,5 | 380349,8 |
| 2025 | 140952,4 | 56009,1 | 369678,7 |

According to the forecast results of Table 4, the gross yield of cotton in Namangan region by 2025 is expected to decrease by 10.9% compared to 2020, reaching 140,952.4 tons. This change is the result of the implementation of measures to gradually reduce the cotton monopoly in the Republic of Uzbekistan.

The structure of water consumption in agriculture is characterized by the following indicators: production needs - 2%; household and drinking needs - 4.6%; irrigated agriculture -81.4%; water supply to agriculture - 5.3%, other needs - 7.1% [10]. Based on these indicators, if we pay attention to the equation, we can see that the volume of water used for cotton cultivation is high, which in turn leads to the waste of large amounts of water, which leads to the need to focus on water conservation in the country.

Now we consider the econometric analysis of cases of wheat cultivation in agriculture of Namangan region. To do this, the total wheat crop grown in the region viloy The area of land allocated for wheat affected by the cultivation of YB – Emb and the volume of water consumed in it – Ssb factors are selected and the above steps are performed in a certain sequence to perform the analysis.

Table 5

Correlation coefficient of factors affecting the volume of wheat grown in Namangan region

|     | <i>Yb</i>  | <i>Em</i>   | <i>Ss</i> |
|-----|------------|-------------|-----------|
| Yb  | 1          |             |           |
| Emb | 0,75936975 | 1           |           |
| Ssb | 0,75876012 | 0,597366848 | 1         |

According to the results in Table 1, the factors were selected correctly and the factors were more intensive than the outcome factor ( $r_{Yb,Emb}=0,7594$  and  $r_{Yb,Ssb}=0,7588$ ) between connected and factors  $r_{Emb,Ssb} \leq 0,8$  conditionally, ( $r_{Emb,Ssb}=0,59737$ ) multicollinearity does not exist. The coefficients of the regression equation for the logarithmic column values determined in the next step and the results for their significance are given in Table 6 below.

Table 6

Coefficients of the regression equation and results on their significance

Dependent Variable: LNYb

Method: LeastSquares

Date: 06/30/20 Time: 13:52

Sample: 2000 2019

Included observations: 20

| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
|----------|-------------|------------|-------------|--------|
| LNEmb    | 2.815186    | 9.325963   | 0.301865    | 0.0064 |

|                    |           |                     |           |           |
|--------------------|-----------|---------------------|-----------|-----------|
| LNSsb              | 0.254863  | 9.279291            | 0.027547  | 0.0483    |
| C                  | -22.35500 | 15.73770            | -1.420474 | 0.0036    |
| R-squared          | 0.544880  | Meandependentvar    |           | 12.93091  |
| Adjusted R-squared | 0.491337  | S.D. dependtvar     |           | 0.141019  |
| S.E. of regression | 0.100576  | Akaikeinfocriterion |           | -1.618328 |
| Sumsquaredresid    | 0.171963  | Schwarzcriterion    |           | -1.468969 |
| Loglikelihood      | 19.18328  | Hannan-Quinncrier.  |           | -1.589172 |
| F-statistic        | 10.17639  | Durbin-Watsonstat   |           | 1.976290  |
| Prob(F-statistic)  | 0.001242  |                     |           |           |

Based on the data in Table 6, when the t-Statistic criterion is  $df = 19$  and  $\alpha = 0.05$ ,  $t_{tab} = 2,093$  parameters in the equation ( $t_{Emb} = 0,3019$  and  $t_{Ssb} = -0,0276$ ) insignificance. Therefore, the significance of the parameters is checked using MAPE and TIC criteria (Figure 7).

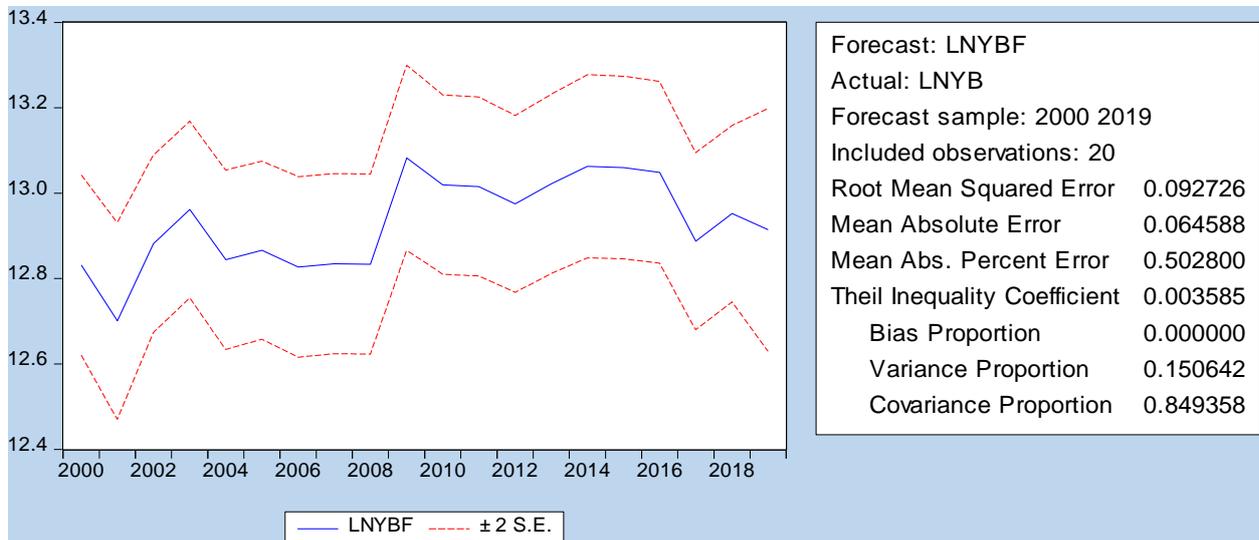


Figure 7. Results of MAPE and TIC criteria

From the data in Figure 7, it can be seen that  $MAPE = 0.5028$ , which in turn means that the higher the  $MAPE < 10\%$  forecast accuracy and the higher the  $TIC = 0.0036$  forecast accuracy, the greater the coefficient tends to zero. This gives the following (2) -regression equation:

$$Yb = 2,82LnEmb + 0,254863LnSsb - 22,4 \quad (2)$$

When the equation (2) -regression is potentiated, the following equation (2 \*) - is formed:

$$Yb = \frac{Emb^{2,82} * Ssb^{0,254863}}{e^{22,4}} \quad (2^*)$$

(2\*) and from the time-dependent equations of the following factors:

$$\text{Land allotted for wheat} - Emb = 80330,6 + 278,8 * t;$$

$$\text{Water consumption for wheat cultivation} - Ssb = 3546526,5 + 1288,8 * t;$$

Using the system of equations, we make a multifactor forecast of changes in the volume of gross wheat production in Namangan region, and the results are reflected in Table 8 below.

8-жадвал

Multifactorial forecast of changes in the volume of gross wheat production in Namangan region

| Years | Wheat production volume, tons | Landarea, e | Consumed water, thousand cubic meters |
|-------|-------------------------------|-------------|---------------------------------------|
| 2020  | 410060,7                      | 86185,4     | 383591,3                              |
| 2021  | 414166,4                      | 86464,2     | 384880,1                              |
| 2022  | 418299,7                      | 86743       | 386168,9                              |
| 2023  | 422460,7                      | 87021,8     | 387457,7                              |
| 2024  | 426649,6                      | 87300,6     | 388746,5                              |
| 2025  | 430866,4                      | 87579,4     | 390035,3                              |

According to Table 8, the volume of gross wheat production in Namangan region in 2025 is expected to increase by 6.1% compared to 2020 and reach 430866.4 tons. It should be noted that such positive results will be achieved, first of all, due to an increase in land area by 1.9% and water volume by 2.0% and the implementation of measures by the Government of the Republic of Uzbekistan on water efficiency.

## 5. DISCUSSION

The vast majority of arable land in the country requires regular reclamation (saline irrigation of many areas). This, in turn, leads to an increase in water use in this case as well. In this sense, in order to improve the use of water and the reclamation of agricultural land, we think it is expedient to do the following:

- The water management system requires the establishment of a single agro-industrial complex, the constant expenditure of large funds. Such a source of funding and its more efficient use requires that it be in the hands of the state alone;
- The majority of agricultural lands require reclamation. This again requires a unified investment policy of the state;
- For the agriculture of the Republic of Uzbekistan, in our opinion, an important area of effective use of land and water resources in the face of water shortages is to improve the composition of crops within the existing arable land.

## 6. CONCLUSION/RECOMMENDATIONS

In conclusion, the analysis of modern use of water and land resources in agriculture shows the low efficiency of their use. There are many reasons for this, but the main ones are: applied irrigation equipment and technologies; the existing economic system, which does not ensure the rational use of bioclimatic resources of the country and, consequently, low yields; lack of paid nature use, etc.

In addition, the existing normative-methodological framework and the existing economic mechanism of nature management do not contribute to the efficient use of natural resources in irrigated agriculture. This is traditionally explained by the fact that the main goals and objectives of land reclamation are limited to addressing current issues aimed at combating consequences rather than causes.

With the development of hydraulic reclamation in our country, the main focus is not on creating conditions for increasing natural resources, increasing the value of land use, environmental sustainability of natural and economic systems and stabilizing agricultural production, but on accelerating agricultural production and food security.

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